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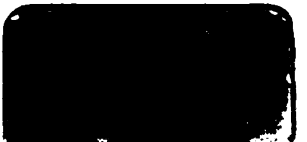

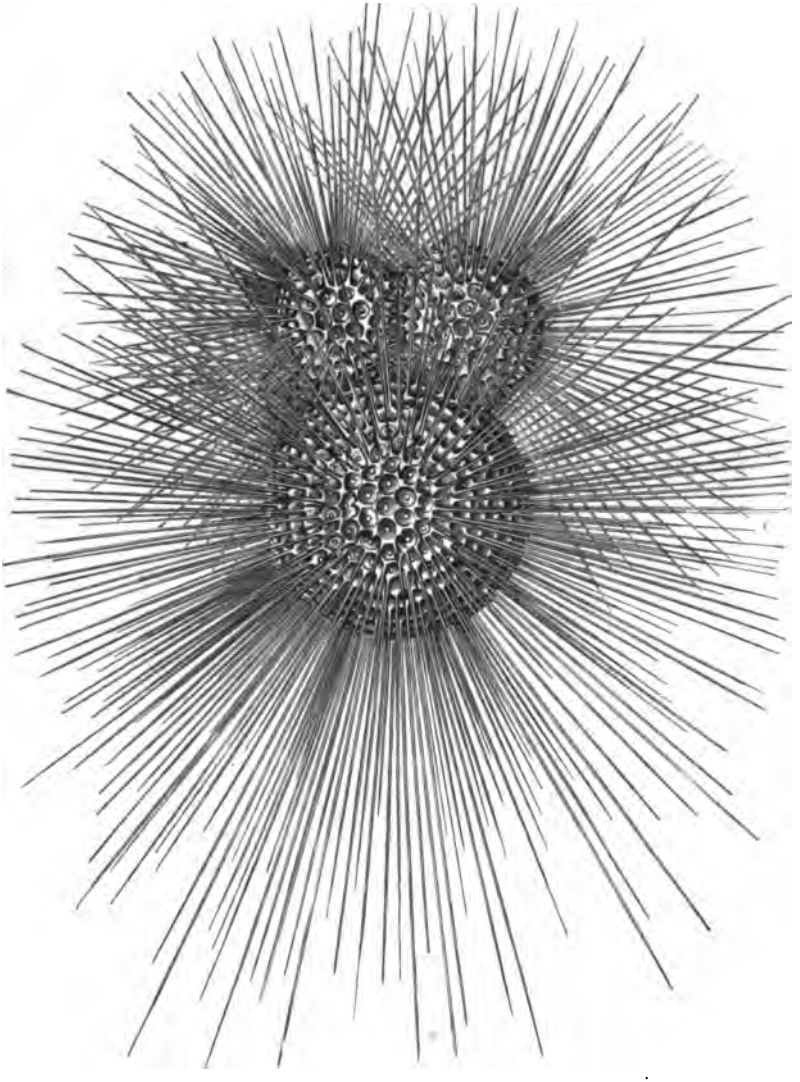

GLOBIGERINA, as seen when alive.

[See Page 126.

370

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ALOG

MAR -3 1919

INDEX TO VOLUME I.

PAGE

Acid in Growing Roots ... 84
Agarious Tridens ... 103, 135
Agricultural College, Maryland ... 24
Air Bubbles, to Avoid ... 76
Algæ, How to Cut Sections of ... 89
American Institute, Fair of ... 117
American Association for Advancement of Science, Microscopy at ... 46, 95
Microscopical Sub-Section ... 116
Amphipleura Pellucida, Resolution of ... 11
Angular Aperture (see Objectives).
Animals, Preservation of Wild ... 115
Anthrenus Lepidus (Carpet Anthrenus) ... 132
Aperture, Angular, (see Objectives).
Aquarium, the New York ... 86
Arrows, Poisoned ... 51
Artemia Salina Wanted ... 49
Aulocodiscus Oregonus with Two Centres ... 82

Bacteria in Perspiration ... 61
Bee's Sting ... 8
Bees, how a Swarm of is Suspended ... 22
Blood, Circulation of ... 48
Globules, Counting the ... 29
Stains, Improved Method of Examining ... 32
Boar, Wild, Trichinæ in ... 21
Bone, Sections of ... 74
Books and Articles, Recent ... 12, 23, 35, 62, 88

BOOK TABLE.

A Handbook of Medical Microscopy. By J. G. Richardson, M. D ... 11
Practical Hints on the Selection and Use of the Microscope. By John Phin ... 12
Microscope and its Revelations. By W. B. Carpenter ... 22
Vision: Its Optical Defects and the Adaptation of Spectacles. By C. S. Fenner ... 22
A Guide to the Microscopical Examination of Drinking Water. By J. D. McDonald ... 35
The Microscope in Gynæcology. By A. Mead Edwards ... 35
A Course of Lectures on Physiology. By Prof. Kuss ... 35
The Student's Manual. By Rev. John Todd ... 35
The Nature of Light. By Dr. Eugene Lommel ... 51
Anatomy of the Invertebrata. By C. Th. Von Siebold ... 62
Field, Forest and Garden Botany. By Asa Gray ... 62
Orchids. By E. S. Rand, Jr ... 75
First Book of Zoology. By E. S. Morse ... 120
Course of Elementary Instruction in Practical Biology. By F. H. Huxley and H. N. Martin ... 135

Books Wanted ... 36, 52, 64, 76, 99, 111, 122, 136, 144
Bottle, Collecting ... 32
Bramhall Illuminator ... 96
Buckland's Cement ... 62
Cabinet of the Queckett Microscopical Club ... 73

PAGE

Carpet Anthrenus ... 132
Caterpillar and Ichneumon Larvæ ... 1
Cell for Opaque Objects ... 50
Cells, Growth of ... 34
Cellulose, Schweitzer's Solvent for ... 74
Cement, Buckland's ... 62
Centennial, Microscopes at the ... 113
Challenger, Expedition ... 97
Trophies of ... 110
Chicory, Test for ... 33
Chicken, the Philosophic ... 123
Circulation of Blood ... 48
Clay Daubers ... 19
Clip, Spring, Mason's ... 50
Wire ... 9
Clothes Moth Scales as Test ... 36
Coal, Preparing Sections of ... 11
Cock, Experiment with ... 32
Coffee, Test for Chicory in ... 33
Collecting Case, Compact ... 91
College, Maryland Agricultural ... 24
Colors, Harmonizing ... 24
Color in Microscopic Objects ... 65
Colored Glass for Entomological Cases ... 120
Combustible Earth ... 114
Correspondents. Carl Reddots ... 17, 143
N. N ... 18, 97
C. N. D ... 19
M. S. B ... 31
* * * ... 48, 60
Allen Y. Moore ... 48, 134
Martindale, Isaac C ... 48
D. S. K ... 48
F. H ... 49
F. H. (No. 2) ... 120
W. C. S., Jr ... 60
Dr. Geo. E. Blackham ... 109, 143
Charles Stodder ... 72
C. F. Cox ... 133
E. P ... 134
A. Mead Edwards ... 134
Cotton Fibres ... 13
Counterfeit Slides ... 33
Court Room, Science in ... 30
Cover Forceps, Phin's ... 21
Fletcher's ... 9
Covers, Cleaning ... 49, 85, 120
Crystallization of Silver ... 53
Crystals of Silver ... 49
of Snow ... 57
Cyclops as Food for Fish ... 19
in Winter ... 48

Decoloring and Staining Vegetable Tissues ... 77
Diatoms—Moller's Test Plate ... 16
Authentic Slides of, by Prof H. L. Smith ... 31
From Guano ... 62
Aulocodiscus Oregonus with Two Centres ... 82
Arranging ... 95
As Food for Plants ... 105, 129, 133, 143

PAGE

Diatoms, Dr. Phipson on ... 129
From Shockoe Hill ... 141
Duty on Imported Microscopes ... 70

Earth, Combustible ... 114
Ehrenberg, Death of ... 117
Entomological Cases, Colored Glass for ... 120
Eye of Beetle, Viewing Objects through ... 91
Eye, Imperfections of the Human ... 7
Power of ... 189
Eye-Pieces *versus* Objectives ... 4, 17
Exchanges ... 6, 23, 36, 52, 68, 76, 88, 99, 111, 122, 136, 143
Experiment with Cock ... 32
Interesting Optical ... 34
in Spontaneous Generation ... 86
New Optical ... 141
Extravagance, Useless ... 21

Fibres, Textile ... 13
Filtering Water to Obtain Diatoms, etc ... 118, 134
Fish, Food for ... 19
Flames, Transparency of ... 139
Flax, Fibres of ... 13
Fleah, shower of ... 54, 69, 84, 110
Fletcher's Cover Forceps ... 9
Foraminifera from Chalk ... 104
Forceps, Cover, Fletcher's ... 9
Phin's ... 21
Forceps Carrier ... 10
Freezing, Restoration of Life after ... 20
Fungi, Preserving ... 20
in Disease ... 22
How to Choose ... 137

Generation, Spontaneous, Experiments in ... 86
Germs, Tyndall on ... 33, 37, 47
Glass, Colored, for Entomological Cases ... 120
Globigerinæ ... 126
Greensand and its Origin ... 28, 67
Growing Slide ... 21
Gum Arabic, American Substitute for ... 135
Gymnastics, microscopic ... 60

Hopes and Aims, Our ... 6
Holder for Hot Slides ... 74
Huxley's Lectures ... 96, 234

Ichneumon Flies ... 1
Illuminator, Bramhall ... 96
Illusion, Optical ... 31
Imagination, Use and Abuse of ... 56
Imitation Wool and Silk ... 51
Infusoria, Two Hundredth Anniversary of Discovery of ... 36
Insects, Lead Boring ... 142
Ivory ... 50

Jute Plant, the True ... 36

Ladies as Members of Microscopical Societies ... 86
Lamps, Oil for ... 10
Lead Boring Insects ... 142
Leeuwenhoek's Two Hundredth Anniversary ... 36
Lepisma Scales as Test ... 36
Life, Restoration of after Freezing ... 20
Light, Measurement of Velocity of ... 32
Lights, Photogenic Powers of Different ... 95
Literature, Microscopic ... 86
Loan Collection of Scientific Apparatus ... 101
Localities of Microscopic Objects ... 97, 119, 134

Kentucky Shower of Flesh ... 54, 69, 84, 110

Magnifying Power of Objectives, to Determine ... 12
Mason's Spring Clip ... 50
Medicine, Photography in ... 74
Moller's Test Plate ... 16
Micro-Cabinet Club, Postal ... 31
Micro-Photography ... 94
Microscope, $5,000, of Silver ... 21
Power of ... 34
How to Study with the ... 3
Learning to Use ... 15, 55
in Summer ... 60
Support for ... 50
Microscopes at the Centennial ... 64, 113
at Loan Collection ... 101
Duty on Imported ... 70
Making and Manufacturing ... 84
Work for Cheap ... 2, 25

PAGE

Microscopic Gymnastics ... 60
Microscopic Objects, Localities of ... 119, 134
Microscopical Conversazione ... 131
Literature ... 86
Societies, List of ... 72
Sub-Section of American Association for Advancement of Science ... 116
Microscopist, Evidently not a ... 34
"Microscopists" ... 56
Tool for ... 88
Microscopy at the American Association ... 46
"Microscopy" ... 155
Monads, Nature of ... 141
Mould, to Prevent ... 12
Mounting Objects ... 48
Opaque Objects, New Method of ... 110
Double Weight for ... 49
Mucilage, a Good ... 74
Mud Wasps ... 19

Newman, Edward, Obituary ... 152
Newspapers at the Centennial ... 110
Nobert, M., Personal ... 108

Objects, Microscopic, Localities of ... 97, 119, 134
Mounting ... 48
Opaque, Cell for ... 50
Opaque, New Mode of Mounting ... 110
Objectives *versus* Eye-pieces ... 4, 17
Improved Method of Numbering ... 24
Measuring Focal Length of ... 71
Angular Aperture of ... 92, 97, 109, 118, 134, 142
Merits of ... 119
to Determine Magnifying Power of ... 12
Oil for Lamps ... 10
Optical Illusion ... 31
Experiments ... 141
Parasites and Caterpillar ... 1

PERIODICALS NOTICED.

The American Naturalist ... 23, 86
St. Nicholas ... 64
Micro-Photographs in Histology ... 64, 98, 120
Cincinnati Medical News ... 86
American Chemist ... 88
Scribner's Monthly ... 135

Philadelphia, Meeting of Microscopists in ... 131
Philosophic Chicken ... 123
Photogenic Powers of Light ... 95
Photography ... 94
in Medicine ... 74
Pickerel, Voracity of ... 11
Picric Acid for Staining ... 102
Pierce's Cell for Opaque Objects ... 50
Pigeons, Carrier ... 103
Pinus Tuberculata ... 128
Plants feeding on Diatoms ... 105, 129, 133, 14
How to Dry ... 115
Poisoned Arrows ... 51
Poisonous Fungi ... 137, 140
Polarization of Living Tissues ... 86, 95
Postal Cards ... 36
Postal Micro-Cabinet Club ... 31
Postal Rules and Rates ... 83
Preservative Fluids ... 60
Preservation of Organic Matters for Microscopical Examination ... 11
Preservation of Wild Animals ... 115
Pritchard's Infusoria, New Edition ... 86
Probe-Platte, Moller's ... 16
Professor of the Natural Sciences ... 86

Readers, to Our ... 6, 16, 132, 140
Recent Books and Articles (see Books.)
Roots, Acid in Growing ... 34
Rotating Stage, Substitute for ... 33
Rubber, to Shape with a File ... 24

Salamander, Larva of ... 48
Salicylic Acid in Microscopy ... 81, 86, 135
Science for the People ... 50
Science in the Courtroom ... 30
Sections for Microscope, Ready Method of Preparing ... 62
Sections of Algæ, How to Cut ... 89
of Bone ... 74

PAGE

Seeds, Germination of in Ice..... 120
Shockoe Hill Diatoms..... 141
Shower of Flesh..... 54, 69, 84, 110
Silk, Fibres of..... 13, 27, 51
Silver, Crystallization of..... 48, 53
  Microscope made of..... 21
Slides, Counterfeit..... 33
  for Opaque Objects..... 85
  Holder for..... 74
  Selection of..... 10
Snow Crystals..... 57
Societies, Microscopical, List of..... 72
Societies (see Transactions of).
Spencer, Chas. A..... 140
Spontaneous Generation, Experiments on..... 86
Spring Clip..... 9, 50
Stage, Substitute for Rotating..... 33
Staining Tissue, New Process for. By M. Cornil.... 61
  Do. Do. By Mrs. Hoggan, M. D. 61
  Muscular Tissue with Picric Acid and Carmine..... 103
  Vegetable Tissues..... 77
  Wood..... 24
Sting of Bee, Form of..... 8
  Death From..... 51
Support for Microscope..... 50
Swarm of Bees, how Suspended..... 22

Test-Plate, Moller's..... 16

PAGE

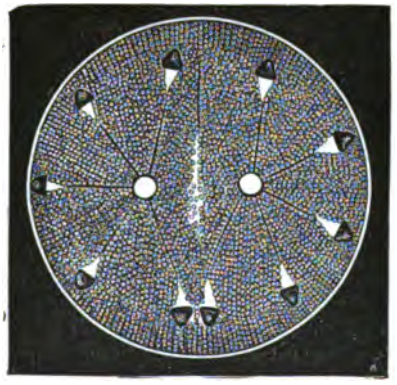
Textile Fibres..... 13
Tissue, New Process for Staining. By M. Cornil.... 61
  Do. Do. By Mrs. Hoggan, M. D. 61
  Muscular, Staining..... 102
Tissues, Hardening..... 33
  Living, Polarization of..... 86, 95
Tool for Microscopists..... 88
Transactions of Societies, San Francisco...34, 52, 63, 75, 87, 98, 111, 121, 135, 143.
  Dunkirk, N. Y..... 87
Trichinæ in Wild Boar..... 21
Turn-Table, Recent Improvements in..... 59
Tyndall on Germs..... 33, 37, 47

Uncalled for..... 7

Vegetable Tissues, Decoloring and Staining..... 77
Velocity of Light, Measurement of..... 32
Vise for Microscopists..... 88
Volvox Globator..... 18

Wasps, Mud..... 19
Watch-Glass Holder for Field Use..... 20
Water, Method of Filtering for Organisms..... 10, 134
Water Weeds, Utility of..... 24
Weight, Double, for Balsam Mounting..... 49
Wood, Staining..... 24
Woolens, Fibres of..... 13, 51
Work for Cheap Microscopes..... 2, 25

Zoological Gardens for New York..... 110



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An Interesting Object for the Microscope.

SOME months ago a friend brought to me a caterpillar which he found feeding on his grape vine, and which was covered with curious little barrel-shaped objects which some who saw it imagined to be its young. Indeed the supposed fact that the caterpillar carried its young about on its back was the point which excited so much wonder and curiosity, and which caused it to be brought to me. This case affords a fair average instance of the defective information possessed by many otherwise well educated persons in regard to objects of

Fig. 1.

natural history. How many are there who know that caterpillars never produce young, or that flies, bees, etc., never grow larger after they escape from the cocoon? Most persons suppose that the little flies that we see around are the same kind as the large ones, only younger.

In the case of the specimen alluded to, it required but a glance to see that the supposed young were the cocoons of what is called an *ichneumon fly*, an insect which lays its eggs in the caterpillar, these eggs hatching into little caterpillars, which live in the body of their "host," as the large caterpillar is called, and feed upon its substance. When these parasitic caterpillars have attained their full growth they emerge from its body and weave a cocoon which

Fig. 2.

remains attached, as shown in the engraving, Fig. 1, in which the caterpillar is seen of its natural size. After a short time, a fly escapes from the cocoon, cutting its way out by slitting its shroud, which it does in such a way as to leave the two parts attached so that the empty cocoon appears like a very deep basket with a hinged lid. The cocoon is shown in Fig. 2 magnified about five diameters, while the fly itself is seen in Figs. 3 and 4, the former being the natural size and the latter a magnified representation.

Figs. 3 and 4.

Under the microscope this cocoon, with its silvery basket work, woven of the finest threads, and its beautiful lid and lining, forms a most interesting object. A low

power (the inch or inch-and-a-half objective answers well) with good illumination is needed, the cocoon being viewed by reflected light.

The various kinds of ichneumon flies or parasites are frequently of great benefit to mankind. The famous Hessian fly, which at one time threatened to destroy our wheat crops entirely, was kept under by the importation of its natural enemy, and an effort is at present being made to import into New Zealand the *Chrysopa*, the natural enemy of the *aphides*, which are very abundant and destructive in that country. We hear that even the formidable potato bug has at length been attacked by a small parasite which threatens to keep it within bounds, a result most devoutly to be wished for.

J. P.

Work for Cheap Microscopes.

WHILE the microscope is unrivalled as a source of mere amusement, it is a fact within the experience of all true lovers of this instrument that the *highest* pleasure is to be obtained from it when it is devoted to earnest *work*. Now the work which may be done by the microscope is of three kinds: 1. The study of subjects which have been already thoroughly investigated, but which we wish to see for ourselves instead of having to depend upon mere descriptions or engravings. 2. Researches having for their object the discovery of new, that is to say, hitherto unknown truth. 3. The solution of practical problems, such as cases of adulteration, medico-legal questions, the examination of fibres, etc. In the first and second of these classes of work, even the cheaper forms of the microscope may be made to do good service; the third class is one which, from its importance and from the immediate and serious nature of the personal relations involved, should never be attempted by any but experts, and not even then unless by means of the very best instruments that can be procured.

By cheap microscopes we mean all those that are furnished with what are known as ordinary French objectives. Such microscopes are frequently fitted up in expensive cases, with finely finished brass stands, mechanical stages, and a long list of accessories, but although they are thus made to cost much money, they must nevertheless be classed with cheap microscopes, so far as good work is concerned.

For the encouragement of the young microscopist, we may state that many of the most important discoveries in botany and physiology have been made with microscopes of very ordinary power. The existence of the so-called globules in the blood; the minute anatomy of most parts of the body, and many of the more important animalcules and minute vegetable forms were discovered by means of microscopes of a quality inferior to many that can now be obtained for ten dollars, and even yet there is an abundance of valuable work to be done which does not demand instruments of great magnifying or resolving power.

So also in the study of any of the ordinary subjects to which the microscope is applicable. While the very highest powers and the very best instruments are necessary to enable us to see many of the most important features in animal and vegetable physiology, it is equally true that a power of 100 to 200 diameters will open up to us a very wide field from which we would otherwise be entirely excluded. To refuse to study the structure of ordinary animal and vegetable tissues because we cannot see the minute markings on some of the more difficult diatoms, would be the height of folly, and because we cannot see the forms of the more minute *Bacteria* is no reason why we should not examine the larger animalcules and microscopic vegetables.

At the same time we must caution those who employ cheap microscopes against attempting to go beyond the power of their instruments. As soon as a certain limit is passed, there is great room for the exercise of the imagination, so much so that a celebrated microscopist, who had been in the habit of using these inferior instruments, said that with a power of 600 diameters we may see whatever we want to see—meaning

thereby that with such powers the imagination had more to do with the results than had actual observation. Great caution is therefore necessary, for it is only when using low and medium powers that any reliance can be placed upon the results obtained, provided we do not use the very highest quality of objectives. But, as we have previously remarked, there is a great deal of useful work that may be performed by means of cheap microscopes, and as the great difficulty in the way of those who have had no experience, and who yet would like to employ their microscopes to some useful purpose, is that that they do not know what to do, we propose to offer, in a short series of articles, a few suggestions on this point.

(To be continued.)

How to Study with the Microscope.

BY JOHN PHIN.

MANY persons, when they first come into possession of a microscope, are at a loss how to make a beginning in the art of using it. Now, in attempting to learn the use of any instrument it is necessary to acquire not only a general knowledge of the best methods of handling it, but practical skill in the manipulations connected with it. Every scientific worker is thoroughly impressed with this fact. Half a century ago, when Faraday published his "Chemical Manipulations," a work which has never been excelled as a specimen of the practical teacher's art, he was not content with giving mere general directions for the performance of the ordinary operations required at the hands of every chemist, but at the end of his book he gave a course of specific experiments and operations, to be performed as a mere matter of exercise, hoping in this way to insure on the part of the student a complete and thorough learning of the *art* of chemistry. So, too, Dr. Beale, even in the first edition of his book, "How to Work with the Microscope," gives a series of tables of operations to be performed by those who would acquire expertness in the use of the microscope, and the fact that the same series of tables (enlarged and improved) finds a place in the last edition of his work, shows that he regards such a course of exercises as of great value. Those who pick up a few points of microscopical manipulation at random never feel that confidence which is to be attained by going carefully over a complete course of practical operations. When anything occurs which is a little out of the usual course they feel lost, and have to refer to books and friends. whereby much valuable time is wasted. Feeling that it was perfectly safe to follow in the footsteps of Faraday and Beale, the writer intended to have added to his "Practical Hints on the Selection and Use of the Microscope" a series of tables of a similar kind, but adapted to the use of beginners, and not confined wholly to the wants of medical students. Circumstances which it is unnecessary to explain, prevented the completion of these tables in time, and it is now proposed to present them in a series of articles in the AMERICAN JOURNAL OF MICROSCOPY, the numbers of which, containing these articles, will be sent to every purchaser of the book in question who will take the trouble to send his address. And we may add that in order to render these articles intelligible to those readers of the JOURNAL that do not happen to have that work, it will be necessary to expand these directions so as to include much that may be already found in the book itself. This being the case, before giving directions for performing the practical manipulations themselves a few preliminary hints may not be out of place.

In learning to use the microscope, or, indeed any other instrument, the first requisite is self-possession. To secure this we must either employ very simple instruments or have considerable skill, and the latter is the very thing in which the reader is supposed to be deficient. Therefore too much stress cannot be laid upon the use of very simple and substantial instruments by those who are beginning the study of the subject. Low powers also should always be used at first—the one-inch objective of Eng-

lish and American makers, or the No. 1 of common French objectives being preferred.

In attempting to acquire facility in any particular manipulation, it will always be found advisable to stick to it until the necessary skill is attained, and not proceed to the next operation with the intention of returning to the first after a time. Thus, if the student is attempting to get an equable and clear light over a large field of view, he should not go at the operation in a haphazard sort of way, but should study each step carefully, endeavor to find out the cause of each difficulty, and then look earnestly for the proper remedy. In the case just mentioned, try to find out the cause of a cloudy or spotted condition of the field of view; try what effect changing the position of the mirror, altering the distance of the lamp, etc., will have, and see that each point is so impressed on the mind that when similar difficulties occur they may occasion no trouble.

In our next we will give directions for making a beginning in the *art* of microscopy.

To be continued.

Eye-Pieces versus Objectives.

TO every one who has worked with the microscope at all, it is familiar knowledge that the magnifying power of the instrument depends upon a combination of three things: 1. The focal length of the objective. 2. The magnifying power of the eye-piece. 3. The distance between these two;—in other words upon the length of the body. In one of the oldest forms of the microscope, every change of magnifying power was effected by varying the length of the body; in later forms the different powers were obtained entirely by the use of objectives of different focal lengths—the objectives employed being lenses of the simplest construction, and costing very little, so that the expense of procuring a full set was but a trifle. Afterwards the objectives were made with greater care, and when this became the rule most microscope makers obtained their higher powers almost wholly by the use of eye-pieces, of which some seven or eight were frequently furnished. This, however, was before the recent great improvements in the construction of the achromatic objective, and so wretched was the performance of microscopes of this type, even with eye-pieces of moderate depth, that it led Raspail to condemn the compound microscope altogether, and most of the best scientists discarded all eye-pieces except the very lowest. Even so late as 1849, twenty years after the publication of Lister's investigations and improvements, Schleiden, the great German botanist, maintained that 280 to 300 diameters was all the amplification that could be obtained by the objective, all beyond this being effected with the eye-piece, and with an almost total loss of light and clearness of definition.

Now although these views were undoubtedly correct at one time, yet at the present day, when objectives are made so perfect that the images formed by them will bear magnifying without any sensible deterioration, they are entirely erroneous and tend to retard the progress of microscopical science. And yet they infest our literature to a wonderful extent. Thus Dr. Danforth, in a recent article in the Chicago *Medical Journal*, says: "It is very common to have two eye-pieces, Nos. 1 and 2, or the A and B eye-piece, the latter possessing a higher magnifying power than the former; but I am persuaded that very little is gained by high eye-pieces. The eye-piece can only magnify the magnified image, and this can only be accomplished at the expense of definition and clearness." Schleiden's expressions over again!

To us it seems that Dr. Danforth, in laying down any such rule as this, entirely misapprehends the principles which should govern us in the selection and arrangement of our apparatus. That there are certain limits to the depth of the eye-piece that may be used, is undoubtedly true, but the man who confines himself entirely to the use of eye-pieces of low power, and tubes of short length, makes a great sacrifice as

regards the convenience and efficiency of his instrument. Moreover, that a certain amount of magnifying power, apart from resolving power or clearness of definition, is absolutely necessary, every microscopist knows. Dr. Beale, one of the ablest of living microscopists, has illustrated this very fully in the last edition of his book, "How to Work with the Microscope." Many objects of deep interest to the modern student can be seen only with a power of 1,800 to 3,000 diameters. Now Mr. Brooke, President of the Royal Microscopical Society, in his work on Natural Philosophy, tells us that with the A eye-piece it is necessary to employ a 1-25th objective in order to get a magnifying power of 1,250 diameters. And every one knows that both on account of its great cost and the difficulty of working with it, the 1-25th is beyond the reach of most students. Those who try it, however, will find that with a slightly greater length of tube and a C eye-piece, the tenth will give a magnifying power of 2,000 diameters, and the images will be clear and sharp.

Dr. Danforth advises the selection of the inch and the one-fourth objectives, and, of course, the A eye-piece. With these the highest power is a little over 200 diameters. With such a magnifying power there are many physiological objects which cannot be seen distinctly, however well they may be defined, simply because they are not large enough. If, however, the fourth be a good one it may be made to bear a magnifying power of 500 diameters without any loss of clearness or deficiency of light, and this involves the use of the C eye-piece, which may be obtained for $3 or $4, while a tenth objective, giving 500 with the A eye-piece, would cost $30.

Every reason that can be urged against the B eye-piece may be urged against the A eye-piece as well, and the result that we arrive at is that reached by Raspail, that *no* compound microscope is trustworthy. Even Dr. Danforth would hardly maintain this.

Instead, therefore, of laying down an arbitrary rule, we would suggest that in their selection of eye-pieces, students should be guided by the quality of the objectives used. If the objective be well corrected, and the eye-piece a good one, the image as magnified by the B eye-piece will show no defects, and the D, or even the E eye-piece, will give satisfactory results. All good English and American lenses are tested and corrected under very high eye-pieces—eye-pieces which would range as high as G or H in the regular series—and consequently when they are used with eye-pieces C or D they give almost perfect results. The tenth, with a tube of regular length and the A eye-piece, gives a magnifying power of 500 diameters; with a somewhat longer tube and a D eye-piece, we have obtained from it a magnifying power of 4,000 diameters, and then the images were clear, distinct and free from spherical distortion.

It is proper to state here that the terms A, B, C, etc., as applied to eye-pieces are very indefinite. No two makers give them precisely the same values. In the standard given by Brooke, the inch objective magnifies 37 diameters with the A eye-piece, 60 with the B, 105 with the C, 170 with the D, and 225 with the E, and these are nearly the values of the eye-pieces of the best makers. With good objectives we find that the C eye-piece gives very pleasant and satisfactory results, and therefore where two eye-pieces are used we would prefer the A and C eye-pieces to any others. French objectives do not bear so well such an increase of amplification, but even those of medium quality work well (comparatively) under the B eye-piece, and we would recommend that.

Instead of using deep eye-pieces, Dr. Beale employs very long tubes—two feet long in some instances. Except in skilful hands, however, such long tubes are very awkward, and they interfere with the corrections of the objective. We prefer a compromise, and increase moderately both the depth of the eye-piece and the length of the tube. J. P.

—We can never surprise Nature in a corner; never find the end of a thread; never tell where to set the first stone.—*Emerson's Essays.*

THE AMERICAN

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AND

POPULAR SCIENCE.

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To our Readers.

IN the interesting article which appears on our first page the reader will find: 1, a hint towards obtaining a beautiful object for his cabinet; 2, a good deal of pleasant information of a practical kind; and, 3, a very good *raison d'etre* for the present undertaking.

To extend, as widely as possible, the usefulness of the AMERICAN JOURNAL OF MICROSCOPY, we propose to adopt a feature which has proved such a marked success in the case of *Science Gossip*, viz., to afford to our subscribers an opportunity to exchange with each other interesting objects of natural history of all kinds. That this system may prove a success, it will be necessary to adhere strictly to the following rules: 1. The privilege of announcing an exchange must be confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines.

In accordance with these rules if any of our subscribers happen to have a surplus of some interesting microscopic material (or objects in any department of natural science) which they are willing to exchange for anythiny else of a similar kind, they can announce it, without charge in the pages of this journal.

Our Hopes and Aims.

IT is a generally recognized fact that the microscope is daily gaining ground in public favor. Thousands of persons, in every part of the country, own instruments and take pleasure in using them, and for purposes of general instruction, in almost every case, access is easily had to standard books, of which so many excellent ones have been published. But it is well known that a regular visitor in the shape of a journal is calculated to sustain a much deeper and more lively interest than can possibly be excited by any book. Just as the living teacher has more power to interest and instruct than any printed page whatever, so a journal has more power than a text-book; it has a closer and more immediate influence, and seems to be more nearly like a personal friend. In addition to this, a book is, in a measure, fixed and stereotyped, while the periodical is progressive—reflecting the latest news and giving information of the most recent discoveries. Therefore books can never entirely fill the place of periodiodicals; and we believe that there is a sufficient number of persons interested in the microscope to sustain a periodical devoted entirely to that subject.

It is true that several unsuccessful attempts have been made to establish a microscopical journal in this country, but the cause of failure was in every case obvious and sufficient. Some of these journals were edited without the necessary ability to command respect, and were devoted almost entirely to advertising certain worthless instruments; the only one that we can now call to mind as being edited by really scientific men—*The Lens*—undoubtedly failed because it never was properly *published*. Hundreds of persons deeply interested in microscopy never even heard of its existence.

Whether the present venture is to share the fate of its predecessors or not remains to be seen. Unless we are greatly deceived the times are ripe for the publication of just such a journal as that which we propose

to issue. The character of the work will, of course, be best gathered from an examination of a few numbers, but we may here state that while our chief object shall be to make it so simple and practical that every owner of a microscope will find it to his advantage to take it, at the same time we shall endeavor to give such an accurate and condensed view of the progress of microscopy that all intelligent microscopists will find something of value in its pages.

Uncalled For.

IN a valuable paper contributed by him to the September number of the Chicago *Medical Journal*, Prof. Danforth uses the following language: "As a general rule, the first thing in order is the purchase of a microscope; and it is also quite true to say that, as a general rule, the purchaser gets cheated." Now against this we most emphatically protest. Dr. Danforth, we feel assured, did not weigh the full meaning of his words. What he evidently meant, judging by the subsequent passages, is that the student rarely succeeds in making a judicious selection, and this is quite true, but it does not arise from any moral obliquity on the part of the dealer, but from ignorance on the part of the student—ignorance as to what he really wants. As Dr. Danforth says, "The uninstructed purchaser asks at once of a given microscope, 'how many diameters does it magnify?' whereas diameters are about the cheapest, as well as the most useless quality in connection with a microscope." Now it will be found in nine cases out of ten that untaught students *insist* upon "diameters," and care for very little else. They want diameters and want them cheaply. They assume the responsibility, and the dealer has no recourse but to let them have what they want. That there are buyers and sellers of microscopes who will cheat cannot be denied, but all our well-known makers are men of high honor, and from them the student may rely upon getting not only a fair equivalent for his money, but judicious advice where there is a desire to accept it.

That the above accusation arose from carelessness and not direct intention, is evident from other passages in the article. No thoughtful man would say that magnifying power is the "most useless quality in connection with a microscope," or that, with good lenses, amplification by means of the eye-piece "can only be accomplished at the expense of definition and clearness." These are extreme ways of "putting things," as the country parson would say, and lead to absolute error of statement. Carelessness is also shown in speaking of the concave mirror as "parabolic." The mirrors attached to all microscopes by our best makers are spherical. Care in statement and moderation in expression may detract from the energy and sprightliness of an article, but they add greatly to its real value.

Imperfections of the Human Eye.

Prof. McLeod, in lecturing on this subject, spoke of the chromaticity of the eye, and said there was abundant evidence of the defects of the organ in this respect. For instance, to short sighted persons the moon appears to have a blue fringe. In using the spectroscope the red and blue ends of the spectrum cannot be seen with equal distinctness without adjusting the focussing glass. A black patch of paper on a blue ground appears to have a fringed edge if viewed from even a short distance; while a black patch on a red ground, when observed under similar conditions, has a perfectly distinct margin. Professor McLeod then explained that the overlapping of images in the eye produces the mental impression that there is no want of achromatism. It is interesting to note that Wollaston considered that the colored bands of the spectrum were really divided by the black (Fraunhofer) lines, and his statement that the red of the spectrum does not appear to have a boundary line "because the eye is not competent to converge the red rays properly," shows that he had very nearly, if not quite, discovered the achromatic defects of the eye. Dr. Young ascribes to Wollaston the merit of having observed that when a luminous point is viewed through a prism, the blue appears to be wider than the red, the eye being incapable of recognizing that the spectrum has the same width throughout its entire

length. An experiment was exhibited to show the relative distinctness of a dark line on grounds of various colors. A string or wire was so arranged that its shadow traversed the entire length of the spectrum, which was thrown on a screen by an electric lamp. When viewed from a short distance the edges of the shadow appeared to be sharp at the red end, but gradually became less distinct, until at the blue end nothing but a blurred line remained.

Young Folks' Column.

How a Bee Stings.

It is probable that most of our readers have at some time or other been stung by a bee or wasp, and have wondered at the ease with which the insect inflicted the wound, and at the excruciating pain produced by such an insignificant looking weapon, for the sting of the honey-bee is so small that it is just clearly visible to the naked eye. The pain, of course, is due chiefly to the poison, but the instrument by which this poison is injected is wonderful in its construction and mode of action.

As will be seen from the engraving, the bee's sting consists of three parts, a sheath and two lancets. The sheath is not a *tube*, that is, it is not made like the scabbard of a sword, but is open all along one edge, just as if a narrow strip of paper had been folded down the middle, the two halves lying against each other and forming an open sheath. In this sheath lie the lancets which can thus be moved out of it sideways, and be drawn back and completely covered by a very slight movement lengthwise, while in order to pull a sword from an ordinary scabbord it must be drawn out its whole length. As we shall see hereafter this is a most important point.

The lancets are furnished with very sharp points, and they are also provided with a row of teeth or barbs, set with the point backwards, so that if these lancets be once inserted in the flesh of any animal, it will be impossible to draw them out, unless by some very ingenious device contrived specially for this end. Each lancet is also furnished with a distinct set of muscles capable of drawing it back and forth with great force, and these muscles seem to act spasmodically, so that even after being removed from the body of the insect, the sting continues to sink into the body of the animal that is attacked. The mode by which these muscles cause the lancets to penetrate is very curious. At first sight it would seem impossible that such a light insect could force the sting into the flesh. It is not done by pressure, however, but by a peculiar and very curious mode of action. Having carefully watched a bee during the act of stinging the following seems to be the process. The point of the sting, which is exceedingly sharp, enters the flesh sufficiently to imbed the lancets beyond the first barb. An exceedingly rapid quivering now occurs—so rapid that the eye cannot follow it, and the sheath and lancets quickly sink into the flesh. The mode in which the lancets operate to effect this is obviously by an alternate "push and pull"—the barbs preventing the lancets from

STING OF HONEY BEE.

being drawn out, but offering no resistance to their sinking in. At each pull, therefore, one lancet remains fixed, and acts as a fulcrum for the other lancet which is being pushed, and is thus driven in surely and quickly. The action of the muscles is then reversed; the lancet that was previously pushed is now pulled, and serves as a fulcrum whereby the other lancet may be driven in. Two or three repetitions of this process are all that is required to insert the sting as deeply as is ever necessary. Meantime a constant stream of poison is poured into the wound, and the pain speedily becomes most intense.

Bees are provided with a sting solely for the purpose of guarding their hives from plun-

derers. Unless when rendered irritable by disease, they never volunteer an attack, but when the hive is annoyed, it becomes important that the intruder be driven away instantly, and to secure this the punishment must be sudden and sharp. If this end be attained, the death of one or two laborers is a matter of little consequence, and, with the honey bee at least, the act of stinging is in general fatal to the insect, since it almost always leaves its sting in the wound—the sting and poison sac being usually torn from the body, and this mutilation almost always causing death. It is a general impression that the bee *always* loses its sting after using it, but this is not the case. If allowed plenty of time it can withdraw the sting and fly off, its mode of retracting the barbed lancets being very simple, but very effectual. Each lancet is, at its upper end, provided with a curious projection which serves partly as a guide in the sheath and partly as a pivot or fulcrum on which it may be tilted as one tilts a lever. The first action of the muscles is to tilt the lancets so as to lift their points out of the sheath, but when the bee wishes to withdraw the sting, and has time to do it, the lancets are tilted in the opposite way, so as to bring the points down and into the sheath, and if this tilting movement is given during the "push," the barbs of the lancet will be freed from all entanglement and safely lodged in the sheath which is perfectly smooth and easily withdrawn. It is probable, however, that the barbed lancets can be retracted only after the poison bag has been emptied of its contents, so that if the bee be driven away before this occurs the poison bag and sting are left in the wound and continue to act.

And now a word as to remedies and antidotes. Onions, ammonia, ashes, beef, and a hundred other remedies have been prescribed, but we never found them of any special value. If the poison bag has not been emptied, remove it with a sharp knife, or still better with a pair of tweezers so formed as to grasp the sting itself, without pressing on the bag. Common hair tweezers are just the thing. This must, however, be done *very* quickly, or it will be of no use. Grasping the bag and sting with the fingers only squeezes the poison out of the bag and into the wound. After the bag has been removed suck the wound strongly and apply a poultice of moist mud. We have never found anything better.

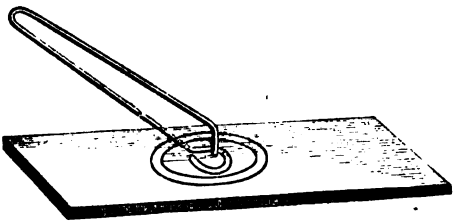
Our Work Table.

Cover Forceps.—Dr. Fletcher has conferred a benefit upon microscopists by devising the very ingenious forceps of which we give an engraving. In their natural condition these forceps remain closed, and are opened by pressing on the blades midway between the upper end and the first bend. This enables us to hold a thin glass cover without any effort, and place it in position on the slide, after which, by pressing on the blades, they open and

FLETCHER'S COVER FORCEPS.

allow the cover to slip out. If the cover should stick to the forceps in the slightest degree, it may be prevented from moving while the instrument is being withdrawn by inserting a common pin in the slit seen in the nose of the forceps. Altogether the instrument is very perfect in its operation, and is a great convenience on the work-table. Every microscopist knows how awkward it is to pick up a cover and place it in position by means of the common straight forceps, which have to be held so that the upper end lies close down to the slide.

Spring-Clip.—The contrivances that have been devised for retaining the thin cover in place while the balsam or cement which attaches it to the slide hardens, are almost innumerable. The oldest appliance was a leaden bullet, flattened on one side and used as a weight; then the spring clothes-peg came into use, but neither of these devices gave satisfaction. Complicated spring-clips were then



SPRING-CLIP.

invented and answered well, but were troublesome to make. Every book on the microscope describes several different forms of these necessary implements. The simplest, and, we think, the most convenient in use is shown in the accompanying engraving. It is simply a wire bent into a ring at one

end, doubled on itself, and having the other end bent at right angles, so as to come opposite the ring. The ring goes under the slide, and the point rests on the cover—a piece of cork being interposed if the latter should be very thin. This clip, instead of being made to open by pressure, as is the case with most others, is opened as follows: Take hold of the upper arm of the clip, as seen in the figure, place the ring under the slide as far as the end of the wire will allow, and raise the upper arm. Then slide the clip forward until the point is over the desired spot. The operation is more easily performed than described. The microscopist can easily make these clips himself, and it is well to have an assortment made of wire of different degrees of strength. For the engraving we are indebted to "How to Use the Microscope," noticed in another column.

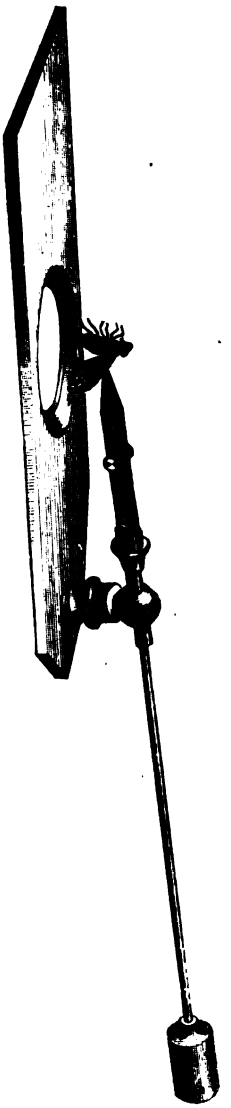
Selection of Slides.—In working upon new or unfamiliar subjects, it is absolutely necessary that all extraneous objects which might prove sources of fallacy should be excluded. Scratches and pits in the surface of the slide serve frequently to cause difficulty. The more easily to detect these, rub the slide *very gently* with the finest plumbago, or with lamp-black made by yourself from a candle, and consequently known to be free from grit. The plumbago or the lamp-black may be moistened with a little alcohol. Even the most delicate pits and scratches retain a sufficient amount of coloring matter to be brought out clearly by a low power objective with a large field of view. It is, of course, necessary to examine only the central portion of each slide.

Oil for Lamps.—The *English Mechanic* gives the following recipe for an oil which is said to be highly illuminating, though the kind of lamp in which it is used is not stated:

"Pound in a mortar 2 ounces of camphor, slightly moistened with alcohol; add a pint of sperm oil, and stir till dissolved. Light the wick, after being thoroughly soaked, and let it burn for a few minutes; then blow out and re-trim with exactness, in order to secure an even, smokeless flame, which can be better done after the wick has been slightly charred."

Sperm oil, burned in the old-fashioned argand lamp, gives probably as pure a light as any for microscopic purposes. We use the student's lamp with good heavy kerosene. Those who find it difficult to obtain a good light might try the above.

Forceps Carrier.—Unless a microscope is furnished with a mechanical stage or the glass stage invented by Mr. Zentmayer and adopted by Nachet and others, the stage forceps is not easily adjusted in position under the objective. The device shown in the accompanying figure removes all difficulty of this kind. A slide of wood, metal or vulcanite has a central hole large enough to allow the passage of abundance of light, and at one end a second hole which is of the exact size required to receive and hold firmly the pin of the ordinary stage forceps. The forceps being attached by its pin to the slide instead of to the stage, as has hitherto been usual, the object is brought nearly over the centre of the



CARRIER FOR STAGE FORCEPS.

hole, and the slide is placed on the stage and adjusted in the same way as any other slide. In the examination of whole insects, unmounted minerals, and similar opaque objects, this device is invaluable to common microscopes.—*Condensed from The Technologist.*

Preservation of Organic Matters for Microscopical Examination.—After trying in vain by other means to transmit morbid pathological specimens by mail in hot weather, Dr. Richardson, of Philadelphia, has found that acetate of potash effects the object perfectly. Tube-casts have been sent by mail in a condition fit for microscopical examination by pouring a fluid drachm of sediment into a two-drachm vial containing the solid acetate. The liquid portion of the specimen disappears, so that the vial can be safely sent by mail to any distance without fear of leakage, and the condition in which the material will be found at the end of a journey of even weeks in hot weather is highly satisfactory. For tumors, etc., Dr. Richardson recommends the following process: Place a small fragment of any tumor or pathological structure, say a quarter to half an inch square and one-tenth of an inch thick, in a couple of drachms of saturated solution of acetate of potash, (made by pouring half an ounce of rain water upon one ounce of dry granular acetate of potash in a clear bottle), and allow it to soak for forty-eight hours. When the tissue has thus been fully saturated with the salt, remove it, allow it to drain, wrap it in several folds of india-rubber or oiled silk, and tie the ends of the package with strong thread. Thus prepared, specimens may be sent by mail in an ordinary envelope for thousands of miles without danger of decomposition, owing to the preservative power of the acetate, or of desiccation, owing to its deliquescent nature. Unlike glycerine, alcohol, etc., the acetate has no effect upon oil-globules contained in cells. Hence we are enabled to recognize fatty degeneration in the cellular elements of a tumor, or in the kidneys, from the minute oil drops in the epithelium attached to the tube-casts of Bright's disease under circumstances where specimens preserved in glycerine or alcohol would afford a doubtful or wholly negative result.

As this plan does not answer well with deposits composed of acetate of lime or triple phosphates, Dr. R. recommends the preservation of the latter by adding 20 to 30 per cent of carbolic acid to the fluid containing them.—*Condensed from Cincinnati Medical News.*

Amphipleura Pellucida.—Professor Morley, of Hudson, Ohio, has recently measured the strie of this well-known test object, and finds that there are 92,600 to the inch. This is about twice as close as the lines on the *P. Angulatum*. At an evening meeting of the Royal Microscopical Society of London, some months ago, the lines on the Amphipleura were resolved with a quarter-inch objective, made by Messrs. Powell & Lealand, of London. The same feat was, however, previously accomplished by Tolles, of Boston, the objective—a quarter-inch—being now in possession of Mr. Noe, of Elizabeth, N. J.

Preparing Sections of Coal.—Dr. Johnston, of Baltimore, gives the following directions, which we reprint from the *Medical News:* 1. Macerate suitable pieces, ¼ or ½ inch thick, in liquor potassa until they swell and soften. 2. Soak for a few hours in pure water and drain. 3. Macerate in nitric acid until the color changes from black to brown. 4. Soak for a few hours in water and drain. 5. Put aside in alcohol for a day or two. If for future use let the pieces remain in alcohol. 6. Fasten in a cutter with paraffine and make sections. 7. Place in absolute alcohol. 8. Transfer to oil of cloves. 9. Mount in balsam and set aside with a small weight on cover—having, before the mounting, attached the label.

Voracity of the Pickerel.—The rapid growth and extraordinary voracity of the pickerel are well shown by Dr. Sturtevant in the report of the Massachusetts Inland Fisheries Commissioners. The doctor investigated their powers of eating in the following manner: He put two young pickerel, five inches long, in a trough with a great quantity of little minnows about one inch in length; and these two pickerel ate 128 minnows the first day, 132 the second, and 150 the third, and they increased one inch in forty-eight hours! They were mere machines for the assimilation of other organisms, and may truly be termed the wolf of the waters.

Our Book Table.

A Handbook of Medical Microscopy. By Joseph G. Richardson, M. D. Philadelphia: J. B. Lippincott & Co.

Almost every physician either possesses a microscope or desires to procure one, some being impelled in this direction because it is the fashion, while others are urged by a true sense of the value and importance of this instrument. Now it is a truth well known to all who have any acquaintance with the subject that in the hands of the ignorant and the inexpert the microscope may prove almost as dangerous as a powerful drug. While it has fallen to our lot to know many physicians to whom the microscope is a most efficient and truth-telling assistant, we have known others who, either from inability to use the instrument, or from the employment of worthless lenses, have been entirely misled by its supposed indications. Hence the importance of a volume like the present which shall, in small compass, give precise and accurate information as to what may be seen, and also as to the import of what is seen. In these busy days ponderous manuals are out of the question; information, to be available, must be condensed, and such a volume as this handbook is a rich boon to the practicing physician, who has no time to study optical theories, and therefore seeks direct practical instruction.

Of the 305 pages of which this book consists, less than 60 are devoted to the construction of the microscope and the mechanical methods essential to its use. The rest of the work covers, and covers well, the ground occupied by the examination of all the liquids and solids of pathological importance—the directions for preparing and examining them, and for making a diagnosis of the disease, being full and clear. Dr. Richardson's handbook is, we believe, the only work of moderate size which embodies the modern knowledge of this subject, and it should be the companion of every physician that aims to make good use of his microscope.

Practical Hints on the Selection and Use of the Microscope. Intended for Beginners. By John Phin, editor of *The Technologist*. Price 75 cents. New York: Industrial Publication Company.

The chief features of this book seem to be simplicity and directness. There are no mathematical formulæ—nothing in short that a beginner in microscopy cannot understand. At the same time the directions for choosing and using the microscope, as well as for collecting, preparing, examining and mounting objects, seem to be as complete as the limits of the work will allow. It cannot fail to prove of value to those who are commencing the study of microscopy, and even to some who have made considerable progress in using the instrument. The following extract from the introduction to this work deserves attention: "Thousands of microscopes throughout the country are at the present day lying idle, simply because their owners do not know how to use them. If properly employed they might be made to afford an incalculable amount of instruction and amusement; but as it is they are a drag upon the popularization of science, because they convey the idea that the microscope is a difficult instrument to use and that it is not of much account after we have learned to use it."

The only way to remedy this state of things is by the diffusion of sound information in regard to all that relates to the microscope.

Recent Books and Articles.

"Text-Book of Botany, Morphological and Physiological." By Julius Sachs. Translated and annotated by A. W. Bennet and W. Thistleton Dyer. 450 woodcuts. $12.50. Macmillan & Co.

"British Wild-Flowers, considered in Relation to Insects." By Sir John Lubbock. $1.50. Macmillan & Co.

"Insectivorous Plants." By Darwin. Illustrated. $2. D. Appleton & Co.

"First Book of Zoology." By Edward S. Morse, Ph. D. Illustrated. $1.25. D. Appleton & Co.

"Insects of the Field." By E. S. Packard, Jr. 25 cents. Estes & Lauriat.

"Life History of the Monads." By Dollinger and Drysdale. (M. Microscopical Journal.) The last of this important series appeared in May of this year.

"Life Histories of the Protozoa." By A. S. Packard, Jr. (The Naturalist, several numbers.)

"Microscopic Examination of Air." (Quarterly Journal Mic. Science.)

"Actinophrys Sol." By James Fullager. (Science Gossip, May.)

"The Genus Arachnoidiscus." By Fred Kitton. (Science Gossip, June.)

"The Development of Hydra Vulgaris." By James Fullager. (Science Gossip, July.)

"Histology of Dental Tissues." By H. S. Chase. (Cincinnati Medical News, July.)

"Animal Phosphoresence." (Popular Science Monthly, August.)

"Ergot." W. Carruthers. (Jour. Royal Ag. Society and Am. Naturalist.)

"Bacteria." L. A. Stimson, M. D. (New York Med. Journal, August.)

"Photographic Enlargements of Microscopic Objects." By Carl Seiler, M. D. (Med. Times.)

"Silica Films and the Structure of Diatoms." By G. W. Morehouse. (Cincinnati Med. News, August.)

"The Microscope in Daily Practice." By I. N. Danforth, M. D. (Chicago Medical Journal, September.)

"Pasteur on Fermentation." (Popular Science Monthly, October.)

NOTES AND QUERIES.

I see that in your prospectus you offer to give information in answer to inquiries sent to you. I enclose my subscription, and would like very much if you would tell me how to avoid the following difficulty: I have mounted various specimens of pollen, etc., in deep cells and sealed them up tightly with cement, but they soon get covered with mould. Preservative solutions, etc., destroy the specimens; how can I prevent the mould from forming?

Dry your specimens thoroughly. If heat injures them, enclose them under a glass cover with a ground edge, first placing beneath them a small pan of sulphuric acid or quicklime. If thoroughly dried no fungus or mould will appear.

I have an objective which, with the stand and eye-piece that I have, magnifies about 150 diameters. There is no number or mark on the objective by which I can tell whether it is a half-inch glass, a quarter-inch, or what it is. How can I find out?

The easiest way is to attach to the body an objective of which the focal value is known, and after finding out how much it magnifies, calculate the focal length of the lens in question. Thus, suppose an object-glass which is known to have a focal length of a quarter of an inch, gives a magnifying power of 450 when used with your stand and eye-piece, then the objective which you now possess must evidently have a focal length of about three-quarters of an inch, for 150 : 450 : : ¼ : ¾.

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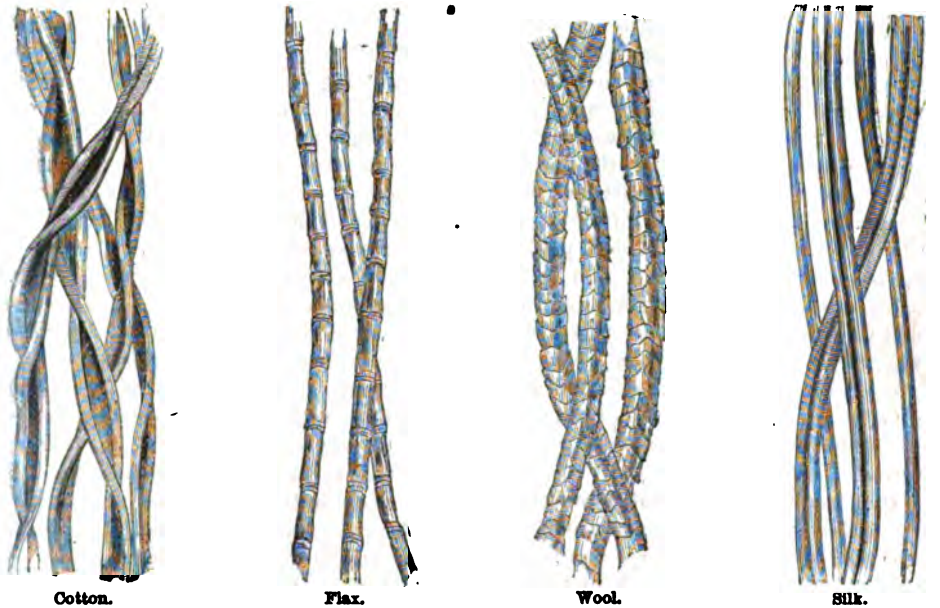
VOL I. NEW YORK, JANUARY, 1876. No. 2.

Our Textile Fibres.

THE textile fibres in common use are wool, silk, cotton and flax—two being animal and two vegetable. An intimate knowledge of the structure of these fibres is of value to the microscopist in several ways. Owing to the fact that they are in use almost everywhere, minute fragments are apt to find their way into substances submitted to examination, and it is of the greatest consequence that the microscopist should be able instantly to recognize them, and so avoid being misled by supposing that they are part of the structure or material which he is investigating. A second reason is that from the very general use of these fibres and the great difference in their prices, manufacturers have been led to substitute one for the other, and to adulterate the more expensive kinds with those of less value, and as the microscope affords a



Cotton. Flax. Wool. Silk.

TEXTILE FIBRES.

instantaneous means of detecting all such sophistications, its utility in this direction is obvious. Not long ago a friend of the writer was offered some flannel which purported to be all wool. The only thing that gave rise to a suspicion of the honesty of this claim was the very low price at which the goods were offered. In *appearance* they were all-wool flannel. One minute's use of the microscope, however, showed that the fabric was half cotton.

A third direction in which a knowledge of the structure of textile fibres is of great use is in deciding as to the feasibility of new processes of manufacture. Cotton, wool, flax and silk all require different modes of treatment, and a process which is not fully adapted to the special fibre in hand will fail. This fact was very fully shown some years ago by the failure of the many attempts then made to convert flax into a fibre which could be treated like cotton. When the late war broke out and our supply of cotton was in a great measure cut off, these schemes were revived, and hundreds of thousands of dollars were wasted in the vain attempt to "cottonize" flax, and this, too, in the face of the most earnest protests from microscopists and others. To prevent a useless waste of effort, those who had investigated the subject published the result of their researches, and this probably had some effect in moderating the extent to which speculation in this direction was carried. We have now before us a pamphlet on flax culture, published at that time, and to which, with this object in view, the writer contributed a paper on the structure of these fibres.

It is an unfortunate fact, however, that the wildest theories of adventurous speculators will frequently carry more weight than sober statements of fact by those who have familiarized themselves with the subject. A notable instance of this occurred not long ago in a neighboring city. A French adventurer introduced himself to some silk manufacturers as one who had discovered a method of changing flax fibre into veritable silk, and in support of his claims he exhibited a small bunch of fibre which he claimed to have so changed. Now a ten dollar fee would have secured from any competent microscopist a complete exposure of the absolute falsehood of his claims, but the persons whom he approached, bankers and manufacturers, grudged this slight expenditure, although they were willing to invest, and did invest, nearly $30,000 in furnishing means to carry out the process. It is unnecessary to say that the whole thing was a swindle; the pretended change from flax to silk was a mere juggle, like that of the Keely motor, and the fibre which was submitted to the examination of experts was *real silk*, made by the silk worm!

Pages of this journal might be filled with illustrations of the general facts which we have presented. Indeed by some they may be deemed too obvious and commonplace to deserve attention from any except the merest tyros, but the fact that in such a recent and authoritative work as Wagner's "Handbook of Chemical Technology,"* we are told (page 343) that "the old method of testing the presence of cotton in linen was by placing it under a powerful microscope, but chemical analysis presents more reliable methods" (!!)—makes it too obvious that a knowledge of the service which the microscope can render in this direction is not by any means too generally diffused. The engravings on the preceding page give a somewhat exaggerated representation of the distinctive features of the four fibres we have mentioned. It is not always, perhaps, that every fibre will have its special characteristics so very strongly marked, but it is obvious that the differences which exist are so very clear and decided that no difficulty whatever can arise in any case. In order to appreciate fully the characteristic features of each fibre, it is necessary to understand its structure and mode of origin, and these points we shall give in a series of articles.

**Handbook of Chemical Technology.* By Rudolf Wagner, Ph. D., Professor of Chemical Technology at the University of Wurtzburg. Translated and Edited from the Eighth German Edition, with Extensive Additions by William Crookes, F. R. S. New York: D. Appleton & Co., 1872.

Learning to Use the Microscope.

(*Continued from page 4*).

AS we now pass from a consideration of general principles to the practical application of special rules, our subject changes from the broad one—"How to study with the Microscope," to one with narrower limits, and hereafter we shall confine ourselves strictly to simple directions for "learning to use the microscope."

The first thing to learn is, the general construction of the instrument. Before attempting to look at anything or even to arrange the microscope for use, study up the mechanical arrangement of its different parts, the mode in which they act and the functions they perform. The following are the chief items, and if you cannot make them out yourself, get either the optician from whom you procured the instrument, or some intelligent friend to explain them to you. To begin with, then, we have the body with its eye-piece, tube and objective, and first of all notice the mode in which this body is moved for adjusting the focus. In some microscopes the body is moved directly by hand and slides within a second tube like the draw of a telescope; in others it is moved by rack and pinion or by a chain. A very smooth, pleasant and delicate movement consists of a pin securely attached to the body, and working in a spiral groove or slot in the outer tube. In the better class of microscopes there are two movements, a coarse and a fine. Examine them carefully, learn to work them steadily, gently, and to the precise point required, remembering that unless the art of doing this skilfully is acquired, you will never obtain a fair view of anything, except perhaps broken objects, and cracked objectives, and these you will be able to see with the naked eye.

Next, observe the mode in which the mirror moves, so as to throw the light on the object. The axis for inclination, and all other points, will also demand careful observation.

Proceed now to examine some very simple, ready-mounted, transparent object, with a low power. A fly's wing, or a slide which is pretty freely covered with scales from a butterfly's wing, are as good as any. Beware of attempting to examine some common and unprepared object, for the probabilities are that you will fail to see it, and that you will seriously injure your instrument. We have known more than one microscope to be spoilt by attempts to examine "a common pebble" or some such thing. Having placed your microscope in front of a window by day, or before a lamp by night, you may sit either facing the light or sideways to it. Sideways is probably the best, but the beginner will find it easier to arrange his apparatus while directly facing the light. The eyes, however, should be thoroughly shaded from all light except that which passes through the microscope, and this may be effected for night work by a properly constructed lamp shade, while for daylight an opaque curtain, cutting off all light except that which falls on the mirror may be used. Heavy paper which costs little, and is easily pinned up and taken down, answers well.

The art of turning the mirror so that the light shall fall on the object is easily acquired. The best plan is to watch where the rays from the mirror fall on the under side of the stage, and then guide them on to the object. The final adjustment is best made by looking through the microscope and turning the mirror in the proper direction, as found by trial. Having obtained a full and equable circle of light, the next thing is to bring the object into focus. To do this, move the body of the microscope until the objective is within a very short distance of the object, and while doing this look at the objective and the slide and see that they do not come into contact. Then look through the microscope and move the body up and away from the object until the latter comes into focus. All danger of injuring objective and object will thus be avoided.

To give elaborate directions for the performance of these operations would be to write a large volume. We merely intend to point out to beginners the successive steps which they should take, and urge them very strongly to practice faithfully all these manipulations *for their own sake.*

THE AMERICAN

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AND

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Where We Stand.

IT was with considerable diffidence that we sent forth our first number. So many previous efforts in this direction had failed, and the tastes and wants that were to be supplied were so diverse, that we felt there was cause for doubt as to the success of our effort. Microscopists are divided by such well-marked lines into special classes, that a work which is invaluable to one may be almost worthless to others. Thus the medical man has, in his microscopic studies, but little in common with the student of natural history; and neither of these two important classes have many wants in common with that large and increasing class of owners of microscopes who use their instruments chiefly for purposes of amusement and general instruction. Therefore, a periodical which appeals specially to any one class, must to a great extent ignore the others. As stated in our first issue, our chief object is to supply the wants of amateurs, rather than of professional microscopists, and in our attempts to do this we seem to have attained success, as the numerous clubs and single subscriptions which we have received, testify. THE AMERICAN JOURNAL OF MICROSCOPY now goes to every English speaking country, and we have already a list of subscribers in England, of which older journals might well be proud. At the same time, we have received numerous subscriptions from medical men and naturalists, who have encouraged us by saying that they find at least enough in our journal to repay them for reading it.

It is not to be supposed that the success of which we speak can compare with that of many literary periodicals, but it has far exceeded our expectations, and is such as to assure the permanence of the undertaking. Much yet remains to be done to bring it up to the standard of excellence which we have set for ourselves, and even on a periodical of the small size of the present one, a good deal of labor is required before the proper arrangements necessary to its usefulness can be completed. While, therefore, we propose to be chary of promises, we do not hesitate to express the hope that ere the close of the first volume, very marked improvement will be noticeable.

To those friends, and they are not few, who have so kindly and freely given, us not only a verbal expression of their good wishes, but the substantial assistance of their active efforts, we would take this opportunity to return our thanks. The only other return we can make is to redouble our efforts to increase the usefulness of THE AMERICAN JOURNAL OF MICROSCOPY.

Moeller's Test-Plate. (Probe-Platte.)

THE markings on various species of diatoms have long formed a favorite test of the resolving power of objectives, and it is probable that they will continue to be favorites for many years to come. Until Möller brought out his test-plate (Probe-Platte) it was necessary for the microscopist to be provided with quite a number of slides, each carrying a special diatom, but now a series of twenty different species are placed on one slide. The diatoms on most of these slides are very clean and perfect, and are placed in the best position for observation, and since the observer always examines the same frustule, as tests for examining objectives, these plates are not only very convenient, but they give unusually trustworthy results. We append a list of the

MÖLLER'S TEST PLATE. (PROBE-PLATTE.)

	Direction of Striæ.	Striæ in 1-1000 of an inch — Smith.	Sollitt.	Morley.	Others.
1. Triceratium Favus, Ehrbg		..	.....	3.7	4–5
2. Pinnularia nobilis, Ehrbg	Transverse.	..	.....	18.	10–20
3. Navicula Lyra, Ehrbg. var	Transverse.	..	.....	16	16–17
4. Navicula Lyra, Ehrbg	Transverse.	..	...	24.5	24–25
5. Pinnularia interrupta, Sm. var	Transverse.	..	.....	26	.....
6. Stauroneis Phoenicenteron, Ehrbg		..	.....	34.5	.....
7. Grammatophora marina, Sm	Transverse.	..	....	38.4	62
8. Pleurosigma balticum, Sm	Transverse.	38	40–20	33.1	.....
9. Pleurosigma acuminatum (Kg.) Grun	Transverse.	..	.....	46.4	.....
10. Nitzschia Amphioxys, Sm		..	.....	49.2	. ...
11. Pleurosigma angulatum, Sm	Diagonal.	52	51–46	47.	.....
12. Grammatophora oceanica, Ehrbg (= G. subtilissima.)	Transverse.	..	.....	61.6	80
13. Surirella Gemma, Ehrbg. (Transverse lines.)		..	...	58.5	.....
14. Nitzschia sigmoida, Sm	Transverse.	85	.....	62	75
15. Pleurosigma Faciola, Sm. var	Transverse.	64	90–50	58	.....
16. Surirella Gemma, Ehrbg. (Longitudinal lines.)		..	.....	67	80
17. Cymatopleuro elliptica, Bréb		..	.....	63	.....
18. Navicula crassinervis, Bréb (= Frustulia Saxonica, Rabh.)		..	.....	86.2	85
19. Nitzschia curvula, Sm		..	.....	90	.....
20. Amphipleura pellucida (= Navicula Acus.)	Transverse.	.	130–120	95.2	95

diatoms chosen by M. Möller, and also the measurements of the distances at which the markings are apart. The measurements by Smith and Sollitt were not taken from the Probe-Platte, but from specimens of the same species mounted separately. They are introduced here to show the range of variations to which the markings on these diatoms are subject. Most of those in the last column were made from a Probe-Platte.

The most extended and accurate measurements are those by Prof. Morley of Hudson, Ohio. The values given in the table are the average of several measurements of each frustule.

It is well to note that mere distance apart is not the only point in which these markings vary. The fineness or delicacy of the markings has frequently quite as much to do with the difficulty of their resolution, as have the spaces which separate them. We have found frustules which were very difficult to resolve, and which on measurement showed that the lines were quite as far apart as lines which were much more easily resolved; the difficulty was due wholly to the fineness of the lines themselves, not to their mere closeness. This is a point which does not seem to have attracted the attention which it deserves, and unfortunately, it is a feature which does not readily admit of very accurate quantitative expression.

Correspondence.

Eye-pieces and Objectives.

Ed. Am. Jour. of Microscopy.—I find the following in your Dec. number, page 5: "It is proper to state here that the terms A, B, C, etc, as applied to eye-pieces, are very indefinite. No two makers give them precisely the same value." This is a great annoyance to users of the microscope. Even your remarks do not tell the whole story, for while most of the English and American makers distinguish their eye-pieces alphabetically, some English and all the French and German makers, number theirs 1, 2, 3, etc., a plan utterly unmeaning, and the numbers used by one maker have no correspondence with those of any other.

This system, or rather want of system, caused the Microscopical section of the

American Association for the Advancement of Science, at their meeting in Troy, in 1870, to recommend all makers to adopt a uniform nomenclature, and to name their eye-pieces by the focus 2 inch, 1 inch, etc. This suggestion was acted on by Tolles, and he is the only maker (to my knowledge) who has done so. With this nomenclature every purchaser can tell *approximately*, what every combination of lenses that he has *ought* to magnify at 10 inches distance. Example: With a ¼ inch objective and 1 inch eye-piece, what is the power? There are 40 quarters in 10 inches = 40 diameters. The eye-piece 1 inch is 10 diameters. $10 \times 40 = 400$ times. So with a 4-10 objective there are 25 times 4-10 in 10 inches with 1 inch eye-piece=250 times; with 2 inch eye-piece, $5 \times 25 = 125$ times. The advantage of this nomenclature is so great that every purchaser should insist on his eye-piece being made and named correctly.

But besides the indefiniteness of the nomenclature, there is a manifest error in the tables of magnifying powers that accompany most microscopes. For example, I have before me a table by Hartnack, (which by the bye does not agree at all with the table accompanying one of his microscopes). The table gives

	E. P. No. 1	No. 3
Objective No. 2.....	25	45 diam.
Objective No. 4...	60	90 "

Here it will be seen that No. 3 eye-piece almost doubles the power of No. 1 with No. 2 objective, while with No. 4 objective, it produces only 50 per cent more power, a result absolutely impossible. Similar discrepancies will be found in the tables of most of the French, German and English makers. One of Hartnack's tables gave the power at 25 c. m. distance,=nearly 10 inches, while the utmost length that could be obtained with the instrument was only 8 inches. Taking the erroneous tables of powers, the erroneous nomenclature of objectives, sometimes much shorter focus, and sometimes longer than the truth, a subject that has been pretty well ventilated in the periodicals three or four years ago, purchasers cannot rely on the stated powers of instruments, as they are usually offered for sale by "shopticians." Even so well known a firm as R. & J. Beck give in their lists 4-10 objectives of two different powers!

CARL REDDOTS.

Volvox Globator.

Ed. Am. Jour. of Microscopy.—Christmas day I took a short walk and carried with me a small pail, in which I brought back some water which I dipped up, through a hole in the ice, from the bottom of a small pool. I had very little idea as to the nature of my "dip," but I took it home, poured it into two glass jars, and after an hour or so proceeded to examine it. What was my surprise to find that the edges of the jars next the light, were crowded with volvoces! I know that desmids and other plants always seek the light, but I have had water abundantly supplied with the volvox globator, and never before observed the same phenomena to anything like the extent presented on this occasion. The following is probably the explanation: The volvox had sunk to the bottom of the pool, as was evident from the fact that a bottle of water taken from the surface, just beneath the ice, contained none. At the bottom the temperature was probably nearly 39° Fah., but light would be almost entirely absent. When brought into an atmosphere of 65° Fah., the activity of the volvox would be at once greatly increased, and owing to the recent previous deprivation of light, an intense want for this agent would be felt. Hence the eagerness with which the plants would, under such circumstances, make for even the light of a lamp.

Being desirous of keeping a few of them for future examination, and having formerly had very poor luck with such attempts, I took special pains this time. I scalded two bottles thoroughly, and partially filled them with boiled water. When quite cold I placed a dozen volvoces in one bottle, taking them up with as little of the original fluid as possible. After an hour or two I transferred them, one by one, from the first bottle to the second, where they are now probably alone, and are thus far doing well. I examined each one carefully, when first caught,

and what was my astonishment to find several with rotifers in their interior, the rotifers being apparently very busy making a meal. That the inhabitants of these volvoces were rotifers, there can be no doubt. Carpenter describes the presence of amœbæ in the volvox and explains it by stating that the endochrome-mass of one of the ordinary cells has assumed this condition. The phenomena which I have just seen certainly cannot be thus explained, and I feel puzzled to know how the rotifer got inside the volvox, while the latter appears to be unbroken and continues to swim about in the usual manner, carrying the strange "entozoon" with it. That the rotifer is inside, is easily shown by focussing down through the volvox. First we see the upper surface of the volvox, then the rotifer, and lastly the under surface of the globe. I think you will agree with me that the subject is an interesting one.

PATERSON, N. J. N. N.

Food for Fish

Ed. Am. Jour. of Microscopy.—An article on pickerel in your first number makes me think that the following facts may not be uninteresting. Some time ago, I made up a few small aquaria for microscopic purposes, the vessels holding about a quart each. One in which I had placed a few cyclops and daphnias happened to be left unnoticed for several weeks and at the end of that time it was literally alive with these minute crustaceans. I was about to throw the contents of the vessel away, when it occurred to me to place three small fishes in it, each about an inch long, which I happened to have. I did so, and in twelve hours all the cyclops and water-fleas were gone—eaten up by the fishes whose aldermanic rotundity showed that they had had a good time.

One of the great difficulties in the way of fish culture is the providing of cheap food for them. It is not impossible that if the best conditions for their rapid growth were fully understood, entomostraca of the kinds mentioned, as well as of other species, would prove a very economical source of fish-food. They are said to be largely vegetable feeders, and they breed so rapidly that there is practically no limit to the numbers that may be produced. Jurine tells us that a single female cyclops may in one year be the progenitor of 4,442,189,120 descendants! Now as most fish are carnivorous, the great problem is to convert the cheapest form of vegetable matter into a supply of animal food for their use. I feel confident that when properly studied, the entomostraca will furnish the means of doing this.

Carpenter, in his work on the microscope, says that "most entomostraca are killed by severe cold, and thus the whole race of adults perish every winter." I have found cyclops and water fleas in water taken from beneath ice two feet thick. The recent cold weather has failed to destroy them in many small pools which have been very thoroughly frozen. C. N. D.

NEWARK, N. J.

Mud-Wasps or Clay-Daubers.

These insects do not form organized communities, and therefore have no neuters or workers, but each female works for herself. Neither does she feed her young as do bees and other wasps, but provides appropriate food in abundance, and leaves them to themselves. But the mode of building her cells and supplying the appropriate food exhibits a marvelous wisdom. She gathers wet clay in pellets about the size of a duck-shot and commences to build. Going and coming from her clay-quarry to her work, with great patience, industry and skill, she builds two or three cells side by side, two or three inches long and about half an inch in diameter. When finished she proceeds to fill them with food. For this purpose she attacks all varieties of spiders, stings them, plunging her sting with the greatest precision directly into the principal nerve-ganglion, and, after laying an egg in the body of each, carries them off and packs them away in the cells, until these are completely full, then seals them with clay and leaves them. In due time the eggs are hatched, the larvæ feed upon the spiders, until they become perfect insects, and cut their way out of the cells.

Observe, then, first, the walls of the cells must be thin and composed of porous materials, otherwise the eggs could not hatch, nor

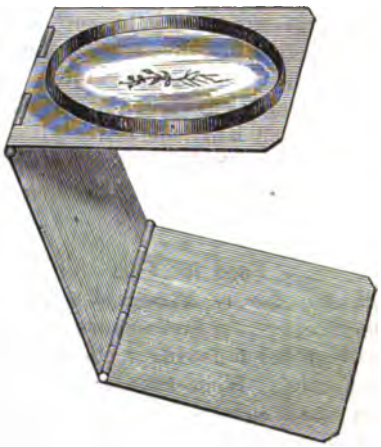
the larvæ continue to live, for want of oxygen; second, the spiders must be helpless but not dead. If they were dead they would decompose or else dry up before they could be used as food. If, on the other hand, they were alive and active, they would destroy each other, and the contained eggs, and perhaps escape from the cell. But the poison is so adjusted as to quantity, and probably as to the place of insertion, as to produce a state of complete helplessness, a deep and permanent coma: the spiders are as it were chloroformed by the poison. If touched or irritated, they move only enough to show that they are not dead. As a boy I have many times watched these wasps gathering their materials, building their cells, gathering their food-supply of spiders. I have many times broken open their finished cells and found them full of spiders in the condition described. If one desires to study spiders, he can gather more varieties in one day, by breaking open the cells of mud-wasps, than in a year in any other way.—*Popular Science Monthly.*

Restoration of Life after Freezing.

A friend residing in Baltimore had in his possession a small alligator, which had been sent him from Florida; its habitation was a tub partially filled with water, kept out doors. During one of the cold snaps of the past winter, in the night the water became completely frozen, imprisoning the reptile in the ice, with but a small portion of his body protruding therefrom. To all appearances the animal was as dead as one of the stuffed specimens seen in a museum collection. The want of time precluding an effort for its extrication in the morning, it was allowed to remain frozen, and was soon forgotten in the maze of the cares of the day. For forty-eight hours the reptile thus remained frozen and lifeless, at the end of which time, on being thawed out, vitality became visible, and in a short time it was as animated as ever, with no evidence of having in the least suffered by the prolonged frigorific confinement. Here is an instance in which the vital spark seems not to have been extinguished by the freezing, nor the animal's organism to have been mutilated, but that vitality merely remained torpid or dormant during the freezing, and ready to respond to its functions whenever the animal's organism returned to its normal condition.—*Exchange.*

Our Work Table.

Watch-glass Holder for Field Use.—Various attempts have been made to furnish microscopists with a convenient instrument which might be used to hold liquids submitted to microscopical examination in the field. Bottles, prisms with concavities in their sides, zoophyte troughs, animalcule cages, etc., have all been tried and found wanting. They are expensive, or they require to be held up against the sky, or they do not hold sufficient liquid: to every one there is a serious objection. The little instrument shown in the cut, folds into very small com-



WATCH-GLASS HOLDER FOR FIELD USE.

pass, it holds a liberal supply of liquid, provides for perfect illumination while held below the level of the eye, it is easily kept clean and is very cheap. Three pieces of good bright tin are hinged together, and in the upper one is cut a hole just large enough to receive a watch-glass. A ring of metal of proper height forms a perfect protection to the glass when the instrument is carried in the pocket. The lower slip of tin may be turned in any direction so as to reflect upwards the bright light from a cloud, and all the joints are made stiff enough to remain in position when once adjusted. When held in a watch glass arranged in this manner, the entire liquid of a considerable "dip" may be completely and thoroughly examined.

Preserving Fungi.—Mr. J. H. Martin recommends placing them in a solution of 1 part of chloride of calcium in 10 parts of water, This will change the phosphates in the fungus into phosphate of lime, after which it will be found to keep well.

Cover-Forceps.—Those who possess the very ingenious cover-forceps of Dr. Fletcher, described in a previous issue of this journal, can desire nothing better, but the very simple device which is shown in the accompanying illustration will be found extremely convenient, as it can be made by any one, and is very efficient. A pair of common brass forceps are bent *on the flat* as shown in the figure, only more so. Both points are then cut off to the same length, and the lower one is filed away to a sharp chisel edge. The chief difference between these forceps and those of Dr. Fletcher is, that they remain open, while his close with a spring. In practice this is found to be no objection, but if it be desired to make these forceps so that they will close with a spring

COVER-FORCEPS.

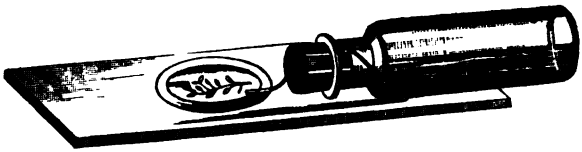
and open by pressure, it is easy to apply to them the same device that is used in blowpipe forceps. Our readers will remember that forceps of this kind are opened by pressing upon two pins, each pin passing through one blade, and being screwed into the opposite blade. An advantage arising from this is, that after the cover has been cleaned, both forceps and cover may be laid on the table without incurring any risk of soiling the thin glass. Instead of the slit and pin for steadying the cover during the removal of the forceps, there is provided a forked wire which straddles the nose of the instrument. The latter device might be used with the Fletcher forceps, and would greatly simplify the construction of the latter.

Growing Slides.—In studying the life-history of any minute animal or vegetable, a growing slide may be considered a necessity. The simplest kinds in use are probably the following: 1. A common slide with a concave centre. After the object has been introduced, the cavity is covered with a large square of glass, which is kept in its place by a simple wire-clip, made so as not to interfere with the field of view, and the slide is set up on end in a tumbler filled with pure water to such a height that the lower edge of the thin square shall be fully covered. If the tumbler be fully three inches deep, the top may be covered with paper so as to exclude the dust perfectly. This idea, which was suggested by the slide of Mr. Beck, we have frequently used with success. It necessitates the removal of the slide from its supply of water during examination, however. 2. The form of slide, which is shown in the accompanying figure, is almost as simple and is more efficient. A small bottle is cemented to one end of a glass slide by means of marine glue or even good tough sealing wax. The slide has a cavity which is covered with a piece of thin glass, or a regular tube-cell may be used. A soft thread which passes underneath the cover and is also carried into the bottle through a notch in the cork, keeps up a constant supply of liquid.

In using these growing slides we find that success depends very much upon the regulation of the light. The clear glass is apt to admit too much light. The most natural condition seems to be when laid upon a piece of dark-colored cloth and placed in diffused light.

Microscopic Examination of the muscular tissues of a wild boar lately shot in the forests of Saxony, showed it to be full of trichinæ. We believe that this is the first case in which this parasite has been found in the wild boar, it having hitherto been the general belief that only domesticated swine were affected.

Useless Extravagance.—Messrs. R. & J. Beck, of London, have recently constructed one of their best microscopes in solid silver, and we understand the order is from an American microscopist. It is provided with a complete set of apparatus, also in silver, and is said to be the most costly instrument ever made. As silver is one of the worst metals that could possibly be chosen for the purpose, the owner shows bad judgment as well as bad taste, and it is safe to predict that he will never do any really valuable work with it. The maker's price for this microscope was £500, and adding to this



GROWING SLIDE.

the duty, exchange, premium on gold, etc., it is no exaggeration to place the ultimate cost at $5,000. This sum, judiciously applied, might have done good service in advancing the cause of microscopy in this country, whereas, as now expended, it can only serve to make us ridiculous in the eyes of every sensible microscopist in Europe.

How a Swarm of Bees is Suspended.—The sight of a swarm of bees suspended from the branch of a tree, and so heavy sometimes as to bend it, is a surprising one, and the observer naturally asks how so great a weight can be supported, without apparent fatigue, by the few scores of bees that are fixed to the inferior surface of the branch. Dr. Bourgeois (in *Les Mondes*), with a supreme disregard of the facts in the case, gives the following answer: "The weight which can be supported by means of a vacuum (of which the sucker on a bee's foot affords an example) is 1 kilogramme 30 grammes per square centimetre. Now the sucker of a bee's foot, magnified 60 diameters, represents a surface of more than a centimetre. Each bee having six feet, it will therefore be possible for 10 bees to support the weight of 1 kilogramme. Thus, the phenomenon in question may be accounted for." This solution of the question has gone the rounds of the scientific press without a contradiction, except from the Boston *Journal of Chemistry*, which points out that in magnifying the bee's foot 60 diameters, the surface is magnified 3,600 times; so that, assuming the other elements of the computation to be correct, it would take 600 bees, instead of 10, to support a kilogramme, or about two and one-fifth pounds avoirdupois. But the strongest objection to the theory of M. Bourgeois is that the bee's foot has no suckers, popular writers to the contrary notwithstanding.

Fungi in Disease.—At a recent meeting of the Newark, N. J. Scientific Association, the President, Dr. Edwards, called the attention of the members to the connection of microscopic fungi with disease in animals and plants. In the discussion in regard to the connection of diphtheria with fungi, it was asserted that the parasitic fungus is always present in the diphtheritic membrane; although whether this was a cause or a simple accompaniment of the disease, was undecided. Dr. Edwards stated that whatever destroyed the fungus would cure the disease, and that he had secured very satisfactory results by the use of salicylic acid.

Our Book Table.

The Microscope and its Revelations. By William B. Carpenter, M. D., L.L.D., F. R. S., etc., etc. Fifth edition. Prepared with the assistance of H. J. Slack, F. G. S., Hon. Sec. to the Royal Microscopical Society. Illustrated with 25 plates, and 449 wood engravings. Price, $5.50. Philadelphia: Lindsay & Blakiston, 1875.

The works on the microscope which are now before the public may, without great impropriety, be divided into two very distinct classes—those devoted to medicine and histology, and those which chiefly discuss subjects connected with natural history. To the former class must be assigned the works of Beale, Frey, Richardson and a few others, while the latter category includes the Micrographic Dictionary, and the works of Pritchard, Carpenter, Hogg, Goose, Lankester, Wood, etc. The student who sets out to select a text book for his microscopic studies will make a great mistake if he ignores this distinction. To the medical student the volume before us cannot entirely take the place of the books by Beale and Frey, while the very able and useful works of the last mentioned authors would be almost useless in the hands of a beginner in the study of natural history.

As a text book of microscopy in its special relations to natural history and general science, the work before us stands confessedly first, and is alone sufficient to supply the wants of ordinary students. But in addition to this particular feature it will be found to present other important claims upon our attention. It gives unquestionably the most complete popular exposition of the structure and use of the microscope that can be found in the English language, so that even to those who take no interest in the latter half of the volume (that devoted to the "Revelations" of the microscope) the work is indispensable. No young microscopist should purchase even a working microscope without having first carefully studied the chapters on the construction of the instrument and especially upon the characteristics and tests for objectives.

Vision: Its Optical Defects and the Adaptation of Spectacles. Embracing, First—Physical optics. Second—Physiological optics. Third—Errors of Refraction and Defects of Accommodation, or Optical Defects of the Eye. With seventy-four illustrations on wood, and selections from the test types of Jaeger & Snellen. By C. S. Fenner, M. D. Philadelphia: Lindsay & Blakiston. (Price $3.50).

This work is evidently addressed quite as much to general as to professional readers. Its scope and contents are very fully set forth in the title, and the author has succeeded in giving an intelligible and accurate resumé of what is known on the different topics discussed. Severe criticism of the execution of this work would be out of place, from the fact that, shortly after it was commenced, the author, by an attack of retinal hemorrhage, was prevented from using his eyes either in original study or in reviewing what he had previously written.

It is not those alone who require spectacles, however, that will find it to their advantage to study the subject of which this book treats. The eye is a tool, and if we would use it to advantage we must study its defects, peculiarities, and the best methods of caring for it. Especially does this apply to those who use the microscope, for certainly to them it is quite as important that they should understand the action of the eye, as that they should be familiar with the principles upon which the microscope itself is constructed. Indeed it is now considered probable that many of the vexed questions which

have agitated the higher departments of microscopy will depend for their solution quite as much upon a more perfect knowledge of the physiology of vision, as upon an extension of our familiarity with mere optical principles. Those who desire an easily followed guide in this direction will find it in the work before us.

The American Naturalist. A popular Illustrated Magazine of Natural History. Boston: H. O. Houghton & Co.

This sterling magazine changes hands with the January number, and will hereafter be published by Messrs Houghton & Co., of Boston, the well known publishers of the *Atlantic Monthly*. We regard this change as a most fortunate one. The well known business energy and skill of the new publishers will insure the wide distribution of the *Naturalist*, and will consequently greatly extend its influence and usefulness. The editorial staff remains the same, and the amount of matter will be greatly increased. The typograpical dress and illustrations, which have heretofore given character to this magazine, will be improved, and it will be of a more popular nature than before, so as to interest the general reader as well as the young naturalist. The latter half of the magazine will be entirely remodeled, and a department of geography and travel added. The department of Microscopy will be edited as heretofore by Dr. R. H. Ward, of Troy, N. Y. Arrangements have been made to report the proceedings of scientific societies with great promptness. A digest of the contents of foreign scientific journals and transactions will also be given each month, together with the latest home and foreign scientific news. On the whole the journal promises next year to be one of the most important agents in the science education of the people.

Recent Books and Articles.

"A Text-Book of Human Physiology." By Austin Flint, Jr. 8vo., 978 pp. Cloth, $6. D. Appleton & Co.

"Outlines of Practical Histology." By William Rutherford, M. D. 18mo., 72 pp. Interleaved for notes. $1.50. Lindsay & Blakiston.

"Elements of Zoology." A Text-Book. By Sanborn Tenney, A. M. Illustrated by 750 wood engravings. New York: Scribner, Armstrong & Co.

"Report on Trichinosis, as Observed in Dearborn, Ind., during 1874." George Sutton, M. D., Aurora, Ind. From Transactions of Indiana State Medical Society.

"The Nature of Light:" with a general account of Physical Optics. By. Dr. Eugene Lommel. London: H. S. King.

"The Work of the *Challenger*." Nature, Nov. 25th, 1875.

"Plants that eat Animals." Mrs. Mary Treat, in American Naturalist, December, 1875. (From New York Tribune, with considerable alterations.)

Literary Announcements.

"Guide to the Microscopical Examination of Drinking Water." By Macdonald. Lindsay & Blakiston.

"The By-Ways of Science." By Prof. R. A. Proctor. J. B. Lippincott & Co.

"Gilbert White's Natural History and Antiquities of Selborne." Edited with Notes by Frank Buckland. "A Chapter on Antiquities," by Lord Selborne, and "The Garden Kalendar." With original illustrations from drawings by Professor Delamotte, taken at Selborne; and from many interesting and curious objects supplied by the editor. Map and colored plate. MacMillan & Co. (This will undoubtedly be one of the most charming and notable books on natural history issued during the year.)

NOTES AND QUERIES.

"I have tried to use the stage of the Excelsior Microscope for holding water containing animalcules, but I have failed, for it leaks. A drop of water on a plain, or even a concave slide is too little. What shall I do?—E. M. B.

Take some varnish, such as copal or gold size, or very strong drying boiled oil, and with a small camel hair brush or pencil paint a fine line round the glass of the stage at its junction with the vulcanite. When dry it will be watertight. For examining, or rather watching the larger animalcules and some vegetable forms, however, we prefer a small watch glass. Get a flat glass (called by the watchmakers a *lunelle*), and you will find that the smallest size rests very nicely on the stage of the Excelsior Microscope. It is easily cleaned, which is a great advantage.

EXCHANGES.

To extend, as widely as possible, the usefulness of the AMERICAN JOURNAL OF MICROSCOPY, we propose to adopt a feature which has proved such a marked success in the case of *Science Gossip*, viz., to afford to our subscribers an opportunity to exchange with each other, interesting objects of natural history of all kinds. That this system may prove a success, it will be necessary to adhere strictly to the following rules: 1. The privilege of announcing an exchange must be confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines.

In accordance with these rules, if any of our subscriber happen to have a surplus of some interesting microscopic material (or objects in any department of natural science) which they are willing to exchange for anything else of a similar kind, they can announce it, without charge, in the pages of this journal.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Wanted in exchange for Vegetable Slides, other well mounted slides. Address F. F. Stanley, 40 Pearl street, Boston.

Publisher's Department.

A New Catalogue.—Mr. T. H. McAllister of this city has just issued a new and enlarged catalogue of his microscopes. In addition to mere price lists it contains a great deal of useful information given in a very simple and concise form.

Shaping Soft Rubber with a File.—Prof. Morton, of the Stevens Institute, states that he finds the ordinary thick sheet rubber, used in making up lantern tanks, and for many similar purposes, may be readily dressed into an exact shape with a file, if only it is supported by being clamped between plates of wood or metal in a vice. The file is used dry, and in all respects as in working on wood or metal.

Utility of Water-Weeds.—Mr. Mechi had a pond from which he took water for household purposes. Weeds grew rankly in it, and a friend advised him to procure a pair of swans and they would clear the pond of weeds. He did procure the swans and the weeds were eradicated; but then the water showed impurities and ceased to be fit for use. He removed the swans, and, as the weeds began to be abundant, the water became clear and pure.

The Naturalists' Advertiser.—Mr. S. E. Cassino, of the Naturalists' Agency, Salem, Mass., has commenced the publication of a small sheet devoted to the advertising of books and supplies for naturalists. Every practical naturalist will find it worth his while to send for a copy. The cost per year is ten cents.

Hard Words.—Readers who are not familiar with the terms used in natural history ought by all means to procure a copy of Webster's Unabridged Dictionary, which is very full and accurate in this department. One of the greatest mistakes that can be committed is to pass over an important word without a full appreciation of its meaning. Those who acquire the habit of so doing can never hope to attain to a sound and thorough knowledge of anything.

Staining Wood.—A fine stain can be imparted to furniture made of beech or pine in a very simple manner. Dissolve three ounces permanganate of potash and three ounces sulphate of magnesia in two quarts of hot water. Apply this to the surface of the wood with a brush, and repeat if necessary. The manganese salt is decomposed in contact with the fibre of the wood, and a fine, permanent stain is produced. If the objects are small, a more dilute bath can be prepared, and the wood immersed in it for one or five minutes, until it is thoroughly stained.

Harmonizing Colors.—The *Journal of Education* gives the following list of harmonizing colors, which will be found very useful in selecting wall decorations or colors for any purpose:—Red with green; blue with orange; yellow with violet; black with warm brown; violet with pale green; violet with light rose; deep blue with golden brown; chocolate with light blue; deep red with gray; maroon with warm green; deep blue with pink; chocolate with pea green; maroon with deep blue; claret with buff; black with warm green.

Maryland Agricultural College.—We learn from the *American Farmer* that for several years this institution has done the State no credit, nor even benefited, in the remotest degree, the agricultural classes. The reasons assigned are "shocking maladministration," and its diversion from the original object of its charter. It would be interesting to know how far the failure of the college is due to the operations of interested parties working ostensibly for the public good, but really for the advantage of their own pockets. One of the oldest agricultural colleges in the country was sacrificed to the selfishness and intrigue of a trustee whose reputation as a public-spirited man was in every body's mouth.

An Improved Method of Numbering Objectives.—Two methods have been hitherto in use for numbering objectives,—that is to say, for expressing their focal value. The custom adopted on the continent of Europe is to use an arbitrary series of letters or numbers, the different series adopted by various makers having entirely independent values. In England and in this country, the general practice is to state the focal value of the objectives in parts of an inch; thus a quarter-inch objective is supposed to be equivalent to a simple lens of one quarter of an inch focus. This is a very simple, obvious and accurate method provided the makers adhere strictly to it. But it frequently happens that a one-fourth is more nearly a fifth or sixth than a fourth. A celebrated so-called four-tenth is in reality more nearly a one-fourth, while a famous one-sixteenth of a well-known English firm is rated by our best microscopists as a one-twentieth. Mr. George Wale, whose objectives are deservedly attaining great favor, has adopted the system of marking his objectives and eye-pieces with their magnifying power, taken at the standard distance of ten inches. Thus a quarter is rated at 40 diameters and a twelfth at 120 diameters. Two important advantages result from this. In the first place the owner of the microscope is enabled to calculate accurately the exact magnifying power of every combination of the different parts of his instrument, and secondly, objectives may in this way be *accurately* rated, which is sometimes difficult, or rather inconvenient, on the other systems. Thus it would be awkward to assign to a lens magnifying 113 diameters, its exact focal value, but 113 diameters is not a very unmanageable number.

THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

VOL. I. NEW YORK, FEBRUARY, 1876. No. 3.

Work for Cheap Microscopes.

(*Continued from page 3.*)

WHILE it is true that even cheap microscopes may, in skilful hands, be applied to original research, it will be well for the beginner in microscopy to devote himself to following in the footsteps of others, rather than to attempting to stake out newer paths. In this way only can he acquire the necessary skill, and unless he has the good fortune to study under able teachers, it is only in this way that he can secure a check upon the accuracy of his operations. Thus, if the young worker should at the very outset endeavor to make a preparation of some new subject, it would be almost impossible for him to tell whether his method and processes gave correct results, simply because it would be impossible for him, with his slight experience, to tell whether or not the various operations were appropriate to the subject in hand, or whether they were accurately performed. But if he should take up some subject which has been fully displayed in good engravings by authors of repute, he has then a check upon all his work, and can at once test the accuracy of his results by the correspondence which exists between them and the standard which he is studying. After having attained a reasonable degree of expertness in the use of the instrument, that is to say, having learned how to arrange the light so as to bring out the best results, and to adjust the focus, so that the view will be clear and distinct, and having also acquired a certain degree of familiarity with all the movements connected with the microscope, the learner should pass at once to the art of demonstrating for himself the principal features of the subject he is studying. Preparations which have been purchased ready mounted are often invaluable, because it frequently happens that we cannot get the material wherewith to make them for ourselves; and they are also of great use to the beginner in his first efforts to use the instrument at all, but they are apt to cause the waste of a great deal of time. Some young people take out their microscopes, evening after evening, and look over a few slides without ever devoting to any one subject the careful study which can arise only from a thorough comparison of the same thing seen under different circumstances. Such mere looking at slides is a sheer squandering of time, and should be carefully avoided, and that the reader may more fully understand what we mean, and be enabled to appreciate the great importance of the point we are endeavoring to urge, we will give an example. Let us take one of the most simple and common of all objects—the scales on a butterfly's wing. Everybody has heard that the wing of the butterfly is covered with feathers or scales, and some persons have seen these scales under the microscope; but, as ordinarily shown, they convey no very clear idea either of their relation to the wing or of the wing itself. Suppose now that the young microscopist should set himself

to study the structure of a butterfly's wing, and the relation and function of the scales. No single preparation will suffice to give the information that is desired, and therefore it will be necessary for him not only to mount the scales separately, but to examine them as attached to the wing, and it will be found advisable to mount portions of the wing with the scales wholly or partially removed. Different shaped scales also will be found on different parts of the wing, and it will be well to put up such a series of preparations as will clearly show their distribution and arrangement. After having studied the form and distribution of the scales, the student may proceed to examine their physiological structure and relations, and for this purpose it will be necessary to collect the insects at several periods of their life-history. The old worn wings of insects that have approached the close of life, will fail to show points that may be easily detected in the butterfly that has just emerged from the chrysalis, and for some purposes it may be necessary to anticipate the time at which the insect assumes its final condition. When we get through, our cabinet may not be filled with a very *brilliant* collection of objects, but it will contain a very *interesting* one, and we will know a good deal about butterfly's wings and scales—a great deal more than those who have merely examined twenty or thirty dollars' worth of "splendid" objects.

SILK-WORM IN ITS VARIOUS STAGES.

Such work as is involved in the line of

study that we have sketched out, does not require a very expensive microscope. Objectives which will fail to show the lines on certain diatoms will be found to show a great many valuable points in physiology, and those who cannot obtain *first-class* lenses, may console themselves with the reflection that perhaps this very circumstance is a fortunate one, since they might otherwise be tempted to waste their time in seeing how well they could show the markings on diatoms and podura scales.

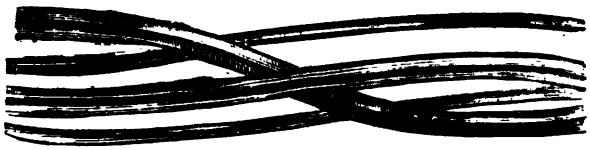
The method of working that we have indicated may be a very slow one, but by carefully studying one object in this manner, the student will acquire greater skill and more knowledge than he could obtain by years of mere desultory looking at things. It is recorded of one microscopist that during his investigations into the structure of the fly's foot, and the functions of its several parts, he made over two hundred preparations, each one illustrating some special point!

Silk as Seen Under the Microscope.

IN order to *see* any object under the microscope, it is necessary that we know something of what we are looking for, since nothing can be more certain than that the eye sees only that which it brings the power to see. In order, therefore, that we may see and understand the appearance presented by silk under the microscope, it is necessary that we learn something of the manner in which it is produced.

Every one has noticed the curious egg-shaped cocoons which at the close of autumn are to be found in every fence corner. These are the coverings spun and woven by common hairy caterpillars for themselves while they are lying in the torpid condition of pupa or chrysalis; and if we examine a small piece of one of these cocoons under the microscope it will be found to consist of delicate threads mixed with singular spiney hairs. These threads are a true silk, but for several reasons they cannot be used in the manufacture of clothing. Owing to the hairs with which they are entangled, they cannot be unwound, and they are neither so lustrous or so strong as to produce a beautiful or durable fabric. But to those who have no opportunity of examining the cocoons of the silk moth, they convey no bad idea of one stage in the production of silk.

The silk used in the arts is the product of several different kinds of moths, the chief of which is the *Bombyx mori* (literally *silk of mulberry*), so called because it feeds wholly on the leaves of the mulberry tree when it can



SILK FIBRE.

procure them. The moth itself, its eggs, the full-grown caterpillar, the pupa and the cocoon are shown in the engraving on the opposite page, it being understood, however, that the pupa is never naturally exposed as there shown, but is always within the cocoon.

The cycle of changes through which the insect passes are as follows: First we have the egg, which is about the size of a grain of mustard seed, and of which it takes 35,000 to weigh one ounce. These eggs are an article of commerce, and since the opening of a railroad across this continent, whole car-loads have been sent from China and Japan to Europe. When placed under proper conditions these eggs produce tiny worms, which, however, are most voracious feeders, and grow so rapidly that in a few weeks they attain a length of two and a half to three inches, and a weight of more than nine thousand times that which they had

at their birth! The worm is now ready to form a covering for itself before it assumes the condition of a pupa or chrysalis, and this covering consists of very fine threads, constructed as follows: The silk-worm has two reservoirs of a very fine gummy substance, secreted by the animal, and these reservoirs are connected with two ducts which open just beneath the jaw and are very minute. Through these ducts the two fibres of silk are drawn in a semi-fluid condition, hardening by exposure to air, and forming a double thread, as shown in the engraving on page 27. When reeled from the cocoon several of these double threads are combined into one, but the original structure of silk from the true silk-worm can almost always be resolved into that which we have described.

There are other sources of silk, that is, other caterpillars which produce a marketable article, and we do not know whether or not *all* of them present the same special characteristics. Silk has also been gathered from spiders, and at one time Prof. Wilder, of Cornell University, entered enthusiastically into the investigation of the silk-producing qualities of a spider which is found abundantly in South Carolina. Of late we have not heard much of spider's silk. The subject is an interesting one, and if any special information turns up in regard to it we will give it to our readers.

The Greensand and its Origin.

"* * * but whether it was mechanical abrasion or chemical solution that removed the foraminiferal shells, whose internal casts formed the greensand deposit of the Cretaceous epoch, must remain for the present an open question."—Dr. Carpenter "On the Nature of the Sea-bottom procured by H. M. S. *Challenger*." (*Ann. and Mag. of Nat. Hist.* vol. xv., No. 88, April 1875.)

THE author of the paper from which the above is extracted, proceeds on an assumption which I have met with repeatedly, and which is based on an oft-quoted statement made by the venerable Ehrenberg, in 1853, to the effect that the grains of Greensand are for the most part, if not entirely, internal casts of Foraminifera in mineral glauconite. Dr. Carpenter has no hesitation in accepting this statement as proved, and, as shown above, with no qualification whatever, nor, as far as appears, with any attempt at verification; thus giving the weight of his name to the assumption that Greensand is a rock made up of casts of Foraminifera. Now as it is not a fact that greensands of the Cretaceous epoch are always composed of foraminiferal casts, it is time that the statement of Ehrenberg, indorsed so unreservedly by Carpenter, should be challenged. Living in a district where the Greensand is well developed, I long since unsuccessfully attempted to discover the internal casts of which I was told it was composed. As far as Ireland is concerned this is not so. Foraminifera to the number of over 100 species abound in the overlying chalk, the specimens being most beautiful and perfect; but only one species recorded from the Greensand, which, however, is not a cast, but a calcareous shell. This itself is almost conclusive against the assumption that the glauconite grains are casts, as we can hardly suppose that amongst millions of shells none would escape destruction. Further, shells of Foraminifera do occur in the Cambridge Greensand, not mere casts, but perfect calcareous tests, having all the characteristic surface-ornamentation, and without any infilling of glauconite. The occurrence of these shells in the English Greensand does away with the notion that there was something in the waters of the Greensand seas that was destructive of calcareous shells. Dr. Carpenter also forgets that the Greensand yields us molluscan fossils in abundance, and that not in the condition of casts, but having their calcareous tests preserved, and showing the finest strise uncorroded. I have already stated that I was unable to find any foraminiferal casts in our Greensand, but, as my less-practiced eye might err, I requested my friend, Mr. Joseph Wright, F. G. S., to examine the material with the microscope, which he kindly consented to do, portions of the Irish Greensand, and also Greensand from Cambridge, passing under his scrutiny. I have every confidence in Mr. Wright's

judgment and acuteness, he having detected in the chalk rocks of Antrim, Down, and Derry, in the course of three years over which his examinations extended, more than 120 species of Foraminifera and Ostracoda, in addition to sponge spicula, and Bryozoa,* being about one-half the number examined by Ehrenberg himself from cretaceous rocks during a long series of years. Mr. Wright was equally unsuccessful as myself; the rounded angular grains are in most cases too large, and present no real resemblance to the many well-marked forms of Foraminifera.

The assumption that the Greensand is formed of casts of Foraminifera should be rejected for the following reasons:—

1st. Foraminiferal shells do occur plentifully and uninjured in the English Greensand; *ergo* there is no cause for assuming the wholesale destruction of calcareous shells in that epoch.

2nd. Calcareous tests of mollusca have remained; casts are rare in the Greensand.

3rd, and conclusive. The grains of glauconite in the Irish Greensand, when examined under the microscope, show no real resemblance to Foraminifera.

Whilst, for what seem good and sufficient reasons, coming to the conclusion above stated, I do not mean to assert that Ehrenberg stated anything but what was correct as regards the material he examined. Doubtless what he saw seemed to bear out his assertion; but hasty generalizations are the greatest fault of our times, and it is to be deprecated that erroneous statements should go forth under the sanction of high authorities in the scientific world. When one finds that Dr. Carpenter makes a false assumption in a matter that comes under our own observation, it is hard to avoid thinking that he may be equally in error regarding such a hazy question as Eozoon *versus* the mineral ophite. If any reader of *Science-Gossip* wishes to examine the subject for himself, I will be happy to send him some of our Greensand for that purpose.—*S. A. Stewart in Science Gossip.*

* *Vide* "Annual Report and Proceedings of the Belfast Naturalists' Field Club, 1873-4."

Counting the Blood Globules.

At a recent meeting of the Medical Society of London, Dr. H. Lawson exhibited M. Hayem's novel method of counting the blood-globules, the apparatus used being from the manufactory of M. Nachet, the celebrated optician of Paris. It was shown, by actual examation of a specimen of blood, that there were about 4,455,250 red globules in the space of a cubic millimetre; that is, in a cube whose edge is a little less than .04 of an inch, and its bulk about .0006 of a cubic inch. We will describe as briefly as possible the mode of conducting the examination.

On the stage of the microscope was an ordinary plain glass slide, on which was cemented a piece of thicker glass whose central part was removed. This space was exactly one fifth of a millimetre in height, and, when a covering glass was placed on it, contained a quantity of liquid whose depth was precisely one fifth of a millimetre. Then in the eyepiece of the microscope was a micrometer which was divided into sixteen squares, which in the aggregate were equivalent to one fifth of a millimetre squared. This furnished a measure by which on looking down through the microscope one could estimate the number of red globules in the cubic fifth of a millimetre. But the globules, if the blood had been undiluted, would have been infinitely too numerous to be counted. Therefore by another instrument exactly two cubic millimetres of blood were taken from a wound, and then, by another somewhat like it, but larger in size, half a cubic centimetre, or 500 cubic millimetres, of serum (which had been obtained from a dropsical patient) was taken up and mixed with the blood thoroughly. This liquid was placed on the prepared slide till it filled it exactly, when the cover was placed upon it. On then looking through the microscope it was quite easy to count the globules, which were found to be 142 in number. This multiplied by 125, to bring it to the cube, gave 17,750, which, multiplied by 251, or quarter of a centimetre plus 1, gave a total of 4,455,250. From this the number in a cubic inch can be readily calculated. It will be found to exceed *seven billions*, a number of which we can form no adequate conception.—*Boston Journal of Chemistry.*

—There are now 175 silk establishments in the United States in successful operation.

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S. E. CASSINO, Naturalists' Agency, Salem, Mass., has kindly consented to act as agent, and will receive subscriptions.

Science in the Court-Room.

AMONGST the numerous important services rendered by science to mankind, none are of greater value than the aid which it affords in the administration of justice. But while these services are inestimable, when derived from able and conscientious sources, the danger to be apprehended when an ignorant or venal pretender assumes the *role* of expert, is of the gravest kind. Some men seem willing to sacrifice everything in their eagerness to astonish the multitude with apparently wonderful exploits, and their highest ambition is not to attain to the serene pleasure which a consciousness of having aided the cause of justice inspires, but to dazzle the gaping crowd with accounts of what the great Professor So-and-So has done.

During the past few months we have had several instances in which science, and especially the microscope, has been called to answer questions, upon the replies to which depended a decision in regard to the guilt or innocence of persons charged with capital crimes. In some of these cases the work performed by the experts has been creditable to themselves and conclusive in the minds of those best fitted to form a correct judgment. Other cases have not been so satisfactory.

The latest case, and that in which the evidence was probably the most satisfactory, is that of Rubenstein, convicted of murdering his cousin, Sara Alexander, in a cornfield in the suburbs of Brooklyn. Here Prof. Eaton, a well known scientist, after a careful microscopical examination, found on the prisoner's boots: 1, mud or soil similar to that of the field in which the girl was murdered; 2, blood which *might* have been that of a human being; 3, fragments of corn husks; 4, woolen fibres similar to those of the murdered woman's shawl. An attempt was made to show that these evidences of crime might have been derived from other sources, but with only partial success. The corn husks might have been picked up in New York, but the soil certainly could not have been so obtained. To break the force of the evidence derived from the blood-stains, it was proved that chickens had been slaughtered near the residence of the accused, but, as every microscopist knows, this evidence, even though truthful, could not explain the presence of stains of *human* blood. The evidence afforded by the woolen fibres was of course only cumulative, and not decisive. So far as we can judge from the reports in the daily papers, no exception can be taken to the expert testimony in this case, nothing having been advanced which the microscope could not be made to decide infallibly.

Such has not been the case, however, in all the cases that have come under our notice. When a man swears positively not only that a particular hair has been derived from a given species of animal, but from a given *individual*, we are at a loss which to wonder at most—the superlative self-conceit of the witness, or his supreme indifference to the sanctity of an oath! So likewise when a witness swears positively that a certain stain has been made by human blood, and by no other kind, he must be either very ignorant or very wicked, or perhaps both.

Such witnesses and such testimony serve to bring discredit upon science and upon the evidence of the cautious, conscientious and experienced scientific expert, and it is

a serious question as to whether our present system of employing experts is not calculated to foster the race of charlatans, who are ever more ready to take the stand than is the truly scientific man.

A Valuable Contribution to Natural History.

EVERY student of the Diatomaceæ is well aware of the reputation of the late Dr. De Brebisson, of France, as one of the cultivators of this branch of science, and that he was one of the most voluminous contributors to the number of species and genera.

Prof. H. L. Smith (himself a master in this line) has secured at great cost the whole of the material which De Brebisson had collected during the last thirty-five or forty years, and is now preparing for sale, from the De Brebisson collection and his own cabinet, slides of species authentically named by De Brebisson or himself. This series of slides will contain many of Dr. De Brebisson's species, which can be obtained from no other source, and consequently will be invaluable for authenticating doubtful species.

They will be issued in series of one hundred slides each—each labeled with the name, sometimes with the synonyms, and often with references to the work and plate where originally figured. The first and second centuries have already been issued, and the third is nearly ready. The whole may require five or six hundred slides. We understand that Mr. Stodder, of Boston, will fill orders for these slides.

Correspondence.

Postal Micro-Cabinet Club.

Ed. Am. Jour. Microscopy.—Will you allow me, through the medium of your journal, to call the attention of other subscribers, and all interested in microscopy, to the American Postal Micro-cabinet Club?

The object of this club is to extend a knowledge of Microscopy, by the circulation and constant exchange of microscopic specimens among its members. It is established on a plan similar to the English club for the same purpose, and already counts within its ranks some of the most distinguished microscopists in this country.

Applicants for membership must either be recommended by members of the club, or else have had some previous knowledge and use of the microscope. The annual subscription is fifty cents. For a copy of rules, and other information, address Rev. A. B. Hervey, No. 10 North Second street, Troy, N. Y. I have been a member of this club for some months, and from experience can recommend it to any one who desires to increase his microscopical knowledge.

New Orleans, La. M. S. B.

An Optical Illusion.

St. Simon, in his famous "Memoires," describing the personal appearance of the twelfth Duke of Albuquerque, characterizes his hair as "coarse and *green*." The question here arises, was the duke's hair really of this color, or was St. Simon the subject of Daltonism, or the victim of an optical illusion? That the latter was in all probability the fact, is shown in a communication made to the Paris Academy of Sciences by the venerable M. Chevreul, "the oldest student in France." On the day when the Duke de St. Simon saw Albuquerque, the latter wore a *bullock's blood coat* of coarse cloth, with buttons of the same, and his hair hung down on his shoulders. "Now," says Chevreul, "if we take hairs of a certain color, and arrange them on a red ground in parallel lines, making a small ribbon of them, and place beside them exactly similar hairs on a white ground, the former relatively to the latter will appear green. If for white we substitute orange, the hairs on the red ground will assume a bluish tint; if violet, a yellow tint; if green, a ruddy tint; if blue an orange tint; and finally, if we substitute black for the white ground, the hairs on the red ground will become whitened. In short, if we look at a broad surface of one simple color, we see it and appreciate it *absolutely*.. If we see it in juxtaposition with another color, or still better, at the centre of a broad surface of another color, we see it relatively, and the sensation produced by it will be quite different."

Measurement of Velocity of Light.

Professor Cornu, of the Ecole Polytechnique, Paris, uses an instrument for the measurement of the velocity of light between stations of observation, depending on an electrical registering apparatus, the results with which are said to be more satisfactory than those obtained by Foucault's method. Foucault determined by his experiments whether light was diffused more rapidly in water than in air, and estimated its velocity in air at 185,157 miles a second. Professor Cornu's estimate, based on the data of his new instrument, is 186,660 miles a second. Fizeau's experiments with his toothed-wheel apparatus gave a velocity of 194,212 miles, and in English text-books the round figure 196,000 miles is commonly given.

Experiment with a Cock.

Place the bird upon a table or board, and, holding his wings down close to his sides, a second person must now bend down his head until his beak touches the board or table, and straight out from his beak draw a line of white chalk in front of him. This done, the person who has been holding the bird's wings may leave him straightway; he will not make the slightest effort to stir. Nay, further, you may clap your hands or shout close to him, without rousing him from his apparent lethargy, from which though, he will ultimately recover.—*Science Gossip.*

Our Work Table.

Improved Method of Examining Blood Stains by the Micro-Spectroscope.—Dr. Richardson, of Philadelphia, gives the following directions for examining blood-stains: Procure a glass slide with a circular excavation in the middle, and moisten the edges of the cavity with a small drop of diluted glycerine. Thoroughly clean a thin glass cover, about one-eighth of an inch larger than the excavation, lay it on white paper, and upon it place the tiniest visible fragment of a freshly dried blood-clot, which need not weigh more than the 25,000th of a grain. Then with a cataract needle deposit on the centre of the cover near the blood spot a speck of glycerine not larger than a full stop(.), and with a dry needle gently push the blood to the brink of the microscopic pond, so that it may be just moistened by the glycerine. Finally, insert the slide upon the thin glass cover in such a manner that the glycerine edges of the cavity in the former may adhere to the margin of the latter, and turning the slide face upwards, transfer it to the stage of the microscope.

By this method an extremely minute quantity of a strong solution of hæmoglobin is obtained, the point of greatest density of which is readily found under a one-fourth objective, and tested by the adjustment of the spectroscopic eye-piece. Dr. Richardson states that in one case, five months after a murder had been committed, he was able to obtain well marked absorption-bands, easily discriminated from those produced by a solution of alkanet root with alum, and those caused by an infusion of cochineal with the same salt, from a scrap of stained muslin one-fiftieth of an inch square. After examining the spectrum, the white corpuscles and the remains of the red corpuscles may be discovered by the use of high powers, and it is possible, he thinks, in this way, by measurements carefully made, to discriminate between the corpuscles of human blood and those of the ox, pig, horse, and sheep. Lastly, to make assurance triply sure, he proceeds to wipe off the tiny drop of blood-solution from the glass with a thin piece of moistened blotting-paper, and allow to fall upon it a little fresh tincture of guaiacum, and then a drop of ozonized ether, which will at once evoke the deep blue color of the guaiacum test for blood.

A Simple Collecting Bottle.—By substituting corks and rubber tubing for brass screws and elaborately fitted metal pipes, it is frequently possible to produce very efficient apparatus at a very moderate cost. The bottle shown in the annexed engraving is an illustration of this fact. A common wide-

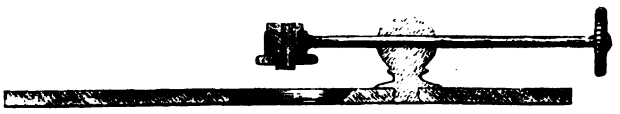
COLLECTING BOTTLE.

mouthed bottle is fitted with a good sound cork having two holes bored in it. Through these holes are passed two tin funnels, arranged as shown. The funnel on the inside is covered with fine cloth, held in its place by a rubber ring, which is prevented from slipping down by means of a wire ring soldered to the funnel. Water poured into the funnel

through the exterior funnel passes out through the filter and the rubber tube, and leaves behind it all the microscopic forms which may be present.

Counterfeiting in a New Field.—Microscopic slides are about the last things that one would expect to be fraudulent, but a correspondent of *The Academy* states that some of the Continental manufacturers, who have had a good reputation hitherto, are cheating their customers. It appears that many polariscope objects are offered for sale, purporting to be plates of minerals, which are nothing more than ingenious manipulations of colored glass and cheap minerals. Thus, spartalite, for instance, is imitated by means of a piece of dark red glass, on which is placed a thin section of calcite. The combination is then mounted in Canada balsam between two plates of glass. An optician at Berlin is said to have originated these ingenious slides.

Substitute for Rotating Stage.—Those who are familiar with Beck's very elegant object-holder know the great advantage which arises from presenting opaque objects to the light in all directions. Some objects, such as feathers, and some minerals, iron-glance for example, have their appearance entirely changed by a variation in the direction in which the light strikes them. The simple piece of apparatus shown in the annexed engraving answers as a very good substitute for Beck's holder, and for



OBJECT HOLDER.

the rotating stage, as used with opaque objects. Its construction is too obvious to require much explanation. The base is a slip of metal 3 inches by 1, with a large hole to permit the passage of light when the Lieberkuhn is used. The object is attached by gum or balsam to a small block, which rotates horizontally in a ring, and which can be turned round vertically by means of the milled head attached to the wire which carries it. We have had it in use for many years, long before we heard of Beck's device, and find it very convenient.

Test for Estimating the Proportion of Chicory in Coffee.—Take 1 gramme of the adulterated sample (proved to contain chicory by the previous microscopical examination); mix 50 c c methylated spirit, and 20 c c paraffin, by shaking in a suitable tube until the mixture looks creamy; then (immediately) add the 1 gramme of sample; shake well for 5 minutes, and allow the fluids to separate. Then pour off the upper fluid, *i. e.* paraffin, which contains all the coffee. The methylated spirit, containing the chicory (which has settled at the bottom of the tube), may then be poured into a small porcelain (tared) dish, the spirit evaporated off over a water bath, the dish containing the chicory dried in the water oven, then cooled and weighed. The weight of the porcelain dish subtracted from the total weight, will give nearly the exact percentage of chicory in the 1 gramme of sample taken.

JNO. H. MARTIN, F. R. M. S.

Hardening Tissues.—Cut the diseased or other animal tissue into required size. Soak in alcohol 4 or 5 days; then dye in alcoholic dye. Wash the tissue well in acetic acid; then place in strong solution of gelatine and simmer for about 3 hours. Take it out and place in saturated solution of chrome alum for 10 hours, then dry gradually. It will soon be found ready to cut. Mount in balsam or glycerine jelly. JNO. H. MARTIN, F. R. M. S.

Professor Tyndall on "Germs."—In a recent lecture at the Royal Institution, Prof. Tyndall gave the results of his experiments on this subject, and he also pointed out some of its possible practical bearings when viewed in relation to medical science. The basis of Professor Tyndall's experiments is that, in the course of searching for means of obtaining air free from floating motes, he found that if air is allowed to remain in a closed air-tight vessel covered inside with glycerine, in the course of three or four days it deposits all its motes which adhere to the glycerine, and it thus becomes quite free from them. The test of its perfect freedom is to pass a powerful beam of light through the case, when, if any motes are still floating, they make known their presence by reflecting the light. With air thus purified, Professor Tyndall has made a long series of experiments bearing on the question of spontaneous generation and on disease germs. From these experiments Professor Tyndall argues that sewer gas of itself is harmless; it is the germs floating in the sewer gas that sow disease. If there are no disease germs present, the gas does no harm Another set of experiments on the horizontal and vertical distribution of motes led to the conclusion that life germs float in little clouds, since an immense number of tubes exposed in different parts and at different heights in the laboratory showed that some were affected many days before others. Clouds of disease germs may explain a puzzle to surgeons—why a wound going on well for a while should suddenly, and without apparent reason, become putrid. It may be that it is being dressed just at a time when a "germ cloud" is passing. In

his concluding remarks, Professor Tyndall referred to the fact that it has remained for modern science to discover that, more than by battle, or accident, or famine, humanity suffers from disease germs conveyed in air and water.

Evidently not a Microscopist.—A writer in the *National Quarterly Review*, discussing the prospect of our seeing the ultimate atoms of matter, says: "It would, however, be overstating the prospect very materially to intimate, as some enthusiasts have, that the final definition of matter, except in Aristotle's view of the case, will ever be accomplished through the agency of the microscope; for the highest power of Beck's best binocular instrument, 10,000 diameters, or 1,000,000,000 areas, to be multiplied by 50,000 in the matter of diameters, or by 2,500,000,000 in the matter of areas, the primitive atom, if that interesting subject of speculation may be regarded as having an entity at all, would scarcely be revealed—a consideration that shows the utter hopelessness of penetrating to the very beginnings of life by any miracle of microscopy that the optician will ever be able to furnish, the practical limits of the instrument having already been pretty nearly attained." A writer who talks of a binocular instrument as the one by which the highest magnifying power can be obtained, is hardly qualified to give an opinion upon questions relating to "the practical limits of the instrument."

Acid in Growing Roots.—If seeds (of barley, for instance), be allowed to sprout between moistened folds of litmus paper, the newly developed roots, according to Ferd. Cohn, attach themselves strongly to the paper, and color it intensely red. The course of the growing roots may be distinctly traced on the back of the paper by means of the red streaks. To this development of a non-volatile acid in the roots must be partially ascribed the solution and assimilation of inorganic matters of the soil.

Interesting Optical Experiment.—Prof. F. E. Nipher sends to *Nature* the following pretty optical experiment. Observe a white cloud through a plate of red glass with one eye, and through green glass with the other eye. After some moments transfer both eyes to the red glass, opening and closing each eye alternately. The strengthening of the red color in the eye, fatigued by its complementary green, is very striking. Many modifications of the experiment will readily suggest themselves.

The Cells in a large mushroom weighing four and a half pounds, were found by Worthington G. Smith, to number 106,596,000,000,000. Each of these is furnished with a coat or cell wall, and contains within itself protoplasm, water and other materials. These cells are so extremely light that in one species of fungus it takes 1,624,820,000,000 to weigh an ounce troy.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—The meeting held on the 20th of January, seems to have been one of special interest. Several additions were made to the library, and to the cabinet, and several interesting papers were read. Mr. Hanks described his method of examining Rock Structures, which offers important advantages to those who have not good apparatus for preparing their sections. He grinds the mineral in a mortar, and, after sifting the powder through a fine sieve, mounts in balsam a part of the material, while the remainder is treated with nitro-hydrochloric acid, and a sample of the residue mounted in another slide in the same manner as the first. Hornblende and mica, which are so troublesome to define under many of the old methods of microscopic examination, offer no difficulties under Mr. Hank's treatment, and with portions mounted as opaque, in section, and treated with liquor potassæ in addition to the two above, one has a series of five slides which offer special facilities for examination with a binocular instrument and with polarizing apparatus.

Dr. Harkness exhibited a specimen of wheat rust found on a choice sample of grain sent to the Academy of Sciences by Prof. Geo. Davidson, who gathered the same in the Valley of the Nile during the month of May last. The Doctor stated that this proved to be the uredo fruit of the *Puocinia graminis*. This fungus had attacked not only the stalks, but also the leaves and glumes of the plant. The Doctor remarked that the fungus had evidently been developed upon the wheat during its transportation.

As proof, the samples bear evidence of having been carefully selected as the most perfect of their kind, and as the unsightly spots are visible to the unaided eye, they would, if existing, have led to their rejection.

As a further proof, the Doctor stated that during a prolonged residence in Egypt, some years since, he had examined many fields of wheat, during every stage of its growth, and had never noticed a single instance of the rust; the climate being altogether too dry to admit of its growth. He further stated that Fungologists universally refer the *Puocinia graminis* to America as its proper habitat. Hence his conclusion was drawn, as above stated, that the spores being already in existence upon the grain when gathered, were *in transitu*, developed through the influence of moisture imbibed. This may be accepted as another fact in evidence to prove the universality of spore distribution.

Other interesting discussions were held upon insectivorous plants, a new dye from a species of lichen gathered near Saucelito, etc.

Our Book Table.

A Guide to the Microscopical Examination of Drinking Water. By J. D. MacDonald, M. D. R. N., F. R. S. With 24 lithographic plates. Philadelphia: Lindsay & Blakiston.

This work is addressed chiefly to those who, as health officers, have occasion to determine the quality of a given water for drinking purposes. While pointing out clearly and accurately the nature of the various impurities which may be detected by the microscope, the author acknowledges that we have not at our command sufficient data to determine the sanitary import of the various forms which present themselves. "No attempt has been made to link particular forms, with special effects; it is doubtful, indeed, if this be possible at present, beyond a limited extent, being rather a point for the enquiry of future times, which this little work can only purport to aid." At the same time our author very justly remarks that "though there is no good evidence of their hurtful action, no one would hesitate to condemn a water containing Bacteria or fungi, or swarming with the lower forms of life;" and it is to the microscopist alone that we can look for information as to the presence of these noxious objects.

There is however, another and larger class of readers to whom the work before us must prove of great value. We refer to mere beginners in microscopy, who take pleasure in examining natural objects and especially the curious forms of animal and vegetable life found in water, and who, from want of training, are unable to identify and name the objects which they see by following out a regular system of classification. Such persons can most easily find out the names of the objects which they examine by referring to a good series of plates, and we know of no work, at a moderate price, that can be compared with the present for excellence and completeness. It is true that the engravings are not very finely executed, but they are accurate and *characteristic*, and even a tyro who should see an object under the microscope would find no difficulty in identifying it amongst the figures in this book. To those who cannot afford such expensive books as the Micrographic Dictionary and Pritchards' Infusoria, this handy volume will be invaluable.

The Microscope in Gynæcology. By A. Mead Edwards, M. D., Newark, N. J.

This paper, which is reprinted from the transactions of the Medical Society of New Jersey, presents a very clear statement, not only of the general claims of the microscope, but of the especial lines in which that instrument may be of service to those who devote special attention to the class of diseases mentioned. Copies can no doubt be procured from Dr. Edwards.

A Course of Lectures on Physiology: As Delivered by Prof. Kuss at the Medical School of the University of Strasburgh. Edited by Mathias Duval, M. D., etc., etc. Translated from the Second and Revised Edition by Robert Amory, M. D., formerly Professor of Physiology at the Medical School of Maine, etc. Illustrated by 150 woodcuts inserted in the text. Boston: James Campbell.

It is generally admitted that while we have several very excellent and elaborate works on physiology, there are none of moderate extent which present a clear and accurate view of the present state of the science, especially of those subjects which depend upon microscopic anatomy or histology. The work before us, which in its preparation has combined the efforts of three able and distinguished physiologists, seeks to supply this want, and it does it well. It is by no means what is commonly called a "popular treatise"—meaning thereby a work which skims the surface and merely presents a readable sketch, which may give pleasure, it is true, but which cannot convey sound and thorough information. It gives very complete views of all the most important departments of human physiology, and is fully adapted to the needs of the earnest student, whether he be pursuing his studies alone or under the instruction of a competent teacher.

The Student's Manual. Designed by Specific Directions, to Aid in Forming and Strengthening the Intellectual and Moral Character and Habits of the Student. By Rev. John Todd, D. D. New and Revised Edition, to which are added Notes by the Author. Northampton, Mass. Bridgman & Childs.

It is now nearly a quarter of a century since this work first fell into our hands, and during all these years it has been regarded as one of the few volumes which always afford pleasant companionship, and are to be read and re-read not only for profit but for pleasure. The style is so clear and pleasant; the illustrations and anecdotes (of which the book is full) are so pat, and the advice is so sound and sensible, that no one can read the book without being charmed with it. Though specially addressed to students at college, it contains much that is of value to those who are struggling alone. Every man and woman that is earnestly endeavoring after mental improvement, will find it to their advantage to read this book.

Recent Books and Articles.

"Climbing Plants." By Chas. Darwin. D. Appleton & Co.

"Lectures on Bright's Disease." D. Campbell Black. 8vo., cloth, $2. Lindsay & Blakiston.

"Atlas of Skin Diseases." By Tilbury Fox. In parts; $2 per part. Lindsay & Blakiston.

"The Microscope in Daily Practice." No. 4. By Dr. J. N. Danforth in Chicago *Medical Journal and Examiner* for February. (This is a very excellent paper, containing much practical information in regard to the *use* of the Microscope.)

NOTES AND QUERIES.

What power are scales of clothes moth a test for? Also, what power are the scales of Lepisma for, and do *Cyclops* live through the winter?—A. Y. M., Coldwater, Mich.

The scales you mention are now rarely used as tests. In the hands of an expert they would afford a good test for objectives of medium power (under one-sixth), but in the hands of a novice, they could only be used for Nos. 1 and 2 of the common French objectives. The fact is, that for all the more important qualities of an objective, except resolving power, more depends upon the observer than upon the test used.

Carpenter, in his latest edition, says that all the adult *cyclops* are killed off every winter by the cold. A correspondent in our last issue says that moderate cold is not necessarily fatal to them. Find out for yourself this winter; *cyclops* are very plenty and you can easily find them all winter long if they do not die off.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Roestelia lacerata, *Puc. xanthii*, and *Puc. aculeata*, in exchange for other unmounted fungi. W. C. Stevenson, Jr., 1,525 Green St., Philadelphia, Pa.

Slides of "Sonorous Sand," from Sandwich Islands, very interesting, for any well mounted objects. W. G. C., Box 1774, Boston, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield. Mo.

Irish and British marine Algæ in great variety, correctly named, for herbariums, etc.; also beautifully mounted in balsam and other mediums; in fruit; many laden with diatoms; or splendid specimens, specially prepared for balsam. Foraminifera from Dog's Bay, Egypt, Java, etc; diatoms, zoophytes, sponge spicula, Holothuria plates, mollusca palates, ghost crabs, starfish, and various other unmounted interesting marine material, as well as botanical and entomological objects, etc. For any American objects, mounted or otherwise. Send detailed list of everything you wish to exchange; all letters answered. T. McGann, Burrin, Ireland.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Wanted in exchange for Vegetable Slides, other well mounted slides. Address F. F. Stanley, 40 Pearl street, Boston.

Publisher's Department.

Webster's Unabridged—Illustrated.—In all the essential points of a good dictionary, in the amplitude and selectness of its vocabulary, in the fulness and perspicacity of its definitions, in its orthoepy and (*cum grano salis*) its orthography, in its new and trustworthy etymologies, in the elaborate, but not too learned, treatises of its introduction, in its carefully prepared and valuable appendices,—briefly, in its general accuracy, completeness, and practical utility,—the work is one which none who read or write can henceforward afford to dispense with.—*Atlantic Monthly.*

Postal Cards.—Many persons seem to be ignorant of the post-office regulations regarding postal cards, and as a consequence their missives either fail to reach their destination, or are saddled with double letter postage. These rules are:

1. On the address side of a postal card never write anything except the address.

2. Never attach any extraneous matter to a postal card. Even pasting a printed address on a postal card subjects it to five cents extra postage, and those to whom it is sent are very apt to refuse it.

The True Jute Plant.—There appears to be considerable confusion as to the plant from which the substance so extensively used in the arts under the name of jute is really derived. On investigation, however, it appears that the crude jute comes from two species of *Corchorus*, namely *C. capularis* and *C. olitorius*, grown principally in Bengal. Plants popularly known as jute, however, growing in the Madras Presidency, are the *Hibiscus cannabinus* and *Crotalaria junca;* and their fibre is not the true jute, though hitherto considered such.

The two hundredth anniversary of Antony van Leeuwenhoek's discovery of infusoria was celebrated on September 8th, at Delft, his birthplace. All the natural history associations of Holland were represented on the occasion, and a fund was established for a Leeuwenhoek gold medal worth six hundred marks, to be awarded to distinguished microscopists. The first recipient of this medal was Prof. Ehrenberg, of Berlin, the oldest microscopist of Europe, and Leeuwenhoek's legitimate successor.

Books Wanted—Address, stating condition and lowest price, E. W., care AMERICAN JOURNAL OF MICROSCOPY, 37 Park Row, New York.

"Micrographic Dictionary." Second edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Caspar's "Forensic Medicine." 4 vols.
Faraday's "Electrical Researches." 3 vols.
Holtzapfel's "Mechanical Manipulation."

THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

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Prof. Tyndall on Germs*.

THE author refers in an introduction to an inquiry on the decomposition of vapors and the formation of actinic clouds by light, whereby he was led to experiment on the floating matter of the air. He refers to the experiments of Schwann, Schröder and Dusch, Schröder himself, to those of the illustrious French chemist Pasteur, to the reasoning of Lister and its experimental verification, regarding the filtering power of the lungs; from all of which he concluded six years ago, that the power of developing life by the air, and its power of scattering light, would be found to go hand in hand. He thought the simple expedient of examining by means of a beam of light, while the eye was kept sensitive by darkness, the character of the medium in which their experiments were conducted, could not fail to be useful to workers in this field. But the method has not been much turned to account, and this year he thought it worth while to devote some time to the more complete demonstration of its utility.

He also wished to free his mind, and, if possible the minds of others, from the uncertainty and confusion which now beset the doctrine of "spontaneous generation." Pasteur has pronounced it "a chimera," and expressed the undoubting conviction that this being so it is possible to remove parasitic diseases from the earth. To the medical profession, therefore, and through them to humanity at large, this question is one of the last importance. But the state of medical opinion regarding it is not satisfactory. In a recent number of the *British Medical Journal*, and in answer to the question, "In what way is contagium generated and communicated?" Messrs Braidwood and Vacher reply that notwithstanding "an almost incalculable amount of patient labor, the actual results obtained, especially as regards the manner of generation of contagium, have been most disappointing. Observers are even yet at variance whether these minute particles, whose discovery we have just noticed, and other disease germs, are always produced from like bodies previously existing, or whether they do not, under certain favorable conditions, spring into existence *de novo*."

With a view to the possible diminution of the uncertainty thus described, the author submits, without further preface, to the Royal Society, and especially to those who study the etiology of disease, a description of the mode of procedure followed in this inquiry, and the results to which it has led.

A number of chambers or cases, were constructed, each with a glass front, its top, bottom, back and sides being of wood. At the back is a little door which opens and closes on hinges, while into the sides

* On the Optical Deportment of the Atmosphere in reference to the Phenomena of Putrefaction and Infection. Abstract of a paper read before the Royal Society, January 13th, by Prof. Tyndall, F. R. S. (Communicated to *Nature* by the author.)

are inserted two panes of glass, facing each other.

The top is perforated in the middle by a hole 2 inches in diameter closed air-tight by a sheet of india-rubber. This sheet is pierced in the middle by a pin, and through the pin-hole is passed the shank of a long pipette ending above in a small funnel. A circular tin collar 2 inches in diameter and 1½ inches high, surrounds the pipette, the space between both being packed with cotton-wool moistened by glycerine. Thus the pipette, in moving up and down, is not only firmly clasped by the india-rubber, but it also passes through a stuffing box of sticky cotton-wool. The width of the aperture closed by the india-rubber secures the free lateral play of the lower end of the pipette. Into two other smaller apertures in the top of the case are inserted, air-tight, the open ends of two narrow tubes, intended to connect the interior space with the atmosphere. The tubes are bent several times up and down, so as to intercept and retain the particles carried by such feeble currents as changes of temperature might cause to set in between the outer and the inner air.

The bottom of the box is pierced with two rows, sometimes with a single row of apertures, in which are fixed, air-tight, large test-tubes, intended to contain the liquid to be exposed to the action of the moteless air.

On Sept. 10 the first case of this kind was closed. The passage of a concentrated beam across it through its two side windows then showed the air within it to be laden with floating matter. On the 13th it was again examined. Before the beam entered, and after it quitted the case, its track was vivid in the air, but within the case it vanished. Three days of quiet sufficed to cause all the floating matter to be deposited on the sides and bottom, where it was retained by a coating of glycerine, with which the interior surface of the case had been purposely varnished. The test-tubes were then filled through the pipette, boiled for five minutes in a bath of brine or oil, and abandoned to the action of the moteless air. During ebullition, aqueous vapor rose from the liquid into the chamber, where it was for the most part condensed, the uncondensed portion escaping, at a low temperature, through the bent tubes at the top. Before the brine was removed little stoppers of cotton-wool were inserted in the bent tubes, lest the entrance of the air into the cooling chamber should, at first, be forcible enough to carry motes along with it. As soon, however, as the ambient temperature was assumed by the air within the case, the cotton-wool stoppers were removed.

We have here the oxygen, nitrogen, carbonic acid, ammonia, aqueous vapor, and all the other gaseous matters which mingle more or less with the air of a great city. We have them, moreover, "untortured" by calcination and unchanged even by filtration or manipulation of any kind. The question now before us is, can air thus retaining all its gaseous mixtures, but self-cleansed from mechanically suspended matter, produce putrefaction? To this question both the animal and vegetable worlds return a decided negative.

Among vegetables, experiments have been made with hay, turnips, tea, coffee, hops, repeated in various ways with both acid and alkaline infusions. Among animal substances are to be mentioned many experiments with urine; while beef, mutton, hare, rabbit, kidney, liver, fowl, pheasant, grouse, haddock, sole, salmon, cod, turbot, mullet, herring, whiting, eel, oyster, have been all subjected to experiment.

The result is that infusions of these substances exposed to the common air of the Royal Institution laboratory, maintained at a temperature of from 60° to 70° Fahr., all fell into putrefaction in the course of from two to four days. No matter where the infusions were placed, they were infallibly smitten. The number of the tubes containing the infusions was multiplied till it reached six hundred, but not one of them escaped infection.

In no single instance, on the other hand, did the air, which had been proved moteless

by the searching beam, show itself to possess the least power of producing Bacterial life or the associated phenomena of putrefaction. The power of developing such life in atmospheric air, and the power of scattering light, are thus proved to be indissolubly united.

The sole condition necessary to cause these long-dormant infusions to swarm with active life is the access of the floating matter of the air. After having remained for four months as pellucid as distilled water, the opening of the back door of the protecting case, and the consequent admission of the mote-laden air, suffice in three days to render the infusions putrid and full of life.

That such life arises from mechanically suspended particles, is thus reduced to ocular demonstration. Let us inquire a little more closely into the character of the particles which produce the life. Pour Eau de Cologne into water, a white precipitate renders the liquid milky. Or, imitating Brücke, dissolve clean gum mastic in alcohol, and drop it into water, the mastic is precipitated, and milkiness produced. If the solution be very strong the mastic separates in curds; but by gradually diluting the alcoholic solution we finally reach a point where the milkiness disappears, the liquid assuming, by reflected light, a bright cerulean hue. It is, in point of fact, the color of the sky, and is due to a similar cause, namely, the scattering of light by particles, small in comparison to the size of the waves of light.

When this liquid is examined by the highest microscopic power, it seems as uniform as distilled water. The mastic particles, though innumerable, entirely elude the microscope. At right angles to a luminous beam passing among the particles they discharge perfectly polarized light. The optical deportment of the floating matter of the air proves it to be composed, in part, of particles of this excessively minute character. When the track of a parallel beam in dusty air, is looked at horizontally through a Nicol's prism, in a direction perpendicular to the beam, the longer diagonal of the prism being vertical, a considerable portion of the light from the finer matter is extinguished. The coarser motes, on the other hand, flash out with greater force, because of the increased darkness of the space around them. It is among the finest ultra-microscopic particles that the author shows the matter potential as regards the development of Bacterial life is to be sought.

But though they are beyond the reach of the microscope, the existence of these particles, foreign to the atmosphere but floating in it, is as certain as if they could be felt between the fingers, or seen by the naked eye. Supposing them to augment in magnitude until they come, not only within range of the microscope, but within range of the unaided senses. Let it be assumed that our knowledge of them under these circumstances remains as defective as it is now—that we do not know whether they they are germs, particles of dead organic dust, or particles of mineral matter. Suppose a vessel (say a flower-pot) to be at hand filled with nutritious earth, with which we mix our unknown particles; and that in forty-eight hours subsequently buds and blades of well-defined cresses and grasses appear above the soil. Suppose the experiment when repeated over and over again to yield the same unvarying result. What would be our conclusion? Should we regard those living plants as the products of dead dust or mineral particles; or should we regard them as the offspring of living seeds? The reply is unavoidable. We should undoubtedly consider the experiment with the flower-pot as clearing up our pre-existing ignorance; we should regard the fact of their producing cresses and grasses as proof positive that the particles sown in the earth of the pot were the seeds of the plants which have grown from them. It would be simply monstrous to conclude that they had been "spontaneously generated."

This reasoning applies word for word to the development of *Bacteria* from that floating matter which the electric beam reveals in the air, and in the absence of which

no Bacterial life has been generated. There seems no flaw in this reasoning; and it is so simple as to render it unlikely that the notion of Bacterial life developed from dead dust can ever gain currency among the members of a great scientific profession.

A novel mode of experiment has been here pursued, and it may be urged that the conditions laid down by other investigators in this field, which have led to different results, have not been strictly attended to. To secure accuracy in relation to these alleged results, the latest words of a writer on this question, who has influenced medical thought both in this country and in America, are quoted. "We know," he says, "that boiled turnip or hay-infusions exposed to ordinary air, exposed to filtered air, to calcined air, or shut off altogether from contact with air, are more or less prone to swarm with *Bacteria* and vibriones in the course of from two to six days." Who the "we" are who possess this knowledge is not stated. The author is certainly not among the number, though he has sought anxiously for knowledge of the kind. He thus tests the statements in succession.

And first, with regard to the filtered air. A group of twelve large test-tubes were caused to pass air-tight through a slab of wood. The wood was coated with cement in which, while hot, a heated "propagating glass" resembling a large bell-jar was imbedded. The air within the jar was pumped out several times, air filtered through a plug of cotton-wool being permitted to supply its place. The test-tubes contained infusions of hay, turnip, beef and mutton—three of each—twelve in all.

They are as clear and cloudless at the present moment as they were upon the day of their introduction; while twelve similar tubes, prepared at the same time in precisely the same way and exposed to the ordinary air, are clogged with mycelium, mould, and *Bacteria*.

With regard to the calcined air, a similar propagating glass was caused to cover twelve other tubes filled with the same infusions. The "glass" was exhausted and carefully filled with air which had passed through a red-hot platinum tube, containing a roll of red-hot platinum gauze. Tested by the searching beam, the calcined air was found quite free from floating matter. Not a speck has invaded the limpidity of the infusions exposed to it, while twelve similar tubes placed outside have fallen into rottenness.

The experiments with calcined air took another form. Six years ago, it was found that to render the laboratory air free from floating matter, it was only necessary to permit a platinum wire heated to whiteness to act upon it for a sufficient time. Shades, containing pear juice, damson juice, hay and turnip juice, and water of yeast, were freed from their floating matter in this way. The infusions were subsequently boiled and permitted to remain in contact with the calcined air. They are quite unchanged to the present hour, while the same infusions exposed to common air became mouldy and rotten long ago.

It has been affirmed that turnip and hay infusions rendered slightly alkaline are particularly prone to exhibit the phenemena of spontaneous generation. This was not found to be the case in the present investigation. Many such infusions have been prepared, and they have continued for months without sensible alteration.

Finally, with regard to infusions wholly withdrawn from air, a group of test-tubes containing different infusions, was boiled under a bell-jar filled with filtered air, and from which the air was subsequently removed as far as possible by a good air-pump. They are now as pellucid as they were at the time of their preparation, more than two months ago, while a group of corresponding tubes exposed to the laboratory air have all fallen into rottenness.

There is still another form of experiment on which great weight has been laid—that of hermetically sealed tubes. On April 6 last, a discussion on the "Germ Theory of Disease" was opened before the Pathological Society of London. The meeting was attended by many distinguished medical men,

some of whom were profoundly influenced by the arguments, and none of whom disputed the facts brought forward against the theory on that occasion. The following important summary of these was then given:—"With the view of settling these questions, therefore, we may carefully prepare an infusion from some animal tissue, be it muscle, kidney, or liver; we may place it in a flask whose neck is drawn out and narrowed in the blow-pipe flame, we may boil the fluid, seal the vessel during ebullition, and keeping it in a warm place, may await the result, as I have often done. After a variable time the previously heated fluid within the hermetically sealed flask swarms more or less plentifully with *Bacteria* and allied organisms."

Previous to reading this statement the author had operated upon tubes of hay and turnip infusions, and upon 21 tubes of beef, mackerel, eel, oyster, oatmeal, malt, and potato, hermetically sealed while boiling, not by the blow-pipe, but by the far more handy spirit-lamp flame. In no case was any appearance whatever of *Bacteria* or allied organisms observed. The perusal of the discussion just referred to caused the author to turn again to muscle, liver, and kidney, with a view of varying and multiplying the evidence. Fowl, pheasant, snipe, partridge, plover, wild-duck, beef, mutton, heart, tongue, lungs, brains, sweetbread, tripe, the crystalline lens, and vitreous humor of an ox, herring, haddock, mullet, codfish, sole, were all embraced in the experiments. There was neither mistake nor ambiguity about the result. One hundred and thirty-nine of the flasks operated on were exhibited, and not one of this cloud of witnesses offers the least countenance to the assertion that liquids within flasks, boiled and hermetically sealed, swarm, subsequently, more or less plentifully with *Bacteria* and allied organisms.

The evidence furnished by this mass of experiments, that errors either of preparation or observation have been committed, is, it is submitted, very strong. But to err is human; and in an inquiry so difficult and fraught with such momentous issues, it is not error, but the persistence in error by any of us, for dialectic ends, that is to be deprecated. The author shows by illustrations the risks of error run by himself. On Oct. 21 he opened the back-door of a case containing six test-tubes filled with an infusion of turnip which had remained perfectly clear for three weeks, while three days sufficed to crowd six similar tubes exposed to mote-laden air with *Bacteria*. With a small pipette he took specimens from the pellucid tubes, and placed them under the microscope. One of them yielded a field of Bacterial life, monstrous in its copiousness. For a long time he tried vainly to detect any source of error, and was perfectly prepared to abandon the unvarying inference from all the other experiments, and to accept the result as a clear exception to what had previously appeared to be a general law. The cause of his perplexity was finally traced to the tiniest speck of an infusion containing *Bacteria*, which had clung by capillary attraction to the point of one of his pipettes.

Again, three tubes containing infusions of turnip, hay, and mutton, were boiled on Nov. 2 under a bell-jar containing air so carefully filtered that the most searching examination by a concentrated beam failed to reveal a particle of floating matter. At the present time every one of the tubes is thick with mycelium and covered with mould. Here surely we have a case of spontaneous generation. Let us look to its history.

After the air has been expelled from a boiling liquid it is difficult to continue the ebullition without "bumping." The liquid remains still for intervals, and then rises with sudden energy. It did so in the case now under considertion, and one of the tubes boiled over, the liquid over-spreading the resinous surface in which the bell-jar was imbedded, and on which, doubtless, germs had fallen. For three weeks the infusions had remained perfectly clear. At the end of this time, with a view of renewing the air of the jar, it was exhausted, and

refilled by fresh air which had passed through a plug of cotton-wool. As the air entered, attention was attracted by two small spots of penicillium resting on the liquid which had boiled over. It was at once remarked that the experiment was a dangerous one, as the entering air would probably detach some of the spores of the penicillium and diffuse them in the bell-jar. This was, therefore, filled very slowly, so as to render the disturbance a minimum. Next day, however, a tuft of mycelium was observed at the bottom of one of the three tubes, namely, that containing the hay infusion. It has by this time grown so as to fill a large portion of the tube. For nearly a month longer the two tubes containing the turnip and mutton infusions maintained their transparency unimpaired. Late in December the mutton infusion, which was in dangerous proximity to the outer mould, showed a tuft upon its surface. The beef infusion continued bright and clear for nearly a fortnight longer. The recent cold weather caused me to add a third gas-stove to the two which had previously warmed the room in which the experiments are conducted. The warmth of this stove played upon one side of the bell-jar; and on the day after the lighting of the stove, the beef infusion gave birth to a tuft of mycelium. In this case the small spots of penicillium might have readily escaped attention; and had they done so we should have had three cases of "spontaneous generation" far more striking than many that have been adduced.

In further illustration of the dangers incurred in this field of inquiry, the author refers to the excellent paper of Dr. Roberts on Biogenesis, in the "Philosophical Transactions" for 1874. Dr. Roberts fills the bulb of an ordinary pipette to about two-thirds of its capacity with the infusion to be examined. In the neck of the pipette he places a plug of dry cotton-wool. He then hermetically seals the neck and dips the bulb into boiling water or hot oil, where he permits it to remain for the requisite time. Here we have no disturbance from ebullition, and no loss by evaporation. The bulb is removed from the hot water and permitted to cool. The sealed end of the neck is then filed off, the cotton-wool alone interposing between the infusion and the atmosphere.

The arrangement is beautiful, but it has one weak point. Cotton-wool free from germs is not to be found, and the plug employed by Dr. Roberts infallibly contained them. In the gentle movement of the air to and fro as the temperature changed, or by any shock, jar, or motion to which the pipette might be subjected, we have certainly a cause sufficient to detach a germ now and then from the cotton-wool which would fall into the infusion and produce its effect. Probably, also, condensation occurred at times in the neck of the pipette; the water of condensation carrying back from the cotton-wool the seeds of life. The fact of fertilization being so rare as Dr. Roberts found it to be is a proof of the care with which his experiments were conducted. But he did find cases of fertilization after prolonged exposure to the boiling temperature; and this caused him to come to the conclusion that under certain rare conditions spontaneous generation may occur. He also found that an alkalized hay-infusion was so difficult to sterilize that it was capable of withstanding the boiling temperature for hours without losing its power of generating life. The most careful experiments have been made with this infusion. Dr. Roberts is certainly correct in assigning to it superior nutritive power. But in the present inquiry five minutes boiling sufficed to completely sterilize the infusion.

Summing up this portion of his inquiry, the author remarks that he will hardly be charged with any desire to limit the power and potency of matter. But holding the notions he does upon this point, it is all the more incumbent on him to affirm that as far as inquiry has hitherto penetrated, life has never been proved to appear independently of antecedent life.

Though the author had no reason to

doubt the general diffusion of germs in the atmosphere, he thought it desirable to place the point beyond question. At Down, Mr. Darwin, Mr. Francis Darwin; at High Elms, Sir John Lubbock; at Sherwood, near Tunbridge Wells, Mr. Siemens; at Pembroke Lodge, Richmond Park, Mr. Rollo Russell; at Heathfield Park, Messrs. Hamilton; at Greenwich Hospital, Mr. Hirst; at Kew, Dr. Hooker; and at the Crystal Palace, Mr. Price, kindly took charge of infusions, every one of which became charged with organisms. To obtain more definite insight regarding the diffusion of atmospheric germs, a square wooden tray was pierced with 100 holes, into each of which was dropped a short test-tube. On Oct. 23, thirty of these tubes were filled with an infusion of hay, thirty-five with an infusion of turnip, and thirty-five with an infusion of beef. The tubes, with their infusions, had been previously boiled, ten at a time, in an oil-bath. One hundred circles were marked on paper so as to form a map of the tray, and every day the state of each tube was registered upon the corresponding circle. In the following description the term "cloudy" is used to denote the first stage of turbidity; distinct but not strong. The term "muddy" is used to denote thick turbidity.

One tube of the 100 was first singled out and rendered muddy. It belonged to the beef group, and it was a whole day in advance of all the other tubes. The progress of putrefaction was first registered on Oct. 26; the "map" then taken may be thus described:—

Hay.—Of the thirty specimens exposed one had become "muddy"—the seventh in the middle row reckoning from the side of the tray nearest the stove. Six tubes remained perfectly clear between this muddy one and the stove, proving that differences of warmth may be overridden by other causes. Every one of the other tubes containing the hay infusion showed spots of mould upon the clear liquid.

Turnip.—Four of the thirty-five tubes were very muddy, two of them being in the row next the stove, one four rows distant, and the remaining one seven rows away. Besides these, six tubes had become clouded. There was no mould on any of the tubes.

Beef.—One tube of the thirty-five was quite muddy, in the seventh row from the stove. There were three cloudy tubes, while seven of them bore spots of mould.

As a general rule, organic infusions exposed to the air during the autumn remained for two days or more perfectly clear. Doubtless from the first, germs fell into them, but they required time to be hatched. This period of clearness may be called the "period of latency," and indeed it exactly corresponds with what is understood by this term in medicine. Towards the end of the period of latency, the fall into a state of disease is comparatively sudden; the infusion passing from perfect clearness to cloudiness more or less dense in a few hours.

Thus the tube placed in Mr. Darwin's possession was clear at 8:30 A. M. on Oct. 19, and cloudy at 4:30 P. M. Seven hours, moreover, after the first record of our tray of tubes, a marked change had occurred. It may be thus described:—Instead of one, eight of the tubes containing hay-infusion had fallen into uniform muddiness. Twenty of these had produced Bacterial slime, which had fallen to the bottom, every tube containing the slime being covered by mould. Three tubes only remained clear, but with mould upon their surfaces. The muddy turnip-tubes had increased from four to ten; seven tubes were clouded, while eighteen of them remained clear, with here and there a speck of mould on the surface. Of the beef, six were cloudy and one thickly muddy, while spots of mould had formed on the majority of the remaining tubes. Fifteen hours subsequent to this observation, viz., on the morning of Oct. 27, all the tubes containing hay-infusion were smitten, though in different degrees, some of them being much more turbid than others. Of the turnip-tubes, three only remained unsmitten, and two of these had mould upon their surfaces. Only one of the thirty-five

beef-infusions remained intact. A change of occupancy, moreover, had occurred in the tube which first gave way. Its muddiness remained grey for a day and a half, then it changed to bright yellow green, and it maintained this color to the end. On the 27th every tube of the hundred was smitten, the majority with uniform turbidity; some, however, with mould above and slime below, the intermediate liquid being tolerably clear. The whole process bore a striking resemblance to the propagation of a plague among a population, the attacks being successive and of different degrees of virulence.

From the irregular manner in which the tubes are attacked, we may infer that, as regards *quantity*, the distribution of the germs in the air is not uniform. The singling out, moreover, of one tube of the hundred by the particular *Bacteria* that develop a green pigment, shows that, as regards *quality*, the distribution is not uniform. The same absence of uniformity was manifested in the struggle for existence between the *Bacteria* and the penicillium. In some tubes the former were triumphant; in other tubes of the same infusion the latter was triumphant. It would seem also as if a want of uniformity as regards *vital vigor* prevailed. With the self-same infusion the motions of the *Bacteria* in some tubes were exceedingly languid, while in other tubes the motions resembled a rain of projectiles, being so rapid and violent as to be followed with difficulty by the eye. Reflecting on the whole of this, the author concludes that the germs float through the atmosphere in groups or clouds, with spaces more sparsely filled between them. The touching of a nutritive fluid by a Bacterial cloud would naturally have a different effect from the touching of it by the interspace between two clouds. But, as in the case of a mottled sky, the various portions of the landscape are successively visited by shade, so, in the long run, are the various tubes of our tray touched by the Bacterial clouds, the final fertilization or infection of them all being the consequence. The author connects these results with the experiments of Pasteur on the non-continuity of the cause of so-called spontaneous generation, and with other experiments of his own.*

On the 9th of November a second tray containing one hundred tubes filled with an infusion of mutton was exposed to the air. On the morning of the 11th six of the ten nearest the stove had given way to putrefaction. Three of the rows most distant from the stove had yielded, while here and there over the tray particular tubes were singled out and smitten by the infection. Of the whole tray of one hundred tubes, twenty-seven were either muddy or cloudy on the 11th. Thus, doubtless, in a contagious atmosphere, are individuals successively struck down. On the 12th all the tubes had given way, but the differences in their contents were extraordinary. All of them contained *Bacteria*, some few, others in swarms. In some tubes they were slow and sickly in their motions, in some apparently dead, while in others they darted about with rampant vigor. These differences are to be referred to changes in the germinal matter, for the same infusion was presented everywhere to the air. Here also we have a picture of what occurs during an epidemic, the difference in number and energy of the Bacterial swarms resembling the varying intensity of the disease. It be-

* In hospital practice the opening of a wound during the passage of a Bacterial cloud would have an effect very different from the opening of it in the interspace between two clouds. Certain caprices in the behavior of dressed wounds may possibly be accounted for in this way. Under the heading "Nothing new under the Sun," Prof. Huxley has just sent me the following remarkable extract:—"Uebrigens kann man sich die in der Atmosphäre schwimmenden Thierchen wie Wolken denken, mit denen ganz leere Luftmassen, ja ganze Tage völlig reinen Luftverhältnisse wechseln." [Which may be translated as follows: "Besides this you can compare the animalcules floating in the atmosphere to clouds, with which perfectly empty masses of air, indeed whole days of entirely pure conditions of air, alternate."—*Ed. A. J. of M.*] (Ehrenberg, "Infusions Thierchen," 1838, p. 525.) The coincidence of phraseology is surprising, for I knew nothing of Ehrenberg's conception. My "clouds," however, are but small miniatures of his.

comes obvious from these experiments that of two individuals of the same population, exposed to a contagious atmosphere, the one may be severely, the other lightly attacked, though the two individuals may be as identical as regards susceptibility as two samples of one and the same mutton infusion.

The author traces still further the parallelism of these actions with the progress of infectious disease. The *Times* of January 17 contained a remarkable letter on typhoid fever, signed "M. D.," in which occurs the following remarkable statement:—"In one part of it (Edinburgh), congregated together and inhabited by the lowest of the population, there are, according to the corporation return for 1874, no less than 14,319 houses or dwellings—many under one roof, on the 'flat' system—in which there are no house connections whatever with the street sewers, and, consequently, no water-closets. To this day, therefore, all the excrementitious and other refuse of the inhabitants is collected in pails or pans, and remains in their midst, generally in a partitioned-off corner of the living room, until the next day, when it is taken down to the streets and emptied into the corporation carts. Drunken and vicious though the population be, herded together like sheep, and with the filth collected and kept for twenty-four hours in their very midst, it is a remarkable fact that typhoid fever and diptheria are simply unknown in these wretched hovels."

This case has its analogue in the following experiment, which is representative of a class. On Nov. 30 a quantity of animal refuse, embracing beef, fish, rabbit, hare, was placed in two large test-tubes opening into a protecting chamber containing six tubes. On Dec. 13, when the refuse was in a state of noisome putrefaction, infusions of whiting, turnip, beef, and mutton were placed in the other four tubes. They were boiled and abandoned to the action of the foul "sewer gas" emitted by their two putrid companions. On Christmas day the four infusions were limpid. The end of the pipette was then dipped into one of the putrid tubes, and a quantity of matter comparable in smallness to the pock-lymph held on the point of a lancet was transferred to the turnip. Its clearness was not sensibly affected at the time; but on the 26th it was turbid throughout. On the 27th a speck from the infected turnip was transferred to the whiting; on the 28th disease had taken entire possession of the whiting. To the present hour the beef and mutton tubes remain as limpid as distilled water. Just as in the case of the living men and women in Edinburgh, no amount of fetid gas had the power of propagating the plague, as long as the organisms which constitute the true contagium did not gain access to the infusions.

The universal prevalence of the germinal matter of *Bacteria* in water has been demonstrated with the utmost evidence by the experiments of Dr. Burdon Sanderson. But the germs in water are in a very different condition, as regards readiness in development, from those in air. In water they are thoroughly wetted, and ready, under the proper conditions, to pass rapidly into the finished organism. In air they are more or less desiccated, and require a period of preparation more or less long to bring them up to the starting point of the water germs. The rapidity of development in an infusion infected by either a speck of liquid containing *Bacteria* or a drop of water is extraordinary. On Jan. 4 a thread of glass almost as fine as a hair was dipped into a cloudy turnip infusion, and the tip only of the glass fibre was introduced into a large test-tube containing an infusion of red mullet. Twelve hours subsequently the perfectly pellucid liquid was cloudy throughout. A second test-tube containing the same infusion was infected with a single drop of the distilled water furnished by Messrs. Hopkins and Williams; twelve hours also sufficed to cloud the infusion thus treated. Precisely the same experiments were made with herring with the same result. At this season of the year several days' exposure to the air are needed to produce so great an

effect. On Dec. 31 a strong turnip-infusion was prepared by digesting thin slices in distilled water at a temperature of 120° F. The infusion was divided between four large test-tubes, in one of which it was left unboiled, in another boiled for five minutes, in the two remaining ones boiled, and after cooling infected with one drop of beef-infusion containing *Bacteria*. In twenty-four hours the unboiled tube and the two infected ones were cloudy, the unboiled tube being the most turbid of the three. The infusion here was peculiarly limpid after digestion; for turnip it was quite exceptional, and no amount of searching with the microscope could reveal in it at first the trace of a living Bacterium; still germs were there which, suitably nourished, passed in a single day into Bacterial swarms without number. Five days have not sufficed to produce an effect approximately equal to this in the boiled tube, which was uninfected, but exposed to the common laboratory air.

There cannot, moreover, be a doubt that the germs in the air differ widely among themselves as regards *preparedness* for development. Some are fresh, others old; some are dry, others moist. Infected by such germs the same infusion would require different lengths of time to develop Bacterial life. This remark applies to and explains the different degrees of rapidity with which epidemic disease acts upon different people. In some the hatching period, if it may be called such, is long, in some short, the differences depending upon the different degrees of preparedness of the contagium.

The author refers with particular satisfaction to the untiring patience, the admirable mechanical skill, the veracity in thought, word, and deed displayed throughout this first section of a large and complicated inquiry by his assistant, Mr. John Cottrell, who was zealously aided by his junior colleague, Mr. Frank Valter.

Note. Jan. 31.—The notion that the author limited himself to temperatures of 60° and 70° Fahr. is an entire misconception. But more of this anon.

Microscopy at the American Association.

At the Detroit meeting of the American Association for the Advancement of Science, last August, the microscopists who were in attendance decided to organize permanently a subsection or club, connected with the association. To allow ample time for preparation, and to facilitate the co-operation of all interested parties, it was decided to adjourn for one year, and to proceed with the organization at the Buffalo meeting of the association, which commences on the third Wednesday of August next, and continues about one week. All persons interested in the microscope, and desirous of joining such an organization as is now proposed, are invited to be present and co-operate, whether at present members of the association or not, and are requested to bring to the meeting original papers of scientific interest upon subjects connected with the microscope and its work, and also to bring instruments, accessories, and objects, especially those illustrating new or unfamiliar inventions, contrivances, and discoveries.

It is hoped that the participation of microscopists in this movement will be prompt and cordial. The general desire for a national organization has become a positive necessity, and it is believed that success could in no other way be so fully obtained as by meeting in connection with the American Association, whose character and influence could not fail to be an advantage, whose meetings are necessarily held only at the most available times and places, and whose elaborate arrangements for the convenience and economy of members attending are designed for the benefit of scientists in every department. The recent accession of the chemists, the ethnologists, and the entomologists marks the tendency of the association to become a general congress of American scientists. In meeting with the American Association the microscopists will enjoy a more than double advantage, but separated from it they would lose from their number those who desire to attend the meetings of the association and whose business or other convenience might interfere with the additional journey and absence demanded by a second meeting.—*Am. Naturalist.*

— There is hardly any department of science in which a student can hope to reach eminence without a familiarity with the microscope.

THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

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NOTWITHSTANDING the additional pages which we have added to the JOURNAL this month, we have been obliged to defer a large amount of important matter until our next issue.

Tyndall's Researches.

IN this number we give our readers the valuable paper contributed by Prof. Tyndall to *Nature*, in which he describes his recent researches on the origin of living organisms in liquids. Various extracts and paraphrases of this article have appeared in different journals, few of them, however, being authoritative. The article which we reprint is from the pen of Tyndall himself, and must, therefore, be assumed to present a complete and authentic account of his views and experiments.

The misconceptions to which the experiments detailed in this paper have given rise are something astonishing. In several respectable papers it has been stated that pure air is *opaque*, or, in other words, that it does not permit the passage of light! And even such a generally well-informed periodical as the Boston *Journal of Chemistry* makes the following singular statement: "If the atmosphere was entirely free from impurities we should be involved in darkness." Prof. Tyndall's experiments, if carefully examined, will be found to give no countenance to such views as these, and indeed we do not understand that their author makes any claim that the recent investigations have established anything new in this particular direction. In employing the electric light for the purpose of ascertaining the purity or impurity of the air under examination, Prof. Tyndall used means which were well known and generally acknowledged to be thoroughly trustworthy. To have used new or doubtful methods would not have answered his purpose.

The importance of these investigations can hardly be over-estimated, though we cannot regard them as entirely conclusive of the point at issue. It will be noted that the results are largely *negative*, and where the conditions and processes are so complicated, a negative is a very difficult thing to prove. Because Prof. Tyndall fails to discover living organisms in solutions placed under certain conditions, it does not follow that these organisms will not make their appearance under other and more favorable conditions, even although these latter conditions may not include the presence of germ-laden air. But Professor Tyndall's experiments render necessary a most careful review of previous investigations.

Since the publication of this paper a great deal of earnest discussion has appeared in the English scientific journals. Bastian and Burdon Sanderson had previously published investigations which do not accord with those of Tyndall, and, even in the light of the most recent investigations, they still avow their belief in the accuracy of their previous conclusions. More extended researches are therefore necessary before the main questions involved in this discussion can be considered settled.

"He who expects to become a botanist or a zoologist without using the microscope, is, to say the least of him, as great a fool as he who wishes to study the heavens without a telescope."—*Schleiden.*

Correspondence.

Mounting Objects.

Ed. Am. Jour. Microscopy—It would be an invaluable addition to the JOURNAL, if correspondents of experience would give short statements of the methods they follow in mounting microscopic specimens, whether in balsam or preservative fluids. Every experimenter is likely to discover some plan of operation in this matter, which might be of great service to others, even though it refers to some of the minor parts of the process. If some of our microscopical friends would occasionally give a statement of their manner of "mounting," which a beginner could follow at each step of the work, they would, at slight expense of time and labor to themselves, confer a favor on others, which would cause their names to be held in enduring remembrance and thanks. Yours, &c.

* * *

Crystals of Silver.

Ed. Am. Jour. Microscopy—In Rev. Thos. Dick's work, "The Telescope and Microscope," (p. 130), he gives the following:—"The *silver tree;* the preparation of which is as follows:—Dissolve a little silver in a small quantity *aqua fortis;* then add twice the quantity of common water to it. When it is applied to the microscope, a little of it should be dropped on a plain glass, and a short piece of small brass wire put into it; immediately trees will appear growing, till they have spread as far as the liquid extends."

When examined as opaque objects, they are very beautiful. Mr. Dick states that a piece of brass wire should be put in the liquid; I have tried copper wire with equal success. I have tried to keep them as permanent objects, by letting the liquid evaporate after the silver has crystallized, but usually the crystals disappear too. The following I tried with success: Cut two pieces of thick cardboard, the size of an ordinary object slide; blacken the centre of one of them; and, in the other, cut a hole about one half inch in diameter; the blackened spot on the first should be about five-eighths inch in diameter. The blacking may be made by dissolving some shellac in alcohol, and mixing in some lampblack. When the cardboard is dry, put a drop of the silver solution on the centre of the black spot and place a short piece of small brass or copper wire in the edge of the drop; then set it away, out of dust for two or three hours. After the crystals have formed and the liquid has evaporated, put some gum or mucilage on one side of the piece of cardboard that has the hole in it, and stick it on the blackened one, which will form a cell, with the crystals in it; then put a piece of thin glass over the cell and fasten it; the whole may be covered like an ordinary object. A power of from ten to fifty diameters will show them beautifully.

ALLEN Y. MOORE.

Coldwater, Mich.

Cyclops in Winter.

Ed. Am. Jour. Microscopy—On February 27th I collected, near Camden, N. J., *Cyclops* in abundance in pools which had been frozen over. For two days I exposed the glass jar containing them to the direct sunlight, and they soon became very active. I have found no difficulty in collecting them at any time this winter.

ISAAC C. MARTINDALE.

Camden, N. J., Feb. 29, 1876.

Circulation of the Blood.

Ed. Am. Jour. Microscopy—I call attention to the fact, if it is not already well-known, that the gills of the larval Salamander afford a convenient and interesting means of studying blood circulation. The eggs may be found in shallow ponds and in ditches in March or April, either singly or in chaplets. If they are transferred to clear water soon after being deposited, the embryo may be seen and its growth studied through its envelope. While the larva is yet in the egg, the circulation is interesting, but

increases in beauty for weeks after hatching. All the manipulation necessary is to remove the lively young swimmer to a watch-glass or a cell, and examine with an inch or half inch objective. While the larva is lying still on the bottom of the dish, with its three-branched, much-divided gills spread out like a fan, there is a strong *horizontal* current of water over the gills from in front toward the tail. Will some one through the JOURNAL have the kindness to explain the cause of said currents? D. S. K.

Cleaning thin Glass Covers.

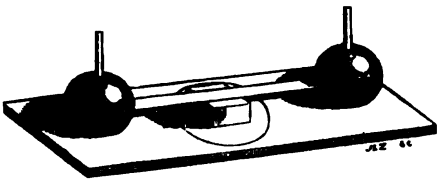
Ed. Am. Jour. Microscopy—Most people mounting objects for the microscope have considerable trouble in cleaning thin glass covers, and from many slides that I have seen from amateur's hands, I think that they are unable to get them anywhere near clean. We put our covers as a lot in a beaker with sufficient sulphuric acid to cover them, and after they have stood a little while we add water slowly (not quick enough to generate much heat) until we get the fluid near neutral—and afterwards displace the liquid by putting it under a spout. The covers then can stand in the water any length of time until one feels in trim for wiping them dry one by one. The dirt appears to be chiefly grease and the use of alkali makes the remedy worse than the disease. If this is not generally known, the information would be a blessing to beginners. F. H.

Our Work Table.

Double Weight for Balsam Mounting.—In mounting microscopic objects in balsam by the use of the hot water bath, and a weight upon the covering glass—which process is slow, but sure—one usual difficulty to be overcome is the tendency of the cover to gradually slide away from its original central position. I do not know if this plan has been adopted before; but I have found the little home-made apparatus here described very satisfactory in conquering this difficulty.

Two bullets are slightly flattened at one point by a few light blows with a hammer, so that they will stand on this flattened part without any tendency to roll. A piece of No. 16 iron wire, one half of an inch long, and sharpened at one end, is driven into the opposite part of each bullet for a handle. A gash, one eighth of an inch deep, is also cut in the side of each, which may be readily done with a hammer and a stout-bladed pocket-knife. A strip of tin-plate, one-eighth of an inch wide, and two inches long, is cut, and each end of the strip is thrust in the gash in a bullet, where the tin can be firmly secured by hammering the gash together with the sharp edge of a tack-hammer, or other suitable tool. A cube of cork is cemented at the middle of the under side of the tin strip, of such thickness that it will touch the covering glass when in use, and a varied pressure can be obtained from the weight of the bullets by slightly bending the tin strips up or down, before the apparatus is placed in position. Care should be taken that each bullet just touches the glass, in which case the slight springing of the tin strips will act as a lever, with the cork as a fulcrum; and, if more pressure is needed, it can be had by placing an additional weight on the cork.

The advantages of this method are, that nothing projects beyond the edges of the glass slip, to take



DOUBLE WEIGHT FOR BALSAM MOUNTING.

up unnecessary room or receive any accidental disturbing blow; and if the double weight is applied while the slide is cool, and the balsam slightly stiffened, even if the top of the hot water bath is not perfectly level, the covering glass will be securely kept for any desired time, without the slightest change from its original position.—*Rev. J. L. Zabriskie.*

Wanted.—Prof. Von Siebold is at present studying the fresh water fishes of Europe, and is also anxious to obtain specimens of the brine shrimp—*Artemia Salina.* We have, on this continent, some interesting congeners of that animal, and if any of our readers who have the opportunity will send us specimens preserved in alcohol, we can forward them to London free of expense. We gather from the letter of Dr. E. Ray Lankester, in *Nature*, that specimens from this continent would be acceptable for purposes of comparison. Packages may be sent to John Phin, No. 176 Broadway, New York, who will forward them to their destination.

ON MEDIC
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A New Form of Clip.—The following simple and ingenious mode of constructing a spring clip for holding covers in place is the invention of Mr. Norman N. Mason. A piece of German silver is cut

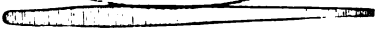


Fig. 1.

Fig. 2.

MASON'S SPRING CLIP.

to the shape of Fig. 1 but twice the size. It is then bent and folded as shown in Fig. 2, which represents the clip of full size. The manner of using it is obvious.

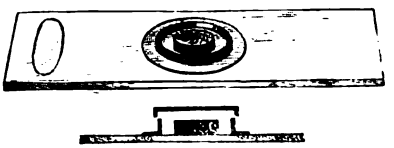
Science for the People.—At the close of his series of six Christmas lectures, in London, on electricity, Prof. Tyndall remarked that five of them had been illustrated with apparatus which any teacher could make of the commonest material, at scarcely any cost. He hoped the example thus set would be followed, for the future of science depended to some extent on teachers in the public schools. The masters of schools, he said, should look the problem of scientific education straight in the face, for science was growing day by day, and hour by hour, and, although he would deprecate any change from without in the public school system, he would advise the masters to make the change from within, before the outside pressure became too strong.

Simple and Convenient.—To those who possess microscopes of the old Continental form, which do not incline, the little contrivance shown in the accompanying illustration, will prove very convenient. Its construction is easily understood. It consists of a base, to the middle of which is hinged a vertical piece, which receives the foot of the microscope, and which may be elevated and depressed

SUPPORT FOR MICROSCOPE.

so as to incline the body of the microscope to any angle. This hinged piece is supported by a triangular block, which regulates the angle of inclination, and is held firm by means of a rubber strap which acts as a spring. This device was invented by Mr. Charles Stodder, of Boston, many years ago, but is not generally known. It may be adapted to any microscope stand which does not incline, and will be found very convenient. The microscope which our artist has figured is, it must be confessed, of a somewhat primitive form. It is the support, not the microscope, however, to which we wish to call attention.

Cell for Opaque Objects.—Opaque objects have always been a source of trouble to microscopists. If covered with thin glass it is difficult to see them clearly; if mounted in an exposed condition, they are liable to injury, and if placed in a deep cell, so as to be protected, it becomes impossible to illuminate them. Prof. Pierce has devised a new mode of mounting, which is shown in the accompanying figures. A metallic cell, having a broad flange like the rim of a hat, is cemented to an ordinary glass slide, as shown in section in the lower figure. To this cell is fitted a cap which covers and protects the object. The object may be placed directly on the glass or raised by means of a disc of



PIERCE'S CELL FOR OPAQUE OBJECTS.

any required thickness so as to be more easily illuminated. The slide, with cell uncovered and containing an object, is shown in the upper figure. Uncovered objects may in this way be very perfectly protected from mechanical violence and from dust. An object mounted in this way, recently went the rounds of the Micro-Postal Cabinet Club, and in one case the slide was broken, but the cap remained uninjured—not even separated from the glass.

Ivory.—To furnish the ivory which is imported into England alone, 50,000 elephants have to be killed every year. The best ivory comes from Zanzibar, the product of the African elephant; it is opaque, soft, easy to work, and free from cracks and other defects. That from Ambriz, the Gaboon river, and south of the equator, is called "silver gray;" it remains white, and never becomes yellow, as is the case with the Asiatic ivory; it is therefore the most valuable of any ivory in the market. The tusks from Siam are translucent, and being soft grained, are preferred for ornamental work. The fossil tusks of the mammoths found in the Arctic Regions and Siberia, form a not inconsiderable amount of the ivory trade; some of these tusks are in as fine a condition for working as the very best of modern ivory, which is very remarkable, as some of these elephants or mammoths have been pre-

served in an ice crust, and have remained imbedded for unknown ages, probably since the glacial period —some 150,000 years ago. If this is so, it goes to show that the change of temperature took place rapidly in a then tropical climate, where these animals previously flourished, and overtaking them suddenly, and covering them with an ice crust, were the causes of their perfect preservation.

Have we any "Microscopists" amongst us?—Mr. F. Kitton, well-known as an expert "diatomaniac," says not, claiming that there is no such *science* as "microscopy," and consequently no such thing as a "microscopist;" and he says we might as well call an astronomer a "telescopist," and astronomy the science of "telescopy!" So far as that goes we see no impropriety, except, perhaps, a philological one, in calling one who is expert with the telescope, a "telescopist," but telescopy is certainly not astronomy, any more than microscopy is botany. "Microscopy" and "microscopist" are good, legitimate words, the first signifying the art (not the science) of using the microscope, and the second, one who is expert in this art. Mr. Kitton seems to have become slightly confused in his philology, but he gives sound advice to his readers when he tells them to use their microscopes for investigation rather than for merely looking at pretty things. The same point was urged in an article in the first number of this journal—"Work for cheap microscopes," in these words: "The highest pleasure is to be obtained from the microscope when it is devoted to earnest work."

Poisoned Arrows.—A detailed description of the poisoned arrows of the Papuans, such as those with which Commodore Goodenough, of the British Navy, was recently killed in the South Pacific, has been received from private sources by Dr. J. D. Hooker, President of the Royal Society. It seems that the points consist of needle-like bits of human bone, which are plunged into a human corpse, and poisoned by being allowed to remain there a number of days. A very slight scratch by arrows thus treated is absolutely fatal, poisoning the blood of the victim, who dies with symptoms resembling those of lockjaw, although no ill effects are usually experienced from the wound until a number of days after its infliction. To distinguish them from ordinary shafts, these poisoned arrows are handsomely carved and elaborately painted.

Imitation Wool and Silk.—According to the Boston *Journal of Chemistry*, there is now produced a class of goods made entirely of cotton, but called merino, and which have the look of the latter fabric, owing to the woolly surface imparted to them in the process of manufacture. These goods are found both in the United States and the Spanish American markets in large quantities, especially in men's undershirts and drawers. To cause the cotton to thus resemble wool, it is scratched, and the surface raised by a particular operation. On drawing out a thread or two and burning them in the flame of a taper, if the material be cotton it will consume to a light, impalpable white ash, cotton being a vegetable fibre; but if, on the contrary, it is wool, and therefore an animal fibre, it will twist and curl in the flame and show a black ash, accompanied with a smell which will at once indicate its origin. Cotton is now so cleverly treated that it is frequently taken for silk—also an animal fibre—and the simple test referred to can always be applied when there is any doubt upon this point. Examination with the microscope is, however, a much more certain test.

Death from the Sting of a Bee.—On the 4th of last September a young girl living at the hamlet of Crevecœur, was stung by a bee on the left cheek and died a few minutes afterward. She had manifested symptons of nervous disorder, supposed to be hysterical, previously. A year and a half before she had been stung by a bee, and had remained insensible for more than four hours afterward.—*Les Mondes.*

Our Book Table.

The Nature of Light; with a General Account of Physical Optics. By Dr. Eugene Lommel, Professor of Physics in the University of Erlangen. With one hundred and eighty-eight illustrations, and a plate of Spectra in chromolithography. New York: D. Appleton & Company.

A knowledge of the general principles of optics is essential to every student of the microscope, and therefore a simple and yet thorough text-book should be in the hands of every one that owns one of these instruments. The difficulty with most works on this subject is that the mathematical knowledge required is too profound for most readers. Not that we would by any means convey the idea that a thorough knowledge of optics can be otained without a sufficient training in mathematics, for this is impossible. At the same time, however, there are very many truths that may be fairly comprehended by those whose mathematical education has not been very extended, and it is of great importance to such persons to know just the book that will give them, in the simplest form, such an amount of information as they may readily comprehend. The work before us is of this kind. It gives all the information that is available to those of limited mathematical knowledge, and it gives it in simple and easily understood form. It is unnecessary to enter into a detail of the contents of the volume. It covers a range sufficiently wide to fill the wants of the class of readers we have indicated, and it has not sacrificed scientific accuracy to popularity, as is too frequently done.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—On March 2d, a letter from Mr. Christian Febiger, of Wilmington, Delaware, accompanied by a box of three slides of arranged diatoms, was received. The gentleman was desirous of exchanging slides with any of the members, and also stated he would give his method of arranging diatoms on application.

Dr. A. Mead Edwards, corresponding member, by letter asked any member of the society to gather specimens of sea ferns or moss from any locality on the Pacific coast, and forward the same to him at Newark, N. J., as he is desirous of obtaining the diatoms that are often found attached, particularly on the red varieties.

A very valuable donation to the library was made by Freeman C. S. Roper, Honorable Secretary Microscopical Society, London, in the shape of a printed catalogue of works on the microscope, and of those referring to microscopical subjects in his private library. The literature on these matters is quite ample, and dates back more than a hundred years, and includes many languages.

Mr. Kinne made a donation of five slides to the object cabinet, mounted by him, as follows: raphides; *zygnema cruciata;* diatoms from Alameda Point and Oakland; and diatoms including the curious *schizonema Grevilli*, all mounted in fluid, natural; and diatoms from Alameda Point cleaned and mounted dry for identification. These slides were all examined, and some time was spent in noting their peculiar characteristics, particularly that of the *schizonema*, which was remarkable for its great external resemblance to some forms of algæ. The frustules were contained in a regular tubular frond, and when gathered by Mr. Kinne, he stated they were living and could be seen passing up and down the canal, while some were emerging from their contracted quarters at the broken end of a filament.

Flowers and Vegetables.—Every one knows that success in cultivating these beautiful and useful objects depends largely upon the character of the seed employed. Other things being equal, one who is himself an enthusiast in such culture is the one who is most likely to appreciate the wants of lovers of good plants. Such a one is our old friend, James Vick, of Rochester, N. Y., whose name is associated with flowers and vegetables in the minds of the most successful growers in the country. Mr. Vick has issued a very elegant catalogue, which is not merely a list of plants, but a thoroughly practical treatise upon gardening, and ought to be in the hands of every person who desires to secure success in cultivation.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

The attention of those who have the opportunity to supply them are called to the wants of Prof. Von Siebold, stated in another column.

For palates of periwinkle and limpet send a stamped directed envelope or an object of interest to F. F. Stanley, Swampscott, Mass.

Foraminifera, very choice, and diatomaceous earth, in exchange for interesting material. George B. Scott, Box 5645, New York City.

Wanted to exchange, periodically, filterings from the water supply of Buffalo for the same of any other city. D. S. Kellicott, 119 Fourteenth street, Buffalo, N. Y.

Mounted specimens of *Humulus Lupulus Ext.*, showing lupulin crystals, for any mounted objects. Richard Allen, 146 North Fourth Street, Troy, N. Y.

Roestelia lacerata, *Puc. xanthii*, and *Puc. aculeata*, in exchange for other unmounted fungi. W. C. Stevenson, Jr., 1,525 Green St., Philadelphia, Pa.

Slides of "Sonorous Sand," from Sandwich Islands, very interesting, for any well mounted objects. W. G. C., Box 1774, Boston, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield. Mo.

Irish and British marine Algæ in great variety, correctly named, for herbariums, etc.; also beautifully mounted in balsam and other mediums; in fruit; many laden with diatoms; or splendid specimens, specially prepared for balsam. Foraminifera from Dog's Bay, Egypt, Java, etc; diatoms, zoophytes, sponge spicula, Holothuria plates, mollusca palates, ghost crabs, starfish, and various other unmounted interesting marine material, as well as botanical and entomological objects, etc. For any American objects, mounted or otherwise. Send detailed list of everything you wish to exchange; all letters answered. T. McGann, Burrin, Ireland.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Wanted in exchange for Vegetable Slides, other well mounted slides. Address F. F. Stanley, 40 Pearl street, Boston.

Books Wanted.—Address, stating condition and lowest price, E. W., care AMERICAN JOURNAL OF MICROSCOPY, 37 Park Row, New York.

"Micrographic Dictionary." Second edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Caspar's "Forensic Medicine." 4 vols.
Faraday's "Electrical Researches." 3 vols.
Holtzapfel's "Mechanical Manipulation."

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AND

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VOL. I. NEW YORK, APRIL, 1876. No. 5.

Crystallization of Silver.

THERE are several microscopic objects which cannot be shown mounted or preserved so as to exhibit their greatest beauty, and these objects are all of the deepest interest and significance. Chief amongst them are the circulation of the blood in living animals, the circulation or cyclosis in plants, the process of crystallization in salts and metals, the ciliary motion of the respiratory apparatus of clams, oysters, mussels, etc., and a few others. On each occasion on which the objects are examined, they must be produced afresh for very obvious reasons. As occasion serves we shall endeavor to point out the best method of observing these microscopic wonders.

CRYSTALS OF SILVER.

One of the favorite objects of the older microscopists, was the crystallization of salts under the microscope. Baker, in his "Employment for the Microscope," gives a long account of the behavior of various saline matters, and amongst the subjects discussed by lecturers, and projected on screens at exhibitions of the solar or oxy-hydrogen microscope, crystallization always takes a prominent place. Of all the crystallizations which can be readily produced, however, none equal in brilliancy and beauty that of pure silver. But to be seen in perfection the crystals must be watched during the process of formation; when mounted, even in their best condition, they fall far short of the appearance which they present while growing. The method which we have found to give the best results is to place a drop of solution of nitrate of silver on a slide, and bring in contact with it a small mass of the amalgam used for ordinary mirrors. The drop of liquid should be well spread out and the glass should be black. If black or dark colored glass cannot be procured, a piece of black paper may be pasted on the under side of an ordinary slide. As soon as the amalgam has been brought in contact with the solution of silver, decomposition takes place, nitrate of tin and mercury formed, and pure silver is thrown down. This pure silver instantly forms, with the other substances present, a minute voltaic battery, and the rest of the silver is deposited in beautiful crystals, just as copper is deposited on one of the poles of the Daniel's battery. These crystals shoot across the field with considerable rapidity, and they are seen to grow in

exquisite fern-like masses, of which our engraving gives a faint representation. While fresh, their surfaces are clear and brilliant, and if well illuminated by means of the bulls-eye condenser, or any similar method of condensing light on them, they are almost dazzling. An objective and eye-piece of low power should be used, a magnifying power of thirty diameters being sufficient.

We prefer the amalgam of tin and mercury to all other agents for throwing down the silver, because it does not interfere with the beautiful white color of the crystals, as do copper and most other metals. When a greenish hue is desired, however, copper or brass may be used. When the solution becomes weak, the crystals form in slender, needle-like stems; when the solution is strong, the silver is deposited in frond-like masses. By varying the strength of the solution during the process of crystallization, the most beautiful effects may be produced.

The Kentucky Shower of Flesh.

IT appears to be a law of nature that weeds should grow with flowers, tares with corn, and that superstition should almost touch truth. Showers of frogs, of fishes, of bloody rain and snow have frequently occurred. The last sensation, however, "the fall of flesh in Kentucky," offers some features of special interest.

In 1537, while Paracelsus was engaged in the production of his "elixir of life," he came across a very strange looking vegetable mass, to which he gave the name of "Nostoc." The want of rapid transportation, combined with the perishable nature of the substances fallen, have hitherto prevented a complete and exhaustive examination. The specimens of the "Kentucky shower," reached New York well preserved in glycerine, and it has been comparatively easy to identify the substance and to fix its status. The Kentucky wonder is nothing more or less than the "Nostoc" of the old alchemist. The Nostoc belongs to the confervæ; it consists of translucent, gelatinous bodies, joined together by threadlike tubes or seed-bearers. There are about fifty species of this singular plant classified; two or three kinds have even been found in a fossil state. Like other confervæ, the Nostoc propagates by self-division, as well as by seeds or spores. When these spores work their way out of the gelatinous envelope they may be wafted by the winds here and there, and they may be carried great distances. Wherever they may fall, and find congenial soil, viz., dampness or recent rain, they will thrive and spread very rapidly, and many cases are recorded where they have covered miles of ground in a very few hours with long strings of "Nostoc." On account of this rapidity of growth, people almost everywhere faithfully believe the Nostoc to fall from the clouds, and ascribe to it many mysterious virtues. The plant is not confined to any special locality or to any climate; sown by the whirlwind, carried by a current of air, in need of moisture only for existence and support, it thrives everywhere. Icebergs afloat in mid ocean have been found covered with it. In New Zealand it is found in large masses of quaking jelly, several feet in circumference, and covering miles of damp soil; and in our own country it may be found in damp woods, on meadows, and on marshy or even gravelly bottom.

All the Nostocs are composed of a semi-liquid cellulose and vegetable proteine. The edible Nostoc is highly valued in China, where it forms an essential ingredient of the edible bird-nest soup. The flesh that was supposed to have fallen from the clouds in Kentucky is the flesh-colored Nostoc (N. carneum of the botanist); the flavor of it approaches frog or spring chicken legs, and it is greedily devoured by almost all domestic animals.

Such supposed "showers" are not rare, and are entirely in harmony with natural laws. In the East Indies the same Nostoc is used as an application in ulcers and scrofulous disease, while every nation in the East considers it nourishing and palatable, and uses it even for food when dried by sun heat.—*Leopold Brandeis in Sanitarian.*

Learning to Use the Microscope.

HAVING carefully studied the construction of the microscope, and become familiar with all its movements, and having also learned how to place an object on the stage, how to illuminate it, and how to bring the object-glass into such a position that the object will be in focus, the beginner should proceed to familiarize himself with all the various means and methods of subjecting an object to microscopical examination; and this is best done by taking a few simple, typical objects and going through all the various steps with them. As the simplest of all common objects, begin with the scales from a butterfly's wing—an object which may be found in every collection or which may easily be procured by the young microscopist. Any butterfly or moth—the common yellow butterflies which flit around during the warm season, or the clothesmoth, which is such a pest to housewives—will answer. Having caught one, take a clean glass slide, breathe on it, press the wing of the insect against the slightly damp glass, and scales innumerable will adhere to the latter. For the present these scales may either be covered with thin glass or left uncovered as may be preferred. If it be wished to cover them, the thin glass must be made to adhere to the slide, and this is best accomplished temporarily in the case of dry objects, by means of three very minute dots of Canada balsam. Place the slide on the stage of the microscope, bring it accurately into focus and examine it with light which passes through it from the mirror, in such a direction as to pass through the axis of the body. In other words, the bar which carries the mirror should be in a straight line with the body. Use first the plane mirror and then the concave, and watch the different effects of each. If the work is done by lamplight, move the lamp to a distance, and also place it very close, and watch the effect of each position. If the field of view should be very brilliantly illuminated, observe the effect of the diaphragm in moderating the light. Many details will be seen when the light is moderated, which are *drowned out* when the light is too intense.

Having carefully studied the effects of variation in the intensity, etc., of direct light, proceed to try the effects of oblique light. Every thing being arranged as before, turn to one side the bar on which the mirror is hung, and direct the light on the object from one side. If the microscope should be furnished with a sub-stage, this must be removed. Now try the effects of various degrees of illumination at various angles of obliquity. If the objective be not very good, cross lines which were perfectly invisible by direct light, will now appear on the finer scales, and even with the best objectives some lines which are invisible by direct light can be shown by oblique light, provided difficult test objects are used. The learner will observe, that with some objectives it is possible to place the mirror much more to one side than with others, and yet not lose the illumination.

The scales should now be examined by reflected light—that is by light reflected from the upper surface of the object, and not by rays passing through it. To do this satisfactorily with ordinary microscopes, the light must be condensed on the upper surface of the object by means of a bull's eye condenser, as it is called. Every boy is familiar with the common burning glass, and knows how to throw a bright spot of light on the object he wishes to set on fire. Condensing the light on a microscopic object is a process of precisely the same kind. Get the lens between the lamp and the object in such a way that the bright spot of light will fall on the latter, and the thing is done. Having brought the object into focus and illuminated it, watch the effects which are produced by a change in the direction of the light as regards the object. Such changes are made by turning the object itself round, either by means of a rotating stage or by hand, and by raising and lowering the light (and with it of course the condensing lens), so as to vary the amount of shadow cast by any irregularities in the surface of the object. The effects produced in the case of some

minerals, butterflies' wings, etc., by such changes are very marked. A fragment of specular iron ore, which is a dull, blackish mass when presented to the light in one direction, becomes wonderfully brilliant when this direction is changed.

Illumination by means of the achromatic condenser, Lieberkuhn, side reflector, parabolic illuminator, etc., should be carefully studied by those who possess such accessories. While thus studying the varying effects of different modes of illumination, the learner should of course keep to one object at a time. When the first object has been carefully and fully examined, a second may be taken, and the whole course gone through with it.

Having made himself familiar with the methods of illuminating objects, the learner should now pass to a study of the effects produced by placing objects in different media. Let him take a few fibres of wool, well washed in alcohol or ether, and examine them as follows:

1. Dry or in air. Lay them on a slip of glass, cover with thin glass and examine.

2. Water. Moisten first with strong alcohol, and then with plenty of water. Place on glass slide as before, cover with thin glass and examine.

3. Alcohol. Proceed as just directed.

4. Glycerine. Use this in two forms—one containing equal parts of water and glycerine, the other being the purest and strongest glycerine that can be obtained.

5. Canada Balsam. To mount in Canada balsam is not quite as easy as to simply moisten with glycerine and cover with thin glass. Warm the slide, let a drop of balsam fall on it, warm again slightly until the air that is present has collected on the surface in bubbles. Remove the bubbles by means of a common pin stuck in a splinter of wood for a handle, and then place the wool in the melted balsam. While still warm and fluid, heat a cover slightly and place it on the drop of balsam. Press the cover and slide together by means of a clip or weight, and allow it to cool. It will then be ready for examination.

Try the same course with starch from the potato. Examine it dry, in water, in alcohol, in glycerine and water, in glycerine, and in balsam, using very fluid balsam or a solution of balsam in benzole.

Observe the effect of the cover in forming an even surface on the fluid. Place a few grains of sand on a slide, moisten with not quite enough water to fully cover them, and examine. We once found a person using a microscope under just such conditions. If thin glass cannot possibly be procured, mica or stove "isinglass," as it is called, may be used.

Until the learner has become familiar with the use of his instrument, it will not be well for him to spend much time in the preparation and mounting of difficult objects. Having acquired skill in examining objects, it is then time to proceed to the next step, which is to prepare and mount them. The following are the principal methods of mounting:

1. Dry. The objects which demand least skill and labor are those which are mounted dry in very shallow cells. Make a cement cell, either with the turn table or by painting a ring on the slide, being guided by a black ring drawn on a piece of paper and placed under the slide. In cells so made mount scales of insects; very small fish scales; wing of fly; blood (by spreading in a very thin layer, drying rapidly and covering); hairs of mouse, etc. The object being in place, the cover is laid on, the slide gently warmed, and the cover pressed to its place until the cement is seen to form a clear black ring all round. After a time a ring of cement should be placed over the edge of the cover.

2. In balsam. Mount human hair, the wing of the bee, the foot of the fly, etc., in balsam. No cells are required.

3. In fluid. Mount the so-called tongue of a fly in glycerine. Having severed the tongue from the insect, under water, place it in a watch glass and add glycerine to the liquid. Beware of dust, and keep changing the liquid and adding glycerine until the object is saturated with strong glycerine which will take one or two days. Place in a deep cell,

made on the turn table, with solution of shellac, fill the cell with glycerine, place on the cover, wipe off superfluous glycerine, and cement the edges of the cover with solution of shellac. When dry, wash off the cover with a camel's hair pencil and a mixture of water three parts, alcohol one part. When thoroughly dry add a coat of cement and allow to dry. Then, but not before, wipe off the slide and add another coat of cement.

When the learner has succeeded in mounting simple objects well, he may proceed to the preparation of sections, injections and the higher departments of the art.

One of the first things the young microscopist should do is to familiarize himself with the common objects which he is likely to meet during the examination of every thing that has been at all exposed to dust. The following is a list of those most ordinarily met: Fragments of wool, cotton, flax and silk; hair of man, cat, dog, calf, mouse; scales from moths, butterflies, etc.; hairs from ditto; particles of woody fibre from pine, oak, mahogany, cedar (so-called) of pencils, etc.; cuticles of plants such as tea leaves, leaves from trees growing near by, straw and chaff of wheat, oat, rye, husks of corn (often used for bedding), etc.; minute fragments of coffee-berry, potato, wheat, maize, oat, bread, feathers, down, sand, soot, etc. etc.

Particularly should he examine globules of air in oil, water, glycerine and balsam; oil in water; water in oil, etc. In studying these it may be well occasionally to color the oil or water with some coloring matter not soluble in both media.

It is only by examining well-known objects in various ways that the necessary skill and experience required in the examination of unfamiliar objects can be attained. Therefore do not get discouraged by the thought that such preliminary work amounts to nothing so far as "seeing things" or building up a cabinet is concerned. We have often known persons so eager to get together a large cabinet of objects that they were thereby prevented from becoming good microscopists. As Dr. Beale says, "Practical work is the very grammar of the subject, and must be mastered, and mastered thoroughly. * * It is certain that he who is most fully conversant with elementary detail and most clever at demonstration, will be the most successful in the consideration of the higher and more abstruse problems."

Snow Crystals—Natural and Artificial.

FEW things are more exquisitely beautiful than snow crystals examined under a low power—say 10 to 25 diameters—the latter power being best obtained by using a good compound microscope and a two or three-inch objective. A good magnifier, such as is used by engravers, however, gives a very fair view of them. But it is only at certain seasons that snow crystals are available, and unless examined in a very cold room they are exceedingly perishable. The best method is to catch them on a piece of black cloth, and carefully protect them from the breath and from the heat radiated from the face. This may be done by means of shields of pasteboard or stiff paper, through which the lens is passed. To avoid these difficulties, however, M. Dogiel, of the St. Petersburg Academy, has endeavored to obtain some substance not liable to dissolve at ordinary temperatures, and crystallizing, like snow, in the hexagonal system. He selected iodoform, which crystallizes in a remarkable variety of forms. To show their multiplicity, M. Dogiel dissolves iodoform in boiling (90 per cent.) alcohol, and lets the solution cool in water of different temperatures. He gets mostly tabular crystals, when a solution containing 15 to 30 per cent. of iodoform is kept ten minutes in water of about 14° to 15° C.; whereas star-shaped and often very complicated crystals are had at temperatures of 26° to 37°. Some other modifications of the result are described by M. Dogiel in a paper recently published, and he also gives drawings of the crystals he obtained. We presume that some of our readers may be interested to repeat his experiments.

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AND

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Use and Abuse of the Imagination.

FEW persons have failed to read Tyndall's valuable and interesting paper on the "Scientific Use of the Imagination," and we may therefore assume that our readers are familiar with what can be said in favor of the *uses* of this faculty. Unfortunately, however, the abuse of the imagination is much more common than its use, especially on the part of those who have not been thoroughly trained to scientific work, and it may be well to offer a few words of caution in this direction, especially as microscopy is a fertile field for the errors arising from this cause. The knowledge which we obtain from a microscopical examination of any object depends almost wholly upon information derived through the sense of sight—a sense that is the most easily deceived of all our faculties. We cannot by our sense of feeling test the impressions we receive; we cannot even look round the corners and examine things from different points of view, and therefore it is of consequence that we exercise our observing powers to their utmost and studiously avoid jumping at conclusions in regard to the existence of objects which we *think* we see rather than which we *know* we see. The extent to which this looseness of observation prevails in microscopy is something of which those who judge by work in other directions have no idea. It is the most common thing in the world to hear inexperienced microscopists describe things which exist nowhere but in their own imagination. We have seen people who, in any given specimen, could discover everything that had ever been described in the books. Pieces of amorphous matter would, under their vision, round out into perfect diatoms, or assume the form of the most beautiful desmids; mere aggregations, without lines or angles, are described as crystals; feet and every other organ spring from such living objects as may appear in the field of view, and dirt and foreign matter are assumed to be complicated organs. This is not by any means a fancy or exaggerated sketch. Dr. Beale describes a case in which a portion of feather which had accidentally found its way into a preparation, is figured and described as part of the nervous structure. This was not done by a beginner, but by an author of repute, who, however, was careless in his observations, and gave a loose rein to his imagination. A certain microscopist, who has recently published some very valuable observations, mixed them up with matters purely imaginary, and thus, for a time, entirely destroyed the value of the work done, at least, so far as the intelligent public are concerned. Over and over again we have had from young microscopists the most glowing accounts of what they had seen, but when these supposed wonders were submitted to the scrutiny of one with a little experience, they faded into nothingness, depending as they did wholly upon the effects of imagination.

The only means by which such mistakes can be avoided is by training oneself to severe accuracy and close observation. To this end nothing is more effective than the habit of drawing objects under the microscope and measuring their dimensions. The latter process, as a means of advancing general knowledge, has frequently been

abused and estimated too highly, but as a means of enforcing close observation, it is invaluable. Above all, however, the student should train his mind to deliberate thought and should avoid jumping at conclusions in regard to structures and especially in regard to the relations of the different parts of any object. This demands close and constant self-criticism.

Recent Improvements in the Turn-Table.

THE invention of the turn-table, by Shadbolt, was one of the most important additions to our means of mounting microscopic objects. For a long time it has retained the form which it received shortly after its invention, and even now the turn-table of twenty-five years ago is equal to almost all the wants of the microscopist. Attempts have been made to produce a table which will automatically centre the slide—not a very difficult task, in view of the immense amount of ingenuity that has been expended in this direction in the kindred subject of the turning lathe. For ourselves, however, we still prefer to centre our slides by hand. Those who have a true eye can do it accurately and expeditiously, and when necessity requires the slide to be out of centre, for the purpose of bringing an already-made cell into the centre, the common table allows full variation in this respect.

The ordinary table is rotated by the action of the finger on a small, milled collar, and when once set in motion, its momentum serves to maintain the movement until the cell has been finished. Under ordinary circumstances this answers every purpose, but when a cell more elaborate than usual is to be made, the varying velocity of the table—a velocity which steadily and rapidly decreases—is a sericus objection. Mr. D. Bryce Scott, of this city, has remedied this difficulty by attaching an old clock work to his table. The gearing is large and strong, and is moved by a heavy weight. Such a table has an equable motion, which can easily be regulated by a brake, and the power applied is sufficient to allow of a deep cell being turned off by means of a cutting tool, so as to improve its shape and make it absolutely true. This improvement we regard as quite valuable. We have now before us a table in which the same result is attained by means of a small electro-motor. A single voltaic cup furnishes sufficient power for ordinary work; two or three cups give a power which enables the operator to turn off his cells if he wishes. The power of one or more cells is easily applied or cut off by means of a proper switch. The whole arrangement is exceedingly neat, convenient and efficient. It is the invention of Mr. G. S. Scott, Superintendent of the Gold and Stock Telegraph of this city.

At a recent soiree of the Oldham (England) Microscopical Society, there was exhibited an ingenious form of turn-table, made by Mr. Charles Butterworth, of Shaw, by which cement cells might be made of any form between a perfect circle and an exceedingly elongated ellipse. By its aid, also, a thin glass cover could be held in position on a cell so made while the finishing rings of cement were added. We regard this as a very valuable invention, and indeed our own necessities, while studying various textile fibres and mounting specimens for permanent preservation, led us to devise a similar table. The ordinary round cell is not well adapted to the display of long fibres, while rectangular cells never have a neat appearance. Such a table ought to be rotated by one of the mechanical methods previously described.

These are efforts towards the perfection of the turn-table. They all involve considerable expense, and therefore it may not be out of place to refer to an attempt in the opposite direction. Mr. Brainard, of Chicago, makes an instrument in which the table is a flat, oblong block of lead, cast on the head of a common wood screw, which, after being smoothed off a little, is fitted into the pipe of an ordinary key fixed vertically in a block of wood. The surface of the block of lead is the exact size of the slide, which is held in place by two rubber

bands. The slide is therefore easily centered, and a touch from the tip of the finger causes it to rotate. Any intelligent boy with a mechanical turn ought to be able to make such a turn-table from the above description. The expense would be scarcely anything.

Correspondence.

The Microscope in Summer.

Ed. Am. Jour. Microscopy—It is too generally supposed that the time when the microscope is chiefly valuable as a source of intellectual pleasure is during the winter months, when the long evenings give abundant leisure around the home fireside. Talking with a well-known manufacturer the other day, he told me that three-fourths of all the microscopes sold were disposed of in the fall and early winter, and I know many of my acquaintances who have laid their microscopes aside for the season. Such persons are accustomed to examine mounted objects mostly, but if they knew the greatly superior beauty of living and freshly prepared objects, they would consider spring, summer and fall, the choice seasons for enjoying the microscope. During these months every brook and pond teems with objects of great beauty. The leaves and stems of plants; living insects, or those which have been freshly killed; all the different objects which are so very interesting to a real lover of nature, afford abundant work for the microscope. Those, therefore, who are going to the seashore, or to the country, I would by all means urge to take their microscopes with them. They will find in the beauties which they may discover by means of them, a pleasure far greater than can ever be derived from the usual run of amusements carried on by young people under such circumstances. * * *

Preservative Fluids.

Ed. Am. Jour. Microscopy—For some time past I have been using the following solution for soaking dried specimens of Sphaeria, Peziza, etc., so as to render their asci, spores, etc., fit for examination.

Glycerine concentrated.....	1 oz.
Alcohol 1 part.....	1 oz.
Water 6 "	

The fungus is placed in a small watch glass and covered with about one-eighth ounce or less (according to the size of the specimen) of the mixture; a tumbler or small bell glass is inverted over it, and all allowed to remain for a day. If a small portion of the fungus is now transferred to a slide, covered with a thin glass, and gently pressed, it will flatten out thin enough to be viewed with any power. The asci, etc., are as "plump" as though the specimen was recently gathered.

The alcohol evaporates first from the mixture, and then the water, thus giving us a solution which gradually becomes denser. Glycerine possesses a great advantage over water for the above kind of work. You can continue your investigations or drawings from time to time without any danger from evaporation of the fluid; with water this is a great source of annoyance. W. C. S. Jr.

[The above liquid resembles in its composition the well-known fluid of Hantzsch which we have frequently used for vegetable preparations, desmids, etc., in a manner similar to that of our correspondent, with most excellent results. Hantzsch's fluid consists of 3 parts alcohol, 2 parts distilled water, and 1 part glycerine. In some cases, as in that described by our correspondent, it is well to diminish the proportion of alcohol.—*Ed. A. J. of M.*]

Microscopic Gymnastics.

The following letter from Mr. J. Edwards Smith, of Ashtabula, Ohio, to the San Francisco Microscopical Society, deserves a place in our pages:

To the Members of the San Francisco Microscopical Society—Gentlemen: The March number of the Cincinnati *Medical News* is at hand, and I have been reading President Ashburner's annual address to your Society with much interest and pleasure.

President Ashburner speaks of the "going through," or resolution of the Möller test plate as a species of microscopic "gymnastics." The word is fitly spoken, is suggestive, and I hope it will *stick* and find a place in the vocabulary of every advanced and advancing microscopist. To such, the education of the eye is of paramount importance, and to this end the study of difficult diatoms is at once the most convenient, and the most valuable assistant.

A common objection urged against the study of diatoms, is that diatomists themselves are

not agreed as to the structure of these minute organisms; that changes in illumination, etc., materially effect the images as seen in the field of the microscope. Even to grave and scientific men this objection appeals with herculean force —while to the Dutch quack, who rejoices in the possession of a French triplet, worth at par value $3, the objection named is a veritable "Balm in Gilead." Nay, he will go farther, (quoting Beale and Carpenter,) and assert that nothing is well done that is not accomplished with low angles.

Far be it from me to evade; let the objection named have its full force—that the true structure of difficult diatoms is not fully demonstrated, is an indisputable fact. Had this been otherwise, the diatomist would have abandoned the study in search of organisms unknown. Yet their labors have not been for naught. To them and to their incessant demands on the optician, are microscopists indebted for the improvement in object glasses and other valuable adjuncts to the microscope, exploring, as they do, fields not only unknown but, to other eyes, invisible. They are early taught the value of instrumentation, as also other conditions necessary to the accomplished observer.

Our "Dutch Quack" referred to, could no more become a diatomist, than could the Jew become a Knight Templar Mason!

In admitting fully the failure of the diatomist, it is becoming to inquire as to the success of other laborers in microscopy, for in every branch of microscopic research the shortcomings that environ the diatomist will be found to have place, and to have still greater force. While we own that change of illumination, etc., will affect the image of a diatom, the same conditions will also similarly affect a blood corpuscle. We turn confidently to our "grave and scientific friend," the professional pathologist, and ask him to tell us something of the ultimate structure of the human lung, spleen, kidney, etc., and find that he knows no more of these than can be told of the diatoms, while (thanks to superior instrumentation and skill in observing) it is sometimes quite possible to materially assist the histologist—for, as a class, the latter are content to work with very poor tools, and are too apt to be satisfied with their performance.

Let those who aspire to become advanced workers practice President Ashburner's "Gymnastics;" but remember that the Möller and the Nobert plates are not the only gymnasiums extant, and that neither Amphipleura Pellucida nor the 19th Band constitutes the limit to human vision.

J. Edwards Smith.

Ashtabula, Ohio, March 27th, 1876.

Our Work Table.

Bacteria in Perspiration.—Dr. Eberth, of Zurich, Switzerland, has found that ordinary perspiration contains large numbers of *Bacteria*. This was to have been expected, since the conditions for growth are very favorable, and the germs must be filtered out of the air in enormous numbers by coming in contact with the extensive moist surface of the body. Powerful reagents do not seem to affect them—acids, alkalies, alcohol, ether, chloroform, etc., having no effect. The only way to get rid of them is to remove them by frequent and careful washing.

New Process for Staining Tissue.—M. Cornil employs "violet methylamine." Its merit is said to be that its constituents separate into red and blue elements, which have different affinities for the tissues acted upon, and it is therefore specially fitted for organs in a state of lardaceous degeneration, the lardaceous part taking a red tint, the normal a blue. M. Cornil has by this process determined that the lardaceous change takes place first in the interior of the small arteries. One objection to the method is the disappearance of the coloration in specimens mounted in Canada balsam, glycerine, etc.

A New Method of Staining.—In the Physiology Section of the British Medical Association, at Edinburgh, Dr. Frances Elizabeth Hoggan communicated a new method of staining tissue for microscopical investigation. After the section or membrane is prepared, it is first steeped for a few minutes in alcohol. This having been poured off, a few drops of 1 or 2 per cent solution of perchloride of iron in distilled water is poured on the tissue; after the lapse of some minutes a few drops of a 2 per cent solution of pyrogallic acid in distilled water is added and allowed to remain from a few seconds to several minutes, according to the thickness of the preparation or depth of tint required. The section may then be washed and mounted in the usual way in glycerine or varnish. If washed in household water containing lime, a bluish tint or tone is given the nuclear elements and cell substance. This method answers well for silver preparations, but no chromate must be used for previous hardening.

Ready Method of Preparing Sections for the Microscope.—Dr. John Stevenson's method is as follows: A mixture of glycerine and tragacanth soon becomes stiff like jelly, and may be used to advantage in which to imbed tissues for the purpose of making slices for the microscope. It cuts like cheese after standing eight or nine hours, and by keeping it in methylated spirit twelve to twenty-four hours it parts with its glycerine and becomes more easily sliced by reason of its being harder. The material is dissolved off the section by cold water with a little glycerine added.

The proportion Dr. S uses is two drachms of glycerine to one and a half drachms of powdered gum tragacanth—to be rubbed together on a slab or plate. Much less gum tragacanth than this proportion makes a material too soft. If not to be sliced within twelve hours from the time of its preparation the material should be preserved in methylated spirit.—*Edinburgh Med. Jour,*

Buckland's Cement.—The following recipe is that used by Dr. Buckland, the famous geologist, and was employed by him in preparing a cement for uniting parts of broken fossils and for attaching specimens to blocks and trays. The ingredients are to be found in every village, and the cement is excellent, as we know by experience, having used it for years. The credit of devising it has recently been attributed to several different persons. The recipe is as follows: Take 4 parts gum arabic, 3 parts starch and one part sugar. Reduce to a fine powder and mix well. The powder should be kept in a well corked bottle, and when required for use mix a little of the powder with water to every ounce of which ten drops of glycerine have been added.

Our Book Table.

Anatomy of the Invertebrata. By C. Th. Von Siebold. Translated from the German. with Additions and Notes, by Waldo I. Burnett, M. D. 1 vol. 8vo, cloth. $5. Boston: James Campbell.

The characteristic features of this work are very clearly set forth by the translator in his preface. He says: "In the text will be found a lucid yet succinct exposition of the anatomical structure of organs, arranged as far as practicable under distinct types. The details, on which this typical summary is based, are comprised in notes which are as remarkable for their erudition as for their copiousness; indeed, the utmost care has been taken in the literature of the various subjects treated, and the student will here find the most reliable and at the same time the fullest reference to the bibliography of nearly every subject in comparative anatomy. In this way, the work, as a whole, furnishes a complete dictionary of the science, and will prove invaluable even as a work of suggestion and reference, to those who would pursue any special line of inquiry and research in this department."

It has now been published for some years, but thus far no other work is to be found which can in any measure take its place.

Field, Forest and Garden Botany. A Simple Introduction to the Common Plants of the United States east of the Mississippi, both Wild and Cultivated. By Asa Gray, Fisher Professor of Natural History in Harvard University. New York: Ivison, Phinney, Blakeman & Co.

A simple, compact and inexpensive work, which will enable beginners to discover the botanical names and structure of common plants, is a necessity to all lovers of nature. Those who wish to become thorough proficients in the science of botany, must of course give their days and nights to the study of larger and more perfect works, but many of those who take a deep interest in plants have neither time nor opportunity for this. The work before us is made simple and concise, 1, by the sparing use of technical language; 2, by the omission, as far as possible, of the more recondite, and, for the present purpose, less essential characters; and, 3, by the omission of most of the obscure, insignificant and rare plants which students will not be apt to meet with or to examine, and which are quite too difficult for beginners. The author's name is a sufficient guarantee for the trustworthiness and accuracy of the work, and it is just the thing for those young microscopists who are devoting some attention to vegetable preparations.

Literary Announcements.

"The Aquarium; its Inhabitants, Structure and Management." By J. E. Taylor, F. L. S. Profusely Illustrated. London: Hardwicke & Bogue.

"Collecting and Preserving Natural History Objects." Being a series of articles by well-known writers in every department of natural science. Edited by J. E. Taylor, F. L. S., etc. Fully illustrated. Price 4 shillings. London: Hardwicke & Bogue.

NOTES AND QUERIES.

Please inform me: 1. How to obtain diatoms from guano. I have first steeped the guano in hot water changing the water until colorless; then trying to burn on thin covering glass 1-70 thick; they always broke. Then boiling in test-tube, which broke also, spilling the contents, guano and muriatic acid. I endeavored to follow the directions given in Davies' Handbook. 2. What should I use in staining vegetable cuticle? JOHN NICOL.

Itasca, Minn.

In boiling liquids in test-tubes, it is necessary to take time and to avoid placing too much liquid in the tube. The tubes also must be of good quality. Covers will always break or bend if not placed upon a thin metal plate. We use a small flat disc of platinum foil, which is placed on a slender ring of iron wire—brass or copper wire will spoil the plati-

num. The best directions for preparing guano are those by Dr. Johnston, of Baltimore, which we hope to republish some of these days.

A description of the process for staining vegetable tissues requires more space than we can give in this column. We will, ere long, publish a full account of a good method.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

We intend to give, in our next issue, as complete a list of the Microscopical Societies now existing in the United States, as we can compile Correspondents who will send us—1, the name of the society and its location; 2, the date of its organization, and, 3, the names of the present officers—will confer a great favor. Address "EDITOR AMERICAN JOURNAL OF MICROSCOPY, 37 Park Row, New York."

San Francisco Microscopical Society.—The regular meeting of this society was held on Thursday evening, April 6, with a good attendance of members and several visitors. Some important additions to the library and cabinet were announced. Under the head of additions to the library, the following were announced by the Secretary:—*Nature; Popular Science Review* for 1875; *Science Gossip* for 1875; Cincinnati *Medical News* for February and March; *Quarterly Microscopical Journal*, for 1875; *Monthly Microscopical Journal* for March; five numbers of "Flora," Regensburg, and two volumes of "Elements of Natural History," Ruschenberger. Twenty additional slides, mounted with as many varieties of acari, were received by purchase, while Mr. Ewing donated a small bottle of washed diatomaceous earth, from Richmond, Virginia.

Dr. Blake placed on the stage a slide mounted temporarily with some living specimens of *phylloxera* taken from the root of a vine in Sonoma county. In addition to the smaller type of insect, which does the injury to the vines, there was one specimen of what he stated was the nymph form of the same, and to which he called special attention, from the fact that in Europe this stage in the life history of the pest is not met with till as late as July or August. He remarked that he could detect no wings or sucker, but found several large ova in the body, which in Europe developed into the sexual insect, which lays a single egg, hibernating till Spring. Whether the one before the society would have produced the mother lice, under favorable circumstances, he was not prepared to say. Some of the remedies suggested to the vine-growers by Dr. Blake had been tried, but, unfortunately, had proved of no avail in staying the development or ravages of this troublesome insect. It would seem from the above that our vine-dressers must prepare for a vigorous prosecution of the war, and that the spring campaign will open early.

In this connection it may be well to state that it appears, from reports supplied to the French Academy, that the most efficacious remedies for vines attacked with the phylloxera are alkaline sulphocarbonates, that of soda being the most effective. It is applied in solution, and destroys the insects without injuring the vine.

Dr. Wythe referred to the amplifiers he exhibited at the last meeting, and stated that he had succeeded in getting excellent definition with them, when used with very high powers; and further, that he had adapted the same to his Crouch binocular. A new illuminator was described by him, and which he had constructed with a right-angled prism, a plano-convex lens cemented to one face, and an ordinary French triplet attached to the other side, at a point near the angle. This gave him, by the slightest tilt out of a line perpendicular to the object, an extreme obliquity of light, and which was at the same time entirely achromatic.

Mr. Charles Stodder, of Boston, wrote the society some very interesting and useful facts concerning the one-tenth objective of Tolles, and stated that one of that maker's objectives, of comparatively low power, a *true* fourth of the same construction as the tenth, had resolved Nos. 18, 19 and 20 on the Möller plate, in the hands of some London microscopists, at a recent date.

The society determined to send on to Congress at once a memorial in favor of the adoption of the metric system of weights and measures, similar to that adopted by the Boston Society of Civil Engineers, as they learn that a large number of other societies have already forwarded such documents.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

For palates of periwinkle and limpet send a stamped directed envelope or an object of interest to F. F. Stanley, Swampscott, Mass.

Foraminifera, very choice, and diatomaceous earth, in exchange for interesting material. George B. Scott, Box 5645, New York City.

Wanted to exchange, periodically, filterings from the water supply of Buffalo for the same of any other city. D. S. Kellicott, 119 Fourteenth street, Buffalo, N. Y.

Mounted specimens of *Humulus Lupulus Ext.*, showing lupulin crystals, for any mounted objects. Richard Allen, 146 North Fourth Street, Troy, N. Y.

Roestelia lacerata, *Puc. xanthii*, and *Puc. aculeata*, in exchange for other unmounted fungi. W. C. Stevenson, Jr., 1,525 Green St., Philadelphia, Pa.

Slides of "Sonorous Sand," from Sandwich

Islands, very interesting, for any well mounted objects. W. G. C., Box 1774, Boston, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield. Mo.

Irish and British marine Algæ in great variety, correctly named, for herbariums, etc.; also beautifully mounted in balsam and other mediums; in fruit; many laden with diatoms; or splendid specimens, specially prepared for balsam. Foraminifera from Dog's Bay, Egypt, Java, etc; diatoms, zoophytes, sponge spicula, Holothuria plates, mollusca palates, ghost crabs, starfish, and various other unmounted interesting marine material, as well as botanical and entomological objects, etc. For any American objects, mounted or otherwise. Send detailed list of everything you wish to exchange; all letters answered. T. McGann, Burrin, Ireland.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Wanted in exchange for Vegetable Slides, other well mounted slides. Address F. F. Stanley, 40 Pearl street, Boston.

Survival of the Fittest.—The Darwinian hypothesis seems to apply in the world of letters as well as in the realms of nature, no better evidence of this being required than the facts connected with the well known juvenile magazine, *St. Nicholas*. While hosts of excellent journals have failed, it has gone on from one success to another—absorbing its competitors and thriving where others have failed. It requires but a glance to see that this is due wholly to its inherent excellence, and not to mere pushing or puffing. It is undoubtedly the best juvenile magazine in the world.

Microscopes, etc., at the Centennial.—We understand that several foreign microscope makers intend to make a very full representation at the Centennial Exhibition. Our American manufacturers, from all we can gather, will not be present in great numbers. A few have taken space, and some very important novelties will be exhibited. We expect to see a very large collection of fine objects. In this department, Wheeler, of London, intends to make a fine display, and it will be a rare opportunity for our American microscopists to acquaint themselves with the latest novelties in this direction.

Labeling Specimens.—The appearance of a cabinet of home-made objects depends very much upon the neatness with which the slides are labeled. The writing should be small, very plain, like the old round hand, and the ink should be perfectly black. We prefer a label without a border, such as those used by Wheeler, of London, and others. In order to write well it is absolutely necessary to use a fine springy pen. The best that we can find are the kind called "Spencerian," and furnished by the well-known house of Ivison, Blakeman, Taylor & Co., of New York, who will send a sample card on receipt of twenty-five cents. We use Carter's black record ink, which we find to possess the two important qualities of intense blackness and non-liability to smear. For labels we employ a plain white oval label which may be obtained at a very cheap rate from any dealer in microscopic materials.

An Important Publication.—We have received the announcement of a series of Micro-Photographs in Histology, Normal and Pathological, by Carl Seiler, M. D., in conjunction with J. Gibbons Hunt, M. D., and Joseph G. Richardson, M. D. This publication is intended to replace the microscope, as far as is possible, for those physicians who have neither opportunity nor leisure to make observations with the instrument for themselves; and also to furnish microscopists, for comparison, correct representations of typical specimens in the domain of normal and pathological histology.

The plan of the publication has been decided upon after consultation with Drs. Joseph Leidy and S. Weir Mitchell, and other gentlemen of high standing in science; but it—as well as the selection of specimens—is principally due to the judgment of Drs. J. Gibbons Hunt and Joseph G. Richardson. The photographs are to be carefully prepared by Dr. Seiler, and will be accompanied by a few pages of text fully describing each plate, indicating the particular points of interest, and showing the connection and analogy of the different specimens. The text, prepared under the supervision of Drs. Richardson and Hunt, will be strictly descriptive and explanatory, dealing only in facts, and setting forth no unacknowledged theories.

It is purposed to give in each monthly issue pictures of at least one pathological and three normal specimens, to illustrate the differences between healthy and diseased structures. In this way they offer a clear insight into the nature of the pathological formations, as revealed by the microscope. As some of the tissues of the human body cannot be obtained fresh enough for microscopic purposes, specimens from the lower animals will be substituted when necessary, as is so frequently done in histological studies. They will, however, exercise due care to use only the best and most typical examples.

The work will be issued in monthly numbers, each containing at least four plates with descriptive letter-press; twelve numbers to form a volume. Price of separate numbers, 60 cents each. Sent postpaid by the publishers at $6.00 per annum. J. H. Coates & Co., publishers, 822 Chestnut St., Philadelphia, Pa.

Books Wanted—Address, stating condition and lowest price, E. W., care AMERICAN JOURNAL OF MICROSCOPY, 37 Park Row, New York.

"Micrographic Dictionary." Second edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Caspar's "Forensic Medicine." 4 vols.
Faraday's "Electrical Researches." 3 vols.
Holtzapfel's "Mechanical Manipulation."

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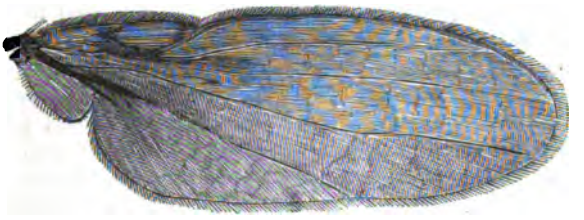
Color in Microscopic Objects.

TO some eyes nothing is more beautiful and attractive than the brilliant colors presented by many microscopic objects. Indeed it often happens, in the case of beginners, that these splendid colors prevent the observer from noticing the presence or absence of those less obtrusive but more important features which are indicated by mere form. Few students who work with the microscope, however, pay sufficient attention to the cause of this color; they do not know whether it is occasioned by the real color of the object, by its mechanical or its physical structure, by the nature of the light which illuminates it, or by some peculiarity in the lenses through which it is viewed. It is not many years ago since a contributor to one of our popular periodicals gave utterance to the most enthusiastic expressions of praise in regard to his microscope, because, as he expressed it, it showed every object surrounded with all the colors of the rainbow! Being totally inexperienced, he did not know that what pleased him so immensely, and called forth his special admiration, was in reality one of the worst defects that a microscope can have.



WING OF GNAT.

Color may arise from many causes. It may be due to the natural color of the object, as is seen in a piece of blue glass, a blue crystal of sulphate of copper, and similar objects. In some cases the color of an object seen by reflected light is entirely different from that of the same object examined by light transmitted *through* it. Of this curious property, known as *dichroism*, crystals of acetate of copper, and of oxalate of chromium and potassium, are striking and well known examples. In some cases the color is equally diffused throughout the entire substance of the object—as, for example, in colored crystals. In other cases the substance is colored by the presence of minute granules of pigment, which exist in such numbers as to give a uniform color when the object is viewed with low powers. Under higher powers the pigment granules become quite distinct.

Color may also depend entirely upon the physical structure of the object. Where the object consists of very thin plates it sometimes presents the most gorgeous colors. A soap-bubble is a common example amongst non-microscopic objects, and the wings of many insects, when mounted dry and viewed as opaque objects, glitter

with all the colors of the rainbow. The figure which we give of a mosquito's wing shows that it consists of an exceedingly thin membrane, strengthened by *nervures*, as they are called. When mounted dry in the ordinary way, between thin pieces of glass, a clean wing is a most beautiful object so far as color is concerned. These colors are, however, entirely destroyed by immersion in fluids, and do not appear when the object is viewed by transmitted light, thus showing that they are not inherent in the object. In this particular case, as we shall see further on, the cause of all the coloring is somewhat complicated. The beautiful color displayed by thin plates is found in the cell walls of the pith of certain plants. When cut in thin sections and mounted dry, it shows these colors splendidly.

Colors are also, in some cases, due to the presence of very fine lines arranged closely together. Sir David Brewster first pointed out that the beautiful iridescence of mother-of-pearl is due to these lines, and he proved the truth of this surmise by showing that such colors are reflected from the surface of sealing wax, and electrotypes which have been moulded from the mother-of-pearl. Acting upon this principle Barton produced buttons heavily gilt and struck with steel dies, the surfaces of which were very finely ruled. The iridescent brilliancy of these buttons was something wonderful, but owing to the extreme delicacy of the rulings, they did not last, and moreover they were very expensive. So they soon went out of fashion, and are now to be found only in the cabinets of the curious. They form a beautiful and instructive microscopic object.

Referring again to the dry wing of the gnat or mosquito, it will be found that not only does it consist of very thin plates, enclosing air-spaces, but it is covered with hairs or very delicate spines, which evidently perform the part of lines. If the wing be laid on the stage of the microscope, and the light be allowed to fall on it in the same direction as from the top to the bottom of the page, the colors will be very brilliant, for we have the colors of the thin plates brightened by the iridescence of the spines acting as lines. If turned quarter round, the colors fade somewhat, because we then have only the colors of the thin plates. The effects of the light, when falling in *exactly* opposite directions, are of course the same.

Many minerals have a structure which gives to some of their faces a surface lined with extremely fine rulings. A prominent example of this is seen in certain kinds of iron ore, which, when viewed in some directions, have an exceedingly brilliant coloring, while the true color of the mineral itself is dull black. In this case the color depends greatly upon the direction in which the rays of light fall upon the lines. When illuminated by light falling in some directions, the colors entirely vanish, but reappear as the object is rotated. The brilliant colors of some minerals is due to the fact that the surface layers consist of very thin plates separated from each other in places by air. Mica which has been bent or hammered often presents such colors. Where colors are due to the presence of lines or thin plates, they disappear almost wholly when the object is immersed in fluid. Some very brilliant insect scales, which are perfectly gorgeous when dry, become dull and heavy when moist. Others again, such as the scales of the diamond beetle, which evidently have a proper color of their own and a brilliantly polished surface, become much more bright when mounted in turpentine or balsam. These facts point out the best method of determining the cause of color in such objects.

(To be continued.)

THE evil spirits which, as long as the world has existed, have always impeded the advances of the human mind, and which, even at the present day, and especially in the natural sciences, and still more in microscopical researches, have caused so much mischief, are precipitation, superficiality, and, we may add to these, scientific dishonesty, of which frivolousness is always guilty.—*Schleiden.*

The Origin of the Greensand.

"* * * Now as it is not a fact that greensands of the Cretacious epoch are always composed of foraminiferal casts, it is time that the statement of Ehrenberg, endorsed so unreservedly by Carpenter, should be challenged."—*S. A. Stewart, in Science Gossip for Nov.* 1875, *p.* 243.

THE author of the note on "Greensand and its Origin," from which the above sentence is extracted, severely censures Dr. Carpenter for accepting the statement that the greensand grains, so constantly met with at the base of the Upper Cretaceous series, are for the most part internal casts of Foraminifera in glauconite.

Now I have no doubt that Dr. Carpenter can very well defend himself, and can give, as indeed he has elsewhere given, very excellent reasons for so unreservedly endorsing Ehrenberg's observation; but as he may not think it worth his while to notice the errors and assumptions visible in Mr. Stewart's paper, I beg leave to offer a few observations on the subject; for as *it is* a fact that some greensands do mainly consist of foraminiferal casts, the general denial thereof by Mr. Stewart should not pass unchallenged.

In the first place I think Mr. Stewart has been misled by the expression used by Dr. Carpenter in the particular paper he quotes, viz., "*the* greensand deposit of the Cretaceous epoch." It is indeed rather a loose statement, since greensand beds occur at many horizons in the series, not at one only, as this might be understood to mean; but any one who has read Dr. Carpenter's other papers on the subject would know that he is, of course, fully aware of this well-known fact.

If Mr. Stewart's argument were that all greensands have not yet been proved to have a foraminiferal origin, and consequently that we should be cautious in taking for granted that they have all been formed in the same way, there would be some reason in it; but no such discretion is to be found in his communication; on the contrary, he denies the fact *in toto*, and says: "The assumption that the greensand is formed of casts of Foraminifera should be rejected for the following reasons:

"1st. Foraminiferal shells do occur plentifully and uninjured in the English greensand; ergo, there is no cause for assuming the wholesale destruction of calcareous shells in that epoch.

"2d. Calcareous tests of mollusca have remained; casts are rare in the greensand.

"3d and conclusive. The grains of glauconite in the Irish greensand, when examined with the microscope, show no real resemblance to Foraminifera."

My first criticism on these objections is that, supposing the statements they contain to be true, they are apparently all founded on the assumption that if certain fossil organisms do not exist in one locality, *therefore* they cannot exist in any other locality; and I submit that such logic is hardly defensible.

With regard to the first of these arguments, Mr. Stewart is quite correct in stating the existence of calcareous shells in the Cambridge greensand, but he has apparently overlooked the published fact that glauconite casts of the same also occur in great abundance, For this I may refer him to papers by Mr. W. J. Sollas, in the *Quar. Jour. Geol. Soc.*, xxviii., p. 397, and in the *Geol. Mag.*, vol. x. From the former I extract the following remarks as being both explanatory and conclusive:

"From the resemblance of most of the green grains to the Foraminifera found with them, from their rough parallelism in size, from the appearance of many of the grains when sections are made of them, and from the occurrence of glauconite casts in the interior of the original Foraminifera, we must attribute to the green grains a foraminiferal origin. That this has not been determined by previous observers is partly due to the use of acid, after Ehrenberg's directions, in preparing the sand; this, of course, would obliterate the calcareous lines which distinguish the lobations. The silica and various silicates mingled with the glauconite grains, must have thrown the analysis of these grains hopelessly wrong."

Taking now Mr. Stewart's second objection, that the calcareous tests of mollusca have remained, and that casts are rare in the greensand—according to the context this should refer to the English greensand, and such a statement sounds somewhat strange to any one acquainted with the fauna of the Cambridge bed, the greater part of which, or some two hundred species, are only found in the state of phosphatic casts; it is true I regard these as derived by erosion from the gault; the fact nevertheless remains that they are now in the greensand or chloritic marl, which here forms the basement bed of the chalk.

Again, take the chloritic marl of the Isle of Wight. Here casts are common, some fossils, such as the Ammonites, rarely retaining their calcareous tests, while those shells that do remain, such as those of the Lamelibranch Molluscs, have always lost their internal nacreous layer, so that any traces of the hinge or internal muscular muscular impressions are rarely visible. This is indeed the ordinary state of shells in many glauconite and all chalk strata, and I regard it as a very significant fact, which may possibly find its explanation in that very presence of carbonic acid in excess at great depths, which Dr. Carpenter and others have suggested to account for the removal of the foraminiferal shells on the sea bottom.

The third reason (which Mr. Stewart regards as conclusive!) simply amounts to the fact that the Irish glauconite grains, though carefully examined by himself and Mr. Wright, show no resemblance to Foraminifera. This may be so, and it is of course worth ascertaining; possibly, however, acid has been used in these examinations, which, as Mr. Sollas has pointed out, increases the difficulty of recognizing their true origin. And even supposing that these Irish greensands are not composed of foraminiferal casts, I fail to see how that is a conclusive objection to their forming the main constituent of other greensands.

It is not necessary for Dr. Carpenter's argument that all greensands should be so constituted; it is sufficient for him that such should frequently be the case; and of this there can, I think, be little doubt, if Mr. Stewart will accept the statements of other authorities in the scientific world.

Besides the testimony of Professor Ehrenberg and Mr. Sollas regarding greensands, Professor Bailey, of the United States, was the first to ascertain that the process was going on at the present time in the Gulf of Mexico. Dr. Carpenter has also obtained such casts both from dredgings in the Ægean and from Mr. Juke's Australian dredgings (see a paper in *Proc. Roy. Soc.*, 1875, p. 242). Lastly, I may quote from a paper read before the Geological Association last year (p. 24): "The observations recently made in the 'Challenger' show that all along the line of the Agulhas current there is a greensand covering the bottom. Now, as Professor W. Thomson says, we should simply have noted this as a greensand if we had not had in our mind the observations of Professor Ehrenberg. Looking at this greensand with a microscope, we are able at once to recognize the grains as almost entirely the internal casts of Foraminifera."

With regard to the question raised by Dr. Carpenter as to whether the absence of the shells is attributable to mechanical abrasion or chemical solution, I am inclined to think that sometimes one cause, sometimes the other, has been in operation. In the Cambridge greensand it is, I think, chiefly due to abrasion, the co-existence of shells and casts in that bed being thus accounted for. Supposing them both to have been contemporaneous with its deposition, it is difficult to see why some should be in the state of casts, and others retain their shells in a perfect and uninjured state; but on the hypothesis that the latter only belong, so to speak, to the indigeneous fauna, while the former have been derived from the Upper Gault, their association in so thin a bed receives a perfectly natural explanation.

It would, perhaps, have been more prudent in Mr. Stewart to have asked for in-

formation on the subject, rather than to have given an unqualified denial to observations which are made by competent men, and he is especially unfortunate in remarking that "hasty generalizations are the greatest fault of our times, and it is to be deprecated that erroneous statements should go forth under the sanction of high authorities in the scientific world." I most cordially agree with this sentiment, and the present communication has sprung from a similar wish, viz., that erroneous statements and hasty generalizations should not be put forward by any one professing to be a scientific man. A. J. JUKES BROWNE.

Cambridge. (*From Science Gossip.*)

The Kentucky Meat Shower.

IN our last issue we published a paper in which the author took the ground that the so-called shower of flesh in Kentucky was merely the rapid development of a species of *Nostoc*, of which the dried spores had been carried about by the wind and scattered over a wide extent of country. It will be remembered that in the first place the specimens were submitted to Prof. J. Lawrence Smith, of Louisville, Ky., who is not only a celebrated chemist, but an able microscopist, and the inventor of a peculiar form of the instrument—the inverted microscope, which bears his name—and that Prof. Smith pronounced it frog spawn. It will be observed that in the following letter to the Louisville *Courier-Journal*, he accepts the theory that the substance is *flesh*, and this not only on the ground that two careful and skilful microscopists pronounce it flesh, but that his own analysis shows the presence of muscular, cartilaginous, gelatinous and fatty matter. That a novice might readily mistake the cellular structure of a *nostoc* for the striations of muscular fibre is not impossible, but that experienced histologists should be so deceived is, we think, highly improbable. The question, therefore, seems to be still an open one. The following is Prof. Smith's letter:

In my first examination of this anomalous substance, I was furnished with two small specimens that had been in alcohol; one of them was so hard and dry that I did not undertake to examine it; the other being soft, I cut it across, and finding the interior of the mass gelatinous, I could see no other source of this gelatinous matter than the spawn of batrachian reptiles. I sent what I had left to Professor Putnam, of Salem, to be examined in his institution, but I have not yet heard from him his results.

Since then two other specimens have been furnished me, one of which had been examined by a distinguished microscopist of Lexington, Mr. A. T. Parker, from whom I received also some specimens carefully mounted for examination. I have examined both the specimens and the preparation, and am perfectly satisfied that they contain muscular fibre, and therefore cannot be, as I first supposed, reptilean spawn. The matter appears to be mixed; some of it is muscular, some cartilaginous, others gelatinous and fatty. I intended examining further into the matter, when, in a conversation with Dr. Kastenbine, of this city, I learned that he had examined a specimen with similar results, and that he had no doubt of the fleshy nature of the substance.

Considering the results obtained by two such careful and skilful microscopists as Dr. Kastenbine and Mr. Parker conclusive, I am satisfied that my original theory of its being batrachian spawn must be abandoned.

This, of course, is calculated to open the whole question again. Professor Robert Peter, of Lexington, through whom I obtained Mr. Parker's specimen, thinks that the fall of flesh was simply the result of a kind of *post prandial* disgorging by a flock of buzzards who had been feasting themselves more abundantly than wisely on the carcass of a sheep; perhaps one of those animals that had undergone a strychnine preparation by some outraged Granger inimical to dogs. I am informed that it is not uncommon for buzzards thus to disgorge their overcharged stomachs, and that when in a flock one commences this relief operation, the others are excited to nausea, and a general shower of half-digested meat takes place. Who knows but this is the true inwardness of the whole matter?

A KNOWLEDGE of science attained by mere reading though infinitely better than ignorance, is knowledge of a very different different kind from that which arises from contact with fact.—*Huxley.*

THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

TERMS—Fifty Cents per Year. (*Note.*—We pay postage on all copies sent out of New York City, but by the absurd regulations of our Postal Laws, it costs us seven times as much to send a copy from our office to a New York city address that it does to send one to Texas or California. From subscribers in New York city, therefore, we are compelled to ask the postage, which is 12 cents per year.)

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S. E. CASSINO, Naturalists' Agency, Salem, Mass., has kindly consented to act as agent, and will receive subscriptions.

Our First Half-Volume.

THE present number of the JOURNAL OF MICROSCOPY completes the first half-volume of our enterprise. Thus far we have occupied very little space with eulogistic notices of ourselves or our work, and we do not now propose to change our habits in this respect. To the many kind friends who have given us words of cheer and praise, we would say that we have refrained from publishing their flattering letters and notices, not because we fail to appreciate these kind expressions, or because we have not felt encouraged by them, but simply because the only claims we desire to present to the public are those based on the quality of the work we are turning out.

Those who have hitherto hesitated to subscribe because they doubted the permanence of the enterprise, may be glad to know that the JOURNAL is now an assured success. As we become better known, our sources of information and our facilities for procuring valuable articles are increasing, and already the number of our subscribers is such that we are assured against pecuniary loss by the undertaking. We can still supply complete sets from the beginning, though the number is limited. Some numbers (notably No. 1) we can no longer supply separately.

We are happy to say that we have secured several valuable contributors, who have promised us illustrated articles embodying original research on matters of general interest. We hope, therefore, that our future numbers will show a marked improvement.

The Duty on Imported Microscopes.

WE do not propose to discuss in these pages the vexed question of free trade *versus* protection. We merely desire to call attention to certain glaring absurdities in our present law, in the hope that what we have to say may lead to the adoption of a more just and rational system.

We have in this country something less than a dozen *manufacturers*, or rather *makers* of microscopes. To some of these men—such as Spencer, Tolles, Wales, etc.—the protection afforded by the present duty of 40 per cent., is really no protection at all, for the simple reason that each man is a special artist in his own line, and a microscopist could not possibly import an objective having the characteristics of those made by the opticians we have named, even if he were to receive a bounty of 100 per cent instead of having to pay the duty of 40 per cent, which is imposed. Those who desire or who require Tolles or Spencer lenses, must go to Tolles or Spencer, and the number of persons who will ultimately require objectives of the kind furnished by these makers, will be in direct ratio to the number of those who are enabled, by means of low-priced but good instruments, to make a beginning in microscopy. Therefore, to even the most rabid protectionist, it must be evident that anything which tends to limit the supply of cheap and good microscopes, tends to limit the business of first-class American artists.

Now the market may be supplied with good and cheap microscopes, either by allowing the free importation of good instruments of foreign manufacture, or by throwing the business *entirely* into the hands of native opticians, who will thus be enabled

to *manufacture* microscopes instead of making them. The difference between manufacturing and making, or, in other words, between producing in large quantities and making singly, or in very small numbers, is very marked. By manufacturing in large quantities the cost of any article is reduced by from one-half to nine-tenths. Take, for example, the sewing machine: A machine which, under a well-developed system of manufacture costs but fifteen or sixteen dollars, would, if made singly, cost over one hundred. Under the present law a duty of 40 per cent is imposed upon all imported microscopes, and this, if fully carried out, would give American manufacturers the control of the market in certain classes of instruments. But unfortunately it is provided that all chartered institutions shall have the right to import instruments free of duty; so that while rich corporations like Columbia College, Harvard University, etc., can obtain a microscope at the lowest European price, a private student, even though he may be doing first-class work in the cause of science, is compelled to pay double price for his instrument, for, as may be seen by an examination of trade price-lists, this is the effect of a duty of forty per cent. To prove it, let us take the case of the Society of Arts Microscope, as it is called. Some years ago the London Society of Arts, impressed with the importance of the microscope in education and the arts, offered a large prize for the best microscope which could be sold at three guineas—about $17. A very excellent microscope was offered for that sum, and according to the terms of the contract between the manufacturer and the Society, it is always kept in stock, and can be purchased at any time for that amount. The catalogue price of that microscope in this market is $45!! It certainly was not a sense of justice or the desire to foster knowledge, which caused this unjust discrimination against the poor private investigator, and in favor of wealthy institutions whose direct interest it should be to foster native facilities for the construction of scientific instruments of all kinds.

But even such a law as this would not produce the evil effects that it now causes, provided it could be faithfully enforced. It is currently reported that many of our institutions are in the habit of importing microscopes without duty, ostensibly for their own use, and selling them to the students at the close of the session, only to replace them by means of a fresh importation when another season comes round. One institution alone is said to have recently imported forty high-priced microscopes in this way. Such an infraction of the spirit, if not the letter of the law, is difficult to detect or to punish, but its effect is to throw into the hands of teachers and professors the business of furnishing microscopes to students.

To even the most superficial observer it is obvious that the only just course is to abolish all distinctions, and either permit the free importation of instruments by every one, or cause all to pay duty alike.

Correspondence.

Measuring the Focal Length of Objectives.

Ed. Am. Jour. Microscopy—In the London *Monthly Microscopical Journal* for this month (p. 243), a correspondent (F. W. Griffin), in a letter about objectives, referring to the discrepancies between their actual power and that specified in the maker's lists, says, "These lists are compiled on the conventional assumption that the distance from the eye-lens to the stage is uniformly ten inches." It is barely possible that some lists are so "compiled," but if so it is a great error. The true rule is ten inches from the optical centre of the objective to the optical centre of the eye-piece. With very high power objectives this difference is very slight—so much so that it is almost impossible to measure it, But with low powers, say a half-inch, it is important, and with the inch and lower it becomes very large, and gives rise to erroneous results widely away from the truth. Take for example a five-inch objective with five inch working distance. At 10 inches from stage to eye-lens, the objective is half way between the

two; but with the English standard length of tube—ten inches—as the microscope is in use, the power is about double what it is the other way; by the correct rule, the magnifying power of different objectives will correspond with their focal length; with the other they will be discrepant.

Of two objectives of equal power, one may have a working distance of two inches, the other of only one inch; by the incorrect rule their power would differ 10 per cent.

Prof. Cross, of the Massachusetts Institute of Technology, made, a few years ago, the most elaborate and accurate comparison of the actual and nominal power of numerous objectives yet published. (*Journal Franklin Institute*, Philadelphia.) Prof. Cross adopted the erroneous rule of 10 inches from the stage to the eye-micrometer. The consequence was that he admits that his measures of two-inch objectives are not accurate, and when he attempted to measure a Tolles 4-inch with a working distance of only one and a half inch, he could not measure it at all.

Mr. Griffin, in the letter referred to, mentions having a one-fifth by Wenham, which magnifies less than his A. Ross one-fourth. Now it is most likely that the Wenham objective was correctly named, because Prof. Cross found many of A. Ross' undernamed.

By the same letter of Mr. Griffin, I see that he has found that Ziess low angle objectives have less of what is *called* penetration than Powell & Lealand's high angle! I have found the same thing to-day with a high angle 1-inch of Tolles. CHARLES STODDER.

Boston, May 16, 1876.

Microscopical Societies in the United States and Canada.

We intend to publish, two or three times a year a list of the Microscopical Societies in the United States and Canada, and we would specially request the secretaries of these societies to inform us in regard to any omissions or errors. The following list has been compiled partly from information obtained in response to a circular sent out by us last month, and partly from a similar list compiled by Dr. Ward, editor of the department of Microscopy in the *American Naturalist*, and published in that journal:

Agassiz Institute, Sacramento, Cal. Organized 1872. Meets second Tuesday evening of month. President, —— —— ——; Vice President, Rev. I. E. Dwinell, D. D.; Secretary, A. P. Andrews; Corresponding Secretary, Rev. J. H. C. Bronte.

Academy of Natural Sciences, Philadelphia; Biological and Microscopical Section. Organized 1868. Meets first Monday evening of the month, except July and August, in the hall of the Academy, corner Nineteenth and Race streets. Director, W. S. W. Ruschenberger, M. D.; Vice Director, James Tyson, M. D.; Recorder, J. G. Richardson, M. D., 1,835 Chestnut street; Cor. Secretary, J. H. McQuillen, M. D.; Treasurer, Isaac Morris, M. D.; Conservator, J. Gibbons Hunt, M. D.

American Association for the Advancement of Science; Microscopical Sub-Section. Has met occasionally in connection with the migratory sessions of the association. It is intended to organize permanently at the Buffalo meeting next August.

American Microscopical Society of the City of New York. Organized 1865. Meets second and fourth Tuesday evenings of the month, at 35 East Tenth street. President, John B. Rich, M. D.; Vice President, William H. Atkinson, M. D.; Secretary, C. F. Cox, 13 William street; Treasurer, T. d'Orémieulx; Curator, O. G. Mason.

American Postal Micro-Cabinet Club. Organized 1875. Business conducted exclusively by mail. President, Prof. John Pierce, Providence, R. I.; Secretary, Rev. A. B. Hervey, 10 North Second street, Troy, N. Y.; Managers, R. H. Ward, M. D., Troy, N. Y., and C. M. Vorce, Cleveland, Ohio.

Bailey Club, New York City. A small club of working microscopists. Meetings informal, every second Tuesday, at residences of members.

Boston Microscopical Society. Organized 1873. Meets first and third Thursdays of month, at residences of members. President, David Hunt, Jr., M. D.; Vice Presidents, Stephen P. Sharples, S. B., and Alfred F. Holt, M. D.; Secretary and Treasurer, R. R. Andrews, D. D. S., Brattle Square, Cambridge, Mass.; Council, S. W. Creech, Jr., J. Frank Brown, and Edward Moulton; Custodian, C. H. Osgood, D. D. S.

Boston Society of Natural History; Microscopical Section, Organized 1864. Meets second Wednesday evening of month. Committee, Edwin Bicknell, R. C. Greenleaf, and B. Joy Jeffries, M. D.

Buffalo Microscopical Club, Buffalo, N. Y. Organized 1876. President, Prof. George Hadley, M. D.; Secretary, James W. Ward; Advisory Council, H. R. Hopkins, M. D., Henry Mills, and Prof. D. R. Kellicott.

Dartmouth Microscopical Club, Hanover, N. H. Organized 1870. President, Prof. E. Phelps; Vice President, Prof. L. B. Hall; Cor. Secretary, Hiram A. Cutting, M. D., Lunenburgh, Vt.

Denver Microscopical Society.

Dunkirk Microscopical Society, Dunkirk, N. Y. Organized 1874. Meets second Friday evening of month. President, George E. Blackham, M. D.; Secretary and Treasurer, M. E. C. Shelton.

Fairmount Microscopical Society, Philadelphia. Organized 1871. Meets third Thursday evening of month. President, S. H. Griffith, M. D.; Secretary and Treasurer, William C. Stevenson, Jr., 24 South Fourth street; Managers, Jno. Gordon Gray, E. O. Shakespeare, M. D., and B. F. Quimby.

Indiana Microscopical Society, Indianapolis, Ind. Organized 1874. Meets first Friday evening of month, at residences of members. President, William B. Fletcher, M. D.; Secretary and Treasurer, E. Hadley, M. D., 191 Virginia avenue.

Jamestown Microscopical Society.

Kirtland Society of Natural History, Cleveland, Ohio; Microscopical Branch. Secretary, John Bowers.

Louisville Microscopical Society, Louisville, Ky. Organized 1874. Meets first and third Thursday evenings of month. President, Prof. J. Lawrence Smith; Vice Presidents, Noble Butler and C. F. Carpenter, M. D.; Treasurer, C. J. F. Allen; Secretary, John Williamson; Cor. Secretary, E. S. Crosier, M. D.

Maryland Academy of Sciences, Baltimore, Md.; Section of Biology and Microscopy. Organized 1874. Meets first and third Wednesday evenings of month, at Academy Buildings, Mulberry street. Chairman, B. W. Barton, M. D.; Secretary, W. G. Harrison, M. D., 69 Centre street.

Memphis Microscopical Society, Memphis, Tenn. Organized 1874. Meets first and third Thursday evenings of month, at 218 Main street. President, S. P. Cutler, M. D.; Secretary and Treasurer, A. F. Dod, 257 Main street.

New Jersey Microscopical Society, New Brunswick, N. J. Organized 1871. Meets second Monday evening of month at Rutgers College. President, Prof. F. C. Van Dyck; Rec. Secretary, Rev. Samuel Lockwood, Ph. D., Freehold, Monmouth Co., N. J.

Portland Society of Natural History, President, William Wood, M. D.

Providence Franklin Society, Providence, R. I.; Microscopical Department. Organized 1874. Meets every second Wednesday evening at rooms in North Main street. President, Prof. Eli W. Blake, Jr.; Vice President, A. O. Tilden; Secretary, Prof. John Pierce; Treasurer, C. B. Johnson, M. D.; Librarian, N. N. Mason.

San Francisco Microscopical Society, San Francisco, Cal. Organized 1872. Meets first and third Thursdays of month at 531 California street; President, Prof. William Ashburner; Vice President, Henry C. Hyde; Rec. Secretary, C. Mason Kinne, 422 California street; Cor. Secretary, Charles W. Banks; Treasurer, Chas. G. Ewing.

Society of Natural Sciences, Buffalo, N. Y.; Microscopical Section. Organized 1872. Curator, Henry Mills, 162 Fargo avenue.

State Microscopical Society of Illinois, Chicago, Ill, Organized 1869. Meets second and fourth Fridays of month, at the Academy of Sciences. President, Henry W. Fuller; Secretary, B. W. Thomas; Cor. Secretary, Charles Adams; Treasurer, Geo. M. Higginson.

State Microscopical Society of Michigan, Kalamazoo, Mich. President, Rev. Dr. Foster.

Troy Scientific Association, Troy, N. Y.; Microscopical Section. Organized 1870. Meets first Monday evening of month, except July and August, at residences of members. President, R. H. Ward, M. D.; Vice President, Rev. A. B. Hervey; Secretary, Prof. Arthur W. Bower.

Tyndall Association, Columbus, Ohio. Microscopical Section. Organized 1874. Meets first and third Saturday evenings of month. President, Rev. I. F. Stidham; Secretary, C. Howard; Curator, M. Hensel.

Our Work Table.

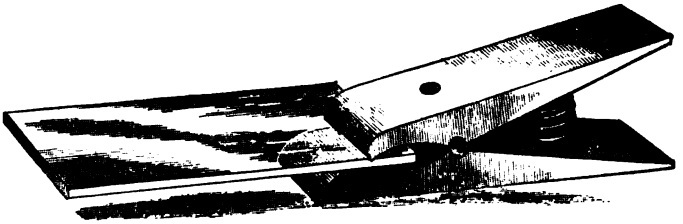
Cabinet of the Quekett Microscopical Club.—A catalogue of the preparations in this cabinet has just been issued. The total number of slides is 2,041. There are 238 specimens of hairs of animals, including a very complete series from Indian and other bats. The seeds amount to 217, and these, together with the greater part of the hairs, especially those from India, were the gift of Dr. M. C. Cook, who also donated most of the microscopical fungi, of which there are 69 specimens. The ferns are well represented by 171 slides. The objects can be borrowed for examination by members, under certain conditions, offering great facilities to those who wish to compare at their leisure a series of specimens. The whole collection has been formed by the liberal donations of members of the club, and it is to be hoped that the annual increase may be a large one, which will certainly be the case if mounters of objects will send their duplicate specimens to the cabinet. Our American clubs and societies would do well to imitate the course of the Quekett Club. A good collection of objects is invaluable for study and comparison, and any well-organized society ought to find little difficulty in increasing its cabinet by a judiciously conducted system of exchanges. If the members would donate to the society a few duplicates of any interesting slide they may mount, these duplicates would bring to the society several other valuable additions by *exchange*. Our exchange column, which is free, offers unusual facilities for carrying this system into practice.

A Good Mucilage.—The following is the formulæ for the Government postage stamp mucilage:

Dextrine	2 ounces.
Acetic Acid	1 ounce.
Water	5 ounces.
Alcohol	1 ounce.

The dextrine is dissolved in the water and acetic acid, by means of a water-bath; after which the alcohol is added.

Holder for Hot Slides.—It is frequently very convenient to warm a slide over a lamp instead of on the hot plate, and in such cases some kind of holder becomes absolutely necessary. We have found a common spring clothespin as efficient as any of the more expensive forceps. But when we come to lay the slide down, the clothespin holds it in an awkward manner. The end of the hot slide is sure to lie on the table, and if fluid balsam or other medium should be present, the fact that the slide is not level produces bad results. By cutting off about half an inch of one of the limbs of the forceps part of the pin, however, this difficulty is avoided. The slide may then be grasped in such a way that when the clothespin is placed on the table, the glass will be held in a perfectly level position. A glance at the figure will show what we mean. A great advantage of this form of holder is that it costs but a trifle, so that the microscopist can supply himself with an abundance of them, and thus several slides may be cooling while work on others is going on.



HOLDER FOR HOT SLIDES.

Sections of Bone.—M. Rauvier communicates to the "Archives de Physiologie" the following mode of preparing sections of bone: A portion of the shaft of a long bone is procured, and immediately on its removal from the body, is plunged into water, and allowed to macerate one year—the water being frequently changed. At the end of that time, the bone will be found to have become as white as ivory and quite free from any adhesing tissue. The object of immediately plunging the bone into water is to prevent the infiltration of the canals and substance of the bone with fat. Sections are to be made with a saw, and these sections are ground down on pumice stone and finally polished on a harder material. In order to remove the powered fragments of bone which have been ground off and which fill the canali culi and lacunæ on the surface, it is sufficient to scrape the section with a scalpel. It is then placed in a warm solution of aniline dye and allowed to remain there for two hours and afterwards dried on a water bath. The section is next rubbed on a hone, moistened with a 2 per cent solution of common salt. It is then washed in this solution, and permanently mounted in a mixture of equal parts of the solution of salt and glycerine.

Photography in Medicine.—Dr. Ultzmann, of the University of Vienna, in a paper read before the Medical Society of Lower Austria on the "Use of Photography in Medical Studies," said that an eruption of smallpox had been made evident by photography twenty-four hours before it actually came out. Although nothing was to be seen unusual on the skin of the patient, the negative plate showed stains on the face which perfectly resembled the variolous exanthem, and twenty-four hours later the eruption became clearly evident. Another analogous use of photography is in the detection of alterations in checks and bonds. No matter how thoroughly the writing may have been erased, a sufficient trace of the iron ingredient will always remain upon the paper to produce a photographic image, even when quite invisible to the eye. A case in point recently occurred in Paris. M. Gobert exhibited a bond for 105 francs which had been altered so as to read 5,000 francs, and had been negotiated at that figure. The alteration was quite invisible to the eye, but a photograph of the figures showed the sum (105) underlying and mingled with the higher amount afterward substituted for it.

Schweitzer's Solvent for Cellulose.—Prof. C. Neubaur recommends the following method for obtaining the well-known cupro-ammonium solution for technical use. He prepares an oxide of copper by the precipitation of sulphate of copper solution with caustic soda, in presence of sal-ammoniac. The resulting precipitate is thoroughly washed with water, first by decantation, and then upon a filter, after which it is preserved under water. To prepare the cupro-ammonium solution, the oxide above referred to, after thorough agitation with the water, is slowly added to a quantity of ammonia contained

in another vessel. The addition of oxide is to be continued so long as the same is dissolved by the ammonia. The resulting deep-blue-colored solution dissolves cotton-wool at once, and in considerable quantity.

Our Book Table.

Orchids. A Description of the Species and Varieties grown at Glen Ridge, near Boston, with lists and descriptions of other desirable kinds. Prefaced by chapters on the Culture, Propagation, Collection and Hybridization of Orchids; the construction and management of Orchid Houses; a Glossary of Botanical Terms, and significance of their names; the whole forming a Complete Manual of Orchid Culture. By Edward Sprague Rand, Jr., author of "Flowers for the Parlor and Garden," etc. 12mo., cloth. Price $3.50. New York: Hurd & Houghton.

The singularity and beauty of orchids have long commended these plants to the attention of cultivators. To the student, also, they present many features which claim his attention, for both in structure and habits they present peculiarities which deserve careful study. Many of our most curious and beautiful microscopic objects are obtained from orchids. The work before us covers not only the cultural relations of the plants, but their scientific or botanical characters, and must therefore prove specially useful to those who desire to know something more about them than merely the kind of soil and treatment they require. It is, we believe, the only American work on this subject, and Mr. Rand is so well known as an able cultivator and enthusiastic plant lover, that his name is ample security for the thoroughness of the work he has undertaken. The typographical execution of the work is unexceptionable.

TRANSACTIONS OF SOCIETIES.

Note.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

We intend to give, in our next issue, as complete a list of the Microscopical Societies now existing in the United States, as we can compile. Correspondents who will send us—1, the name of the society and its location; 2, the date of its organization, and, 3, the names of the present officers—will confer a great favor. Address "Editor American Journal of Microscopy, 37 Park Row, New York."

San Francisco Microscopical Society.—The regular meeting of the San Francisco Microscopical Society was held April 20th, with a fair attendance of members.

Rev. J. F. Stidham, of Columbus, Ohio, was proposed for corresponding membership. Letters from Dr. R. H. Ward, Troy, N. Y., and Terrence McGann, Burrin, Ireland, were read, and several additions to library and cabinet were announced.

Dr. Blake presented a slide, mounted with gold, which he had obtained from so-called telluride of gold, by treating with acid. The telluride was obtained from the American mine, Sunshine District, Colorado, and showed no gold before the application of acid, and Dr. Blake stated his belief that the pure gold was simply concealed by a superficial coat of tellurium, which was a decided case in favor of the assumption by Mr. Hanks, which he had offered at a former meeting, that there was no chemical compound of gold found in nature, or, in other words, as he then stated in his paper on "*Micro-Mineralogy*," "The results of my microscopical examinations cause me to doubt if gold ever becomes mineralized, in the strict sense of the term."

Mr. Hanks exhibited two photographs of blood-corpuscles, each being from a slide with the blood of a dog and a cat, mounted in juxtaposition with that of man, in order to show at a glance the relative size of the globules. The photographs showed a distinct difference between the disks of the cat's blood and that of man, but no appreciable difference in the case of the dog's blood. The slides from which the photographs were taken, were prepared by Rev. J. F. Stidham, of Columbus, Ohio, and his method of mounting is copied from a letter to Mr. Hanks, as it is deemed of interest to many. "The mode of preparing the slide is, to spread first a drop of blood on a carefully-picked *flat* slide. In spreading we use Dr. Christopher Johnson's me hod, which is to place a small drop of blood on a slide, then taking another slide—the narrow edge ground straight and smooth—touch this edge to the edge of the drop, where it will run along by attraction; then draw steadily along the slide, and, after a few trials, you will never fail to get magnificent slides. Now take the slide, when the spread blood is dry, and holding a slide across the centre, with a knife straight and sharp, cut along the edge of the slide, and carefully scrape away one-half of the blood. The cut down the top side, is necessary to have a sharp edge to the blood. Your slide will now have blood on one-half of a slide, and taking a small cover, say five-tenths, fasten it to another slide by a little moisture, repeat the operation as given, and you have only to remove the cover, turn it over, carefully bring the edges of blood together, and sealing first with a hot wire, or gum and wax, then finish. It will be essential to pick out a flat cover and slide first of all, which may be tested by placing the cover on the slide and putting a drop of water on edge of cover; see whether capillary attraction carries it evenly and entirely under the cover. If both surfaces are not flat, the two bloods will not be in focus at once."

Dr. Blake exhibited some blood obtained from a rabbit after the introduction of sulphate of thorium into the blood vessels. Although the quantity used was only a grain, yet the physical properties of the blood had been very much altered, the blood cor-

puscles having entirely lost their natural form and presenting an indented outline with numerous small highly refracting dots at the circumference. This marked influence on the blood corpuscles, tends to explain the highly poisonous character of the salt, death taking place in two minutes after the introduction of the above minute quantity into the circulation. It is also in accordance with the law which connects the physiological action of substances with their isomorphous relations and atomic weights, thorium having the highest atomic weight (115), of any of the members of the aluminium group with which its physiological reactions shows it to be isomorphous.

After an examination of the peculiarities as stated by the Doctor, upon motion it was decided to hold the annual reception of the Society on May 25th, and the trustees were instructed to attend to the details of the matter. Judging from the interest evinced by those fortunate enough to obtain tickets of invitation to the previous receptions, there will be no trouble of obtaining an appreciative audience on this occasion.

NOTES AND QUERIES.

A friend of mine, a photographer, told me of a new and excellent way of dipping paper in a silver solution, without getting any air-bubbles between the paper and the solution, and I find that in carrying out the same idea in making microscopical specimens, I lose those hateful air bubbles between the cover and balsam. The method of doing it is this:—Take the covering glass with the forceps, and place one edge in contact with the top of the drop of balsam on the slide; then slide it along as it descends, till the balsam comes in contact with the entire surface of the covering glass; then press and dry as usual, and if properly done you will have no air bubbles in your specimen. M. D.

Nyack, May 4.

As applied to microscopic mounting, this method will succeed only in certain cases. It does not get rid of those air bubbles which are actually imbedded in the object, and which are those that cause the greatest difficulty. A worse objection, however, is that in the case of delicate objects the motion of the cover would be apt to disarrange them.

Personal.—We understand that Mr. Henry Crouch, whose binocular microscope was selected by Dr. Carpenter for use on the important expeditions of H. M. S. "Porcupine," intends to make a fine exhibit at the Centennial, and will accompany it to this country in person. Mr. Crouch has recently brought out some new and very excellent models of his binocular microscopes.

Microscopes and Microscopic Objects at the Centennial.—We intend to give, in July or August, a very full account of the microscopes, etc., exhibited at the Centennial.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

For *Humulus Lupulus Ext.*, howing lupulin crystals, send stamped envelope to Richard Allen, 146 North Fourth Street, Troy, N. Y.

Wanted in exchange, well mounted specimens for mounted sections of either lung or kidney specimens, showing perfect minute anatomy of these organs. C. E. Nichols, M. D., 14 Fourth street, Troy, N. Y.

For palates of periwinkle and limpet send a stamped directed envelope or an object of interest to F. F. Stanley, Swampscott, Mass.

Foraminifera, very choice, and diatomaceous earth, in exchange for interesting material. George B. Scott, Box 5645, New York City.

Wanted to exchange, periodically, filterings from the water supply of Buffalo for the same of any other city. D. S. Kellicott, 119 Fourteenth street, Buffalo, N. Y.

Roesielia lacerata, *Puc. xanthii*, and *Puc. aculeata*, in exchange for other unmounted fungi. W. C. Stevenson, Jr., 1,525 Green St., Philadelphia, Pa.

Slides of "Sonorous Sand," from Sandwich Islands, very interesting, for any well mounted objects. W. G. C., Box 1774, Boston, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield. Mo.

Irish and British marine Algæ in great variety, correctly named, for herbariums, etc.; also beautifully mounted in balsam and other mediums; in fruit; many laden with diatoms; or splendid specimens, specially prepared for balsam. Foraminifera from Dog's Bay, Egypt, Java, etc; diatoms, zoophytes, sponge spicula, Holothuria plates, mollusca palates, ghost crabs, starfish, and various other unmounted interesting marine material, as well as botanical and entomological objects, etc. For any American objects, mounted or otherwise. Send detailed list of everything you wish to exchange; all letters answered. T. McGann, Burrin, Ireland.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Wanted in exchange for Vegetable Slides, other well mounted slides. Address F. F. Stanley, 40 Pearl street, Boston.

Books Wanted—Address, stating condition and lowest price, E. W., care AMERICAN JOURNAL OF MICROSCOPY, 87 Park Row, New York.

"Micrographic Dictionary." Second edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Caspar's "Forensic Medicine." 4 vols.
Faraday's "Electrical Researches." 3 vols.
Holtzapfel's "Mechanical Manipulation."

THE AMERICAN

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AND

POPULAR SCIENCE.

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Decoloring and Staining Vegetable Tissue for Microscopical Examination.

BY GEORGE D. BEATTY, M. D.

IN the Main Building at the Centennial Exhibition, amongst the chemical exhibits in the American Department, is a small case containing thirty slides of stained vegetable tissues, prepared by Dr. Beatty, of Baltimore. It has been our good fortune (through the kindness of Mr. William H. Walmsley, of Philadelphia, himself a skilful preparer,) to be allowed to examine these slides, and a more beautiful and instructive series of preparations we have never seen. As Dr. Beatty has contributed to the pages of *Science Gossip* a complete description of his methods and processes, we here republish his article from the pages of that journal. For the encouragement of our readers we would say that Dr. Beatty's methods have succeeded completely in other hands besides his own, so that the production of beautiful preparations after the process described is not entirely a question of skill. We may also add that the value of these preparations is not due to their beauty alone. The different structural elements of the plant absorb the various stains with different degrees of avidity, and consequently vary very much in color and shade. This enables the student to distinguish the different parts more readily than he could otherwise do. The following is the article referred to:

On previous occasions I have contributed to this journal articles on decoloring and staining vegetable tissue. Experience gained during the past year enables me to give in this article processes that will produce improved results.

All vegetable sections, and some leaves, may be prepared for staining by soaking them in alcohol, or in a mixture of dilute nitric acid and chlorate of potash; but I much prefer the results obtained by first bleaching them in "Labarraque's solution of chlorinated soda," and then treating them with alcohol for a few hours. In half an ounce of the soda solution a large number of sections may be placed, but not more than a dozen half or one-inch leaves, or parts of large leaves cut into inch pieces. Leaves in greater number adhere to each other, and thereby take longer to bleach.

Sections of matured wood should be kept in this solution from twelve to eighteen hours; sections of stems, leaves and petals from six to eighteen hours; pistils and stamens, and sections through the gynæcium and receptacle of flowers, from two to six hours.

Leaves and petals should not only be bleached by the Labarraque, but should also be rendered translucent. This is accomplished in from six hours to six days.

If delicate leaves show evidence of disintegration after they are bleached, but before they have become translucent, they should be removed to alcohol, after washing them in water as described be-

low. This renders them translucent within two days.

After removing from the Labarraque, put them into half a pint of clear water. Change the water five times during twenty-four hours, acidulating the third washing with five or ten drops of nitric acid. Sections can be washed in half the time required for leaves.

Next, put into alcohol, which in a few hours prepares them for staining.

In alcohol, tissue may be kept for months without turning yellow.

I.—STAINING LEAVES AND PETALS.

For staining leaves and petals the best dyes are aniline blue and hæmatoxylin.

Other anilines than the blue may be used, but they are not so pleasant to the eye, and are harder to work, as they fade out in both alcohol and oil of cloves.

Red aniline may be used, one quarter of a grain to an ounce of alcohol; violet, one-half grain; and green, three grains.

To make the blue aniline dye, dissolve in a mortar half a grain of "Nicholson's soluble blue pure" in one ounce of 90—98 per cent alcohol, which has been acidulated with half a drop of nitric acid; then filter.

Dilute a portion of this with alcohol to obtain a quarter-grain solution.

The formula for the hæmatoxylin dye is given further on.

A bright purple dye, good for leaves and sections, is made by steeping fresh berries of the *Phytolacca decandra* in alcohol. The stainings are quite permanent, but the dye does not keep over six weeks.

To Stain Leaves and Petals in Aniline blue.

1st. Transfer several small leaves from alcohol to about half a drachm of the quarter-grain blue.

If not stained of sufficient depth of hue in one hour—

2d. Transfer to the half-grain blue for a quarter or half-hour.

3d. Brush in 98 per cent alcohol with camel-hair pencil, and trim the edges of cut leaves. Any excess of color may be soaked out in this dilute alcohol.

4th. Put into half a drachm of absolute alcohol for half or one hour. In this but a trace of color will be lost.

5th. Put in oil of cloves for one hour, or until ready to mount in Canada balsam and benzole.

To Stain Leaves and Petals in Hæmatoxylin.

1st. Transfer from alcohol to water for five minutes.

2d. To 3 per cent alum-water for ten minutes.

3d. To hæmatoxylin dye, diluted with an equal part of 3 per cent alum-water, for one hour.

4th. To full strength dye, if necessary, for half or one hour.

5th. To alum-water for a moment, or until any excess of color is soaked out.

6th. Brush thoroughly in water, and put into one ounce of clean water for fifteen minutes, to remove alum crystals.

7th. To 98 per cent alcohol for fifteen minutes.

8th. To absolute alcohol for two hours, or longer.

9th. To oil of cloves for one hour, or until ready to mount.

Some leaves, chiefly ferns with sori, may be double-stained with hæmatoxylin and aniline blue; the former going to sori and spirals, the latter to other parts. The process is first to stain in hæmatoxylin, and then to soak the color in part from the body of the leaf by putting it in alum-water. Next carry through pure water and alcohol to a half-grain aniline blue solution for thirty or forty-five *seconds*, and proceed as you do with a single blue staining.

II.—DOUBLE STAINING OF SECTIONS.

For double stainings I use hæmatoxylin and carmine, and blue, green, and red anilines.

Of the red anilines I prefer that known under the head of Magenta or Roseine Pure, though Fuchsin, Ponceau, and Solferino may be used. These anilines are manufactured at the Atlas Works of Brooke, Simpson & Spiller, London.

The aniline dyes are made by dissolving

the quantity given in each process, with aid of mortar and pestle, in one ounce of 93 per cent alcohol and filtering.

The hæmatoxylin and carmine dyes are made according to the following formulæ:

Hæmatoxylin Dye.

Ground Campeachy wood....	½ ounce.
Pulv. alum.....	1 "

Mix and triturate in a mortar for twenty minutes, then add five ounces of hot distilled water, and let it stand for two days. Filter, and to each ounce of the dye add two drachms of 75 per cent alcohol. In twenty-four hours again filter to remove precipitated alum. This dye is made somewhat after Dr. Arnold's formula; he using the extract instead of the wood. It keeps, with occasional filterings, in well-stoppered bottles for two months.

Borax Carmine Dye.

Pulv. carmine.....	7½ grains.
Saturated aqueous solution of borax	7½ fl. dr.
Mix and add absolute alcohol	15 drachms.

Filter and collect crystals when dry. Dissolve nine grains of crystals in one ounce of distilled water.

This is Dr. J. J. Woodward's formula; but not so strong, as his is a saturated solution.

Ammonia Carmine.

Pulv. carmine.....	7½ grains.
Water of ammonia.....	20 drops.
Absolute alcohol.....	½ ounce.
Glycerine.....	1 "
Distilled water.....	1 "

Put the pulverized carmine in a test-tube, and add the ammonia. Boil slowly for a few seconds, and set aside, uncorked, for a day, to get rid of excess of ammonia. Add the mixed water and glycerine, and next the alcohol; then filter.

Process I.—*To Stain Sections with Magenta and Blue Aniline.*

1st. Transfer from alcohol to magenta dye (one quarter of a grain to the ounce), and let remain from fifteen to thirty minutes.

2d. Soak in alcohol for about the same time, or until the color is entirely, or in great part, removed from parenchymal tissue.

3d. Place or hold in a quarter, or a half-grain aniline blue solution from fifteen to forty-five seconds.

4th. Shake in absolute alcohol for a few seconds.

5th. Put in oil of cloves for ten minutes.

6th. In clean oil of cloves for ten minutes.

7th. In half a drachm of benzole for five minutes.

8th. Mount in Canada balsam softened with benzole.

The benzole may be omitted, as it sometimes slightly contracts delicate tissue; but it causes the mounting to harden much more rapidly, and, perhaps, is beneficial in preserving the magenta.

Process II.—*To Stain Sections in Magenta and Blue Compound.*

1st. Mix seven drops of a one-grain solution of magenta with five drops of a two-grain solution of blue (*non*-acid).

2d. Into this purple mixture put your section for five or ten seconds.

3d. Shake rapidly in absolute alcohol for a few seconds.

4th. Treat with oil of cloves and benzole, as in Process I.

Process III.—*To Stain Sections in Green Aniline and Carmine.*

1st. Put your section in a three-grain solution of iodine-green, and let it remain for one or two hours.

2d. Soak in alcohol for five or ten minutes, for reasons given above.

3d. Put in water for a minute.

4th. In the borax carmine from thirty to forty-five seconds.

5th. Shake rapidly in water, and soak out any excess of carmine that may be taken up.

6th. Put in alcohol for five minutes.

7th. In clean alcohol for ten minutes.

8th. In absolute alcohol for ten minutes.

9th. In oil of cloves for fifteen minutes.

10th. Mount.

Process IV.—*To Stain Sections in Green Aniline and Carmine Compound.*

1st. Mix fifteen drops of borax carmine

with fifteen drops of the three-grain iodine-green solution.

2d. Transfer section from alcohol to water for a minute.

3d. Put in the dye from thirty to sixty seconds.

4th. Shake rapidly in water, and soak out any excess of carmine that may have been taken up.

5th. Treat with alcohol and oil of cloves as in Process III.

Ammonia carmine may be used in the same proportion as the borax. Formerly, in Process III, I used the carmine before the green, but I now follow Dr. B. W. Barton's plan of using the green first, as far better results are thereby obtained.

To stain sections in hæmatoxylin and aniline blue, the mode of procedure is the same as for leaves; but they stain more rapidly, and only require the dilute dye.

Whether sections are stained by the alternate, or by the compound methods, the selection of colors is the same. The red and green aniline and the hæmatoxylin go to spirals, bass cells, scattered thickened cells, and, sometimes, to thick epidermis and hairs.

The blue aniline and carmine always go to parenchymal and often to thin epidermic and hypodermic tissues. The selection of color in matured wood is different, as will be seen further on.

It is not possible, I think, to give a satisfactory explanation of double staining of either animal or vegetable tissues. We can only say that certain dyes seem to have an affinity for certain cells. This is best shown by soaking single stainings in a fluid that removes their color. If sections stained in red or in green aniline be soaked in alcohol, and those stained in hæmatoxylin in alum-water, the color will rapidly leave the loose parenchyma, but will be retained for many days by the denser cells, as spirals, bass, etc.

On the other hand, specimens stained in blue aniline, if left in alcohol, and those stained in carmine, if left in water, lose the color much more slowly in the parenchymal than in other parts.

In my previous paper on double-staining of wood, etc., I said, if the blue was used before the red aniline, the selection of color was reversed. This is true as regards matured wood, but does not hold good when stems and midribs are under treatment.

Matured wood is better stained by the alternate methods. In longitudinal cuts, the first color used goes to longitudinal woody fibres, the second to spiral vessels, ducts and bark. Sections of stems and leaves not infrequently give better results by the compound methods. These results are superior to those obtained in wood, for the reason, I think, that in the latter there are not the same extremes of hard and soft tissues.

Double stainings should be examined by artificial light. Compound dyes should be used immediately after they are made.

Care should be taken to obtain a good article of absolute alcohol. That manufactured by Dr. E. R. Squibb, of Brooklyn, N. Y., gives me perfect satisfaction, while a German article I have used bleaches blue and green aniline stainings as though it contained some alkali.

Benzole instantly fixes those anilines that fade in alcohol and oil of cloves; but it does not do to transfer objects from alcohol to benzole, except through the medium of oil of cloves, on account of the injurious contraction it causes.

It should be borne in mind that chlorinated soda acts somewhat injuriously upon starch and protoplasm. This is not the case with dilute nitric acid and chlorate of potash, nor with alcohol.

In regard to fading, an experience of eighteen months enables me to speak quite favorably.

Some few leaves stained in blue aniline and in hæmatoxylin fade injuriously; others lose little or no color. Sections double-stained in green and carmine have perfectly stood the test of twelve months. Those in magenta and blue as a rule hold well.

If the effects produced by staining properly prepared vegetable tissues, with one or two colors, were more generally known

and availed of, the study of vegetable histology would be even more attractive than at present. So striking and precise is the manner in which certain dyes seize upon certain tissues, that it must be seen in order to be fully appreciated.

A word about the cutting of sections, for much depends upon this preliminary step. They must be cut thin and even.

Vegetable parts cut into pieces should be kept in alcohol for a week or two before sectioning. If leaves become crisp, which rarely occurs, a few minutes' residence in water renders them pliable.

In making sections of leaves, longitudinal cuts of midribs may be made, or vertico-transverse cuts through the midrib, including one-third of an inch of leaf on either side, or through several veins; leaves and small stems held against a piece of potato or turnip that has been hardened in alcohol, may be cut with a razor flat on the side, which is inferior when the back is held towards you. Alcohol should be poured over the object and razor while cutting. Large stems are better cut in a section machine, using paraffine as an imbedding agent. The object should be flooded with alcohol while cutting, and the paraffine should be trimmed to a cone-shape around it after every two or three cuts.

A knife I use with my section-cutter acts so satisfactorily upon both animal and vegetable tissues that I will describe it. It weighs 7½ ounces (avoirdupois.) The handle is stout, and is 4½ inches long, the blade is 7½ inches long by 1½ inches wide, the back being ¼ inch thick. The inferior side, holding the back towards you, was first ground flat and afterwards slightly concave from back to edge. A similar knife I find is figured in Mr. Rutherford's "Outlines of Practical Histology."

A list of some of the vegetable objects I have found most interesting may be acceptable to some of your readers:

Leaves.—Drósera rotundifolia, Dionea muscípula, Hepática triloba, Oxalis stricta, flava, hirsuta, and Bowiei; Deutzia gracilis, cruenta and Fortunii; Tradescantia zebrina, Eucalyptus globulus, Buchu serratifolia, Cassia acutifolia, Rhus Toxicodendron, Adiantum cuneatum and pedatum, Pteris serrulata, Elaeagnus.

Sections of Stems and Midribs.—Ficus elastica, Strelítzia Regina, Althæa rosea, Asclepias cornuta, Rùbus villòsus, Impatiens Balsaminia, Pteris aquilina and serrulata, Paulownia imperialis.

Sections of Stems.—Aspidium Filix mas, Ricinus communis, Mùsa sapientium, Euphorbia splendens, Datura stramonium, Dracæna Braziliensis, Ailanthus.

Baltimore, Md.

Salicylic Acid in Microscopy.

BY A. MEAD EDWARDS.

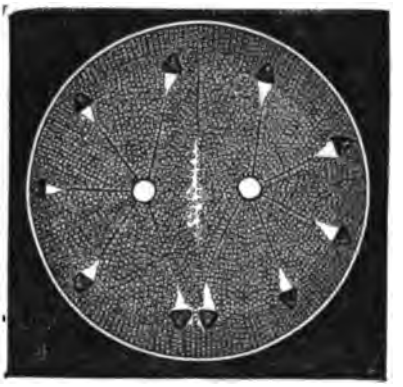
I HAVE been waiting anxiously from day to day to see if some one would not announce the fact that in salicylic acid, the marvelous disinfectant and preservative, the microscopist had a firm and valuable friend. But as no one has said anything as to its value as a preservative of microscopic objects, I have felt it my duty to come forward and say my say. Towards the end of 1874, as soon as I saw the announcement of the wonderful properties of this substance, I tried it in medicine and in microscopy, and in both fields found it of inestimable value. I put up some casts of uriniferous tubules obtained from a severe case of nephritis, and to-day those specimens are in as good a condition as they were the day I put them in clear water, with a few grains of salicylic acid added. Every medical microscopist, at least, knows how perishable casts are, and will, I feel sure, thank me for this hint. Leucorrhœal discharges put up in 1874 do not appear to have changed in the least, and if salicylic acid will preserve such things as these, what will it not do? At present I am experimenting with it on various substances, and although it seems to alter the color of most vegetable tissues, yet the softer and more perishable parts are so nicely preserved, that I feel that in it the working microscopist has a medium of greater value than any other preservative he possesses. The beautiful little *Volvox*

Globator, which, by the bye, seems to be quite common in some parts of the country —as I have received it from near Hoboken, N. J., and Bethlehem, Pa.,—can be kept in an almost unaltered condition in a cold, saturated solution of salicylic acid, and I have made a truly elegant preparation of *volvox* by first immersing it for a few minutes in Beale's carmine staining fluid, and then mounting it in the salicylic acid liquid. Details are brought out in this way that are difficult to see in the living plant. Desmids, likewise, seem to keep well in the same preservative, and diatoms, with which I am at present experimenting, seem not to change materially after immersion in salicylic acid solution for a week at least. I trust that naturalists will give it a trial and publish the results of their investigations.

Newark, N. J.

Aulocodiscus Oregonus with Two Centres.

Ed. Am. Journal of Microscopy—In the August (1875) number of the *Monthly Microscopical Journal*, appeared the following note addressed by me to its editor:



AULOCODISCUS OREGONUS WITH TWO CENTRES.

"Dear Sir—Allow me to offer you for publication, if you please, a photo of a drawing of mine representing a disc of *Aulocodiscus Oregonus* with two centres, conveying the idea of two half-discs, each eccentric, joined along a line of suture. I am aware that this class of objects is not extremely rare, but such a valve as the one in my possession must give rise to questions of interest with regard to the manner of their production."

The photo, however, was "not sufficiently distinct to make an engraving from," as a foot note declares, and so no figure of the disc appeared. But Mr. Kitton, to whom the matter had been referred, repeated my own statement, but in different words, as follows:

"'Monstrosities are not very rare in this department of Botany.'—*Ed. M. M. J.*"

It now gives me pleasure to comply with your request, by furnishing you with a new negative of my drawing, and also a brief notice of "the questions of interest," to which I made allusion, without discussing the frequency of "monstrosities in this department of botany," which I think Mr. Kitton somewhat exaggerates.

In Animal Teratology two principal views have been, and are still, perhaps, entertained by the scientific world with regard to the production of double monsters. The older one of dual formation, followed by a more or less extensive grafting, or even fusion by pressure, emanated from the St. Hilaires, Père et Fils; and the more modern one of excessive developmental power and action, forcibly advocated by Vrolik, Alan Thomson and other persons—who, amongst other objections against the double germination, urge the impossibility of accounting for excessive digitation, or even an extra member by so nearly perfect a merging of two beings into one. Neither would that theory explain satisfactorily the presence of dermic tissues, or even bone, in the substance of the virgin ovaries, or the testicle, a case of which abnormality recently occurred in my practice.

To apply the foregoing remarks, I would urge the adoption of Vrolik's opinion, and regard the formation of two centres in a single valve, as an evidence of the action of an excessive developmental potency, even if it have been confined to the one valve of the frustrule which I have the pleasure to possess.

I am, etc.,

CHRISTOPHER JOHNSTON.

Baltimore, Md., May 7, 1876.

THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

TERMS—Fifty Cents per Year. (*Note.*—We pay postage on all copies sent out of New York City, but by the absurd regulations of our Postal Laws, it costs us seven times as much to send a copy from our office to a New York city address that it does to send one to Texas or California. From subscribers in New York city, therefore, we are compelled to ask the postage, which is 12 cents per year.)

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37 Park Row, New York.

MR. CHARLES STODDER, 131 Devonshire Street, Boston, is authorized to receive subscriptions and to receipt for the same.

S. H. CASKINS, Naturalists' Agency, Salem, Mass., has kindly consented to act as agent, and will receive subscriptions.

Postal Rules and Rates.

IT is an unfortunate fact that the average Congressman has neither the ability nor the desire to foster the increase or the diffusion of knowledge, and consequently the necessary facilities for intercommunication have rarely been afforded to students of nature in this country. While the publisher of a sensational weekly story paper, whose sole influence is to corrupt, or at least debilitate the mind, can send his journal through the mails at the rate of two cents per pound, journals like the one now in the hands of the reader are charged three cents per pound, and objects of natural history are charged sixteen cents per pound! Formerly the charge for the latter was eight cents per pound, but by the grace of Hannibal Hamlin, the rate was doubled about a year ago. By this act Mr. Hamlin has certainly become very extensively, if not very favorably known. So obscure has he hitherto been, that some years ago, when he was nominated to a high position, half the people of Europe supposed he was a negro. He has since given proof that in this they did great injustice—to the negro. Since, however, students of natural history have little power as law makers, the only thing left for them is to carefully study existing rules and rates, and avoid those difficulties which arise from a violation of the law, whether committed wilfully or in ignorance. Our experience during the past few weeks has convinced us of the general ignorance which exists in regard to this subject, and the necessity for a few words of explanation.

In sending packages by mail, it must be remembered that while printed matter is admissible, anything, *except the address*, written outside or inside, subjects the package, if not prepaid, to *double letter postage*. On five occasions during the past few weeks we have had to pay double letter postage on specimens because the senders had violated this rule. Slides with written labels, or with the names or numbers written on the glass; packages in which the contents, or the words "with care," etc., are written outside, are all subject to letter postage. Therefore, whenever it is necessary to distinguish slides, etc., the best way is to number them by means of printed numbers, which may be cut from any old almanac and pasted on.

Single slides with written labels may be packed between two thin strips of wood and sent for three cents (letter postage), and this is as safe a way as any. If the slides are of very thick glass they may cost more.

All packages sent as first or second class matter are stamped by the post-office, the stamp being heavily struck on the postage stamp, and on the place where the address is written. This stamping process is sure to crush any ordinary pasteboard box, and consequently very many slides are broken in transit. All addresses and postage stamps should therefore be placed on a tag which hangs loosely from the package. The tag then receives the blow and the specimen is saved.

In packing slides see that they are firmly imbedded in some elastic material—cotton being as good as any. Pack the cotton tightly around and between the ends of the slides, and they will go safely.

Finally, remember that packages sent as

second-class matter must be left open for inspection. If sealed or pasted up they are subject to letter postage. If tied so that they cannot be opened, letter postage will be charged; though in the latter case the delivering postmaster may remit the extra postage on being shown that the package contains nothing that violates the rules.

The Kentucky Meat Shower.

SINCE our last issue the substance which is said to have fallen from the sky in Kentucky has been carefully examined in this city by men of experience and ability, and has proved to be of undoubted animal origin. Through the kindness of Mr. Walmsley, of Philadelphia, we were enabled to examine a slide sent to him by Mr. A. T. Parker, of Lexington. This specimen was, without any doubt, *striated muscular fibre*. Since then we have received from Mr. Parker himself, specimens not only of muscular fibre, but of cartilage.

The identical specimens which were examined in Brooklyn, and pronounced by Mr. Brandeis and others to be *Nostoc*, have been submitted to experienced histologists, who find that they are *lung tissue*. Professor J. W. S. Arnold and Dr. A. Mead Edwards are, amongst others, the authority for this opinion.

We therefore regard the question as to the nature of the material composing the so-called meat shower as no longer an open one. The source or origin of the meat is, however, still *sub judice*.

Correspondence.

Making and Manufacturing Microscopes.

Ed. Am. Jour. Microscopy—The paper in your No. 6, page 70–71, "The Duty on Imported Microscopes," is one that deserves the attention of both makers and purchasers of microscopes, and other instruments also. While the observation in regard to certain makers, that "each man is an artist in his special line,"—an artist in the highest sense, not a mere laborer, as too commonly considered—the next sentence conveys the impression that they do not manufacture in quantities, but only make instruments singly at a greater cost. I can speak for one, or perhaps two, who certainly manufacture in quantities, with the aid of the best machinery, and therefore at the lowest cost for the highest grade of mechanical work.

The comparison which was made of the cost of making one sewing machine by hand with the manufacture of hundreds by machinery, is not strictly a parallel case, for the parts and pieces of a sewing machine are such that machinery can be applied to the greatest possible advantage, which is not the case with microscopes, and most other scientific instruments. Morever, the consumption of sewing machines is all but unlimited except by the price; while the market for microscopes could so easily be overstocked, by a few hundred, that they could not be sold for the cost of the material, which is but little compared with the labor.

The foregoing applies to the brass work—the stands. But when you come to the optical part—the lenses—it may be asserted positively that they cannot be "manufactured," in the sense the word was used, and produce first-class work.

Making a modern microscope objective is the work of an artist. Every lens (from 5 to 10) in every objective is made by itself, of itself, of a certain material, of a certain diameter, a certain curvature, and a certain thickness, to fulfil a certain purpose; any variation from the formula for these elements will produce a different result. The maker who is versed in the theory of optics can construct his own formulas, but the maker who merely works to a formula given or dictated to him by another is only a workman. No machinery or substitute for the hand and eye of the maker can be used; as well might one talk of "manufacturing" Church's "Heart of the Andes," as of manufacturing a modern first-class objective or telescope lens. As the painter is paid for his talent and skill, and years of study spent in acquiring his art, so the optician is to be paid for his knowledge, skill and time spent in acquiring them, according as his work is worthy.

But the article in question conveys the idea that low-priced lenses are not made in this country. I think the writer of the paper had been shown some very low-priced American

lenses, of which he pronounced a favorable opinion.

But all so-called first-class objectives are not made as I have described. This is not generally understood by those in front of the curtain—the purchasers.

Witness the following from the *Monthly Microscopical Journal* (London), April, 1876, page 191. A correspondent referring to the mode of making objectives cheap—for the American market, probably—says:—"Their *modus operandi* is pretty much as follows: The back combinations are fixtures put together and placed as fairly as is compatible with a moderate expenditure of labor. The workman then addresses himself to what he regards as the real business of the day, that is to 'marrying lenses,' as he calls it. In other words, he tries on front after front, taken almost at random out of a great number, till he hits upon that one which exactly accommodates itself (according to his idea) to the previous combinations, these fronts being, as an accomplished optician expressed himself to me, 'Made in bushels! Yes, Sir; made in bushels by girls.' I could give, if it were desirable, a goodly list of French and German *opticians* (!) who follow this facile plan of manufacturing first-class objectives."

Now, intending purchasers should be informed that it is these manufactured lenses that they are often advised to purchase, because they are cheap, by newly returned students from Paris or Vienna, who know little or nothing of what has been done in England in the last forty years, and in America during the last twenty-five years in the improvement of the microscope.

I intended, Mr. Editor, to have added a few words on the subject of the importation of instruments without paying duty, but I fear I should take up too much of your space. I will only say to those incorporated institutions: If you want to get your instruments cheap, buy them of your neighbors, and their competition will soon bring the prices low enough. If they have all the business, that alone will reduce the cost. Keep your money at home, among those who have given you the funds to buy anything with, and who are to furnish your future students and support.

If there are any who practice violation of their oaths, by selling instruments that they have sworn were not intended for sale, it is simply disgraceful. CARL REDDOTS.

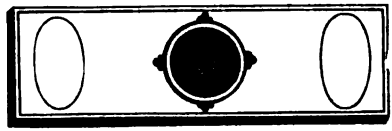
Cleaning Thin Covers.

Ed. Am. Jour. Microscopy—It is sometimes desirable to clean thin glass covers which have been in contact with cements or media of various kinds; this may be done quickly and thoroughly by immersing them in a solution made by adding powdered bichromate of potash to oil of vitriol. I make use of this method to clean covers at any time. After the organic matter has been oxydized, the solution is poured off, the glass washed, a little solution of ammonia added to neutralize any free acid that might adhere, and the washing finished with distilled water. F. N. P.

Sheffield Scientific School, New Haven, Conn.

Our Work Table.

Slide for Opaque Objects.—There are large numbers of very interesting and beautiful objects which add greatly to the attractions of a cabinet, but which are not regarded as worth a great amount of trouble or expense in the way of cells, slides, mounting, etc. Prominent amongst objects of this kind are seeds, minerals (in small masses), small shells, etc., and for such the slide figured in the accompanying engraving is very convenient and very efficient. It consists simply of a slip of wood, three inches by one, and rather more than an eighth of an inch thick. In the centre is drilled a hole nearly but not quite through. The inside of this hole or cell is coated with dead black varnish, and the upper surface of the slide is entirely covered with a paper cover of light color, on which the



SLIDE FOR OPAQUE OBJECTS.

name of the specimen may be written. The object is cemented to the bottom of the cell, and there is no necessity for a thin glass cover, as dust is perfectly excluded either by placing the slide face down in the cabinet, or by packing the slides face to back, and keeping them in this position by means of an india-rubber band. Where the slides are kept face down, the backs may be labeled with ordinary labels; but when they are packed face to back no labels must be used, as any label which did not cover the entire slide would produce an opening between the two slides, and permit the entrance of dust. The names may, however, be written on the *edge* of the slide, and thus any particular specimen

may be singled out of a package in a moment. These slides are so cheap and so efficient that they must come into extensive use. They resemble much a slide described by Dr. Carpenter, but vary in the details of construction and application, and we think are a decided improvement on the older form.

Professor of the Natural Sciences.—An American gentleman of considerable national notoriety lately visited England bearing letters of recommendation, in which he was styled "Prof. of the Natural Sciences." The first English savant upon whom he called and presented his credentials, advised him as a friend to not present such papers, for, said he, "Its a good deal in this country to be a Professor of Chemistry; its a great thing to be a Professor of Geology; and the magnitude of a Professor of Astronomy is something not easily measured. But when you are recommended as a Professor of all these and much more, the idea is overwhelming."

The New York Aquarium.—An aquarium, possessing features which will ally it to the educational institutions of the country, is about to be constructed in this city. It will be more than a mere aquarium for observing the forms, habits, etc., of marine animals. To it will be attached a library, reading room and museum, and a naturalists' laboratory and workshop, in rooms which will be wholly at the service of students and teachers. The library will be supplied with such works as may be needed for consultation, and a full list of American and foreign magazines on natural history; and the laboratory will be furnished with microscopes, dissecting tables and implements, and with a set of experimental tanks. These rooms will be free to students, who will be afforded every facility for the prosecution of original researches. The direction of this special scientific department has been placed in the hands of a gentleman who has been active in securing for the city such an institution. His services are gratuitously rendered, and the generous appropriations made by Mr. Coup are such as to assure to persons interested all the privileges of study and observation that could be desired.

Microscopical Literature.—The microscope and its revelations are now attracting more attention than ever, and most of our scientific periodicals contain articles relating to the microscope or microscopic objects. Amongst those which devote regularly considerable space to a "Department of Microscopy," may be mentioned the Cincinnati *Medical News*, which makes a specialty of this subject, and the *American Naturalist*, in which this branch is ably edited by Dr. Ward, of Troy. Our subscribers who desire to extend their reading in this direction will find in these periodicals much that is of great value.

Polorization of Living Tissues.—Some time since, while examining the contents of a "microscopic" aquarium, I tried the effect of the polariscope on the *Daphnia pulex*, expecting to find the shell would polarize in a similar manner to the ova of the oyster. I was very much surprised to find the shell not affected, but the body itself; the intestines and muscles of the tail and antennæ showed a greater intensity of color than almost any object I had ever seen polorized. I have at different times examined several specimens of Crustacea, Cypridina, Polyphemidæ, etc., and always with the same results. The young of many water-beetles are also good examples; in fact, from the observations I have made, I think there is no doubt that living tissues generally will polarize in some degree. The leaves of many aquatic plants examined while living form very striking objects for the polariscope.—*W. C. H. B. in Science Gossip.*

Experiments on Spontaneous Generation.—In the *Popular Science Review* for April there is a capitally-written and well-illustrated article by the Rev. W. H. Dallinger, already well known for his researches in the life-history of the monads, giving a review of Professor Tyndall's "Experiments in Spontaneous Generation," and Dr. Bastian's position thereto. The author thinks that as to the development of *Bacteria* in infusions charged with solid matter, precise experiment of a sufficiently comprehensive character has yet to be made on them in relation to the demonstrated germs. Mr. Dallinger sums up against Dr. Bastian's theory.

Salicylic Acid when pure is a white, crystallized substance, soluble in 300 parts of water, or in 4 parts of alcohol. It is stated to be even more powerful than carbolic acid in destroying low organic forms, such as those which produce decay and fermentation.

Pritchard's Infusoria.—A new edition is in preparation, and will be published by Van Voorst, of London.

— Prof. Theo. G. Wormley, of Columbus, Ohio, has been selected by the Medical Commission of Philadelphia to prepare an address on "Medical Chemistry and Toxicology," before the International Medical Congress, to be held in Philadelphia during the coming summer.

— The Birmingham (England) Natural History and Microscopical Society admits lady members, and finds great advantage therein.

— It is well enough to talk of elevating the tone of social conversation, but when a well-meaning young man tries to introduce protoplasm as a subject, at a little gathering, and finds that everybody thinks he is referring to a new kind of plaster, and considers him indelicate in doing so, he is apt to feel that the life of the reformer is a kind of perpetual picnic on an ant-hill.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—In addition to the more important work undertaken by the members of any society and discussed at the regular meetings, the exhibition and explanation of popular objects, at stated periods, tends to increase the interest felt in the society, to add to its membership, and to extend its usefulness. We have just received a very interesting report of the fourth annual reception of the San Francisco Microscopical Society, which was held in Mercantile Library Hall, on Thursday evening, May 25, and the many ladies and gentlemen present, who were fortunate enough to be invited, went away pleased with the results of the endeavors of the gentlemanly exhibitors to give a pleasing and popular entertainment.

As stated on their programme for the evening's exhibition of objects, the Society endeavored to make the reception instructive as well as interesting, by exhibiting a series of objects selected from the various departments of Nature—mineral, vegetable and animal—in a somewhat orderly arrangement. It is difficult to particularize, where so much was to be seen, but Mr. Atwood, in Micro-Lithology, and Messrs. Hanks and Murdoch, in Mineralogy, exhibited objects pertaining to their departments, of great beauty and scientific interest, while Dr. Burgess, in Micro-Chemistry, pleased all, and particularly the ladies, by the changing flashes of light produced in crystals, by the aid of polarized light.

The lower forms of vegetable life were shown by Mr. Kinne, who took occasion to fully explain the curious and wonderful powers of motion found in the *protococcus* and *diatoms*, and it was hard for him to convince many who witnessed the very positive movements of these plants that they were not animal instead of vegetable structures.

Mr. J. P. Moore, in the higher *algæ*, exhibited many curious objects, and aided the observer by a series of fungoid growths laid on the table, selected from his herbarium, to understand some of the mysteries of their propogation.

Messrs. Denison and Langstroth, in vegetable tissues and organs, ably filled their part of the exhibition, the series of pollens of the latter attracting marked attention.

Passing to the Animal Kingdom, we found Mr. Banks with some of the lower forms, and hardly noted any well drawn line in the transition, remembering the active little plants in the stage of Mr. Kinne's microscope; yet the animalcules, with the beautiful little groups of cilia, arranged like revolving wheels, at the mouth of the animal, called forth many marked expressions from those unused to the sight. Mr. Myers carefully explained his objects, and late in the evening placed a part of the gill of the common sea-mussel on a slide to show the movement of the cilia, which was finely done. The earnest desire of those in waiting to take a look, often prevented the removal of one object from the stage, and many missed seeing the ciliary action of the shell fish in this case, as well as others, till late in the evening.

Mr. Hyde attracted attention with matters of interest, by showing the *trichina*, itch insect, and *phylloxera*, parasites of unquestionable voracity, and took occasion to explain the various modes by which each fulfilled their allotted place in nature and earned the name of *pest*.

Mr. H. K. Moore exhibited the scales of various insects, arranged to represent a basket of flowers with a bird hovering over it, forming an object of great beauty.

Dr. Mouser showed, under a quarter-inch objective, the striated voluntary muscle fibre, and the anastamosis in the capillary blood vessels, both characteristics being brought out clear and distinct.

Messrs. Boswell and Ewing, as well as Dr. McQuesten, dealt in objects pertaining to the structure of man, and from these three gentlemen many learned more of how fearfully and wonderfully he is made than they were previously informed.

Dr. Harkness' exhibit of the circulation of blood in the mesentery of a frog, showing the characteristic elliptical red corpuscles of the Reptilia, with the white or colorless corpuscles, attracted the attention of every one present. The doctor had considerately put Mr. Frog to sleep with a subcutaneous injection, and, judging from the way in which the observers kept their eyes glued to the end of the tube, it was one of the most interesting objects on the list, although Dr. Wythe's preparations of morbid structures were not passed over with a single glance, and his objects very properly closed the list, as the others had been graded from inorganic to organic, up through the vegetable to animal, and here in the pathological study of man was found the end of things.

The whole exhibition was a decided success, and passed off smoothly and pleasantly to all. The half a dozen gentlemen who started in but four years since, to build up a working society to foster the study of microscopy, may well feel proud of their success, and of the many scientific gentlemen they now count as members of the San Francisco Microscopical Society.

Dunkirk (N. Y.) Microscopical Society.—At a meeting held Feb. 21, Dr. Geo. B. Blackburn, President, in the chair, Mrs. M. E. C. Shelton, Secretary, Dr. C. P. Alling called attention to Dr. W. W. Kean's liquid for preserving specimens in natural history, either by immersion or injection. The liquid is composed of 10 to 12 grains of chloral hy-

drate dissolved in one fluid ounce of distilled water. Dr. Alling also read an elaborate essay on "The Diurnal Lepidoptera in the Society's Collection." The President announced that at the next meeting Rev. J. W. Armstrong, D. D., would read an essay on "The Natural History and Classification of the Diatomaceæ."

Recent Books and Articles.

The American Chemist. A monthly Journal of Theoretical, Analytical and Technical Chemistry.

This valuable journal, one of the most important of the scientific periodicals of the country, is again published by the editors, Profs. C. F. and W. H. Chandler. The April number is before us and is fully up to the standard of what such a journal ought to be. It gives not only a number of valuable and elaborate articles, but a complete list, with occasional short abstracts, of all the papers on this subject which appear in cotemporary literature. The yearly subscription is $5.00, and the publication office is at the School of Mines, in this city.

The Poduridæ, or "Spring-tails" of Sweden are fully described in a monograph by T. Tullberg. Illustrated with 12 plates. Trans. Royal Swedish Academy for 1871.

"Lecture on Lenses." By Joseph Zentmayer. *Jour. Franklin Institute* for May. (A very clear exposition of this important subject.)

"Multiplication by Fission in Stentor Müllerl." By Hon. J. D. Cox. Illust. *Am. Naturalist* for May.

"The Black Knot." By Prof. W. G. Farlow. Bulletin of Bussey Institute for March, 1876. An abstract, with plates, is also published in *Amer. Naturalist* for June, 1876.

"Organisms and their Media." By H. Charlton Bastian, M. D., F. R. S. *Popular Science Monthly* for June.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

For spines of Echinus send objects of interest, Polycystina especially, to F. F. Stanley, 40 Pearl street, Boston.

Pure guano, containing diatoms, in half-ounce packages. Has been washed in pure water. Anything of interest accepted. E. W., Box 4875, New York city.

Very fine old-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 355, Milford, Mass.

Wanted, slides of diatomaceæ or foraminifera in exchange for pathological preparations. Geo. A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

Wanted in exchange, well mounted specimens for mounted sections of either lung or kidney specimens, showing perfect minute anatomy of these organs. C. E. Nichols, M. D., 14 Fourth street, Troy, N. Y.

Slides of fossil diatoms from Nova Scotia, for any other mounted objects. G. C. G., Box 2055, Rockford, Ill.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, or seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

For *Humulus Lupulus Ext.*, showing lupulin crystals, send stamped envelope to Richard Allen, 146 North Fourth Street, Troy, N. Y.

Foraminifera, very choice, and diatomaceous earth, in exchange for interesting material. George B. Scott, Box 5645, New York City.

Wanted to exchange, periodically, filterings from the water supply of Buffalo for the same of any other city. D. S. Kellicott, 119 Fourteenth street, Buffalo, N. Y.

Roestelia lacerata, *Puc. xanthii*, and *Puc. aculeata*, in exchange for other unmounted fungi. W. C. Stevenson, Jr., 1,525 Green St., Philadelphia, Pa.

Slides of "Sonorous Sand," from Sandwich Islands, very interesting, for any well mounted objects. W. G. C., Box 1774, Boston, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield, Mo.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

A Useful Tool for Microscopists.—In setting needles in their handles; holding small tools for filing, grinding, etc.; holding small pieces of hard material for filing or sawing, and a hundred other operations that every working microscopist requires to perform, nothing is so convenient as a good little hand-vise. The best article of this kind that has come to our notice is one made by the Miller's Falls Manufacturing Company. The jaws move parallel to each other, and are made of well-tempered steel. By means of a notch in the jaws, and a centre point in the main stem, it is easy to grasp any object so that it will be held true, and in this way the vise may be used to hold drills, bits, etc., and by removing the wooden handle, it may itself be grasped in an ordinary brace. Descriptive circulars may be obtained from the manufacturers at No. 74 Chambers street, New York.

Stained Vegetable Preparations.—Those who desire to examine the results of this process, which is now attracting so much attention, will be glad to learn that Mr. W. H. Walmsley (of James W. Queen & Co., Philadelphia,) has placed on sale a limited number of preparations from his cabinet. We have examined Mr. Walmsley's slides, and were greatly pleased with the skill shown in every stage of the work. Those who intend to commence work in this direction would do well to procure a few of these slides as examples.

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POPULAR SCIENCE.

VOL. I. NEW YORK, JULY, 1876. No. 8.

How to Cut Sections of Algæ.

MRS. MERRIFIELD, of Brighton, England, contributes to *Science Gossip* an article upon this subject, containing a great many useful hints. In regard to some of the apparatus used, it may perhaps be well to suggest that a good anatomist's scalpel is the instrument which will come nearest to the knife described by her. At the same time we believe that it is the experience of those who have worked much with cutting tools, that of all the cutting implements that are easily procured, a good razor is apt to have the best temper, and to receive and retain the best cutting edge. In cutting very thin sections, after the method described by Mrs. M., great assistance may be derived from the use of a low power lens, magnifying, say, 3 to 6 diameters. Such a lens may be fixed on a small stand, and adjusted directly over the work, leaving both hands at liberty. The following is Mrs. Merrifield's article:

I have been asked how to cut sections of algæ, and thinking that some of your readers may also like to know how to perform this simple operation, so indispensable to the students of algæ, I beg to send the following communication on the subject for insertion in your journal.

MATERIALS.

1. Some pieces of clear glass, about 3 inches by 1 or 1½ inch.

2. A piece of thin, smooth cork, about 2 inches diameter; a good smooth bung will do.

3. A piece of white cardboard (not glazed), about 2 inches by 1½ or 2 inches, with square corners.

4. Two pointed instruments for arranging the sections, etc. Convenient tools for this purpose are made by inserting the heads of large needles into the pith of pieces of elder, about 4 inches long, and as thick as a lead pencil. When dry, the elder twigs form good handles.

5. A pair of fine-pointed scissors.

6. A cutting instrument. Dr. Harvey recommended for this purpose a razor set in a firm handle, so as not to close; or, a child's gum-lancet, also set in a firm handle. The razor may do for cutting sections of laminaria, etc., but I found it very clumsy for small weeds. I obtained from a cutler, to whom I explained what I wanted, a very thin knife-blade, about the size of a penknife, set in a firm handle, with a sheath to protect it when not in use. This answers the purpose very well.

7. A few "Naturalist's pockets" of paper, for putting away small scraps of algæ, which you wish to preserve.

8. A good drawing-pencil, and india-rubber.

9. Some pieces of white paper to make enlarged drawings of sections, small branches, fruit, etc.

10. Some oblong pieces of clear talc, on which specimens of fruit and small branch-

lets may be preserved for after examination by the microscope.

11. A small bottle with glass stopper, containing dilute muriatic acid.

12. The stick of a lucifer match.

13. A moderate-sized hair pencil; some pieces of rag.

14. A box to hold all these objects.

15. A glass of clean water.

To make a cross-section of an alga: If you can get fresh plants from which to cut sections, so much the better. They must not, however, be too wet, for in this case the pressure of the knife would crush them, so that you could not cut a clean section, or understand the structure. If the plant to be examined be wet, cut off a convenient piece, and lay it in a cloth, when it will soon be dry enough for the purpose. Select for cutting a portion which is a fair sample of the plant, bearing in mind that the lower parts of the stem are often of denser structure than the upper. For this reason it is sometimes necessary to make cuttings from both upper and lower branches across the frond. A piece of the plant about the fourth of an inch in length will be enough. If the plant from which you are cutting be too dry, the sections will scatter away and be lost. To avoid this, wet the fragments, and let it dry sufficiently in a cloth. When it is ready, place the cardboard on the cork, and the piece of alga on the cardboard, the surface of which is yielding, and not so likely to blunt the knife as the harder surfaces of wood or metal, and being white, you can see the sections as they are cut. Bring forward the forefinger of the left hand, lay your nail on the alga, so that you can only just see the edge of it beyond your nail. Then take the thin knife, lay the blade against your finger-nail, and cut gently and cautiously down to the pasteboard, lest the sections should be jerked away. The thinner the slices are cut, the better. They cannot be too thin. It is better to cut eight or ten slices, because they afford more scope for observation, and it is as easy to cut a dozen as to cut one, by moving the finger-nail gently backward between each cutting. If great care be not taken in cutting the sections, the central part, often of very lax texture, may be torn, or even displaced, so that the frond appears to be hollow. This appearance is always to be distrusted. And now will be found the advantage of having cut many sections. Close observation of all these will seldom fail to discover, not only traces of the central stratum, but probably a good section of it, from which the structure of the frond may be ascertained. If all the sections fail in showing the central stratum in perfect condition, other sections must be cut until this object is attained. A little practice will render this operation easy.

When you have cut as many sections as you wish, tilt the cardboard gently on to one of the pieces of glass, using the knife or needle to remove the sections if necessary. Add a small drop of water. If you put too much water, the pieces of alga will float about. Superfluous water may be removed with a piece of rag or dry hair pencil. Perhaps it may be found more convenient to put the water on the glass, and then remove the sections on to the wet part of the glass; they are then less likely to scatter and be lost. Place the glass on the field of the microscope, not using too high a power, as you require a large field. The needles may now be useful to place the sections conveniently near together, or to turn them into a horizontal position, as they are very apt to lie on their edges. It is very beautiful to see the sections expand, which they do in some algæ more quickly than in others. Some require a few minutes only for this purpose, others an hour or two. In the latter case, put a watch-glass or inverted wine-glass over the sections (having previously removed the glass on which they are from the microscope), to prevent evaporation. If the sections do not open properly, add a drop of the muriatic acid, which will generally cause the sections to open, though it will deprive them of color. The best way to apply the acid, is to dip the end of the stick of the match into the bottle, so as to

take up a very small quantity only. Then cork the bottle carefully. If you use the microscope in a sloping position, the sections with the water and acid should be placed on a glass with a hollow sunk in it to avoid injuring the brass work of the microscope. It is generally an advantage to place another glass on that which holds the sections.

Longitudinal sections of small plants are more difficult to make than transverse sections. The best plan, as the late Mrs. Gatty used to say, is to choose a forked branch, that you may have something to hold. Sometimes an oblique section will be easier to hold and cut than a longitudinal one.

Of fruit, when large enough, sections may be cut both horizontally and vertically. When making a vertical section of the fruit, the best plan is, to cut through the frond as well as the fruit. It will then be seen exactly how one part is attached to the other. In many cases it is preferable, instead of cutting sections, or in addition to so doing, to press the fruit gently between two pieces of glass, and you will then see the structure of the receptacle, and the shape of the spores and tetraspores which exude under the pressure.

Having completed your examination of the sections and fruit, you should now make careful drawings of both. These drawings should be put away with the specimens. They will be useful not only in identifying the plant, but also for future reference.

It may be as well to mention, before I conclude, that I have tried an instrument used by microscopists for cutting sections, and found it not nearly so well adapted for algæ as the more simple plan I have just described. Patience and practice will enable you to cut clean and thin sections; but when you have accomplished this object, a greater difficulty still remains to be overcome, namely, to understand the structure which the microscope has revealed, and to refer the plant under examination to its proper order, genus and species.

On a Mode of Viewing the Seconds Hand of a Watch through a Beetle's Eye.

DR. WHITTELL, of Adelaide, South Australia, contributes to the *Monthly Microscopical Journal* the following very explicit directions for exhibiting this interesting object:

Take a watch with a white face, take out the front glass, and remove the hour and minute hands. Paste over the face of the watch a piece of dead-black paper with a round window cut in it, so as to leave nothing exposed but the small circle in which the seconds hand rotates. Place the watch on the front of the mirror of the microscope, and condense the light of a strong flame on the small white circle that has been left exposed. Reflect this light through the beetle's eye, previously placed on the stage, just in the same manner as if the ordinary mirror were being employed. Bring the eye into focus, and then gradually draw back the objective by means of the fine adjustment, until the images of the watch hand appear. At first these will probably be dim, but by varying the inclination of the watch, and careful adjustment of the light, the observer will at length obtain a bright and distinct image through each lens of the eye. The nearer the watch can be brought to the stage, without cutting off light from the condenser, the larger will be the image. Any power may be used from one-eighth to one-third inch, but I prefer a four-tenth, with a No. 2 eye-piece. Under this power the images are sufficiently enlarged, and a good number of them are included in the field. The eye may be mounted in balsam, but I think I have obtained better results from one specially prepared and mounted in glycerine.

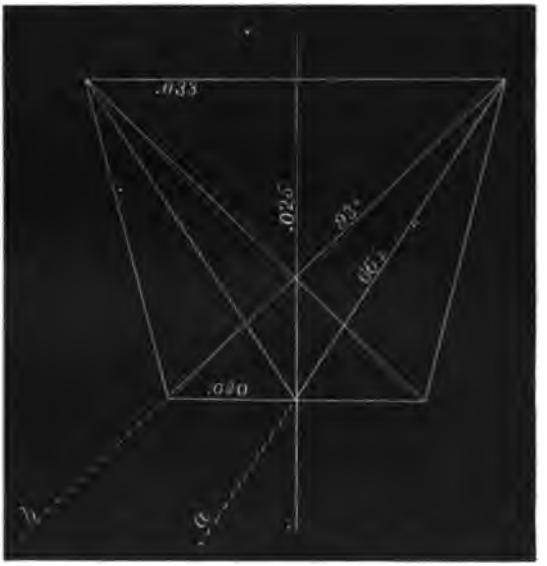
A COMPACT COLLECTING CASE.—Mr. Kinne recommends the small leather pocket-cases used by physicians, as being convenient collecting cases, when only small quantities of microscopic objects are to be obtained.

On the Aperture of Object-Glasses.

[The following articles were published by Mr. Wenham in the *Monthly Microscopical Journal*, the first article in the issue of April, the second in July, 1876:]

THE number of degrees that include a pencil of light radiating from one single point from the focus of a microscope object-glass, represents the true angle of aperture.

In order to obtain accurate results, the light indicating the admitted degrees should be confined to a mere point or line situated in that focus,



In the diagram the angles are the result of ascertained dimensions from a known immersion object glass, as follows:—Acting diameter of front lens, .033; focal distance from the front surface, .025, with a width of field of .020, or one-fiftieth of an inch. With correction adjusted, the resulting angle from central focal point is 66½°, each ray giving a distinct image. In order to determine the direction of the outer rays by the usual sector method, a narrow slit must be set in the focus: the extreme light of [the] true aperture will pass through from *a*.

Let the slit now be opened out to one-fiftieth of an inch, so as to admit the effective oblique pencils embracing the entire field of view. Light will then enter from direction *b*. This ray will also show a distinct image, and an aperture of 93° will now be indicated instead of the former 66½. This excess of angle is a false quantity, because it does not come as a radiant from one single position in the *axial* focal point, but from other lateral rays of the marginal foci.

From this it may be inferred that unless precautions have been taken to exclude these lateral pencils, all measurements for ascertaining large apertures have hitherto been erroneous, and far in excess of the true pencil from a single radial point; and this source of error will exist from the same cause, whether the measurement is taken by means of the usual convenient sector, or what may be termed the telescope method, of obtaining distinct images with a suitable eye-piece arrangement.

I disclaim invidious intentions in putting forth the expression that the apertures of high-power object-glasses published in the lists of opticians are all wrong, and shall not quote any particular one as an example. If this is a scientific fact, let it be fairly discussed as such, without rancour or per-

sonality. The question is a simple one, and I cannot at present see that I am in error in a theory clearly proved by point of fact measurement.

The result may always be verified by the measurement of the focal distance (suitably corrected by the adjustment) and size of the working portion of the front lens, through which rays are admitted. Many will be surprised to find how small this portion is. In high powers it may be defined by screwing the object-glass in the place of the achromatic condenser, and the diameter of the spot measured with a micrometer, used with a low power. The front of the object-glass should have a drop of milk dried upon it to serve as a screen, or if the lens is flush with the setting, a piece of thin covering glass, greyed on one side, may be laid upon it, by means of which the proper light area can be determined having a definite margin.

The slit that I have employed for cutting off the lateral rays of an object-glass (which indicate an erroneous aperture beyond the true angle), consisted of a clean cut line cut through a thin coating of black varnish. As it is a difficult operation to lay this on uniformly, and it has besides an objectionable thickness, I now make use of a slit constructed as follows. A 1×8 slip of glass is moved about over the flame of an ordinary petroleum lamp, till the the black deposit nearly ceases to be transparent. This coating has but little coherence, and particles are swept before a scribing point, so that a clean cut line cannot be made; but if a drop of turpentine is caused to flow gently over the smoke deposit, and then evaporated by heat, the film has some consistence, and a narrow clean cut slit can be made through it, with the keen point of a penknife drawn along a straight edge; a thin glass cover is now laid over the slit, and Canada balsam run beneath it by capillary attraction aided by heat.

A slit prepared this way has some advantages. It is protected from dust and injury. It enables the object-glass to be tested for either dry or immersion, under the proper adjustment in either case, for the usual cover thickness. This adjustment can be easily made on the edges of the slit itself or any detached particle. Finally, the rays of the pencil are refracted outwards to a less angle through a slit mounted in balsam, which consequently may be narrower than an air slit, without the risk of interfering with very oblique rays.

I am quoted in the last *Journal* (page 266) as having many years ago affirmed that Professor Robinson's method of measuring apertures is by far the best. It makes no difference whether Professor Stokes "admits the validity of this" or not; the question must be decided by fact, and not by force of opinion. If every one else has hitherto been wrong, so have I; and I cannot admit the concluding sentence in Mr. Hogg's review in the last *Journal*, that "with Prof. Robinson's modified method no slit is required, and most conclusive and reliable results will be obtained;" for the lateral pencils directing light far beyond the axial one greatly enlarge the diameter of the proper light disk, and an excess or false aperture is delineated. My present standpoint is, that every method, *without exception*, hitherto employed in measuring angles of aperture is exceedingly erroneous. An aperture mapped out on a screen shows very instructively the outline of the false aperture and the true one, as obtained with the slit. The first is faintly portrayed as an outer circle of light, while the bright disk given by the slit takes an oval form within the other. This is more difficult to manage than the slit with the ordinary sector method and lamp, by which it is easy to focus and adjust for the thickness of cover.

I give the result on three object-glasses made nearly twenty years ago, viz.: a one-fifth, a one-eighth and a one-twelfth, whose apertures were stated to be 100°, 130° and 170°; these measured with the slit gave 56°, 92° and 100°. I invite fair discussion on the question; as one of science, it should cause no feeling of the animosity displayed by a few whose only motive appears to have been to endeavor to show me in the wrong.

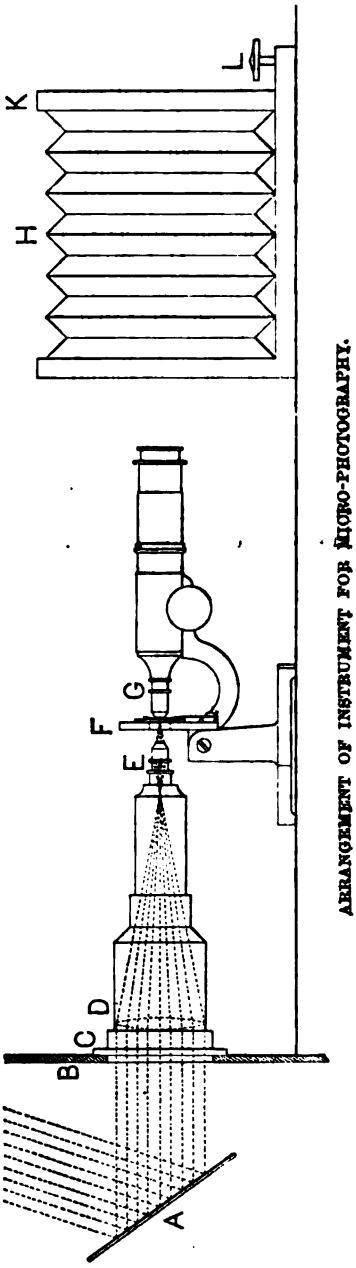
Micro-Photography.

BY CHARLES JEWETT, M. D.

I SEND you by mail a micro-photograph of *Amphipleura pellucida*, made with a Tolles one-fifth immersion objective. The lens, when adjusted as used in making the photograph, magnifies 45 diameters at 10 inches, and is therefore even a lower power than one-fifth. The angle of aperture at uncovered is 115°, and, as used, is of course a little in excess of that. Amplification was obtained by means of a B eye-piece and a Zentmayer amplifier.

The resolution is perfect throughout the length of the frustule, and the definition is not excelled in any photographs by higher power objectives that I have seen.* The striæ on this frustule number ninety-four thousand five hundred lines to the inch. I would be glad to subject first-class one-fifths of other makers to the above test.

I append a diagram illustrating my method of photographing with the microscope. The sunlight is controlled by means of a *porte lumiere*, with mirror, A, capable of adjustment in any position. The light reflected from the mirror is rendered monochromatic by passing through a solution of ammonio-sulphate of copper about one-eighth of an inch in thickness, contained in a cell, C. This cell is attached to the inside of the shutter, B, of the dark room. The light is then concentrated by a four-inch plano-convex lens, D, having a focal length of about ten inches. A low power objective, used as an achromatic condenser, is placed just beyond the focus of the large condenser. This position of the achromatic condenser separates the luminous and thermal foci, and thus obviates the necessity of using an alum cell. The microscope body is then placed in a horizontal position, and the stand so adjusted that the object shall fall in the focus of the achromatic condenser. An eye-piece may be used or not, as desired.



ARRANGEMENT OF INSTRUMENT FOR MICRO-PHOTOGRAPHY.

[*The photograph is certainly very excellent, and does great credit to Dr. Jewett and to the maker of the lenses used. Any person interested in the subject can have an opportunity of examining it in our office.—ED.]

A camera with front removed is then adjusted in position, H. The image is projected upon plate glass, flowed with matt varnish, placed in the usual position, K. The approximate focus is obtained by means of the fine adjustment of the microscope. The final focussing is done by racking the focussing screen back and forth by the milled head, L. While the focus is being adjusted, the image should be observed by means of a lens of a power of 4 or 5 diameters, used as in ordinary photography. If great amplification is desired, the camera may be removed to a distance of six to twelve feet. In this case the image may be projected upon a card of Bristol board placed in the plate shield. The approximate focus may be obtained by observing the image through a small telescope mounted firmly upon the table close by the microscope. For the resolution of test objects, like amphipleura, the microscope must of course be placed in a position oblique to the luminous pencil.

For an excellent method of working without a dark room, see the *Monthly Microscopical Journal* (London), of January and June, 1876.

310 *Gates Avenue, Brooklyn, N. Y.*

PHOTOGENIC POWERS OF DIFFERENT LIGHTS.—Artificial light being frequently used by microscopists for photographic purposes, it may be interesting to know the power of the different lights used. According to recent researches by Riche and Bordy, they are as follows:

Oxyhydrogen light*	1.1
Drummond light (lime light)	3
Zinc burning in oxygen	3 to 4
Magnesium light	5
Bisulphide of carbon in nitric oxide	6 to 7
Bisulphide of carbon flame supplied with pure oxygen	7
Oxygen directed upon sulphur	8

*The authors probably mean the Bude light—that is, a light produced by a liquid or gaseous hydrocarbon and oxygen. The term Bude light is sometimes applied to the lime light, but this is a mistake. The lime light is generally called the *calcium* light, but this is obviously a misnomer. A calcium light should be produced by the combustion of metallic *calcium* in a manner similar to that of the magnesium light.

Arranging Diatoms.

DR. G. C. MORRIS, of Philadelphia, arranges diatoms with facility and success, by using the mechanical stage as a means of holding and moving the bristle which handles the diatoms, while the substage prolonged upwards (through the opening of the regular stage) by means of a tube, serves as a stage to hold the object slide. An arm, attached by means of a socket to the stage, carries a small cork, through which is passed a needle, and the bristle is fastened to this needle in such a manner as to project about a quarter of an inch beyond its point. With this arrangement the objective can be readily focussed upon the bristle-point, which can then be moved in any horizontal direction, while the object can be brought up to focus, or depressed below it, by means of the rack of the sub-stage.—*Am. Naturalist.*

Polarization of Living Tissues.

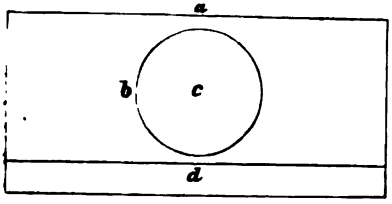
A CORRESPONDENT of *Science Gossip* has recently noticed that the tissues of a living shrimp are affected by the polariscope, giving most beautiful colors, which cannot be obtained by using the flesh after it has been boiled, and he desires to know whether any one else has observed this. Rev. E. C. Bolles, of Salem, Mass., has been accustomed for years, in his popular lectures on the microscope, to demonstrate this by exhibiting upon the screen small crustaceans or aquatic larvæ, illuminated by polarized light; and a finer screen-effect can hardly be conceived than the flashes of color that play over the large and well-defined image of the muscular fibres at every contraction connected with the movements of the living animal.—*Am. Naturalist.*

—We would call the attention of microscopists throughout the country to the approaching meeting of the American Association for the Advancement of Science, at Buffalo, N. Y., at which it is intended to form a sub-section devoted to Microscopy. Those interested should address Dr. R. H. Ward, Troy, N. Y.

A New Oblique Light Illuminator.

MR. F. KITTON, well known as a successful user of the microscope, contributes the following to *Science Gossip*:—

The utility of a more or less oblique pencil of light has long been recognized by those who use the higher power of the microscope. The instruments contrived for obtaining this have been various, and many of them very complicated and expensive, and, so far as my own experience goes, none of them have produced a more effective oblique ray than can be obtained by a mirror on a separate stand, or the lamp placed at an angle with the axis of the microscope. The Rev. J. Bramhall, of Lynn, has called my attention to the following arrangement, and asks if it is new, which, so far as I am aware, it is. The subjoined diagram will



THE BRAMHALL OBLIQUE ILLUMINATOR.

enable any one possessing the slightest mechanical ability to manufacture one of these illuminators without difficulty. *a* is a piece of wood 3½ inches in length, 1½ inch in breadth, and three-sixteenths of an inch thick; the central perforation, *b*, is ⅝ of an inch in diameter, in which is placed a silvered disk of glass or metal, *c*, the face of which should be not less than ½ of an inch below the upper surface of the wood, *d*, a ledge for the slide to rest against. We will now describe the method of using it, premising that a light of considerable obliquity is required. The wooden stage, with its mirror, is placed on the stage of the microscope, and the lamp elevated some three or four inches above it, and a beam of light condensed upon the mirror by means of a "bulls-eye." I need scarcely observe that the obliquity of the reflected beam depends upon the angle at which the ray impinges on the mirror. The objectives with which the illuminator was tested were a ⅛ of Baker's, made many years ago, but a very good glass, and a "Beneche No. 7," using the following objects as tests:—Navicula rhomboides, N. cuspidata, N. peregrina, N. rostellum, Synedra robusta, Nitzschia sigmoidea, N. sigma (the finely-marked variety called by Möller N. curvula), and Lepidocyrtis curvicollis. The ⅛ resolved the transverse striæ of N. rhomboides, which it had not done before; the longitudinal striæ on N. cuspidata shown very sharp and distinct, as were also the transverse striæ on costæ of N. peregrina and S. robusta. The beautiful curved striæ on N. rostellum were better shown than I have ever before seen them. N. sigmoidea, the striæ resolved with as much ease as those on Pleurosigma angulatum with a ⅛. N. sigma as difficult as N. rhomboides. The "Beneche" resolved N. sigmoidea, N. rostellum, N. peregrina and S. robusta. The podura scale was shown well, but not better than by a less oblique ray. The mirror would probably be more effective if mounted so as to slide up or down in the substage tube;* but this, of course, would be more expensive. It is desirable that the cover should not be attached to the slide with the usual black varnish, but with "dammar," or some similar transparent cement. Mr. Baker, of 224 High Holborn, London, has undertaken to supply both kinds of the Bramhall oblique illuminator.

—Arrangements have been made with Prof. Huxley to deliver three lectures in this city on the 18th, 20th and 22d of September; subject, "The Direct Evidence of Evolution." This will prove an intellectual treat to our scientific men. We presume that tickets, etc., may be obtained from the Messrs. Appleton, who are Prof. Huxley's American publishers.

*Further experiments prove this to be the case. A second and smaller bulls-eye, placed as close as practicable to the stage, in order to further condense the light, is desirable. With sunlight the resolving power of the objective is greatly increased.

THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

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S. E. CASSINO, Naturalists' Agency, Salem, Mass.
J. G. LANEGUTH, Optician, 88 State Street, Chicago, Ill.

The Angular Aperture of Objectives.

MOST of our readers are aware of the fact that during the past few years the angular aperture of certain objectives has been the subject of a very earnest discussion in the pages of one of our contemporaries. With this discussion we have no intention of meddling.

In recent numbers of the *Monthly Microscopical Journal*, however, Mr. Wenham has laid down certain propositions which challenge the attention of all thoughtful microscopists, since he claims that the aperture hitherto assigned to all objectives is greatly in excess of the reality so far as *effective* aperture is concerned. We have reproduced his articles, and it must be at once obvious to every well-read microscopist that the angle which Mr. Wenham claims to be the true angle is that which is defined as the angle of aperture by all writers on optics. It is further obvious that so far as light from other parts of the field of view is concerned, such light cannot aid the definition of any particular point.

It is also evident, however, that if the angular aperture, estimated according to the usual method, bears a constant and definite ratio to the aperture measured according to the method proposed by Mr. Wenham, it makes very little difference to the working microscopist which of the two systems is adopted. But we are not by any means certain that this ratio is constant, and if this should not prove to be the case, the question becomes one of vital interest.

Our columns are open to any of our correspondents who see fit to discuss the question in a calm, scientific spirit, and without any personalities.

The Challenger Expedition.

THE "Challenger" has returned to Great Britain laden with scientific material which it will require years to work up. During her voyage, the Challenger traversed nearly seventy thousand miles, and made observations at three hundred and sixty-two places, at all of which soundings have been made, and the sea bottom examined. Amongst the many remarkable objects discovered was a gigantic hydrozoan polyp, which was found off the Japanese coast, and again off Honolulu. This polyp measured nine inches across the non-retractile, tentacled cup, and had a stem more than seven feet in length, with a diameter of half an inch. Also living encrinites of new but dwarfed species, "Venus' flower-baskets," or old-world types of silicious sponges, etc., etc. We are glad to learn that Professor Wyville Thompson proposes to publish, this fall, through MacMillan, two volumes descriptive of this expedition.

Correspondence.

Localities of Microscopic Objects.

Ed. Am. Jour. Microscopy—Since most of our books on the microscope and microscopic objects are of European origin, it is frequently difficult for Americans to tell whether or not a given species is to be found in this country. Until within a few years it was a very general belief that the *Volvox globator* is not found here, and I have met a number of hard-working mi-

croscopists who have never met that beautiful object the *Conochilus*. Now, would it not be well for those who are pursuing microscopic studies to contribute to your pages occasionally lists of species and localities of even the more common objects, so as to encourage beginners by showing them what may be found by careful search? N. N.

[We regard the suggestion of our correspondent as quite a valuable one, and will gladly devote to it the space required for such lists. As we have many times stated, our journal is published chiefly in the interest of beginners.—Ed.]

Our Book Table.

Micro-Photographs in Histology, Normal and Pathological. By Carl Seiler, M. D., in conjunction with J. Gibbons Hunt, M. D., and Joseph G. Richardson, M. D. Philadelphia: J. H. Coates & Co., 822 Chestnut street.

We have already called attention to the prospectus of this important publication, and are now in receipt of the first two numbers containing eight plates showing: I. Section of skin (× 80). II. Epithelioma of Lower Lip (× 80). III. Pavement Epithelium, from a Triton (× 80). IV. Endothelium, from diaphragm of a Guinea Pig (× 80). V. Elastic Connective Tissue (× 120). VI. Scirrhus of Mammary Gland (× 180). VII. Non-elastic Connective Tissue from Omentum of a Cat (× 80). VIII. Connective Tissue Corpuscles, from Cornea of a Frog (× 120).

The execution of the photographs do great credit to Dr. Seiler, and the names of Dr. Hunt and Dr. Richardson are sufficient guarantees of the sound judgment exercised in the selection of the specimens. The work is addressed chiefly to those who have no time for actual work with the microscope, but like all good work it will prove extremely useful and interesting to every one engaged in this department of study.

TRANSACTIONS OF SOCIETIES.

Note.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—The regular meeting of the San Francisco Microscopical Society was held on Thursday evening, June 1, President Ashburner in the chair.

Several additions were made to the library, and Mr. C. G. Ewing presented eight slides prepared by Dr. Eisen, as follows, viz: *Phyllopoda branchipus*, male and female; *Notonecta;* parasite of Turkey; *Hepaticæ;* ovary of butterfly; *cuscuta*, a vegetable parasite on the tobacco plant; and specimens of *daphnia* and *cyclops*, all mounted in glycerine. Mr. Ewing also presented as a donation from Mr. J. A. Jackson, a quantity of diatomaceous earth for mounting, from Lyons Creek, Calvert county, Md.

Mr. C. L. Peticolas, of Richmond, Va., sent the society a finely mounted slide of fossil diatoms from that place.

Mr. H. G. Hanks donated a slide mounted with diamond Boron, which he had prepared in his laboratory. Mr. Hanks describes this very interesting substance as an element of which boracic acid is the teroxide. Like carbon, it assumes three allotropic forms, the amorphous, the graphoidal, and the crystalline, or diamond Boron. It is the hardest of all known substances, scratching even the diamond itself. To prepare it, boracic acid is kept at an intense heat for five hours with aluminium in a charcoal-lined crucible. Under the two-third objective, and lighted by a parabolic illuminator, the effect was beautiful, and the general topography of the crystals was clearly shown.

Mr. J. Edwards Smith, of Ashtabula, Ohio, corresponding member, sent a communication in which, referring to Dr. Wythe's amplifier, "which consists of a double concave lens, having a virtual focus of about one and one-half inches, at the end of a tube about six inches long, at the other end of which is the ordinary negative eye-piece." He says: "I have in my possession exactly the amplifier above described, which was made for me by Mr. R. B. Tolles seven years ago, and it has been in almost daily use. My attention was first called to the amplifier from seeing an advertisement of them by Mr. Tolles, and it must have been some two years afterward that I sent Mr. Tolles my order. Hence it is probable that Tolles has made these amplifiers for the last nine years. I am entirely in harmony with Dr. Wythe's general position, to wit: 'That future progress in the power of the microscope must depend on the eye-piece, or intermediate arrangements of lenses between the eye-piece and object-class.'"

Dr. Wythe, who was present, remarked that he had not been aware of such an amplifier as his ever having been made before; and Mr. Hyde stated that he had used one of Tolles' amplifiers for some years and it seemed hardly possible that they could be "exactly alike," for the results regarding magnification and definition were not at all the same, and that Tolles' does not approach the Wythe amplifier.

At the regular meeting on the 15th of June, several additions were made to the library and cabinet. Amongst the latter were a Nobert's Test Plate, 19 bands mounted in brass, received by purchase.

Mr. J. A. Langstroth presented two slides mounted by him with the transverse section of the ovary of Tropæolum majus, and the pollens of convolvulus, honeysuckle, pansy and others, fixed

on the same slide in order to readily compare their size and shape, both of which slides on examination were found very interesting.

Gen. Hewston donated a slide mounted with volatilized gold, which under a two-third objective, opaque, was not only a beautiful but instructive object. The microscopic globules were perfect in shape, and were obtained at some distance from the melting pot, from which they had been thrown off by the draft and heat in a volatile form, so to speak, and condensed in the air in the form of minute shot, forming a veritable shower of golden rain. With all the care and appliances for the prevention of wastage in smelting or refining gold, a portion is lost in this way, and no doubt the roofs of the houses adjacent to mints and refineries would yield enough of the precious metal to show the color, at least under the microscope.

The fact that the Society's Nachet No. 5 objective had shown No. 19 of Möller's test plate into beads, at a former meeting of the Society, and had attracted considerable attention from some microscopists in the East, was alluded to by Mr. Hyde, and in connection he made a statement to the effect that the test plate used on that occasion was one of a dozen which had been but recently sent out from London, and has proved to differ from all the rest, and others owned by members of the Society, in the respect that not only this No. 5, but any good glass of one-fifth and upward, could resolve No. 19.

Mr. Hyde further stated that he has examined the diatom carefully, after securing the slide as a curiosity, and has no hesitation in stating that it is a true *Nitzschia curvula*, but with the peculiarity amounting to almost an anomaly, that it is so easily resolved. The No. 5 fails to resolve No. 19 on the other slides, and while it is an exceptionally good glass, it has, by a curious combination of circumstances, provoked considerable discussion—not its fault or the observers of the dots, but attributable to the fact that the anomaly was in the object and not the objective.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Wanted, slides of pathological or anatomical preparations, in exchange for diatomaceæ fossil and other well mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Diatomaceous earth from Berlin, Prussia; also from Richmond, Va., in exchange for other material. H. B. Chamberlin, Syracuse, N. Y.

Mounted scales of Lipisma saccharina in exchange for any other mounted objects. Address N. C. Small, Yarmouth Port, Mass.

Slides of Polyzoa coralline and seeds (opaque) to exchange for interesting objects. Richard Allen, 146 North Fourth street, Troy, New York.

Slides of pollen of Agave Americana and other southern United States flowers, for any well mounted objects. Mat. Stuart Beard, Box 1817, New Orleans, La.

For spines of Echinus send objects of interest, Polycystina especially, to F. F. Stanley, 40 Pearl street, Boston.

Pure guano, containing diatoms, in half-ounce packages. Has been washed in pure water. Anything of interest accepted. E. W., Box 4875, New York city.

Wanted in exchange, well mounted specimens for mounted sections of either lung or kidney specimens, showing perfect minute anatomy of these organs. C. E. Nichols, M. D., 14 Fourth street, Troy, N. Y.

Slides of fossil diatoms from Nova Scotia, for any other mounted objects. G. C. G., Box 2055, Rockford, Ill.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 423 California street, San Francisco, Cal.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. B. Hatch, Box 355, Milford, Mass.

Foraminifera, very choice, and diatomaceous earth, in exchange for interesting material. George B. Scott, Box 5645, New York City.

Wanted to exchange, periodically, filterings from the water supply of Buffalo for the same of any other city. D. S. Kellicott, 119 Fourteenth street, Buffalo, N. Y.

Roestelia lacerata, *Puc. xanthii*, and *Puc. aculeata*, in exchange for other unmounted fungi. W. C. Stevenson, Jr., 1,525 Green St., Philadelphia, Pa.

Slides of "Sonorous Sand," from Sandwich Islands, very interesting, for any well mounted objects. W. G. C., Box 1774, Boston, Mass.

"Bough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield, Mo.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Books Wanted—Address, stating condition and lowest price, E. W., care AMERICAN JOURNAL OF MICROSCOPY, 37 Park Row, New York.

"Micrographic Dictionary." Second edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Caspar's "Forensic Medicine." 4 vols.
Faraday's "Electrical Researches." 3 vols.
Holtzapfel's "Mechanical Manipulation."
"Botany of the State of New York." 2 vols., 4to.

THE AMERICAN

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PROSPECTUS.

The object of the JOURNAL OF MICROSCOPY is to diffuse a knowledge of the best methods of using the microscope; of all valuable improvements in the instrument and its accessories; of all new methods of microscopical investigation, and of the most recent results of microscopical research. The JOURNAL does not address itself to those who have long pursued certain special lines of research, and whose wants can be supplied only by elaborate papers, which from their thoroughness are entitled to be called monographs rather than mere articles. It is intended rather to meet the wants of those who use the microscope for purposes of general instruction and even amusement, and who desire, in addition to the information afforded by text-books, such a knowledge of what others are doing as can be derived only from a periodical. With this object in view, therefore, the publishers propose to make the JOURNAL so simple, practical and trustworthy, that it will prove to the advantage of every one owning even a pocket magnifier to take it. The contents of each number may be classed under the following heads:

GENERAL ARTICLES, either contributed by well known microscopists or reprinted from the more expensive cotemporary periodicals. Very important articles of greater length than can be contained in a number of regular size will be issued in supplements.

NEWS.—All important improvements in the construction of the instruments and in methods of manipulation, and all discoveries which may be due to microscopical research will be faithfully chronicled.

ILLUSTRATIONS.—Every number of the JOURNAL will contain several illustrations, either of objects of natural history or apparatus connected with the microscope.

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OUR YOUNG FOLKS' COLUMN.—In this department we will present each month one or more articles upon popular microscopical topics. They will in general be fully illustrated.

CORRESPONDENCE.—An important object of the JOURNAL is to serve as a medium of intercommunication between all who use the microscope. In this column we hope also to aid beginners by supplying, in answer to enquiries, such information as may be at our command.

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THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

VOL. I. NEW YORK, AUGUST, 1876. No. 9.

Microscopes at the Loan Collection of Scientific Apparatus of the South Kensington Museum.

[The following article, though evidently very imperfect, is interesting in some respects.—ED.]

AMONG the relics of early microscopy, the compound microscope, invented and constructed about 1590, by Zacharias Janssen, of Holland, is certainly a very primitive affair. As this, and in fact all the other instruments, are inclosed in a glass case, a critical examination is impossible. The outward form presents the simple appearance of an iron or tin tube about ten inches long and about an inch and one half in diameter; the magnifying power is very moderate.

In the same case is a silver microscope, by Anthony van Leeuwenhoeck (born 1632, died 1723), the noted Dutch philosopher and microscopist. It may be remembered that he made a microscope for almost every object, which must have consumed much of his valuable time. This microscope of Leeuwenhoeck's is simple in form, being a silver plate, perforated with a single minute hole, in which is fixed a tiny lens, in front of which, and in focus, is placed a silver needle upon which the object was fixed.

It was with such an instrument that Leeuwenhoeck carried on his wonderful discoveries, and laid the first steps in histological science. What glorious results might have followed had he possessed a modern instrument and objectives!

The great microscope made by Benjamin Martin (1770), for George the Third, is probably the largest and most elaborate instrument ever manufactured. It stands nearly three feet high, and is decorated with much scroll-work, while in all directions are lying the most complicated pieces of accessory apparatus, which must have sorely bewildered the royal scientist. Looking at this piece of scientific magnificence, some comfort is suggested, that if we have not yet reached perfection in designing microscopes, we have at least attained a good degree of simplicity of construction.

There are many other instruments made by the early microscopists, illustrating the progress of the instrument. That made for or by Galileo is of special historical interest. The glasses have been lost; the tube alone remains. The body is an upright, supported on a tripod.

The modern instruments offer no field for comment. One looks in vain for anything novel in construction. There are the well-known forms of the different makers enclosed in glass cases. Probably the London shop-windows present as great a variety in microscopes as this section of the collection. The instruments are all muddled together without any order or attempted arrangement.

Powell & Lealand do not exhibit. Messrs. Ross & Company exhibit a large instrument on the Jackson slide principle, designed by Mr. F. H. Wenham. The great point in this form is, that the fine

adjustment is placed under the instrument, and can be reached without taking the hand from the coarse adjustment. Thus the old objection to this model has been removed. Messrs. R. & J. Beck also have one of their best microscopes, showing great perfection of work; also a cheap form called "The Economic." It is monocular, highly finished, and is altogether a charming instrument, and furnished for five and six guineas, with objectives and case.

Mr. Stephenson exhibits his erecting binocular microscope, for which he claims many decided advantages, which should make it extremely useful. The instrument of the future, the comfort of looking through inclined tubes and still having the stage horizontal, and the image in its natural position, certainly marks a great advance in construction.

Mr. J. Browning shows a microscope upon the same model, but with what is claimed to be an improvement. In this instrument, for the first time, the planes introduced by Mr. Stephenson for altering the direction of the rays, so that the microscope can be used with the stage in a horizontal position, have been introduced near the eye-piece in the separate bodies. This arrangement will, it is believed, be found to possess considerable advantage. Such is the official description, which must be taken for granted, as the exterior presents no novel feature.

Swift, who is turning out some of the best moderate priced optical instruments in London, shows a microscope very similar to Messrs. Beck's "Economic" called the "New College Microscope." Also a new crane-arm binocular. This is an excellent full-sized instrument, and for a good, working microscope, appears all that can be desired, and is sold with good objectives at a price within the reach of the student microscopist.

The German manufacturers have sent a few instruments, and are chiefly represented by Messrs. Tiebert* & Krafft, and E. Leitz, both of Wetzlar. Respecting these microscopes, I noticed nothing special, except that they appeared inferior in workmanship to those exhibited by the London makers.

Among accessory apparatus will be found that used by Messrs. W. H. Dallenger, and J. J. Drysdale, M. D., for the continuous observation of minute organisms. Those who read the *Monthly Microscopical Journal*, know what valuable results were obtained by its use. Would that the faculty to make use of instruments could be sold to the many purchasers.

Microtomes, for cutting sections, are here in great variety and of all sizes—one with a marble basin larger than an ordinary washing-basin. In some of the microtomes the knife is fixed and worked by a piece of mechanism like a lathe rest, such as that made by W. Apel, mechanician to the University of Göttingen. In another microtome the preparation is pressed forward by a micrometer screw, against a circular knife, set in motion by a lathe. This instrument is from the University of Prague.

United States opticians and manufactures are totally unrepresented, which is much to be regretted, as in this section they could have made an excellent show—perhaps have carried off the palm.—*Am. Naturalist.*

*Evidently a misprint for *Siebert*.

Double Staining of Muscular Tissue with Picric Acid and Carmine.

BY GEO. D. BEATTY, M. D.

THIS paper is written rather to call attention to the muscular tissue of the tongue of the *Lissotriton punctatus*, the smooth skin newt, and of the *Amphiuma tridactylum*, than to describe a mode of double staining with picric acid and carmine that is well known.

The muscular tissue of these two species of the order *Urodela* is deserving of notice on account of the well marked transverse striæ, and very large sarcolemma cells or nuclei. These nuclei in the *Lissotriton* are oval; in the *Amphiuma* they are oval, but often very much elongated, some of the latter extending one-third across the field on using a one-fifth objective and A eye-

piece. In staining with picric acid and carmine, the carmine is appropriated by the nuclei, while the picric acid is taken up by the sarcous elements and the perimysium.

Picric acid causes the transverse striæ to come out more distinctly than any other dye. The tissue should be hardened by first putting into 95 per cent alcohol, and afterwards absolute alcohol. Transverse sections are best obtained by cutting in a section machine; longitudinal fibres by carefully teasing out with needles before staining.

The process of staining is as follows: Remove the sections or small shreds that have been teased out to 25 per cent alcohol for one minute. Place in Dr. J. J. Woodward's borax carmine for five minutes. Soak about ten minutes in alcohol acidulated with 20 per cent of hydrochloric acid. This will in great part remove the carmine from other parts than the nuclei. Wash in alcohol for fifteen minutes to remove acid, changing the wash once or twice.

Put for thirty or sixty *seconds* into an alcoholic solution of picric acid, one-twelfth of a grain to the ounce. Wash in alcohol and put into absolute alcohol for fifteen minutes, and oil of cloves for the same time. Mount in balsam.

Other parts of the *Amphiuma* than the tongue afford beautiful muscular fibre, but with fewer nuclei; indeed this batrachian is a microscopical treasure all through, as is our aquarium friend, the graceful *Lissotriton*. I am indebted to Dr. Christopher Johnston for the *Amphiuma* material I am fortunate in possessing.

Baltimore, August, 1876.

— A physician of the Isle of Wight has found the carrier-pigeon to be of considerable service to him in his country practice. At every village through which he passes, when his last patient has been seen, he writes a list of prescriptions for that village, affixes it to the leg of a pigeon, and dispatches it to his residence.

Description of Agaricus Tridens.

[The following is an interesting description of a novel form of fungus, but we cannot help feeling that our knowledge of it is altogether too meagre to warrant its being erected into a distinct species. When we consider the wonderful influence which peculiar conditions of atmospheric pressure, light, temperature, moisture, etc., exert upon ordinary plants, it would not surprise us to learn that one of our common fungi, grown under the peculiar conditions described in this paper, should prove to be unrecognizable. An instance is on record where a plant found growing in a mine, and pronounced by able botanists to be a new species, turned out, when grown on the surface, to be a common weed.— Ed. A. J. M.]

THE following is a paper read by Mr. J. P. Moore before the San Francisco Microscopical Society:

Pileus fleshy, conchiform, skin very thick, coriaceous, color light buff. Edge entire and involute. The peculiar manner in which the pileus is attached to the stem gives it the form of a nautilus shell, as will be seen by the accompanying illustration. The stem is three feet four inches in length, being attached to the timber on which it grows by a large disk of from eight to ten inches in diameter. This disk is clothed with a thick, soft brown felt, which also extends along down the stem for some eight or ten inches. At the point of attachment to the disk, the stem is two inches in diameter, and of a firm woody character, though no traces of any woody fibre can be found, but on the contrary the entire stem is of the same character as the pileus. At nine inches from the point of attachment to the disk, the stem divides into three branches, which, singularly enough, in the space of nine inches, again unite; but two of the three brances at this point come off and terminate at the side of the main stem, in smooth terete points. The main stem now continues downward and enlarges to a diameter of nearly three inches. It is now no longer covered with felt, but becomes smooth and hard till the point at which the pileus is thrown off. Here a most singular growth has taken place. From all sides short branches resembling the young antlers of a stag have been thrown out, and two of these becoming more vigorous than the rest, have pushed down; the larger of these two was now divided into three, forming a per-

fect trident, as will be seen. These antlers, if I may so call them, are at first roughened, and slightly sulcate; at their division they become smooth, as if turned in a lathe, the ends are blunted, and at the very end it is divided so as to give the end a stellate ap-

AGARICUS TRIDENS.

pearance. The gills are distant, decurrent, notched and sinuate, and of a pale straw color. It was found growing attached to the timbers in one of the abandoned drifts in the Yellow Jacket mine, Gold Hill, Nevada, at the depth of four hundred feet below the surface. The drift had been closed for a long time, and in that still, warm and moist air it had grown down from one of the timbers of the drift. It is most assuredly one of the Hymenomycetes, and an Agaric. The spores are ovate or round, exceedingly minute and borne on true basidia.

Through the kindness of Mr. William Lee, of Gold Hill, I am furnished with this specimen, and Mr. W. H. Rulofson has very generously made the accompanying photographs for the society.

Foraminifera from Chalk.

MR. C. J. MULLER gives the following directions for cleaning these interesting forms: Having obtained a quantity of the shells by the usual process of elutriation, mix it with four or five times its bulk of silver sand which has previously been well washed, and put the mixture in a long two or three ounce phial with a sufficiency of water. Shake up the whole (not violently) for ten or fifteen minutes, and then pour off the turbid water. Renew this operation as many times as you like. The foraminifera will always settle down last and form a distinct stratum upon the surface of the deposited sand. The sand, when shaken up with the shells, will act as a gentle rasp, and remove from their surface most of the hard granular particles which injure their appearance. When the cleansing operation is completed, the water will rapidly clear, upon the mixture being set aside for three or four minutes. There is no difficulty in separating the shells from the sand. Let the whole quietly settle down; pour off the clean water and allow the whole to rest for a few minutes. Now add a fresh supply of water, rather forcibly, when the shells, will immediately rise, leaving the sand below. The water with the shells must now be poured off, before they have time to settle down, into another vessel, where they may subside. The deposit may then be dried.

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Diatoms as Food for Plants.

THE enormous beds of fossil diatoms which exist in various parts of the world have called forth innumerable attempts to utilize them. These efforts have been attended with considerable success, and of late years the demand which exists for pure deposits is such as to make beds of this material quite valuable. Amongst other uses, the manufacture of artificial stone, of soluble glass, and of dynamite, consume immense quantities. But not content with the demand which exists for legitimate purposes, certain parties have endeavored to create an artificial demand by producing an impression on the public mind that this material is specially valuable as a manure for cereal crops—an object which would almost prove sufficient to exhaust any ordinary source of supply. As is usual in such cases, there has been no lack of pseudo-scientists ready to bring forward theories and alleged facts in support of the proposition which it is desired to establish. Fortunately, however, these hired advocates have, in this case, overshot the mark, and rendered a refutation of their claims easy and unimpeachable. Indeed so palpably absurd are their statements of facts, that we would not have taken the trouble to allude to them if *Silliman's American Journal of Science and Art*, had not given currency to these fallacies, and by so doing misled able men who had not made a special study of this particular subject. Thus, for example, Dr. Wahl, who is well-known as an able chemist, but who does not, we believe, make any claims to a knowledge of microscopic forms of vegetation, has, in an article published in the *Polytechnic Review*, and also in the *Journal of Science* (London), given currency, though with perhaps some slight reservations, to the monstrous propositions advanced by these dealers in artificial manure. The subject has even been admitted to the pages of the *Monthly Microscopical Journal* (London), though with a faint protest, and there is scarcely a scientific periodical of lesser note that has not made some abstract of the papers in question.

With the general discussion concerning the value of silica as plant food, we do not propose at present to meddle. We apprehend that very few, if any, of our acknowledged authorities will assign to it the high place claimed for it by the dealers, to whom we have before referred. The point to which we desire to direct the attention of those interested in microscopy, is the singular statements and absurd theories by which the manurial value of the diatomaceous deposits is attempted to be substantiated and which are as follows:

To *Silliman's Journal* for June, 1876, (page 373), Prof. P. B. Wilson, of Washington University, Baltimore, Md., contributed an article of which the following is the title: "*Silica of Grasses and Other Plants carried up as Diatoms or other Siliceous Grains, and not in Solution or as Soluble Silicates.*" This article contains the following passages:

"* * * my friend G. I. Popplein, Esq., of this city, suggested the application of infusorial earth of the Richmond formation—found in large quantities on the Western shore of Chesapeake Bay—to land sown in wheat. I have obtained straw from wheat so grown, and have found, after it has been treated with nitric acid, and the sili-

ceous remains placed on the field of the microscope, that it consisted wholly of the siliceous shields of diatomaceæ, the same as found in the infusorial earth, excepting that the larger discs in their perfect form were absent (*Actinocyclus Ehrenbergii* and *Actinoptychus undulatus*). * * * * The discovery of Diatomaceæ in their original form in this wheat straw precludes the possibility of the infusorial earth having undergone any chemical change in the soil, either by forming chemical combination with the alkalies or the earths, or by suffering physical disintegration from any catalytic action of any salts present in the soil. In the particles of silica placed upon the glass slide, when they were completely separated from each other, the outlines of the individual diatoms were sharply and distinctly defined. On the other hand, when the physical action of ebullition with nitric acid was not sufficient for the complete separation of the particles of the epidermal shield, there was observed a marvelous interlacing of the various forms, showing that they were conveyed by the sap cells directly to the section of the plant where they were destined to complete its structure. * * * The result of these investigations shows the necessity of finely divided silica in the soil, so minute as to be capable of passing with facility through the sap cells; secondly, that simple or compound silicates are useless as fertilizing agents, either natural or artificially prepared."

The latter sentences of the quotation contain the gist of the matter, which is—*if you want to raise good crops buy our finely divided silica.* We hardly agree with Prof. Wilson, however who looks

"upon this discovery as leading agricultural investigation in a new direction, and it must eventually change many of the views expressed and accepted by scientists."

In a letter to Messrs. G. & N. Popplein, Jr., he further elaborates these ideas as follows:

"In making these investigations, thorough precautions were observed, to cleanse the straw from all accidental impurities by washing and gentle friction, not sufficient, however, to destroy the epidermis. This was to profit by Ehrenberg's experience, and investigation of dust showers, which he has found to contain some infusorial forms. The organic matter was then removed by the prescribed methods, aided by my own experience.

My labors have been amply rewarded by one of the most enchanting views, that has ever fallen to my lot to behold through twenty years of varied scientific investigations. When the epidermal silicious coating was adjusted upon the field of the microscope, some thirty-six forms of the diatomaceæ, which I have carefully sketched, were observed (see wood cut magnified 300 diameters), where perfect disintegration has been produced. When the structure to a great extent is retained, the marvelous interlacing of these forms present themselves, sometimes side by side, at other times overlapping, showing with what vigor and regularity nature performs the dictates of her laws.

This investigation is final. It overthrows all theories that have ever been advanced, that silica enters into plant structure in combination with the alkalies, the alkaline earths, or the earths proper. Chemical investigation led me to this conclusion some months since, now confirmed by that of the microscope. A new era has dawned upon the science of agriculture. By close observation and strict scientific investigation, *new information* will be brought to light to reward the tiller of the soil for his time, labor and capital. * * * * * These microscopic investigations show the absence of other forms of silica, that is, in granular particles in the (Kunkel) straw, they being entirely replaced by diatoms. This leads to the conclusion that the diatom is the more acceptable for assimilation—and when sufficient infusorial remains are present, replaces any other divided form of silica."

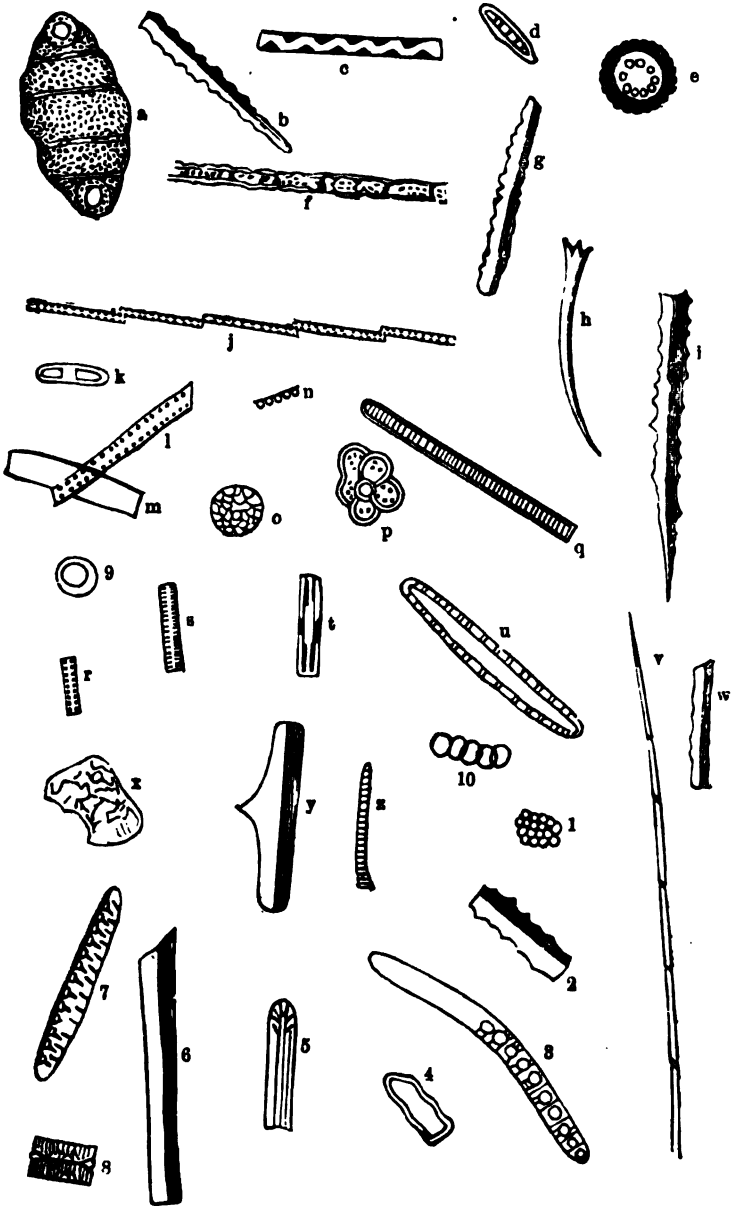
And he endeavors to impress his readers with the trust-worthiness of his observations by the following self-gratulatory sentence:

"I look upon this application of vegetable silica to fertilizing purposes as the most important adaptation of matter for the reproduction of vegetation that has ever been discovered. It is the first step in a new direction, rationally conceived and judiciously carried out; a new impetus to the study of plant physiology will be given, and demonstrate that more than a heterogeneous mixture of elementary bodies, and their compounds, is required for the production of the crops beneficial to the requirements of man."

A single glance at the engraving to which he so confidently refers is sufficient to convince any microscopist that Profesor P. B. Wilson never saw "upon the field of his microscope," under the circumstances

Forms of Diatoms found in Col. Kunkel's Straw.

MAGNIFIED 300 DIAMETERS.



which he has described, the objects which he has delineated. This is a bold assertion, and a severe accusation, but the proof is simple and unimpeachable.

Bearing in mind that these organisms, as figured, have been obtained by destroying the organic matter with nitric acid, we find *Bacillaria* (Fig. j) figured as it exists only in the living condition—the frustules being joined together in the peculiar way which has given to this form the specific name *paradoxa!!!* For this diatom to have passed through a bath of nitric acid, and come out in the condition figured, would have been almost as great a miracle as the passing of Shadrach, Meshach and Abed-nego unscathed through the fiery furnace of Nebuchadnezzar. So, too, we find a *calcareous* foraminifer figured at p under the same circumstances! Verily this *is* such a view as has not "fallen to the lot" of ordinary microscopists to behold—either in twenty, or in four times twenty years.

After such instances, the numerous minor features which are utterly irreconcileable with facts, and which are found in this plate, may be safely passed over.

We may look with complacency on the Moon Hoax of Locke, and the extravaganza of Dr. Neulenz and his discoveries, effected by means of an objective of $195\frac{1}{10}°$ of angular aperture, for these *jeux d'esprit* were harmless, and tended only to create a little amusement. But such a fabrication as the present is of a much more serious character, since the hard-earned dollars of the farmer are paid out on the strength of these so-called scientific investigations, and so obviously and demonstrably erroneous are they, that it must bring a blush to the cheek of every scientific man in the country, when he reflects that Silliman's *American Journal of Science and Art*—a journal which claims to be the foremost scientific authority in America—should have lent its aid to the propagation of such nonsense.

Since writing the preceding article, we have submitted an impression of the engraving accompanying Prof. Wilson's article to one of our ablest diatomists, and requested him to note for us the names of the "some thirty-six forms of the diatomaceæ which he (Prof. Wilson) has carefully sketched." The following is his reply:

" * * The miserable wood cut shows a mixture of marine and fresh water diatoms, sponge spicules, a little of the silicious cuticle of the straw, and a foraminifer. Only one form belongs to the Virginia deposit, with which Kunkel's field was fertilized (?)—and which is exclusively *marine*. That one form, a, is possibly a side view of *Biddulphia tridentula* of Ehr., though it is much more likely *B. pulchella;* it is much larger in front view.* Figures 2, b, g, i, w, and possibly l, m, y, are portions of the silicious cuticle; c is a front view of a *Cymatopleura*, fresh water; d, a *Denticula*, fresh water; e, *Cyclotella*, brackish; f and v are some vegetable remains; h, probably a sponge spicule; k and t are side and front views of a *Diatomella*, or possibly, and perhaps more likely, a *Mastogloia*, marine or fresh;. n is a fragment of 7, 8, *Epithemia ocellata*, fresh water; o, uncertain; p, foraminifer, (*Rotalina?*) marine; q and s, side and front views of *Synedra*, fragments, marine or fresh; r, fragment, front view of j, which is side view of *Bacillaria paradoxa*, marvellously carried up in connected series through the cell walls, but not dissolved, being *vegetable* silica!!; (u) is probably a *Surirella*, fresh water; x, y, z, 1, 10, 6, 5, 4, are doubtful; 8, portion of a *Tessella*, or possibly of a *Tabellaria*."

Personal.

WE recently ordered from M. Nobert, of Barth, in Pomerania, one of his test plates—so well-known for the delicacy and accuracy of their rulings, and have been so fortunate as to secure a very superior specimen of his 20-band plates. We regret to be obliged to state that during the past few years M. Nobert has been deeply afflicted by sickness in his family, and has also been personally indisposed. This has prevented his filling or even recording a very large number of orders. We feel assured, however, that those who have failed to receive

*And consequently less likely to pass through the tissues of the plant. This hypothesis is, however, too absurd to deserve serious consideration.—Ed.

a response from M. Nobert will readily excuse the apparent neglect when they learn the cause which has occasioned it. For ourselves we tender M. Nobert our deep and heartfelt sympathy.

—We have on hand a few copies of a catalogue of very valuable works on natural history, published by Messrs. Hardwicke & Bogue, of London, England, which we will send to any person who will enclose a stamp for same.

Correspondence.

Aperture of Object-Glasses.

Ed. Am. Jour. Microscopy—In the July number of your valuable journal, I find an article by Mr. Wenham, of London, "On the Aperture of Object-Glasses." As I believe a correct understanding of the optics of the microscope to be absolutely necessary to all who would make the instrument anything more than a mere toy, and as I believe Mr. Wenham's position to be totally wrong, and the arguments by which he attempts to support it entirely fallacious, I propose to accept your invitation "to discuss the question in a calm, scientific spirit, and without personalities." In so doing, I will make use of his own diagram, and quote the first three paragraphs of his article, viz:

"The number of degrees that include a pencil of light radiating from one single point from the focus of a microscope object-glass, represents the true angle of aperture.

In order to obtain accurate results, the light indicating the admitted degrees should be confined to a mere point or line situated in that focus. In the diagram the angles are the result of ascertained dimensions from a known immersion object-glass, as follows:—Acting diameter of front lens, .033; focal distance from the front surface, .025; with a width of field of .020, or one-fiftieth of an inch. With correction adjusted, the resulting angle from central focal point is 66½°, each ray giving a distinct image. In order to determine the direction of the outer rays by the usual sector method, a narrow slit must be set in the focus: the extreme light of the true aperture will pass through from *a*.

Let the slit now be opened out to one-fiftieth of an inch, so as to admit the effective oblique pencils embracing the entire field of view. Light will then enter from direction *b*. This ray will also show a distinct image, and an aperture of 93° will now be indicated instead of the former 66½. This excess of angle is a false quantity, because it does not come as a radiant from one single position in the *axial* focal point, but from other lateral rays of the marginal foci."

Especial attention is called to the last paragraph quoted, and to the singular *reductio ad absurdum* involved in the argument.

It is admitted that the ray from *b* "will also show a distinct image, and an aperture of 93° will now be indicated instead of the former 66½°;" but "This angle is a *false quantity*, because it does not come as a radiant from *one single position* in the *axial* focal point." The same will apply to all rays between *a* and *b*, and to all rays except the single pencil from the axial focal point.

Now a point having *no* dimension may be subtracted from the field with loss, and the entire field will then be lighted by false rays, and the entire image will be formed by them. The false rays then are the ones on which we must depend for what we see with the microscope; but Mr. Wenham says they are false, and that only the single pencil from the centre of the field, which, taken alone can show us nothing, are the only true rays, which seems to me an absurdity. Of course I admit the right of any man to select any single pencil of rays that he chooses, and to proclaim his belief that they are the only true rays; but it seems to me that it will be more theoretically correct, as well as more practically useful, to say that all rays which show a distinct image are true rays, and to discard Mr. Wenham's imaginary triangle, included between the extreme rays of the pencil, emanating from the one axial focal point and the working diameter of the front lens, as our measure of angular aperture. That this is the generally accepted opinion is proved by the fact that Mr. Wenham's new rule would reduce the nominal aperture of all lenses far below what is claimed for them by their makers. Mr. Wenham's first proposition was to use a slit that should just trench upon the borders of the field, and in that he was right. His latter one, to use a slit as nearly as possible approaching that mathematical fiction, a *line*, would, if it were possible to construct such a slit, cut off all the useful rays from the entire field, and is, therefore, in my opinion, wrong.

GEO. E. BLACKHAM, M. D.

Dunkirk, N. Y., Aug. 15, 1876.

Current Notes.

Another Shower of Flesh Reported.—The Columbus (Ga.) *Enquirer* of June 10 has the following statement:—"A few days ago Messrs. Dick and Ab. Kervin were standing in the back yard of the latter when quite a shower of flesh fell upon and around them. It at first seemed as a miracle to them, as they had often heard of flesh 'raining' from above. They cast up their eyes and discovered several buzzards about 100 feet above them, flying about, and this explained to them the mystery, and one, too, which has so often occurred and been unexplained. As a Louisville Professor has suggested, this may account for the famous shower of flesh in Kentucky. The particles of the Columbus shower were not gathered or analyzed as were those of Kentucky."

Zoological Gardens for New York.—During the coming Winter an effort will be made to organize a society, with a capital of over $200,000, for the formation of zoölogical gardens in this city. It is hoped by the movers that the Legislature will empower the Commissioners to set aside a portion of Central Park for such gardens, but the Commissioners themselves are opposed to this at present, claiming that they cannot afford room. The zoölogists hope to convince them to the contrary.

Newspapers at the Centennial.—The special correspondent of the London *Times* says it would be difficult to find an apter illustration of the big way in which the Americans do things than that furnished by the "Centennial Newspaper Building," in the exhibition grounds. Here you may see any one, or, if you like, all of the 8,129 newspapers published regularly in the United States, and see them, one and all, for nothing! You are not only permitted as a favor to see them, but invited, nay, pressed to confer the favor of entering the building and calling for what paper you like. It is about as cool and agreeable a place—quite apart from its literary attractions—as a visitor to the Exhibition could wish to be offered a chair in. He may at first wonder how, among 8,000 papers, among them such mighty sheets as the New York *Herald*, he is to get at the small, loved print of his home, thousands of miles away, it may be, over the Rocky Mountains. But the management is so simple that, by consulting the catalogue, or even without the aid of the catalogue, any one can at once find whatever paper he wants. They are pigeon-holed on shelves in the alphabetical order of their States or Territories and their towns, the names of which are clearly labelled on the shelves. The proprietors of the Centennial Newspaper Building are advertising agents, the largest in all America—Messrs G. P. Rowell & Co., of New York. Their enterprise will cost altogether about $20,000 or £4,000, including the building and the expenses of "running" it for six months. The 8,000 and odd American newspapers are declared, by the same authority, to exceed "the combined issues of all the other nations of the earth."

Trophies of the Challenger.—Amongst the wealth of zoological specimens the Challenger has brought home, are two large living tortoises,—one forty years old and the other a hundred. The large tortoise can walk quite as fast with two men standing on its back as when only carrying its own weight.

Our Work Table.

Filtering Water.—The usual manner of filtering water in order to secure the microscopic forms for study, is to tie a cloth bag of any convenient size and form over the hydrant or faucet, and then let the water run for a given length of time, after which the bag is turned inside out and rinsed. The mixed dirt and organic forms soon fall to the bottom; portions of this sediment may then be removed, by means of a pipette, to the glass slide for examination. I have tried the following plan with very satisfactory results. Indeed, I have mode collections of diatoms and desmids at the hydrant on my own table during November and December last, so pure that to call them *beautiful* for cleanliness is no figure of speech. I use a V shaped bag of well-worn, thin cotton cloth. It is hung beneath the hydrant, and the water allowed to fall into it for a sufficient time. Then I close the stop-cock and let the water run out of the bag nearly; with a pipette I gently agitate the water remaining, and suck it up and remove to a suitable dish for further treatment. I hope other observers may try this, and, if successful, report.—*D. S. K. in School Bulletin.*

New Mode of Mounting Opaque Objects.—At the recent meeting of the Microscopical Section of the American Association for the Advancement of Science, Prof. H. L. Smith described a new method of mounting opaque objects, where it is desirable to cover them with thin glass. He takes a circular disc of thin sheet wax, which is easily cut with a punch from the sheet wax ordinarily used for making flowers, and attaches it by means of heat to the centre of a glass slide. A brass ring, of which the interior is the same size as the disc, is then attached to the slide, and the object is fixed to the wax by slightly moistening the surface of the latter by a minute drop of turpentine. When dry, a cover which exactly fits into the bevel of the ring is attached with a little cement, and the whole may then be finished off on the turntable. The appearance is very elegant, and the specimens are perfectly preserved.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—The stated meeting of the San Francisco Microscopical Society was held on Thursday evening, July 6, with Vice-President Hyde in the chair.

Recognizing the fact that to Mr. H. G. Hanks, of San Francisco, the first president of the society, is largely due its prosperity and interest, and for other cogent reasons, Mr. Hanks was unanimously elected an honorary member of the society, and the Corresponding Secretary instructed to notify him of the fact.

Mr. W. H. Bulofson was proposed for active membership.

Under the head of donations, Dr. Mouser presented a section of the kidney of a rat, finely injected and mounted by him. Mr. Hanks donated a sample of diatomaceous earth from Santa Monica, Cal., for mounting. Dr. Charles Jewett, of Brooklyn, N. Y., presented two fine photographs of *Amphipleura pellucida*, photographed with Tolles' one-fifth immersion objective, B eye-pieces, and Zentmayer's amplifier. The stria, 95,000 to the inch, were most perfectly brought out, showing the perfection of the definition and of the photographer's manipulation.

Mr. W. H. Bulofson donated two photographs, being different views of a new fungus described by Mr. J. P. Moore, and which he has named *Agaricus tridens*. While this very curious and peculiar-shaped growth is fully described in Mr. Moore's paper, it needs a sight of the thing itself or its picture to be fully appreciated. The paper itself will be found in another column.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Wanted, slides of pathological or anatomical preparations, in exchange for diatomaceæ fossil and other well mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Diatomaceous earth from Berlin, Prussia; also from Richmond, Va., in exchange for other material. H. B. Chamberlin, Syracuse, N. Y.

Mounted scales of Lepisma saccharina in exchange for any other mounted objects. Address N. C. Small, Yarmouth Port, Mass.

Slides of Polyzoa coralline and seeds (opaque) to exchange for interesting objects. Richard Allen, 146 North Fourth street, Troy, New York.

Slides of pollen of Agave Americana and other southern United States flowers, for any well mounted objects. Mat. Stuart Beard, Box 1817, New Orleans, La.

For spines of Echinus send objects of interest, Polycystina especially, to F. F. Stanley, 40 Pearl street, Boston.

Pure guano, containing diatoms, in half-ounce packages. Has been washed in pure water. Anything of interest accepted. E. W., Box 4875, New York city.

Wanted, slides of diatomaceæ or foraminifera in exchange for pathological preparations. Geo. A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

For *Humulus Lupulus Ext.*, showing lupulin crystals, send stamped envelope to Richard Allen, 146 North Fourth Street, Troy, N. Y.

Wanted in exchange, well mounted specimens for mounted sections of either lung or kidney specimens, showing perfect minute anatomy of these organs. Also, injected sections of human stomach, mounted, for other histological specimens. C. E. Nichols, M. D., 14 Fourth street, Troy, N. Y.

Slides of fossil diatoms from Nova Scotia, for any other mounted objects. G. C. G., Box 2055, Rockford, Ill.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. B. Hatch, Box 355, Milford, Mass.

Foraminifera, very choice, and diatomaceous earth, in exchange for interesting material. George B. Scott, Box 5645, New York City.

Wanted to exchange, periodically, filterings from the water supply of Buffalo for the same of any other city. D. S. Kellicott, 119 Fourteenth street, Buffalo, N. Y.

Roestelia lacerata, *Puc. xanthii*, and *Puc. aculeata*, in exchange for other unmounted fungi. W. C. Stevenson, Jr., 1,525 Green St., Philadelphia, Pa.

Slides of "Sonorous Sand," from Sandwich Islands, very interesting, for any well mounted objects. W. G. C., Box 1774, Boston, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield. Mo.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Books Wanted—Address, stating condition and lowest price, E. W., care AMERICAN JOURNAL OF MICROSCOPY, 37 Park Row, New York.

"Micrographic Dictionary." Second edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Caspar's "Forensic Medicine." 4 vols.
Faraday's "Electrical Researches." 3 vols.
Holtzapfel's "Mechanical Manipulation."
"Botany of the State of New York." 2 vols., 4to.

THE AMERICAN

JOURNAL OF MICROSCOPY

AND

POPULAR SCIENCE.

PROSPECTUS.

The object of the JOURNAL OF MICROSCOPY is to diffuse a knowledge of the best methods of using the microscope; of all valuable improvements in the instrument and its accessories; of all new methods of microscopical investigation, and of the most recent results of microscopical research. The JOURNAL does not address itself to those who have long pursued certain special lines of research, and whose wants can be supplied only by elaborate papers, which from their thoroughness are entitled to be called monographs rather than mere articles. It is intended rather to meet the wants of those who use the microscope for purposes of general instruction and even amusement, and who desire, in addition to the information afforded by text-books, such a knowledge of what others are doing as can be derived only from a periodical. With this object in view, therefore, the publishers propose to make the JOURNAL so simple, practical and trustworthy, that it will prove to the advantage of every one owning even a pocket magnifier to take it. The contents of each number may be classed under the following heads:

GENERAL ARTICLES, either contributed by well known microscopists or reprinted from the more expensive cotemporary periodicals. Very important articles of greater length than can be contained in a number of regular size will be issued in supplements.

NEWS.—All important improvements in the construction of the instruments and in methods of manipulation, and all discoveries which may be due to microscopical research will be faithfully chronicled.

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OUR YOUNG FOLKS' COLUMN.—In this department we will present each month one or more articles upon popular microscopical topics. They will in general be fully illustrated.

CORRESPONDENCE.—An important object of the JOURNAL is to serve as a medium of intercommunication between all who use the microscope. In this column we hope also to aid beginners by supplying, in answer to enquiries, such information as may be at our command.

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THE AMERICAN

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VOL. I. NEW YORK, SEPTEMBER, 1876. No. 10.

Microscopes at the Centennial.

THE collection of microscopes now on exhibition at the Centennial Exposition in Philadelphia, is undoubtedly the most extensive as well as the finest that has ever been brought together in this country. It consequently not only deserves the attention of microscopists, but will well repay a careful study. It is true that some noted makers, such as Hartnack, of Paris; Powell & Lealand, of London; Tolles, of Boston; Spencer, of Geneva (formerly of Canastota), and some others are absent, but this does not invalidate our general statement. Unfortunately it is somewhat difficult to find out whether a given maker is represented or not, from the fact that the various exhibits are so scattered. Thus we find the British opticians by themselves; the French by themselves, and so with Canadians, Germans, Japanese, Austrians, Americans, etc., etc. But this is not the only difficulty. After we have examined the American collection of microscopes and microscopical preparations, we find, off amongst the chemical products, the remarkably fine collection of stained preparations by Dr. Beatty, of Baltimore; and after we have made an exhaustive examination of every place where microscopes ought to be, we will find, in the buildings devoted to the fine arts, a good sized case filled with the microscopes of one of our best known makers. For ourselves, therefore, although we have visited the exhibition half a dozen times, each time paying particular attention to the microscopes, we hardly feel prepared to give a complete list of the exhibitors, and if it should happen that some are omitted, we trust it will be attributed to inadvertence.

A thorough and critical examination of the various stands and objectives in the exposition would demand more time than we have as yet been able to devote to it, and a greater amount of space than we could afford in several numbers of this journal. For it requires more than a mere cursory examination to enable even an expert to decide in regard to the merits of either objectives or stands. They must be studied and used practically—not on one or two occasions only, but under varying conditions, and as applied to different subjects. Such an examination, if carefully made, could not fail to throw a much needed light on the special characteristics of the products of different makers. It might not enable us to give a positive and sharp answer to the question "who makes the *best* stands?" or "who makes the *best* objectives?" but it would enable the student to select judiciously the instrument best suited to his particular requirements. This idea has, we understand, been carried out to a certain extent in the report of the jurors of the exposition, and cannot fail to make that report exceedingly valuable. We hope to be able to give it to our readers at no very distant date, and will do so provided we can obtain a copy.

There is also another and very elaborate report in preparation under the direction of the conductors of this journal. The examinations in this case will be studies rather than examinations, and will require so much time that no promise can be made as to when the report will be ready. In the mean time, however, we purpose to take a cursory view of the principle instruments on exhibition.

Adopting the rule which in doubtful cases governs the presiding officers of public assemblies, who recognize the more distant first, our attention is attracted by the exhibit of Japan. This, so far as we could see, consists of a single microscope, a poor affair it is true, but of deep interest as a specimen of Japanese imitative skill, for it is little else. We have been unable to examine the optical part in the only way in which such work can be properly examined—that is by by applying it to actual work. The instrument is modeled after a common English pattern, the finish is not by any means up to the mark of even amateur work, and from the slight examination that we have made, we are inclined to believe that its performance would be anything but satisfactory. But as a first attempt on the part of a people old in years and old in the arts, but young as regards all that concerns true science, this instrument is deeply interesting.

Unquestionably the finest collection of instruments on the ground is that exhibited by the London opticians—Beck, Crouch, Dallmeyer, Negretti & Zambra, and Ross & Co., whose names we have placed in alphabetical order.

On approaching this department, the first object that usually strikes the eye is the very handsome display made by Ross & Co. Enclosed in a large and handsome case, all four sides of which are of the finest plate glass, is a full series of the various instruments manufactured by this house, all of whose work is of the first class, no inferior or second class microscopes being made by them. By this it is not meant that they do not make microscopes of different prices, for their list shows that they do. But the work on every instrument, whatever may be its price, is the very best of its kind, and the lower priced instruments are lower priced, not because they are inferior in *quality*, but because they are smaller in size, less complicated in structure, and supplied with fewer accessories.

In succeeding issues we shall describe the special characteristics of these microscopes, as well as those of Crouch, Beck and others.

Combustible Earth.

WHILE recently engaged in botanical exploration on the higher parts of the island of Réunion, M. de l'Isle heard of some caverns, the soil of which was combustible. He visited one of them and found it a grotto about ten metres in depth and six metres broad. Entering by a small aperture, you descend to the bottom by a rapid slope. The bottom is formed, more than an inch thick, of a substance of ochre-yellow color, soft to the touch, insipid, inodorous, dividing readily into very light fragments which leave yellow powder on the fingers; these are easily reduced to powder by pressure or friction. When a lighted match is applied to one of the fragments, the latter burns, if dry, with a very short yellow flame, almost without smoke or smell. If a little moist, it is consumed without flame, with abundant smoke, and a smell of burnt herbs. MM. Bureau and Poisson have studied this interesting substance with the microscope, and found it entirely composed of small bodies which must be spores or grains of pollen. After various comparisons they were struck with their resemblance to spores of Polypodeæ in form and reticulation and color; and they found among the Polypodeæ of Réunion, sent home by M. de l'Isle, one whose spores are almost identical with the small bodies in question. From the cohesion of the spores, and the slit found in most of them, by which the contents have escaped, it is inferred that this accumulation has been caused by water and not by wind. It is probably the first time that a rock has been found of such composition.

Preservation of Wild Animals.

BUT I believe that if we go to work in the right way there is yet time to save many an otherwise expiring species. In this country there is happily a strong disposition, which grows stronger day by day, to preserve our wild animals. It is very desirable that this feeling should not be limited to the British Islands. If it is, as I maintain, a right feeling—a feeling sanctioned alike by humanity, by science, and by our own material interests—it cannot be too widely disseminated. But its propagation must not be left to humanitarians and sentimentalists, whose efforts are sure to be brought to nothing through ignorance and excess of zeal, nor to economists, whose endeavors would unquestionably fall short of what is required. The officiousness of the one class, and the slackness of the other, must equally be tempered by the naturalist. He can be trusted not to interfere with the use, but with the abuse, of the animal world. Only to do this he must place himself in the forefront of the movement; for he can submit to no other leader. He alone has, or should have, that knowledge which gives the power of coping successfully with the difficult questions that will arise; and the advantage it gives him he must not abstain from exercising.—*Address of Prof. Alfred Newton before the British Association for Advancement of Science.*

How to Dry Plants.

The following directions have been furnished by Rev. G. Henslow, one of the best practical botanists in England:

The materials required are common cartridge paper, thick white blotting paper, cotton wadding and mill-board, all cut to the same size. The plants should be gathered in dry weather, and soon after the flowers open, when their colors are brightest. Succulent plants (such as daffodil, orchis or stone-crop), should be put into scalding water, with the exception of the flowers, for a minute or two, then laid on a cloth to dry.

Arrange the specimens and papers in the following order: Mill-board, cartridge paper, wadding (split open, and the glazed side placed next to the cartridge paper), blotting paper; the specimens, having small pieces of wadding placed within and around the flowers to draw off all the moisture as quickly as possible, blotting paper, wadding as before, cartridge paper, mill-board. When the specimens, etc., are thus arranged, heavy weights should be put on them; about thirty pounds the first day, sixty pounds afterwards. Remove them from under pressure in a day or two; carefully take away all the papers, etc., except the blotting papers between which the specimens are placed; put these in a warm air to dry, whilst the removed papers, etc., are dried in the sun or by the fire. When dry (but not warm) place them in the same order as before; put all under the heavier pressure for a few days when (if not succulent) they will be dry.

Flowers of different colors require different treatment to preserve their colors. Blue flowers must be dried with heat, either under a case of hot sand before a fire, with a hot iron, or in a cool oven. Red flowers are injured by heat; they require to be washed with muriatic acid, diluted in spirits of wine, to fix the color. One part of acid to three parts of spirit is about the proportion. The best brush with which to apply this mixture is the head of a thistle when in seed, as the acid destroys a hair pencil, and injures whatever it touches (except glass or china); therefore it should be used with great care. Many yellow flowers turn green even after they have remained yellow some weeks; they must therefore be dried repeatedly before the fire, and again after they are mounted on paper, and kept in a dry place. Purple flowers require as much care, or they soon turn a light brown. White flowers turn brown if handled or brushed before they are dried.

Daisies, pansies, and some other flowers must not be removed from under pressure for two or three days, or the petals will curl up. As all dried plants (ferns excepted) are liable to be infested by minute insects, a small quantity of the poison, corrosive sublimate, dissolved in spirits of wine, should be added to the paste, which it will also preserve from mould. The best cement for fixing the specimens on to the paper or cardboard is gum-paste. It is composed of thick gum-water, and flour mixed in warm water, by adding the two together, warm, and of a consistency that will run off the hair pencil.

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The American Association for the Advancement of Science—The Microscopical Sub-Section.

THE recent meeting of the American Association, at Buffalo, was generally acknowledged to be one of the most valuable and enjoyable ever held. The citizens of Buffalo did everything that could be done to promote the comfort of their visitors, and the presence of numerous distinguished foreigners—Centennial commisioners, and others—added greatly to the interest of the occasion. The reception by the Buffalo Club was certainly most pleasant and brilliant, and the trip to Niagara Falls, under the judicious management of Captain E. P. Dorr, gave such an opportunity for observation as is rarely enjoyed. W. H. Vanderbilt, Esq., placed an entire train at the disposal of the Association, by which the members were taken, not only from Buffalo to the Falls, but to Lewiston, stopping occasionally on the way so as to get a full view of all points of interest. When at the Falls, Goat Island, Prospect Park, and Suspension Bridge were all thrown freely open, and after a thorough examination of all the special features of this noted locality, the excursion wound up by a visit to the beautiful grounds of Mr. Bush, where a most sumptous collation was served. Other excursions were also made, so that the Buffalo meeting will long be remembered as a special occasion of hospitality and good fellowship. To microscopists, however, it will possess even deeper significance, for on this occasion there was organized a special microscopical sub-section, from which very important results are anticipated. It is true that previous efforts in this direction have not met with marked success, but from the intense interest in microscopy which is now being manifested all over the country, we cannot but feel that the time has come when a fair measure of success may reasonably be expected. One difficulty, and, perhaps, the chief one, lies in the fact that many persons can see no good reason for erecting microscopy into a separate subsection. They would relegate the various sub-divisions of this subject to other departments, as, for example, the general principles and construction of the instrument, to optics; its application to the taxonomy of the animal kingdom, to histology, and to the anatomy and physiology of plants, to the general department of biology. In short, they look upon the microscope as a mere tool, and deride the idea of according to it any more prominence than they would give to the telescope or the balance. All this is unquestionably correct in the abstract, but when we come to downright practical facts, we find that the existence and success of the various microscopical societies which have been established throughout the country during the past few years give a pretty flat contradiction to such views. In these times, methods of research become almost as important as results, because really good methods have a general application, and exert a pretty broad influence on the results that may be reached in departments of research that are very distinct and very widely separated. It seems to us, therefore, that the work of this sub-section is positive and well defined, and that but little difficulty can arise in assigning to it the papers

to which it has a special right. Where a paper is devoted chiefly to methods of microscopical research, or to theoretical questions bearing upon them, it should be assigned to the sub-section of microscopy; where it deals chiefly in anatomical, physiological, or taxonomical results, even if these are attained by the use of the microscope, it should be assigned to that department of biology, chemistry, or physics, which takes cognizance of these results.

At this, the first meeting, Dr. Ward, of Troy, the able editor of the microscopical department of the *American Naturalist*, was unanimously elected chairman of this subsection, and several very valuable and able papers were read—among others, one by Prof. Morley, of Hudson, Ohio, on the "Measurement of the Striations on the Diatoms of Möller's *Probe-Platte;*" one by Dr. Mees on Micro-photography, and also one on "a Method of Comparing the Blood Corpuscles of Various Animals;" and one by Dr. Ward, "on a Combined Compressor and Forceps-Carrier."

It ought to be pretty generally understood by microscopists throughout the country that the American Association for the Advancement of Science has been organized on a very liberal basis. Almost any person of good moral character and general intelligence, is eligible as a member, and consequently there is no reason why all the members of our various microscopical societies should not become members of the association, and take an active part in the microscopical sub-section, thus constituting the latter a most efficient AMERICAN MICROSCOPICAL SOCIETY, of which the local societies might be informally sub-societies. That some such plan will ultimately be carried out, we have no doubt. We need a National Microscopical Society, and the sub-section of the association is just the organization to fill this place.

The next meeting will be at Nashville, Tenn., and we trust that all who take an interest in microscopy will join the association, and aid in the development of the subsection. Prof. Putnam, of Salem, Mass., is the permanent secretary to whom all letters concerning general business should be addressed. We presume that those having special business with the sub-section—that is to say, having papers to bring before it, would do well to address Dr. R. H. Ward.

Death of Ehrenberg.

THERE is probably no name so well known amongst microscopists as that of Christian Ehrenberg. For years he was the great authority upon this subject, and although some of his observations have been proved faulty, and many of his conclusions have been set aside, no one can dispute his claim to a front place in the ranks of scientific workers. That he has made mistakes all will readily acknowledge, but then, as Liebig said: "Show me a man who makes no mistakes, and I will show you a man who does nothing." Ehrenberg was born in 1795, and was consequently eighty-one years old at the time of his death. By the age of thirty-two he had published numerous works, and was made Professor Extraordinary in the University of Berlin. In 1829 he was chosen by Humboldt as a companion during the expedition to Siberia. In 1839 he was made titular Professor. His great work: "Die Infusions Thierchen" (Infusorial Animalcules)—is well known, and when we consider the time at which it was written and the instruments at his command, it must always command for him a high position.

The Fair of the American Institute.

THE annual exhibition held under the auspices of the American Institute is now open, and does great credit to the enterprise and skill of the managers. Thousands of those who reside in the city of New York and its vicinity will be unable to visit the great Centennial Exposition at Philadelphia, and to such the exhibition of the American Institute will give a very fair idea of modern progress in the arts. The fair this year is quite up to the standard of former exhibitions, and is well worth a visit, even to those who have seen the Centennial.

Correspondence.

Aperture of Object-Glasses.

Ed. Am. Jour. Microscopy—The subject discussed in Mr. Wenham's recent article is one which, from its great importance, must engage the attention of all microscopists, and it was therefore with peculiar interest that I read Dr. Blackham's article in your last issue, and with considerable regret that he should have committed such "singular" absurdities in his *reductio ad absurdum*. His argument turns upon the hypothesis that a point has "no dimension." This, we all know, is the definition of a *mathematical* point, which is mere position without magnitude. But such a point cannot serve the purposes of the microscopist, since it has no physical existence, and therefore cannot possibly reflect or transmit light. We speak, and properly too, of the point of a needle, of point of contact, and of various other points, all of which have a definite physical existence. Such points cannot be subtracted from the field without loss,* so that Dr. Blackham's *reductio ad absurdum* falls to the ground.

While entirely agreeing with Mr. Wenham in his general conclusions, I think it is to be regretted that he used the unqualified term "false quantity," as applied to image-forming rays, since it is liable to give rise to just such misapprehensions as those which seem to have misled Dr. Blackham. If we take an objective of one-sixth inch focus, having a field of view of 0.0102 inch, and focus it on a micrometer ruled to thousandths of an inch, we will see eleven lines in the field of view, the two outer ones being close to the edge of the field, and the others dividing the remainder of the field into ten equal parts. Now it is evident that if we see all these lines clearly, the rays from every one of them must be true image-forming rays, but they are not all true image-forming rays *for every one of the lines*. That is to say: the rays which are true image-forming rays for line No. 1 are not true image-forming rays for line No. 2. Indeed, so far as No. 2 is concerned, they are not only a *false* quantity, but an *injurious* quantity, for it is a well-known rule in microscopy that every ray which is not of actual use is a damage. But while the rays from No. 1 do no good so far as increasing our ability to see No. 2 is concerned, Mr. Wenham claims that they add materially to the apparent angular aperture of the objective. Now it is an acknowledged fact that the value of an objective for many purposes depends very largely upon the extent of its angular aperture, but I think it is obvious to any one who will think upon the subject, and apply to it the simple and self-evident principles just laid down, that the efficient angular aperture must relate wholly to the rays proceeding from the particular object which we are examining—whether this be a mere physical point or line, or a diatom. It will not add to our power of resolving a given diatom to find that our objective is capable of taking in, at the same time, rays proceeding from some other diatom, even though these rays may add greatly to its apparent angular aperture. Therefore when Mr. Wenham says that they are a false quantity, he is undoubtedly correct, though it would have been well, perhaps, to have qualified the expression, since these rays may not be a false quantity in regard to some other object.

There may be some question as to the extent to which the new system actually reduces the apparent angular aperture of objectives, and in this connection your readers may refer to a paper by Mr. Tolles, published in the *Monthly Microscopical Journal* for January, 1875. The following passages quoted from that letter are to the point:

"With a slit one-half or one-third the breadth of the field, the result was just as satisfactory *with water* contact; but with air only intervening, the angle was reduced, accordingly *as the field* was reduced, from less than 100° (small enough!) to one-half or one-third that angle.

"Properly used, it is evident that for taking angles a narrow slit of field aperture is as good as more, and therefore a slit at the focus suitable for a one-twelfth might serve for a one-fourth. In fact, what suits a one-twentieth, ought to serve for all powers below. The thinnest covering glass will do, that being needed merely to secure the objects, as tests of definition, in place. The space may be filled up with glycerine to contact as well, ordinarily. Always, where only infinitely near, 180° of aperture is to be measured. Water has too low refraction to correct in place of glass. ...

*I assume that there is a misprint here in Dr. Blackham's article—the syllable "out" having evidently been omitted. [On referring to Dr. Blackham's MS. we find that the printer has faithfully followed copy. We believe, however, that Dr. B. has made a slip of the pen—a thing which is liable to happen to the best writers.—Ed. A. J. M.]

Localities of Microscopic Objects.

Ed. Am. Jour. Microscopy—I most heartily endorse your idea of publishing the localities of objects of interest to microscopists, and, therefore, herewith contribute my mite to the general fund. A few days ago, on a small marsh at East Newark, I gathered *Utricularia*, where it grows in profusion, and I am sure that microscopists, and in fact naturalists generally in this region, will be glad to know of a handy locality for this plant which Mr. Darwin has made doubly interesting since he has so ably detailed its carnivorous powers. If those at a distance who would like to have specimens of this wonderful plant will, before the frost sets in, send me their names and a three cent stamp, I will forward them a supply. On the branches of the *Utricularia* I found in profusion that beautiful rotifer, *Floscularia Ornata;* and when it expands its innumerable rigid cilia, and is viewed by means of dark ground illumination, obtained with a Wenham's parabola, I know of few microscopic objects which can compare with it in beauty. Besides the *Floscularia*, I observed *Euplotes Charon* and *Chætonotus Larus* (I presume) wandering around amongst the vegetation everywhere. I say *Chætonotus Larus*, I presume, although it does not agree in all respects with European descriptions and figures of that creature. By the way, it may be of interest for microscopists to know that there is a good monograph of what he calls the Hairy-backed animalcules, including the *Chætonotus*, by Gosse in the *Intellectual Observer* for July, 1864, with two plates full of figures. Likewise Gosse's description of *Floscularia Ornata*, in his "Tenby," will bear perusal, as it is very truthful; but his colored plate, although it is very pretty, does not do justice to this creature. In my gathering there were as many as a dozen specimens in the field, of one inch, at a time. Diatoms were present in great numbers, although not in any great variety; *Homœocladia filiformis*, in and out of its tube, was plentiful. Some years ago, namely in 1870, I published in the proceedings of the Boston Society of Natural History, a paper in which I called attention to the fact that a *Homœocladia* having been found outside a tube had been called a *Nitzschia;* so with *Homœocladia filiformis*—it is quite as commonly found sailing about free as in a tube. And in this same gathering was *Nitzschia reversa*, which I am convinced I shall see some day within a tube. *Bacillaria paradoxa* was to be seen in the same gathering, and in an extremely active condition, so this is another locality, besides those I have already published, where this form lives in fresh water. Other Diatoms were present as a *Pleurosigma*, an *Amphiprora* and a *Cyclotella*, but I have not determined their specific names as yet.

In the Passaic River, near the Erie railroad station, and on *Ceratophyllum demersum* I have found plenty of that really splendid rotifer *Megalotrocha alba-flavicans*. This is one of the largest of the rotifers, and the bunches of it are conspicuous objects easily seen with the naked eye. I put a small branch of *Ceratophyllum* in a small glass globe one day, and by the next morning I had on the sides of the globe half a dozen lively colonies of *Megalotrochia* with all of their peduncles attached close together, so that the lively creatures formed a little white hemisphere on the glass. Touch the globe, and the little hemisphere suddenly shrinks, into insignificance, only to spread out again the next moment. In fact although the *Megalotrochia* can be frightened by a sharp blow given to the glass upon which it is, yet it does not stay frightened long, but soon spreads its disc again in search of prey. As I make notes of microscopic organisms which I find in this locality, I will do myself the pleasure of sending them to your journal. A. MEAD EDWARDS M. D.

Newark, N. J., Sept., 1876.

Merits of Objectives.

Ed. Am. Jour. Microscopy—One of the most important things for the consideration of the microscopist, or of one intending to purchase, is the quality and merit of objectives.

Every one at all familiar with the subject is aware that even experts differ in their opinion as to the merit of any one objective. Some buyers will place implicit confidence in the judgment of any well known microscopist.

An eminent histologist had a one-fifth made by Tolles two years since, of which he says: "It combined in the greatest degree resolution of lined objects with penetration. It was the best lens in all respects for the ordinary and extra work of the histologist I ever saw." That objective is now in London, and has been tried by certain very eminent men there—men whose reputation is world wide. Mr. L——— says: "My one-fifth is the worst lens of Tolles' make I ever saw." Mr. W——— says: "It is very

superior in all its points, especially its fine field."

Here are the opinions of three experts upon the same thing, either one of which alone would by many be taken as conclusive. On what or whom is a purchaser to rely? I see but one way; that is to educate himself and use his own judgment, with the full assurance that when he has exercised it some will disagree with him. S.

Cleaning thin Glass Covers.

Ed. Am. Jour. Microscopy—I clean thin glass covers of balsam by letting them lie over night in strong soap suds; the balsam will then scrape off easily. This would not answer with very thin covers. F. H.

Aug. 28, 1876.

[We are in the habit of throwing all soiled covers into a wide-mouthed bottle containing solution of potash or soda, and allowing them to soak until wanted. Even rain water will remove balsam and varnish from glass, if time be given. After a few days or weeks soda or potash will so act upon balsam or cement that a very slight shaking, so slight as not to injure the thinnest cover, will remove all adhering matter. The covers may then be washed in water and cleaned in sulphuric acid, bichromate of potash and sulphuric acid, or any other medium. In this way the long-continued action of the cleansing fluid is substituted for delicate manipulation.—ED. A. J. M.]

Current Notes.

Colored Glass for Entomological Cases.—At a meeting of the Entomological Society of Belgium, some time ago, M. Capronnier was charged to make experiments as to the influence of different colors of glass on insect collections; the object being to preserve collections from the decoloration which green and carmine parts especially undergo in daylight. He operated with four tints of glass—yellow, violet, green and blue—also with uncolored glass. It was found that yellow is the best preservative; after 90 days it was the only color which left carmine nearly quite intact. It is not an absolute preservative, for at the end of this time the tint was slightly altered. It seems that the only way known at present of keeping collections absolutely intact is to keep them in darkness.

Germination of Seeds in Ice.—A full investigation of the limit of lowest temperature at which plants may germinate has recently been made by M. Haberlandt. The experiments were upon wheat, rye, barley, red beet, rape, lucerne, poppy, and many other seeds. Several hundred seeds were employed of each species, and every fourteen days the seeds were taken out of the ice-chest, whose temperature was kept constant between 0° and 1° C., and examined in a space whose temperature was under freezing-point. In forty-five days a decided beginning of germination was observable in eight different species. In four months it had continued to progress in a minority of these; the rest had stopped. In fourteen species there was no germination. M. Haberlandt is of opinion that those seeds which can germinate at a lower temperature than others of the same species will give plants that require a less amount of heat for their complete development than the others, and thus by artificial sowing in cold spaces a means is at hand of obtaining species soon ripe and needing little heat. Of all the seeds which had remained for four months in the ice-chest, only a few were found capable of development when brought into a warmer temperature of 16° C. These results are certainly very curious.

Our Book Table.

Micro-Photographs in Histology, Normal and Pathological. By Carl Seiler, M. D., in conjunction with J. Gibbons Hunt, M. D., and Joseph G. Richardson, M. D. No. 4. Philadelphia: J. H. Coates & Co., 822 Chestnut street.

This valuable publication continues to make satisfactory progress, and maintains its usual standard of excellence. We are glad to see that it has been received with great favor in England, where the well known London house of MacMillan & Co., publishers of *The Practitioner*, and of *Nature*, have undertaken its publication. We understand that a very large edition is required for the European market.

First Book of Zoology. By Edward S. Morse, Ph. D., late professor of Comparative Anatomy and Zoology in Bowdoin College. Second edition. New York: D. Appleton & Co.

The fact that this excellent little book reached a second edition within a year after its publication, is sufficient evidence that it supplies a distinctly felt want. It is intended for a class-book for pupils who are not very far advanced, and the author has therefore sought to give clear and complete views of special departments of zoology, rather than a condensed statement of general principles. Thus, very excellent though brief chapters on molluscs, insects, spiders, crustaceans, etc., giving in many cases the life-histories of the more important species, introduce the student at once to practical zoology and impart a direct interest which no other method could do. Very good directions are also given for collecting and preserving specimens, so that from the first the pupil is taught to find his own subjects for study, as well as initiated into the best methods of examining them.

For example, we find full directions for making

nsect boxes and gathering and putting up insects for an elementary collection, and these directions are so simple and the material so easily obtained, that any bright boy or girl can readily follow them. And, by the way, let us here call the attention of Professor Morse to a curious verbal mistake which occurs in this part. He directs the student to cut his cork into *lozenge-shaped* pieces, meaning thereby into discs or very short cylinders. *Lozenge-shaped*, as the professor will see by refering to Webster, is not the shape of ordinary round lozenges.

As a work suitable for beginners, whether self-taught students or the pupils of a skilled teacher, we know of no better hand-book.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—At a regular meeting of this Society, Vice-President H. C. Hyde in the Chair, the following additions to the library were reported: "AMERICAN JOURNAL OF MICROSCOPY;" "Monthly Microscopical Journal;" "Nature" (two copies); "World of Science" (two copies); "D'Orbigney's Dictionaire Histoire Naturelle" (sixteen volumes); "Greville's Scottish Cryptogramic Flora" (six volumes); "Dillon's British Conferva;" "Reference Catalogue Current Literature;" "Tulasne's Selecta Fungorum Carpalogia" (three volumes); "Fasiculi of Fungi, Fries" (four volumes).

The following contributions to the cabinet were received: Twenty specimens marine algæ of Pacific Coast, from Dr. C. L. Anderson; diseased grape leaves from Mission San Jose, from I. C. Woods (taken for examination by Mr. J. P. Moore); and a handsome donation of fourteen slides of rock sections of Comstock ore, accompanied by the exceedingly interesting paper from Mr. Melville Atwood, which we give in full below. Mr. Atwood being absent, the paper was read by Mr. Hanks. Mr. Moore read a letter from Mr. Thos. Taylor, editor of the Microscopical Deparment of the Monthly Report of the U. S. Department of Agriculture. Mr. Moore exhibited a section of the trunk of a pine of a very peculiar variety, whose history he will fully elucidate at the next meeting. Dr. Wythe exhibited a sertularian polyp from Monterey Bay covered with diatoms of various sorts, naviculæ and sertalariæ, etc. The specimen was interesting from its novelty, and the question arises as to whether the polyp was the habitat of the diatoms or the latter an accidental accretion. The following is Mr. Atwood's communication, above referred to:

The slides marked Nos. 1, 2, and 3, are sections of rocks from what, at the Gold Hill portion of the Comstock, is known as the Black Dyke. The specimens from which they are cut were taken from the Dyke at different depths below the surface, at 1,100, 1,400 and 1,740 feet. I have made a careful examination of them, and think they are from a basaltic rock, belonging to the class called Dolerites, in confirmation of which, these sections will be seen to consist of crystals of Labradorite and Augite, imbedded in a grayish paste or matrix, in which are also numerous minute particles of magnetic iron—presenting that mottled appearance so characteristic of that class of volcanic rocks. The matrix is a compound of the same ingredients. Specific gravity, 2.7; contains silica, 50 per cent.

Slide No 4 is a section of Dolerite and Anamesite, from Bolvershahn, in Siebengebirge. It resembles the Black Dyke so much that I can hardly distinguish any difference between them.

This Black Dyke, except in some places where it is separated from the fissure by small masses of Diorite and an altered trachytic greenstone, may be said to form the *foot-wall*, or western boundary, of the greater portion of the Comstock Lode—though the term Lode can hardly be applied to the Comstock, as, according to the generally accepted meaning of that word, "a true Lode" should have well-defined foot and hanging walls. Now in the case of the Comstock there is no well-defined hanging wall. Indeed the indistinct character of the eastern boundary renders the determination of the width of the main fissure a difficult matter.

The main fissure with the dyke for a foot-wall, dips easterly at an angle varying from 45 to 55 degrees to a depth of upward of 1,000 feet; but the inclination after that appears to gradually diminish, and in some of the lower workings it is said to be less than 35 degrees.

The main fissure does not carry much ore. The bonanzas or rich ore bodies are found in separate fissures, which branch off and rise nearly vertically from the foot-wall. They are from two hundred to many hundreds of feet apart.

The old plans (cross-sections) of the Ophir, Mexican, Savage, etc., show that these branch fissures rise in a wavering line to the surface, giving that Y like appearance to the workings at the croppings. They do not in their course, however, follow the irregularities of the foot-wall, so that at different points they run into it again. As depth is attained they do not reach the surface, but only rise to a limited height above the foot-wall, rendering cross-cutting from it the best and safest trial to make for proving the value of the ground. The rock occupying the space between these fissures is an altered trachytic greenstone, but as the difference between it and the unaltered overlaying rock is not easily recognized by the naked eye, the importance of a microscopic examination of these rocks, as the trial of cross-cutting progresses, cannot be over-estimated. I need not add that to cross-cut in the unaltered rock

would be a fearful waste of time and money. From all appearances these branch fissures may continue to be met with at much greater depths than even the most sanguine have been led to suppose.

Argentiferous gold has lately been found mixed with the silver ore in some of the deepest workings (2,000 feet) in fully as large a proportion as when the mines were only a few hundred feet deep.

Slides Nos. 5 and 6 are sections from the unaltered trachytic greenstone. Specific gravity 2.7; contains silica 52 per cent.

Slides Nos. 7 and 8 are sections of the altered trachytic greenstone, specific gravity 2.658, contains silica 62 per cent. The green mineral so conspicuous in these altered rocks is smaragdite. Slides Nos. 9 and 10 are sections from what may be called "True Horse," found in the ore bodies; specific gravity, 2.5; contains silica 85 per cent.

I have often felt greatly humiliated when asked the name of the rock in some of the Comstock mines which I was examining, and, like many others, had to cover my ignorance by telling them it was "porphyry."

Slides Nos. 11 and 12 are sections from the Comstock ore, showing how the argentiferous gold is mechanically mixed with the silver ore.

Slides Nos. 13 and 14 are sections cut from rock taken from different points on Mount Davidson, and sent to me as specimens of the Mount Davidson syenite. On examination it will be seen that the feldspar is not *orthoclase*, so that it is a Diorite, instead of a syenite. I will try and procure some more specimens and submit them to the Society at some future meeting.

I am greatly indebted to my friend Mr. Hanks for having kindly assisted me in determining the amount of silica in the different specimens, and also for helping me in taking the specific gravity of them. MELVILLE ATWOOD.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Wanted, slides of pathological or anatomical preparations, in exchange for diatomaceæ fossil and other well mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Diatomaceous earth from Berlin, Prussia; also from Richmond, Va., in exchange for other material. H. B. Chamberlin, Syracuse, N. Y.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Mounted scales of Lepisma saccharina in exchange for any other mounted objects. Address N. C. Small, Yarmouth Port, Mass.

Slides of Polyzoa coralline and seeds (opaque) to exchange for interesting objects. Richard Allen, 146 North Fourth street, Troy, New York.

Slides of pollen of Agave Americana and other southern United States flowers, for any well mounted objects. Mat. Stuart Beard, Box 1817, New Orleans, La.

For spines of Echinus send objects of interest, Polycystina especially, to F. F. Stanley, 40 Pearl street, Boston.

Pure guano, containing diatoms, in half-ounce packages. Has been washed in pure water. Anything of interest accepted. E. W., Box 4875, New York city.

Wanted, slides of diatomaceæ or foraminifera in exchange for pathological preparations. Geo. A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

For *Humulus Lupulus Ext.*, showing lupulin crystals, send stamped envelope to Richard Allen, 146 North Fourth Street, Troy, N. Y.

Wanted in exchange, well mounted specimens for mounted sections of either lung or kidney specimens, showing perfect minute anatomy of these organs. Also, injected sections of human stomach, mounted, for other histological specimens. C. E. Nichols, M. D., 14 Fourth street, Troy, N. Y.

Slides of fossil diatoms from Nova Scotia, for any other mounted objects. G. C. G., Box 2055, Rockford, Ill.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 355, Milford, Mass.

Foraminifera, very choice, and diatomaceous earth, in exchange for interesting material. George B. Scott, Box 5645, New York City.

Wanted to exchange, periodically, filterings from the water supply of Buffalo for the same of any other city. D. S. Kellicott, 119 Fourteenth street, Buffalo, N. Y.

Roesleia lacerata, *Puc. xanthii*, and *Puc. aculeata*, in exchange for other unmounted fungi. W. C. Stevenson, Jr., 1,525 Green St., Philadelphia, Pa.

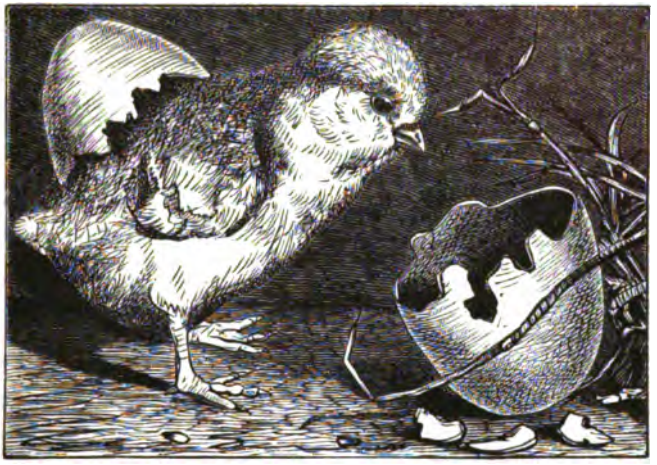
Slides of "Sonorous Sand," from Sandwich Islands, very interesting, for any well mounted objects. W. G. C., Box 1774, Boston, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield. Mo.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Books Wanted—Address, stating condition and lowest price, E. W., care AMERICAN JOURNAL OF MICROSCOPY, 87 Park Row, New York.

"Micrographic Dictionary." Second edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Caspar's "Forensic Medicine." 4 vols.
Faraday's "Electrical Researches." 3 vols.
"Botany of the State of New York." 2 vols., 4to.
Holtzapfel's "Mechanical Manipulation."



The Philosophic Chicken.

Most strange!
Most queer,—although most excellent a change!
Shades of the prison-house, ye disappear!
My fettered thoughts have won a wider range,
And, like my legs, are free;
No longer huddled up so pitiably:
Free now to pry, and probe, and peep and peer,
And make these mysteries out.
Shall a free-thinking chicken live in doubt?
For now in doubt undoubtedly I am:
This problem's very heavy on my mind,
And I'm not one to either shirk or sham:
I won't be blinded, and I won't be blind!
Now, let me see;
First, I would know how I got in *there?*
Then, where I was of yore?
Besides, why didn't I get out before?

Bless me!
Here are three puzzles (out of many more),
Enough to give me pip upon the brain!
But let me think again.
How do I know I ever *was* inside?
Now I reflect, it is, I do maintain,
Less than my reason, and beneath my pride
To think that I could dwell
In such a paltry, miserable cell
As that old shell.
Of course I couldn't! How could *I* have lain,
Body and beak and feathers, legs and wings,
And my deep heart's sublime imaginings,
In there?

I meet the notion with profound disdain;
It's quite incredible; since I declare
(And I'm a chicken that you can't deceive)
What I can't understand I won't believe.
Where *did* I come from, then? Ah! where, indeed?
This is a riddle monstrous hard to read.
I have it! Why, of course,
All things are moulded by some plastic force
Out of some atoms somewhere up in space,
Fortuitously concurrent anyhow:—
There now!
That's plain as is the beak upon my face.

What's that I hear?
My mother cackling at me! Just her way,
So prejudiced and ignorant, *I* say;
So far behind the wisdom of the day!

What's old I *can't* revere.
Hark at her: "You're a little fool, my dear,
That's quite as plain, alack!
As is the piece of shell upon your back!"
How bigoted! upon my back, indeed!
I don't believe it's there:
For I can't *see* it; and I do declare,
For all her fond deceivin',
What I can't see, I never will believe in!
—*Leisure Hour.*

—The programme for the next French International Exhibition, 1878, has been published in the *Journal Officiel*. The regulations are substantially the same as in former exhibitions. The building is to be a long parallelogram, and will be divided into rectangular stripes, two of these stripes being allotted to special divisions, one for France, and the other for foreign countries.

THE AMERICAN

JOURNAL OF MICROSCOPY

AND

POPULAR SCIENCE.

PROSPECTUS.

The object of the JOURNAL OF MICROSCOPY is to diffuse a knowledge of the best methods of using the microscope; of all valuable improvements in the instrument and its accessories; of all new methods of microscopical investigation, and of the most recent results of microscopical research. The JOURNAL does not address itself to those who have long pursued certain special lines of research, and whose wants can be supplied only by elaborate papers, which from their thoroughness are entitled to be called monographs rather than mere articles. It is intended rather to meet the wants of those who use the microscope for purposes of general instruction and even amusement, and who desire, in addition to the information afforded by text-books, such a knowledge of what others are doing as can be derived only from a periodical. With this object in view, therefore, the publishers propose to make the JOURNAL so simple, practical and trustworthy, that it will prove to the advantage of every one owning even a pocket magnifier to take it. The contents of each number may be classed under the following heads:

GENERAL ARTICLES, either contributed by well known microscopists or reprinted from the more expensive cotemporary periodicals. Very important articles of greater length than can be contained in a number of regular size will be issued in supplements.

NEWS.—All important improvements in the construction of the instruments and in methods of manipulation, and all discoveries which may be due to microscopical research will be faithfully chronicled.

ILLUSTRATIONS.—Every number of the JOURNAL will contain several illustrations, either of objects of natural history or apparatus connected with the microscope.

NEW BOOKS AND MONOGRAPHS.—Every student feels the importance of knowing just where to look for the most complete information in regard to the subjects upon which he is working. To aid in this direction we will give each month a complete list of all the more important books and monographs that may appear, and when possible we will also give a summary of their contents.

OUR YOUNG FOLKS' COLUMN.—In this department we will present each month one or more articles upon popular microscopical topics. They will in general be fully illustrated.

CORRESPONDENCE.—An important object of the JOURNAL is to serve as a medium of intercommunication between all who use the microscope. In this column we hope also to aid beginners by supplying, in answer to enquiries, such information as may be at our command.

TERMS.

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THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

VOL. I. NEW YORK, OCTOBER, 1876. No. 11.

Globigerinæ.

A GREAT deal has recently been said and written about the *Globigerinæ*, and many of our readers doubtless have, in their collection of microscopic objects, slides of this well-known foraminifer. Comparatively few persons, however, outside of professional naturalists, know what the *Globigerina* is, or the place which it occupies in nature.

If we take a quantity of the sand which is found in the bins of the sponge dealers, or which may be shaken from any new sponge, and examine it under the microscope, we shall find that it contains a large proportion of very minute shells, which resemble somewhat in appearance the ordinary shells of the seaside, and which we are at once inclined to class with oysters, clams and shell fish in general. But if we examine them more closely we shall find that the majority of these shells belong to creatures entirely different from molluscs or so-called shell fish, and that they are as far below these last as *they* are below birds or lizards. To the ordinary mind, nothing that is animated can be lower than the oyster and the clam—the latter being the proverbial representation of mere animal life in its supposed lowest form. But if we examine the oyster closely, we will find that it has special breathing, digesting and assimilating organs—in a word, that it is highly organized, while the *Globigerina* is an almost unorganized mass of the lowest form of living

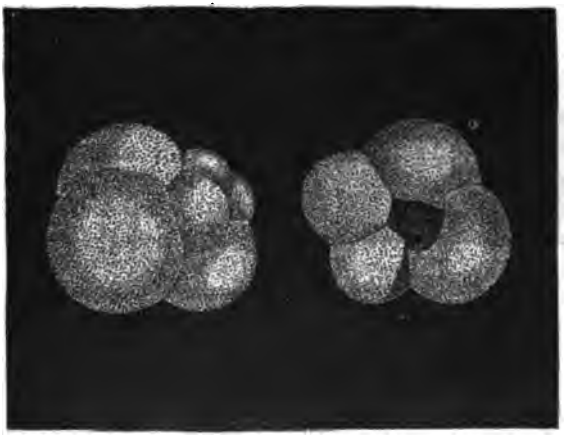

Fig. 1.—GLOBIGERINA BULLOIDES.

animal matter, contained in a calcareous shell. And yet largely by such lowly organisms have the cretaceous formations which exist all over the world been built up, and at the present day, in almost every latitude, they are busy extracting from the sea water the soluble earthy matter which it contains, and depositing it in a sheet over the bed of the ocean. The precise mode in which this is done was for a long time unknown, naturalists being uncertain as to whether the *Globigerinæ* lived at the bottom and died there, or whether they lived near the surface, and when dead fell in a continuous shower on the ocean bottom. Ehrenbergh was a strenuous advocate of

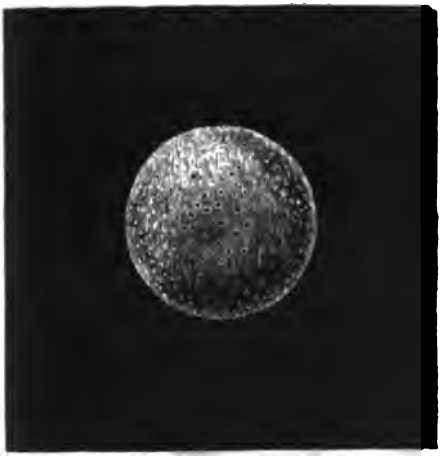

Fig. 2.—ORBULINA UNIVERSA.

the first theory, and we believe that for a long time Prof. Huxley was inclined to agree with him. Our own Prof. Bailey, of West Point, propounded the opposite theory, which has now come to be universally held by the best naturalists.

The dead shells of *Globigerinæ*, as usually mounted, present the appearance shown in Fig. 1. On a slide now before us, they vary in size from the one-thirtieth to the one-hundredth of an inch in diameter—the latter being little white specks just clearly discernable. It will be seen that they are composed of several globular cells, aggregated together as in the engraving. Of the class to which these belong (the foraminifera) there are an almost infinite number of species. One of the simplest is shown in Fig. 2. At first it was thought to be a mere fragment of the foraminifer shown in Fig. 1, but subsequent examination showed that it was a perfect organism forming a species by itself.

When dead, however, these creatures present an appearance very different from that which they exhibit in the living condition, and the following excellent description, which with the figures showing the living organisms, we quote from a description of the *Challenger* expedition, published in a recent number of *Nature*, cannot fail to prove of great interest to our readers:

"In all seas, from the equator almost to the polar ice, the surface-water contains *Globigerinæ*. They are more abundant and of a larger size in warm seas; several varieties attaining a large size, and presenting marked varietal character, are found in the inter-tropical area of the Atlantic. In the latitude of Kerguelen they are less numerous and smaller, while further south they are still more dwarfed, and only one variety, the typical *Globigerinæ bulloides*, is represented. The living *Globigerinæ* from the tow-net are singularly different in appearance from the dead shells we find at the bottom. The shell is clear and transparent, and each of the pores which penetrate it, is surrounded by a raised crest, the crest round adjacent pores coalescing into a roughly hexagonal network, so that the pore appears to lie at the bottom of a hexagonal pit. At each angle of this hexagon the crest gives off a delicate flexible calcareous spine, which is sometimes four or five times the diameter of the shell in length. The spines radiate symmetrically from the direction of the centre of each chamber of the cell, and the sheaves of long transparent needles, crossing one another in different directions, have a very beautiful effect. The smaller inner chambers of the shell are entirely filled with an orange-yellow granular sarcode; and the large terminal chamber usually contains only a small irregular mass,

or two or three small masses run together, of the same yellow sarcode stuck against one side, the remainder of the chamber being empty. No definite arrangement, and no approach to structure, was observed in the sarcode; and no differentiation, with carmine solution. The presence of scattered particles of bioplasm was indicated by minute spots here and there throughout the whole substance which received the dye.

When the living *Globigerina* is examined under very favorable circumstances, that is

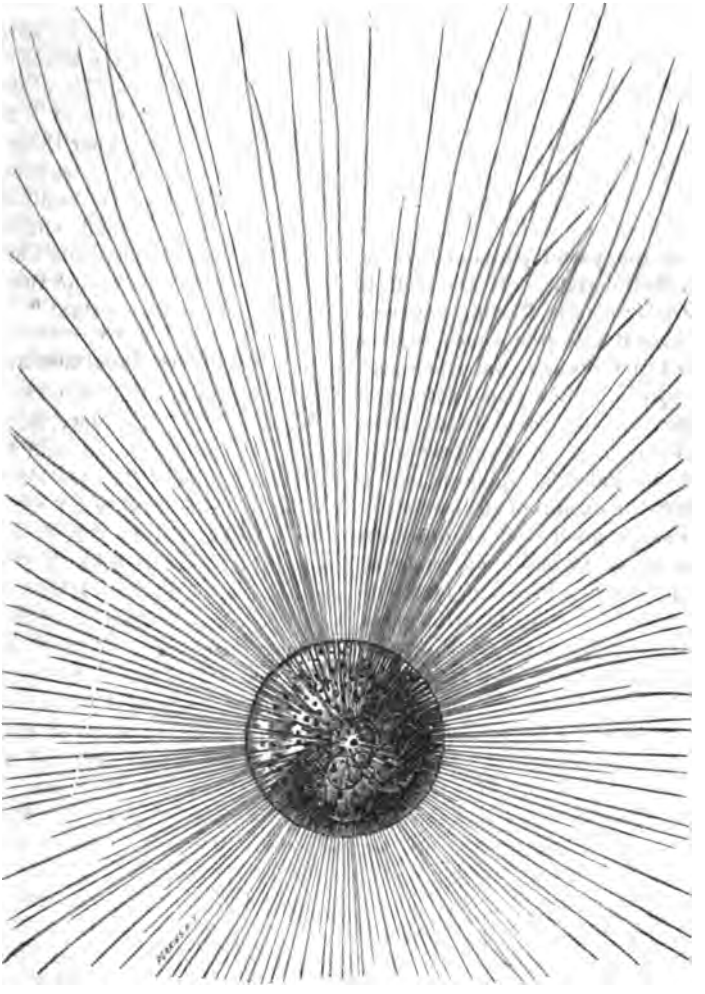

Fig. 3.—ORBULINA, *in the living condition.*

the exception of bright-yellow oil-globules, very like those found in some of the Radiolarians, which are scattered apparently irregularly in the sarcode, and usually one very definite patch of a clearer appearance than the general mass colored vividly with a

to say, when it can be at once placed under a tolerably high power of the microscope in fresh still sea-water, the sarcodic contents of the chambers may be seen to exude gradually through the pores of the shell, and spread out until they form a kind of floccu-

lent fringe round the shell, filling up the spaces among the roots of the spines and rising up a little way along their length. This external coating of sarcode is rendered very visible by the oil-globules, which are oval, and filled with intensely-colored secondary globules, and are drawn along by the sarcode, and may be seen, with a little care, following its spreading or contracting movements. At the same time an infinitely delicate sheath of sarcode containing minute transparent granules, but no oil granules, rises on each of the spines to its extremity, and may be seen creeping up one side and down the other of the spine with the peculiar *flowing* movement with which we are so familiar in the pseudopodia of *Gromia* and of the Radiolariana. If the cell in which the *Globigerina* is floating receive a sudden shock, or if a drop of some irritating fluid be added to the water, the whole mass of sarcode retreats into the shell with great rapidity, drawing the oil-globules along with it, and the outline of the surface of the shell and of the hair-like spines is left as sharp as before the exodus of the sarcode.

"There is still a good deal of obscurity about the nature of *Orbulina universa*, an organism which occurs in some places in large proportion in the globigerina ooze. The shell of *Orbulina* is spherical, usually about ·5 mm. in diameter, but it is found of all smaller sizes. The texture of the mature shell resembles closely that of *Globigerina*, but it differs in some important particulars. The pores are markedly of two different sizes, the larger about four times the area of the smaller. The larger pores are the less numerous; they are scattered over the surface of the shell without any appearance of regularity; the smaller pores occupy the spaces between the larger. The crests between the pores are much less regular in *Orbulina* than they are in *Globigerina;* and the spines, which are of great length and extreme tenuity, seem rather to arise abruptly from the top of scattered papillæ than to mark the intersections of the crests. This origin of the spines from the papillæ can be well seen with a moderate power on the periphery of the sphere. The spines are hollow and flexible; they naturally radiate regularly from the direction of the centre of the sphere; but in specimens which have been placed under the microscope with the greatest care, they are usually entangled together in twisted bundles. They are so fragile that the weight of the shell itself, rolling about with the motion of the ship, is usually sufficient to break off the whole of the spines and leave only the papillæ projecting from the surface in the course of a few minutes. In some examples, either those in process of developement, or a series showing a varietal divergence from the ordinary type, the shell is very thin and almost perfectly smooth, with neither papillæ nor spines, nor any visible structure except the two classes of pores, which are constant."

Pinus Tuberculata.

AT a recent meeting of the San Francisco Microscopical Society, Mr. J. P. Moore presented some transverse and longitudinal sections of cones of *Pinus tuberculata*, accompanied by the following interesting paper:

In a recent visit to the Sierras, I had an opportunity to make a study of some of the peculiarities of this very interesting pine. It can not be said to be a common tree, in the ordinary acceptance of that term. It is mainly confined to the Sierras, and at an elevation of about 3,000 feet. It seems to prefer the southern slope of the mountain, where the soil is very dry, and where it can be fully exposed to the sun. It can be readily distinguished by the fact that, unlike other pines, it bears its cones on the main trunk of the tree, giving it a singular appearance, as they are arranged around the trunk in almost a circle. Usually, five, though often seven cones, compose the circle. Sometimes two or three of these circles of cones will be closely crowded together, overlapping each other as they hang down.

A peculiar feature of these cones, and one worthy of your attention, is the manner of their attachment to the trunk. You will observe that the bases of the cones rest

against bark, and that they are so firmly fixed as to bear the pressure of several hundred pounds without breaking off. These cones appear upon the trunk while yet the tree is quite young, and yet the successive layers of growth of the trunk rarely ever surround and bury them. The petiole of the cone seems to lengthen, but not quite fast enough to keep pace with the growth of the trunk, so that in many instances it would seem as if the pressure of the subjacent tissue against the base of the cone has forced it out, leaving a hole where the petiole entered the older wood. Nature has also made good provision for the preservation of the seed. The cones are very compact, and coated with a resinous coating, which insures them against cracking open. The cones are never shed until the tree dies or has been felled, and then not for a long time do they open. I have specimens now, seven to ten years old, which, though exposed, have not yet opened their cones.

In the forests where this pine abounds the trees are all of the same age. This may readily be accounted for from what I have said of its cone shedding. It has no special value as a tree of commerce, but finds, or should find, a place as an ornamental tree. It thrives, though, poorly in our vicinity. It rarely ever attains great height.

Dr. Phipson on Diatoms.

BY A. MEAD EDWARDS, M. D.

THE microscopic world, and, in fact, naturalists in general, owe thanks to the AMERICAN JOURNAL OF MICROSCOPY for its *exposé* of Prof. P. B. Wilson's absurd paper published in *Silliman's Journal* for June, 1876, and it must always remain a matter of surprise that the editors of that periodical could have published it. Of course anybody with the slightest knowledge of the diatoms could see through the shallow sham, but the worst point in the matter is the fact that farmers, on the recommendation of such "scientists" should lay out money for such, to them, useless stuff as the Virginia infusorial earth, and thereby, at the same time injure their soil by diluting it with barren silica. Some years since a gentleman in Massachusetts discovered on his farm a deposit of diatoms, and kindly sent me specimens of it. At the same time I was informed that he was using it as a fertilizer. I warned him of the danger, but too late. He learned by experience that even grass will not live when covered over with an impervious layer of moist, finely divided silica.

It is lamentable that certain gentlemen will not inform themselves with regard to particular branches of science before they "rush into print." One would have thought that Prof. Tyndall's unfortunate experience in the field of practical medicine concerning the germ theory of typhoid fever would have served as a warning, but it would seem that such is not the case.

Now we have Dr. T. L. Phipson, a pretty good chemist, we believe, publishing in the London *Chemical News*, of September 8, 1876, an analysis of the infusorial earth of Barbadoes, so well known to microscopists everywhere. As to the analysis itself, nothing can be said, but as to his microscopical examination of it, I do most earnestly protest. Reading it, I am reminded of what my good friend, the late Dr. Walker-Arnott, once pointed out in his vigorous manner to me—that there are microscopists and naturalists. Dr. Phipson may be a microscopist, but if he be so, he is a very young one. But he certainly is not a naturalist. And here I may, I think, with benefit to many, quote Dr. Arnott's remarks on this subject. I had written to him, introducing myself as a brother microscopist, hoping thereby to secure his good will. His reply was, "I am afraid you mistake me and my pursuits. So far from being a microscopist, I wage war with the fraternity, and I have on that account refused to become a member of the Microscopical Society of London. I consider that a microscopist looks on everything as subservient to the microscope, and that whatever he sees and which appears distinct to the eye, he thinks ought to be described or figured as distinct. I am, on

he other hand, a naturalist, a botanist in particular, and use the microscope, simple or compound, as a necessary evil, merely to enable my eyes to see better minute structures; but whether these differences amount to specific or generic importance, or are only peculiar forms of one species, is the result of analogy, a mental process which can only be attained by a training in botany in all its branches, for many years. A microscopist is to a naturalist what a gardener is to a botanist. In general, microscopists are amateurs carrying on some other profession, and not having their attention devoted uninterruptedly to natural history. In fact few microscopists know anything of the laws of natural history for genera or species; and therefore the species created by them are in general worthless." Unfortunately these words, which were penned twenty years ago, apply just as well at the present day. Most of our microscopists are not naturalists, but fortunately many of our naturalists now are microscopists. Of course a botanist who grows his own plants, and is his own gardener, will know more concerning their habits and peculiarities than he would if he only studied such specimens as were brought to him by a collector.

Dr. Phipson, as I have said, has shown himself not to be a naturalist, and, at the same time, I fear not much of a microscopist, for there are few mere microscopists who could not correct the errors in his paper, which are as follows. He says that "the genera most easily recognized in these deposits"—and, as he mentions the analysis of a fresh water deposit from Pay de Dome (France), made by Fournier, we are somewhat in the dark as to whether he is enumerating such forms as are to be found in the Barbadoes deposit alone, or in the French one likewise—"with the aid of a moderately powerful microscope (200 to 250 diameters), are *Desmidium*, Euastrum, Xantidium, *Peridinium*, Gomphonema, Hemanthidium, *Pinnularia*, *Navicula*, *Actinocyclus*, *Pixidula*, Gallionella, Synedra, and *Bacillaria*. I have italicized those which appear to me most prominent in the Barbadoes deposit. Of these, Gallionella, Desmidium, Bacillaria and Navicula are supposed to be plants, all the others to be animals. The great resemblance of these fossil animalcules to some of the active little beings in our ditches and stagnant waters is very striking." Aside from the ignorance of the subject of which he is treating, displayed in the misspelling of so many of the names he quotes, students of the minute forms will be amused to learn from Dr. Phipson that Pinnularia, Synedra, Actinocyclus, Gomphonema and Himantidium are animals. But six of the forms enumerated are found in the Barbadoes deposit, whilst over a dozen genera of diatoms found therein are not mentioned. The Polycystina, which make up the bulk of the earth, are not even alluded to; Desmidium is a desmid, found in fresh water and never found in any deposit; Euastrum likewise; Xanthidium, not Xantidium, the same. Peridinium is an animal with a membranous shell, and the occurrence of fossil species is extremely doubtful. Pixidicula, not Pixidula, is a genus the existence of which is extremely doubtful; and Gallionella has been ruled out of the books.

In short, it is unfortunate that writers for scientific periodicals will not confine themselves to subjects with which they are acquainted, or, at least, have their manuscript revised by those who have made special studies of particular branches of science. It is writers of the character of the one I have quoted who presume to criticise, without understanding, the works of Darwin, and with their feeble power attempt to annihilate the work of years. None are so well satisfied with their own knowledge as those who possess very little of that commodity; and nothing makes a man so modest as the possession of knowledge.

"A little learning is a dangerous thing."

— He who cannot distinguish between the merits of a naturalist and a collector had better be silent, lest, by uttering a word, he should betray himself.—*Burmeister.*

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Microscopical Conversazione.

THE gathering of microscopists and microscopes, attracted to Philadelphia by the Centennial Exhibition, gave occasion for a meeting at the rooms of the Philadelphia Academy of Sciences, where those interested in the subject might exchange views and compare instruments. Amongst the well-known microscopists present were Dr. Leidy, Dr. Hunt, Dr. Richardson, Dr. Seiler, Mr. Walmsley, Mr. Chas. A. Spencer, Mr. Crouch and others. There was a very large display of microscopes—considerably over one hundred—representing the work of all the best known makers. Quite a large number by the Becks, of London, varying from the cheapest to the best; one or two by Powell & Lealand, and several by Crouch and Zentmayer. Crouch was represented by a remarkably fine No. 2 stand of exquisite workmanship. This stand attracted a great deal of attention as being a really first-class instrument at a moderate price. In addition to this several of his smaller stands were present in the hands of their owners. Zentmayer exhibited a very fine new stand of a recent pattern, several devices about which he has just patented. The owner, Dr. Hunt, considers it the finest instrument in the world, and it certainly is a very complete stand. We hope, some day, to have the pleasure of sitting down for an hour or two with it and its owner, after which we will be able to report more fully, the crowded rooms of a microscopical reception not being the place best adapted to the careful and thorough investigation of a new instrument. A microscope which attracted a good deal of attention from workers was the little pocket microscope of this maker. The whole instrument packs into a case three or four inches square and a couple of inches deep, and when opened out it forms a fair-sized working microscope, capable of taking an inch-and-a-half objective, and quite equal to all ordinary requirements. As a traveling companion it would be a little gem.

Amongst the objects shown were some very fine stained tissues by Dr. Hunt and Mr. Walmsley. The collection of the former (both animal and vegetable) is very large, and many of the specimens are of great value from the special features which they display. Mr. Walmsley is acquiring a deservedly high reputation for the excellent character of his work. Dr. Richardson showed the circulation of the blood in the tail of the triton by means of Mr. Holman's life-slide, one of the most effective contrivances for this purpose that has ever been devised. The so-called circulation of the sap in plants was very beautifully shown under several instruments, but by none more effectually than by Mr. Crouch under his large instrument with dark ground illumination produced by the paraboloid. Our American makers have neglected too much these special methods of illumination, and have depended altogether upon the mere quality of their objectives. Not that the latter should be ignored, or any less degree of importance attached to it than has been done, but at the same time the other should not be left undone. Our English cousins, by means of their special and not very expensive devices, obtain results that we find it difficult, or, rather, im-

possible to equal. One reason why Crouch's instrument's are such general favorites is that special attention has been paid to these too often neglected points.

Altogether the meeting was a most pleasant and instructive one. It brought together face to face a large number of men who had known each other by reputation for years, but who had not previously met, and it afforded such an opportunity for comparing the different forms of microscopes as does not often occur.

Drawing to a Close.

ONE more number will complete the present volume, and fulfil the promise which we made to our subscribers when, in our first issue, we appealed to them for support. It is a source of great gratification to us to know that our little journal has been a welcome visitor to many households, and we have positive assurance that it has done much to advance the cause of microscopy, and to increase the interest which is now felt in everything that relates to this instrument, and to the discoveries made by its agency. And so cordial and general has been the support which we have received, that the stability of the journal is completely assured.

When we first announced a journal of the character which we promised, at the low price of fifty cents a year, many persons at once concluded that either the enterprise must fail, or the journal must become a mere advertising organ for some commercial enterprise. That it has not failed, the present issue amply testifies; that its columns have never been sullied by any "axe-grinding" articles, our readers can determine for themselves. And as it has been in the past, so it will be in the future. During the coming year we intend to introduce many improvements, but in no case shall we deviate from the general principles which we first laid down for our guidance.

During the past year we have received many urgent requests to enlarge the journal and increase the price. That we may enlarge the journal slightly, if our success next year bears a reasonable ratio to that of the year that is past, is not impossible, but we must respectfully decline, under any circumstances, to change the price. Our object was to publish a journal to the taking of which, even by a school boy, the *price* should be no hindrance, and we intend to do it.

It is not improbale, however, that if we receive sufficient encouragement, we may issue a monthly supplement containing articles of a higher grade than those suited to the class for which the journal is now prepared. This would be a simple and effectual method of meeting the difficulty. We must remind our readers, however, that if they wish to see the journal *improve*, they must exert themselves in its behalf. We cannot appeal to agents or news-dealers, for the simple reason that our price is too low, but we would impress upon every subscriber that each addition to our list enables us to make a better journal for those who have already subscribed.

The Carpet Anthrenus.

[The following note in regard to the new pest which threatens utter destruction to the carpets in some localities, has been handed to us by the well-known entomologist, A. S. Fuller, editor of the *Rural New Yorker*. We hope to give a figure of this beetle in an early number.—ED. A. J. M.]

THE *Anthreni* as a genus are well known pests of museums of natural history the world over. There are numerous species, some half-dozen of which are found in this country, including the well-known *Anthrenus musæorum*, LINN, the great enemy of collections of natural history, especially of stuffed birds, insects and other zoological specimens. But the *Anthrenus lepidus* of Leconte appears to frequent carpets and is particularly destructive to the former.

My first specimen came from Oregon. The next received came from Central New York, where this pest had received the name of "the California Carpet Moth," probably because some one had recognized it as the same insect which had been found infesting carpets in California, but it is not a moth, but a beetle, and like all the *Anthreni* be-

longing to the great order of *Coleoptera*, and to the family of *Dermestidæ*.

The larva of the *A. lepidus* are small hairy grubs, and change to pupa within the larval skin, not casting off, as do some other kinds of beetles, the imago or perfect insect emerging from the pupa skin, passing out of the old cast-off shell of the larva at the same time. Any one who will take the trouble to collect a few of the larva, and put them into a glass bottle, with a few shreds of woolen cloth, can observe their transformations.

Correspondence.

Diatoms as Food for Plants.

[We insert the following very pleasant letter from the inventor of the well-known self-adjusting turntable, because some of the statements which it contains ought to be published in justice to the journal which we censured in our first article. At the same time, we reiterate our opinion that it was a piece of unpardonable carelessness to admit, without protest, to the columns of such a highly esteemed periodical the vagaries of Prof. Wilson. Further investigation convinces us that whatever hold the theory therein propounded obtained upon the public mind, was due largely to the appearance of the article in *Silliman's Journal*.

In connection with the letter of Mr. Cox, we take occasion to thank the many friends who have encouraged us by warm commendatory letters, and to assure them that if we have not published their communications it has not been because we did not appreciate them, but because we did not feel justified in occupying the small amount of space at our disposal with matters merely personal to ourselves. It is true that they would have formed good advertisements for us, but on the other hand, the journal is now firmly established, and we prefer to let it rest on its own merits or demerits.—Ed.]

Ed. Am. Jour. Microscopy—Your article, in the August number of the Journal, on "Diatoms as Food for Plants," does you great credit, and raises my opinion of the Journal. I have watched, with much interest, the progress of Prof. Wilson's wonderful paper with a wonderful title, ever since it appeared in *Silliman's Journal*, last May, and have been very curious to see where it would first meet with something like scientific treatment, and suffer summary refutation, as it deserved. It is exceedingly gratifying that, after having traveled half way round the world and back, gaining in magnitude as it rolled from journal to journal, it should at last be "finished" near the place where it started. Surely our English cousins have not been very wide awake, and have missed an unusual opportunity to expose a Yankee trick. The *Polytechnic Review*, and the *Quarterly Journal of Science*, seem to have accepted the new discovery with unquestioning faith; and the only thing the *Monthly Microscopical Journal* thought suspicious was the truly remarkable "plate," which you have copied to some purpose, but which, for the credit of Professors Dana, Silliman and Gray, be it said, did not originate in the *American Journal of Science and Arts*. Also for the credit of that journal, be it known that in its September number (rather late, to be sure,) appeared the following cautious note:

"*Diatoms in Wheat Straw.*—The article by Prof. P. B. Wilson, in this journal for May last, is referred to in *Frimen's Journal of Botany* for July, with the remark that the asserted discovery 'is not very likely to meet with acceptance among botanists.' The real nature of the siliceous molds or casts which Prof. Wilson took for diatoms must have suggested itself to those familiar with such matters, and would have been indicated to the author of the communication if this had happened to receive attention before insertion.—A. G."

In reply to a note of inquiry from me, Prof. Asa Gray courteously explained how it was that this remarkable article had *not* "happened to receive attention before insertion," and it seems that it occurred by what I should call an editorial accident, during Prof. Gray's absence, and that he did not know of the communication until it was in print. As soon as it did receive his attention he inserted the mild disclaimer quoted, the only fault of which is its mildness.

I am afraid that, in view of the exposure made by your journal, the scientific world will not feel disposed to give Prof. Wilson the benefit of the charitable supposition that he took the siliceous molds or casts of stomata and cells for diatoms. If he drew the illustrations of "Forms of Diatoms found in Col. Kunkel's Straw," it is hard to believe that he "took" any real things for them. C. F. Cox.

13 *William Street, New York, Oct.* 3, 1876.

Localities of Microscopic Objects.

Ed. Am. Jour. Microscopy—I think the plan of giving the names and localities of objects an excellent one, and, although I have not collected many, those few are quite interesting, and are all within the compass of a microscope magnifying not more than 100 diameters. In pond water, during the months of May and June, I found *Daphnia*, *Hydrachna* and *Volvox* in abundance; later in the season, *Cyclops*, *Cypris*, larva of *Ephemera* and *Gordius*. In creek water, *Cyclops*, *Cypris*, larva of *Chironomus*, *Paramecium*, and other animalcules, *Pleurosigma* and other diatoms, and Vorticella. The beautiful *Tingis hyalina* I found on the under surface of the leaves of buttonwood trees. The larva of *Ephemera* is a very good object for examining the circulation of the blood, as the internal organs can be well seen.

ALLEN Y. MOORE.

Coldwater, Mich., Oct. 12, 1876.

Filtering Water so as to Obtain the Minute Organisms Contained in it.

Ed. Am. Jour. Microscopy—In your August number you quote a writer in the *School Bulletin* on the subject of filtering water so as to obtain the minute organisms contained in it. His method of concentrating, for such it is, with a conical muslin bag, is good, but I think I can tell you of two better ways of accomplishing the same object; both of which have their applications under special circumstances, and both of which I have used for several years with great satisfaction. First, a modification of the conical muslin bag. Have a conical muslin bag, but leave the point open, and place therein a one-ounce wide-mouthed phial, which fasten by means of string tied around its neck, or, better still, with a rubber ring. Now pour your water into it to any extent. The water will run through the meshes of the muslin, and the minute organisms will gradually collect in the phial below. When you have enough, remove the phial, turn the bag inside out and wash it thoroughly in clear water, replace the phial by another, and you are ready for another haul. Such a bag having a stick tied across its mouth, and a large cork fixed to the phial, can be towed after a boat or ship, and the "wonders of the deep" gathered in any quantity. My second device I have commonly made use of in examining potable water; and I have the sediments so collected from several of our large cities. Anon it is my intention to publish something with regard to what I have therein. Take a large glass jar of a half to one gallon capacity—a large beaker or "specie jar" will do, or even a pitcher may be used on a pinch—fill it with the water we wish to "concentrate" at night, and let it stand. Next morning carefully pour off all the water except about a pint. Fill up again and let it stand until night. Pour off again and go on so for at least a week. At the end of that time we will generally find that we have a pint of pretty thick sediment without the admixture of any fibres that might come from a muslin strainer. A. MEAD EDWARDS, M. D.

Newark, N. J.

Aperture of Object-Glasses.

Ed. Am. Jour. Microscopy—In regard to the question of angular aperture, it seems to me that Dr. Geo. E. Blackham very greatly misapprehends Mr. Wenham's meaning. The latter nowhere speaks of "false rays," but says, and rightly, I think, that "this excess of angle is a false quantity, because it does not come as a radiant from one single position in the axial focal point, but from other lateral rays of the marginal foci;" and here, I think, he states the reason for his position very concisely. For it appears very clear to me that the angular aperture of an objective is the angle formed at some one object or point in the field of view, and not an angle formed in the air, between the objective and the object. And I do not see how any fault can be found with the choice of the axial focal point, for not only does it give a slightly larger angle than any other one focal point, but is more convenient than any other, and it certainly seems most natural to use it.

E. P.

Philadelphia, Oct. 2, 1876.

Current Notes.

Huxley's Visit.—Prof. Huxley was most pleasantly treated during his recent visit to this country. The railroad presidents gave him palace-car journeys without price, and for each of his three lectures at Chickering Hall he received $1,600. He was also offered but declined $500 for his address at the opening of the John Hopkin's University. He carried back to England as the result of his few weeks' visit the agreeable sum of $5,000.

Messrs. MacMillan & Co., of London and New York, have recently issued a "Course of Elementary Instruction in Practical Biology," by Professor Huxley and H. N. Martin.

"Microscopy."—The President of the Quekett Microscopical Club, in his recent annual address, discusses the question as to whether "microscopy" is a science or an art. His final conclusion is that it is neither an art nor a science, but a happy compound of both.

Agaricus Tridens.—Mr. J. P. Moore stated at a recent meeting of the San Francisco Microscopical Society that when the mycelium first begins to make its appearance on the timbers in the drifts of the mines, it presents a pure white appearance, and seems to burst out of the wood. It is called by the miners the Lily of the Mines.

Salicylic Acid.—Where a solution, stronger than usual, is required, acetate of potassa will be found a very good solvent. We have prepared a preservative fluid which seems to work well, by mixing such a solution with glycerine. Time is required, however, for the purpose of testing its availability in microscopic work. This time next year we hope to report for or against.

An American Substitute for Gum Arabic.—It is said that the mesquite gum of Western Texas is almost identical with gum arabic, and during the past year has become an article of export, some 12,000 pounds having been gathered in Bexar county, and as much more between that and the coast. This gum exudes from the stems and branches of the mesquite, a mimosa, several species of which grow in Texas, New Mexico and Arizona.

Hours with the Microscope.—A series of articles entitled "Twelve Hours with the Microscope," are announced as to appear in the next year's volumes of *Scribner's Monthly*. They are by Mrs. Sophie B. Herrick, and will be illustrated by a series of engravings which she has drawn on the block herself, and many of which are new. The subjects are selected with excellent judgement, and are as follows: 1. The Beginnings of Life. 2. Single-celled Plants. 3. Liverworts and Ferns. 4. The Microscope among the Flowers. 5. The Pitcher Plants. 6. Insectivorous Plants. 7. Pond Life. 8. The Protozoa. 9. The Bottom of the Sea. 10. Microscopic Corals. 11. Bees. 12. Ants. The first number is before us, and is far superior in clearness and accuracy to the usual run of popular articles on microscopic subjects. Some of these, which have recently appeared in professedly scientific journals, have been filled with crudities—engravings of bee's stings, handed down for two hundred years, and utterly unlike the reality, and figures of textile fibres which no microscopist could recognize. We are glad to see that Mrs. Herrick has combined simplicity with accuracy.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—The regular meeting of the San Francisco Microscopical Society was held on Thursday evening, Sept. 21, with a good attendance of members.

A letter was received from Mr. O. C. Oliver, Corresponding Secretary of the State Microscopical Society of Illinois, asking for exchanges in the way of diatomaceous earths, and correspondence on subjects of material interest to the members of the Society.

Messrs. B. P. Flint & Co., of San Francisco, sent the Society a sample of wool which was grown in Eastern Oregon, and found to possess the very remarkable feature of alternate growths of black and white in the staple throughout the whole fleece. Mr. Kinne took a portion for microscopic examination and mounting, and will probably report at the next meeting. [This, by the way, is not by any means an unusual phenomenon. We have in our cabinet several specimens of wool so marked.]

Additions to the library were received in the way of four numbers of Regensberg *Flora*, *Monthly Microscopical Journal* for September, *American Naturalist* for September, and two volumes of "Carpenter's Mental Physiology."

Mr. Ewing presented a variety of rock sections from Idaho and Washington Territory, while Mr. Hanks shared with the society some material for mounting in the way of a leaf of *Elæagnus*, leaf of *Deutzia scabra*, skin of sole, section of bone of sword fish, section of hedgehog spine, hair of camel, fossil earth from Toomebridge, and section of elephant's hair.

Mr. Moore donated a slide mounted by him with a leaf and section of the stem of *Laurencia*, and also presented some transverse and longitudinal sections of cones of *Pinus tuberculata* from Blue Canon, the latter being accompanied by a very interesting paper on some peculiarities of the tree and fruit. This paper our readers will find *in extenso* in another column.

Mr. Moore also furnished the Society with a report of his examination of the grape vine leaves handed in at the previous meeting, and showing to what is due the disease of the vines, with some suggestions as to prevention if not cure of the trouble.

Report on Grape-vine Fungus by Mr. J. P. Moore.

The grape leaves sent to this Society by Mr. Woods, of Mission San Jose, and put into my hands for examination at our last meeting, prove to be infested with the fungus commonly called *Oidium Tuckeri*, but which recent mycologists class as an Erysiphe. This is by no means a new fungus, but has been fully figured and described in European works. It is common in many parts of the Old

World. It does not, I think, occur on our native vines, but rather on such as have been imported. Berkeley says: "No species of Erysiphe occurs, so far as I am aware, in very warm climates." It first makes its appearance as a fine, delicate cottony layer, upon the surface of the leaves, the branches and fruit; very soon the leaf assumes a pale color, and brown or reddish-brown spots begin to appear, and the vitality of the leaf is soon destroyed. The destruction seems to take place, not so much through an abstraction of the chlorophyll of the leaf, as by shutting down upon the cell structure, excluding light and air, and, as it were, squeezing the life out of the tissue. To what extent the ravages of this fungus may already have proceeded on our coast, I am unable to say. I have received specimens from several localities showing that it has begun to spread.

As to the best remedy for it, I can only say that finely powdered sulphur is as far as at present known the best remedy. Tersulphuret of potassium, hyposulphite of potash, and sulphuret of potassium answer, perhaps, the same purpose. I would suggest that, as far as practicable, the dead leaves be gathered and burned.

It would afford me much pleasure to receive specimens from any part of the State or Coast where it has made its appearance, and to ascertain the varieties of vine most affected.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Mounted scales of Lepisma saccharina, and of Polyzoa, a very handsome variety, in exchange for other well mounted objects. Address N. C. Small, 37 East Springfield street, Boston, Mass.

For Tingis hyalina, send other objects of interest, polycistinæ especially, to Allen Y. Moore, P. O. Box 68, Coldwater, Mich.

Slides of diatoms containing Stauroneis Phœnicenteron, Cymbella Ehrenbergii, Circular Gonphonema, Navicula, etc., in exchange for any well mounted object. William Beadle, Garnerville, Rockland, County, N. Y.

Wanted, slides of pathological or anatomical preparations, in exchange for diatomacean fossil and other well mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Diatomaceous earth from Berlin, Prussia; also from Richmond, Va., in exchange for other material. H. B. Chamberlin, Syracuse, N. Y.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Slides of pollen of Agave Americana and other southern United States flowers, for any well mounted objects. Mat. Stuart Beard, Box 1817, New Orleans, La.

For spines of Echinus send objects of interest, Polycystina especially, to F. F. Stanley, 40 Pearl street, Boston.

Pure guano, containing diatoms, in half-ounce packages. Has been washed in pure water. Anything of interest accepted. E. W., Box 4875, New York city.

Wanted, slides of diatomaceæ or foraminifera in exchange for pathological preparations. Geo. A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

Stained petals, and sections of some common plants to exchange for other mounted objects. Address F. H., Box 96, Cherokee, Iowa.

Wanted, well-mounted specimens, for slides of American Podura mounted whole, and scales of same. Address Geo. W. Fries, Friendship, N. Y.

Wanted in exchange, well mounted specimens for mounted sections of either lung or kidney specimens, showing perfect minute anatomy of these organs. Also, injected sections of human stomach, mounted, for other histological specimens. C. E. Nichols, M. D., 14 Fourth street, Troy, N. Y.

Slides of fossil diatoms from Nova Scotia, for any other mounted objects. G. C. G., Box 2856, Rockford, Ill.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 355, Milford, Mass.

Foraminifera, very choice, and diatomaceous earth, in exchange for interesting material. George R. Scott, Box 5645, New York City.

Rocoplia lacerata, *Puc. xanthii*, and *Puc. aculeata*, in exchange for other unmounted fungi. W. C. Stevenson, Jr., 1,525 Green St., Philadelphia, Pa.

Slides of "Sonorous Sand," from Sandwich Islands, very interesting, for any well mounted objects. W. G. C., Box 1774, Boston, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield, Mo.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Books Wanted.—Address, stating condition and lowest price, E. W., care AMERICAN JOURNAL OF MICROSCOPY, 87 Park Row, New York.

"Micrographic Dictionary." Second edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Faraday's "Electrical Researches." 3 vols.
"Botany of the State of New York." 2 vols., 4to.
Holtzapfel's "Mechanical Manipulation."
Ehrenberg's "Mikro Geologie."
Ehrenberg's "Die Infusions Thierchen."
Williamson's Recent Foraminifera.
Pritchard & Goring's Works (any vols.)
Hook's "Micrographia."
Carpenter on "Foraminifera."
Beck on the Microscope.

THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

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How to Discriminate Between Edible and Poisonous Fungi.

FOR some considerable time past, attempts have been made to introduce and popularize the Continental fungus-eating customs; but, up to the present, these attempts have not been crowned with any special degree of success. In spite of our preconceived notions of French cooks and Parisian *cuisine*, it must be admitted much comes to table, and is eaten with considerable gusto abroad, that our less highly educated taste rejects as unpalatable. This is equally true of fungus-eating. A friend of ours, a keen naturalist, frequently resides for some months in the year in the South of France, and although he enjoys French fare as well as most people, he speaks of the cooked fungi as being insipid to a degree. The method of procedure with these articles of diet seems to be that the fresh fungi, when gathered, are cut into small pieces and dried in the sun, and are preserved for winter use. Before being cooked, they undergo a series of continued washings in water, until literally all the remaining flavor is washed out of them. By this process it is extremely probable many species are rendered not only innoxious, but perfectly wholesome, which would otherwise produce most serious, if not fatal symptoms; and from being useless waste products, become material for the formation of unexceptional protoplasm. Many analyses of fungi have been published, but a real knowledge of their chemistry remains a desideratum: their ultimate composition has been more or less worked at; but our knowledge of their proximate constituents is very meagre. We learn from Dr. Badham, that in Rome the common mushroom is classed with poisonous fungi, and not allowed to be sold in the public market. It is highly improbable this would have been the case without there being some good and substantial reason for it, for Italy is a country where numerous species of fungi are largely consumed, and no fear of these plants as a class exists. It would seem as if there were something special in the climate of the districts from which the Roman market is supplied that renders the mushrooms grown in it poisonous. We know how powerful is the influence of surrounding circumstances upon flowering plants. For example, the exclusion of light from potato tubers or celery plants considerably modifies their properties. Every now and then we hear of people being poisoned (not necessarily fatally) in this country by eating mushrooms, and, when this happens, it is almost always attributed to the wrong kind having been gathered, and not to the nature of the plant being modified by special circumstances. Upon more than one occasion such cases have come under my notice personally, in which people who knew what was a mushroom and what was not, have been made seriously ill by their repast. What the precise differ-

ence in the composition of the plant is, which causes the unpleasant effects, is at present unknown, and is one of those points which have to be worked out. As a rule, however, the wholesomeness of the mushroom is well-nigh cosmopolitan. Several years ago the late Mr. Thomas Baines, who had travelled much in Australia and Africa, told me mushrooms were always eaten when found in his expeditions. Popular credence points to the unwholesomeness of those specimens grown under trees or woods, but this is in no way substantiated by my experience. The possibility of distinguishing an edible from a poisonous fungus by bruising with a piece of gold or silver, has been repeated time after time in all kinds of books, so that it is no way surprising that a correspondent should ask, in a recent number of *Science Gossip*, whether there be any truth in it or not. Many an excellent mushroom has been rejected by the credulous housewife because, when rubbed with salt and a silver spoon, it has turned yellow! The vast majority of mushrooms grown in my district, upon the salt marshes and elsewhere, turn most distinctly yellow when cut or bruised; but this is simply because they are specimens of *Agaricus arvensis*, Shœff., the horse-mushroom, and not *A. campestris*, Linn. Fries, in his "Hymenomycetes Europæi," p. 279, says of *A. arvensis*, "caro alba, immutabilis;" but Mr. Berkeley, in the "English Flora," says it may be known from *A. campestris* by its almost white gills when young, and yellow stains when bruised. Most British fungologists regard this change of color as one of its specific characteristics; and thus it is really a proof of the wholesomeness of the fungus. At the present moment we do not remember any fungus which changes color in at all a similar manner; in fact, excepting one or two of the Lactarii, this particular change is a very uncommon one. *Agaricus arvensis*, the so-called horse-mushroom, is by far the most generally eaten fungus in this country: it occurs far more commonly, is much more abundant, and attains a considerably larger size than *A. campestris*, the so-called true mushroom. They are equally nice in flavor, and equally wholesome.

In several books certain general rules are given for ascertaining off hand whether a fungus may be eaten or not: they are so absurd, however, that botanists simply smile and never think of refuting them. Who originally drew up this code I do not know; but subsequent writers have copied it more or less implicitly. It is not exactly easy to see whether these rules are intended for the discrimination of the mushroom from other fungi, or edible from poisonous species generally. Perhaps the most important of these canons is, that edible species never change color when cut or bruised. We have seen how *A. arvensis* comports itself under such conditions! But there is a variety of *A. campestris* (var. *rufescens*, Berk.) which becomes brilliantly pink at the seat of injury; and this plant is one of the most savory forms of the mushroom we know. *A. rubescens*, P., assumes, as its name implies, a rufous tint, especially where it has been injured by insects. *Lactarius deliciosus*, Fr., turns from bright orange to a dirty green, and this alone is sufficient to distinguish it from all its compeers. The mere fact of a fungus changing color to blue cannot be regarded as an absolute proof of its toxic qualities, for a friend of ours has eaten *Boletus chrysenteron*, Fr., before he knew accurately *B. edulis*, Bull.; and during my noviciate I several times partook of *B. badius*, Fr., without any ill effects whatever accruing.

Another rule very commonly relied on is, that if a fungus be pleasant to the taste, and its odor not offensive, it may be eaten. But this is not only a fallacious but an exceedingly dangerous guide. It is true some fungi are intensely acrid, and are irritant poisons; but, upon the other hand, *Lactarius deliciosus*, one of the very best of our British species, as its name implies, when eaten raw causes a very unpleasant amount of tingling of the mouth and tongue. Far more important, however, is it to remember that a fungus may have a pleasant odor and taste, and yet be most virulently poisonous.

Mr. W. G. Smith was poisoned by eating less than a quarter of an ounce of *A. fertilis*, P., which had anything but a disagreeable taste. Again *A. muscarius*, L., has no acridity, neither has *A. phalloides*, Fr., or *A. Mappa*, Batsch; and whatever may be the character of the two latter, the poisonous properties of the former are well known. It must be remembered that fungi may be irritant narcotic, or narcoto-irritant poisons, and while it is possible to recognize an irritant by the taste, a narcotic may be nearly tasteless.

There is one way and only one, by which edible fungi can be discriminated from poisonous ones with absolute certainty, and that is by a knowledge of the individual species. As well might a code of rules be laid down for the discrimination of wholesome from poisonous fruits or vegtables, as for fungi. People do occasionally mistake aconite-roots for horseradish, or fool's-parsley for paraley proper; but we have no general rules drawn up in this case, neither do people become panic-sticken and eschew the whole race of condiments because of these unfortunate accidents. But if any misadventure occurs from eating fungi, the whole race are scouted and branded as the harbingers of death. In this country fungus-eating is reserved for the few; but it by no means follows these few are experimentalists, far from it; for the species they eat have been known to be edible, and have been eaten, by the initiated, from time immemorial, in other lands, if not in this. Like other kinds of food, they vary much in flavor, in the facility with which they can be digested, and in their nutritious qualities. Certain excellent species cannot be too widely known, and every housewife should be able to discriminate them, especially as they have all well-marked characters. Amongst these may be mentioned—*Agaricus procerus*, Scop.; *A. gambosus*, Fr.; *A. nebularis*, Batsch; *Lactarius deliciosus*, Fr.; *Coprinus comatus*, Fr.; *Cantharellus cibarius*, Fr.; *Hydnum repandum*, L.; *Boletus edulis*, Bul.; *Lycoperdon giganteum*, Batsch; and *Fistulina hepatica*, Fr.—*Science Gossip.*

Transparency of Flames.

M. ALLARD has recently investigated this subject in its relation to light-houses, and some of the results which he has obtained are of considerable interest to microscopists. He has determined the co-efficient of this transparency by three series of experiments—by measuring the intensity of different flames with a flat wick looked at side or edge wise; by means of a curved mirror, which reflects toward the focus the rays which it receives, and thus causes them to pass through the flame; and by measuring the intensity of an electric light across a flame of large diameter. These investigations have led to the adoption of the number 0.8, as a mean value of this coefficient reduced to a thickness of one centimetre in the flame passed through. One important conclusion is arrived at, viz., that the total quantity of light produced, or the absolute intensity, increases much more rapidly than the weight of oil consumed; but, as the quantity of light absorbed by the passage of the rays across the flame itself, increases in a still greater proportion, the difference between these two quantities, or the effective intensity, follows a law of augmentation a little less rapid than the consumption of oil. Microscopists are aware that the most intense light is from a broad flame placed edgewise to the mirror.

Power of the Eye.

ACUTENESS of vision varies so considerably in different individuals as to render an average estimate somewhat difficult. I witnessed the accidental detection of Jupiter's Satellites (three mentioned) by a person unacquainted with their existence, and this person at my request drew their position on paper, which exactly corresponded with my view of them through a good telescope. Another individual distinguished two children ascending the sunny side of a hill, and the color of their jackets, at a distance exceeding half a mile (also verified with a good opera-glass). The same person could see bullet marks at 500 yards. —*Dr. Royston Pigott.*

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TERMS—Fifty Cents per Year. (*Note*—We pay postage on all copies sent out of New York City, but by the absurd regulations of our Postal Laws, it costs us seven times as much to send a copy from our office to a New York city address as it does to send one to Texas or California. From subscribers in New York city, therefore, we are compelled to ask the postage, which is 12 cents per year.)

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S. E. CASSINO, Naturalists' Agency, Salem, Mass.

J. G. LANGGUTH, Optician, 88 State Street, Chicago, Ill.

JAMES W. QUEEN & Co., 924 Chestnut St., Philadelphia.

Poisonous Mushrooms.

THE recent sad death of three persons in Union County, N. J., caused by eating poisonous mushrooms, gives special value to the article on our first page, which we reprint from *Science Gossip*. We commend it to the attention of our readers.

End of Volume I.

WITH this issue we complete the circle of the year, and close our first volume. We would remind our readers that our subscription rate is too small to allow us to open accounts or give credit. We must, therefore, ask them to remit promptly if they desire the journal. Failing to hear from them, we shall conclude that they do not want it. Subscriptions may be sent directly to this office, but where the subscription was originally sent through an agent, we prefer that remittances should be again made through the same channel.

The first number of Volume I. was dated December, 1875; for the purpose of making our volumes begin and end with the year, the first number of Volume II. will be dated January, 1877.

We have had a number of very neat cases made, with the title "AMERICAN JOURNAL OF MICROSCOPY, Vol. I., 1876," stamped on the back in gilt letters. These cases we can supply at 35 cents each. Any book-binder can stitch the sheets and put them in the cases, but for those who desire it, we will, on receipt of numbers, bind the volume in one of these cases for 60 cents.

We can supply clean copies of any number, except Nos. 1 and 4, at the rate of five cents each. We will pay eight cents each for clean copies of Nos. 1 and 4. We have a few bound volumes on hand, made up of copies with wider margin than the ordinary copies; these we offer at $1.25 each.

Personal.

IT is now more than forty years since Lister published those researches which led to the construction of the modern objective, and which were so ably applied by Andrew Ross. Scarcely, however, had Ross embodied the new discoveries in practice, ere a young American backwoodsman applied them with equal success, and even went a step beyond the limits assigned by Lister and Ross to possible achievement in this direction. When we use the term "backwoods," we employ no figurative expression, for at that time the chief cities of central New York were but villages, and proper materials for the manufacture of objectives were not to be found in that region. But our young countryman, no way daunted by such difficulties, tried to make his own glass, and succeeded so well that whereas 135° was the limit assigned by Ross to the possible angular aperture of objectives, he obtained an angle of 162°, and soon acquired an enviable reputation on both continents. The young American optician was Charles A. Spencer, and we have rarely felt greater pleasure than when a few days ago we took him by the hand, and welcomed him to our office. For the first time in many years, Mr. Spencer has visited New York, bringing with him a number of lenses, which show that his hand has not lost its cunning, nor has his

intellect become dim with years. The number of real Spencer lenses in existence is comparatively small, for Spencer has always been an artist who *made* objectives, rather than a manufacturer who produced them in quantity. But, by the aid of his son, who promises to be a worthy successor, he now turns out a considerable number of glasses of various grades, his first-class lenses taking rank with the best. His address is Geneva, N. Y.

We trust our readers will for once forgive us for introducing into these pages matters of commercial interest, but in this case we could not forbear saying a word in favor of one who has done so much for the art in America, and of whom the best amongst us are proud to claim that they are pupils.

Shockoe Hill Diatoms.

In a late number of the *Proceedings of the Boston Society of Natural History*, Mr. Charles Stodder states that Mr. R. B. Tolles examined the stratum as it is exposed in a ravine on the west side of Shockoe Hill, near Richmond, and obtained specimens at the depths, 5, 7½, 10, 11 and 14 feet below the top of the bank, and also from the north side 40 feet below the top, from a bed which was apparently a continuation of the 14-feet bed, the hill being higher on the north side. The lower layer contains 50 to 80 per cent of organic forms, the uppermost about 20 per cent. The species about this top layer vary but little; while in that they are partly different in species, and the frustules are less broken. The species of diatoms peculiar to it are: *Coscinodiscus perforatus*, *Aulacodiscus crux*, *Eupodiscus Rogersii*, and *Mastugonia actinoptychus*. Mr. Stodder gives a list of the species afforded by the several beds.

New Optical Experiments.

Mr. F. E. Nipher send the following to *Nature*:—

1. Fold a sheet of writing-paper into a tube whose diameter is about three centimetres (an inch or so). Keeping both eyes open, look through the tube with one eye, and look at the hand with the other, the hand being placed close by the tube. An extraordinary phenomenon will be observed. A hole the size of the tube will appear cut through the hand, through which objects are distinctly visible. That part of the tube between the eye and hand will appear transparent, as though the hand were seen through it. This experiment is not new, but I have never seen it described. The explanation of it is quite evident.

2. Drop a blot of ink upon the palm of the hand, at the point where the hole appears to be, and again observe as before. Unless the attention be strongly concentrated upon objects seen through the tube, the ink-spot will be visible within the tube (apparently), but that part of the hand upon which it rests will be invisible, unless special attention be directed to the hand. Ordinarily the spot will appear opaque. By directing the tube upon brilliantly illuminated objects, it will, however, appear transparent, and may be made to disappear by proper effort. By concentrating the attention upon the hand, it may also be seen within the tube (especially if strongly illuminated), that part immediately surrounding the ink-spot appearing first.

3. Substitute for the hand a sheet of unruled paper, and for the ink-spot a small hole cut through the paper. The small hole will appear within the tube, distinguishing itself by its higher illumination, the paper immediately surrounding it being invisible. Many other curious experiments will suggest themselves. For example: If an ink-spot somewhat larger than the tube be observed, the lower end of the tube will appear to be blackened on the inside.

4. Look through a paper tube with one eye at green paper, and through another tube with the other eye, at red paper. The paper should be illuminated by the direct solar ray. The two colors, at first vivid, are rapidly enfeebled. After half a minute transfer both eyes to either one of the papers, say red. To the eye fatigued by green, the red color is very brilliant, and the effect is the more striking on account of the simultaneous impressions now received by the two eyes.

The Nature of Monads.

We have additional discoveries regarding the nature of monads by the Russian naturalist, Cienkowski. These organisms are on the border land of the plant world, and in some cases form proplasmic nets (plasmodia) like the plant *Myxomycetes*. These plasmodia have the function of falling apart into amœba-like forms, which have hitherto been regarded as independent animal organisms; hence he thinks

that many Amœbæ do not represent independent forms, but belong to the developmental cycle of other and plant-like organisms. Among the monads, Cienkowski, according to a German correspondent of *Nature*, has observed forms in various stages of encystment, self-division, and formation of colonies. But the most remarkable series of changes were observed in *Diplophrys stercorea*, an extremely small cell-like organism with a yellow spot and pseudopodia at two opposite ends of the body. These little bodies, observed in moist horse-dung, multiply by division, and form by union of the pseudopodia long strings in which separate individuals can glide to and fro. "Thus the boundary lines which it has so long been usual to draw between the individual groups of those lowest forms of life, appear more and more illusory, and the supposition is recommended of a common lowest kingdom of organisms, that of Protista (Haeckel), out of which animals and plants have by degrees been differentiated."

Lead Boring Insects.

M. Bode writes to *Dingler's Journal* that he has several times had occasion to observe it in lead chambers. The culprit is *Sirex spectrum*, an insect with uncommonly powerful biting apparatus, and a prong-like prolongation of the after part of the body. In the trenches at Sebastopol lead balls were found perforated; the sheet lead on which M. Bode observed the insect's action was 3 and 5 mm. thick. From a forester's statement, it appears that the insect bores its way especially into fresh pine-wood. It therefore attacks the pine used for the outer walls of the lead chambers in sulphuric acid works. On meeting the lead it continues its operations, producing a perfectly round hole, which is contracted conically in front. When the lead plate is perforated the insect is, of course, killed by the issuing vapor and acid. The insect does not enter old or dry wood, apparently, so that this should be used in constructing lead chambers.

Obituary.

Mr. Edward Newman, of London, the well-known entomologist, died June 12th at the age of seventy-five. He was editor, at the time of his death, of the *Zoologist* and *Entomologist*, and the author of several popular works on British butterflies and moths.

Correspondence.

Angular Aperture of Objectives.

Ed. Am. Jour. Microscopy—It was with much pleasure that I read the courteous review, by an anonymous critic, of my letter in reference to Mr. Wenham's new method of measuring angular aperture of objectives. The gist of this criticism is that I "committed the singular absurdity" of assuming that when Mr. Wenham said: "In order to obtain accurate results, the light admitted should be confined to *a mere point or line* in that focus" (italics mine), he meant what he said. After carefully re-reading Mr. W.'s article, I am unable to see how any other meaning can be fairly extracted from the text, and am, indeed, more fully convinced than ever that, in theory, the point should be a mathematical point, and the narrow slit a mathematical line, "in order to obtain [absolutely] accurate results," and that, in practice, the results will approximate accuracy (*a la* Wenham) just in proportion as the slit approximates a mathematical line.

I still believe, then, that "the one axial focal point," from which only Mr. Wenham's "true rays" are allowed to come, "may be subtracted from the field without loss." *

My critic, however, speaks of it as a point which, like "the point of a needle," etc.,† has "a definite physical existence." If this be true it must have definite physical dimensions, which can be ascertained, and I would be grate to my critic for a statement of these definite dimensions, with a clear demonstration of their correctness. Of course, if this point has a definite physical existence, but one set of dimensions can be correct for any given lens. For illustration the "known immersion-object glass" of Mr. Wenham's diagram had better be selected, as that glass forms the basis of the present discussion.

So much for this point till we get the definite physical dimensions.

Now for the micrometer illustration. Grant-

*Of course, I meant to say "with*out* loss," instead of "*with* loss," and thank my critic for calling my attention to the error. On reference to a press copy of my letter, I find the omission is mine, and not the compositor's.

†Have just measured the "point" of a cambric needle, and find it to be one-1,500th of an inch, certainly a very definite physical dimension, under a power of, say, 2,000 diameters.

ing that the true image-forming rays from one line are not only "a *false* quantity, but an injurious quantity," so far as every other line is concerned, the same will apply to the different lines on a diatom, and the image-forming rays from them, but this is as good a reason for rejecting the *least oblique* as the *most* oblique image-forming rays. The problem, however, is to find the maximum, not the minimum angular aperture—that is to say, "What is the most oblique ray that the lens under examination will admit and *utilize* for the formation of a distinct image?" For this purpose we must take the most oblique image-forming rays, and are justified in so doing, as, by my critic's rule, all image-forming rays are placed on a par as to truth or falsity, being true as to one line, and false as to all others.

Now, there are objectives by which very oblique rays are admitted, but *not* utilized, serving only to confuse and distort the image, and there are other lenses in which these same rays, and even others still more oblique, are not only admitted, but utilized in the formation of wonderfully distinct images, and add greatly to the resolving power of the lens. My objection to Mr. Wenham's new rule is, that by cutting off these extremely oblique rays, he reduces these two classes of objectives to the same level, and gives two lenses, whose available angles are widely different, one and the same aperture.

GEO. E. BLACKHAM.

Dunkirk, N. Y., Oct. 20, 1876.

Diatoms as Food for Plants.

Ed. Am. Jour. Microscopy—It did me good to read in No. 9 your comments on Prof. Wilson's paper, and the accompanying engraving. A more ridiculous thing has rarely been put forth in a scientific publication. You have done good service in exposing its pretensions, and if you do no more, that will pay for the cost of your journal.

However, even if diatoms are not sucked up from the earth by the rootlets of plants, and carried by the circulation into the epidermis, retaining their entire original form, they may still be of service as fertilizers. Some years ago a very pure sub-peat deposit was found in New Hampshire. Reasoning that as silica is an essential element in the cuticle of all the grasses, that diatoms present silica in the minutest state of subdivision, readiest and easiest for solution by alkalies, I suggested that it should be tried as a fertilizer for grasses. Indirectly I have been informed that the experiment was tried, and that the result was favorable.

I have no further information in regard to the matter, but as such deposits are abundant all over New England, it is to be hoped that more experiments may be made, and the results published for the benefit of agriculture.

CARL REDDOTS.

[Any discussion in regard to the value of silica as a fertilizer is somewhat foreign to the class of subjects to which our journal is devoted, but as it has been alluded to incidentally, and is of great importance, we intend to publish an article relating to it in an early issue. We feel confident that, under ordinary circumstances, it is of no commercial value whatever as a fertilizer. At any rate, the idea of asking farmers to pay $40 or $45 per ton for an article which can be had for the digging, and which does not command more than $10 per ton in New York, is certainly a bold one. And it was to the enforcement of this demand that Prof. Wilson's article tended.—ED. A. J. M.]

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—The regular meeting of the Microscopical Society was held on Thursday evening, Oct. 5, with a good attendance of resident members, Vice-President Hyde in the chair.

Mr. J. D. Putnam, Corresponding Secretary of the Davenport (Iowa) Academy of Sciences, sent a copy of their proceedings for the years 1867 to 1876, which, though not containing much microscopical matter, was found of general interest, and, in addition to other matters, contained a large number of plates of Indian relics.

Nine numbers of *English Mechanic*, *Grevillea* for September, and Part II. of "Mycographia seu Icones Fungorum" were received and placed on the shelves of the library.

Mr. C. Mason Kinne donated a slide mounted by him with spicules of sponge *in situ*, which was found, on examination, to be well adapted to show the manner in which the acicular spicules were thrust through the leathery portion of the animal.

Dr. Harkness sent a slide and some leaves, as set forth in the following paper, and which goes to show that there is equity in nature at times, for the pest of the stock-raiser has its parasite, as well as those plants that are cultivated to some purpose. The following is Dr. Harkness' communication:

"I send to-day to your address, for the Society's Cabinet, a few leaves of the *Xanthium Strumarium*, a plant well know to the stockmen under the name of "cockle burr." This plant attains a height of

from two to three feet, with leaves somewhat resembling the sun-flower. The burr, being something over one half an inch in length, is attached to the stalk, and in the Autumn is easily detached, clinging to the hair of animals to such an extent as to prove a great source of annoyance to stock-breeders.

"You will observe upon the under surface of the leaves many dark-brown spots, in some instances no larger than a pin's head, in others exceeding in diameter one-fourth of an inch. They may be found at the present time in the greatest profusion throughout the valley of the Sacramento. In many localities scarce a leaf may be gathered which is free from them.

"These spots are formed by the aggregated spores of *puccinia* (a coniomycetous fungus), growing parasitically upon the plant.

"The accompanying mounted slide contains a section of leaf showing the brand spores, each septate, with a dark-brown investment, and attached by a short stalk. Mingled with these are a few sub-globose bodies with yellowish contents; these are uredo spores, indicative of one stage of development of the fungus."

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Mounted scales of Lepisma saccharina, and of Polyzoa, a very handsome variety, in exchange for other well mounted objects. Address N. C. Small, 37 East Springfield street, Boston, Mass.

For Tingis hyalina, send other objects of interest, polycistinæ especially, to Allen Y. Moore, P. O. Box 68, Coldwater, Mich.

Slides of diatoms containing Stauroneis Phœnicenteron, Cymbella Ehrenbergii, Circular Gonphonema, Navicula, etc., in exchange for any well mounted object. William Readio, Garnerville, Rockland, County, N. Y.

Wanted, slides of pathological or anatomical preparations, in exchange for diatomacean fossil and other well mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Diatomaceous earth from Berlin, Prussia; also from Richmond, Va., in exchange for other material. H. B. Chamberlin, Syracuse, N. Y.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Wanted to exchange, periodically, filterings from the water supply of Buffalo for the same of any other city. D. S. Kellicott, 119 Fourteenth street, Buffalo, N. Y.

Stained petals, and sections of some common plants to exchange for other mounted objects. Address F. H., Box 98, Cherokee, Iowa.

Wanted, well-mounted specimens, for slides of American Podura mounted whole, and scales of same. Address Geo. W. Fries, Friendship, N. Y.

Wanted in exchange, well mounted specimens for mounted sections of either lung or kidney specimens, showing perfect minute anatomy of these organs. Also, injected sections of human stomach, mounted, for other histological specimens. C. E. Nichols, M. D., 14 Fourth street, Troy, N. Y.

Slides of fossil diatoms from Nova Scotia, for any other mounted objects. G. C. G., Box 2055, Rockford, Ill.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 355, Milford, Mass.

Foraminifera, very choice, and diatomaceous earth, in exchange for interesting material. George B. Scott, Box 5645, New York City.

Roestelia lacerata, *Puc. xanthii*, and *Puc. aculeata*, in exchange for other unmounted fungi. W. C. Stevenson, Jr., 1,525 Green St., Philadelphia, Pa.

Slides of "Sonorous Sand," from Sandwich Islands, very interesting, for any well mounted objects. W. G. C., Box 1774, Boston, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield. Mo.

Wanted, slides of diatomaceæ or foraminifera in exchange for pathological preparations. Geo. A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

PUBLISHER'S COLUMN.

Books Wanted—Address, stating condition and lowest price, E. W., care AMERICAN JOURNAL OF MICROSCOPY, 37 Park Row, New York.

"Micrographic Dictionary." Second edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Faraday's "Electrical Researches." 3 vols.
"Botany of the State of New York." 2 vols., 4to.
Holtzapfel's "Mechanical Manipulation."
Ehrenberg's "Mikro Geologie."
Ehrenberg's "Die Infusions Thierchen."
Williamson's Recent Foraminifera.
Pritchard & Goring's Works (any vols.)
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CONTENTS OF NO. 1.

*Illustrated articles are marked with an *.*

	PAGE
*An Interesting Microscopic Object	1
Work for Cheap Microscopes	2
How to Study with the Microscope	3
Eye-Pieces vs. Objectives	4
Publisher's Announcement	6
To our Readers	6
Our Hopes and Aims	6
Uncalled For	7
Imperfections of the Human Eye	7
Young Folk's Column.	
*How a Bee Stings	8
Our Work Table.	
*Cover Forceps	9
*Spring Clip	9
Selection of Slides	10
Oil for Lamps	10
*Forceps Carrier	10
Preservation of Organic Matters for Microscopical Examination	11
Amphipleura Pellucida	11
Preparing Sections of Coal	11
Voracity of the Pickerel	11
Our Book Table	11
Recent Books and Articles	12
Notes and Queries	12

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VOL. I. NEW YORK, JUNE, 1876. No. 7.

CONTENTS OF NO. 7.

*Illustrated articles are marked with an *.*

	Page
Decoloring and Staining Vegetable Tissue for Microscopical Examination	77
Salicylic Acid in Microscopy	81
*Aulocodiscus Oregonus with Two Centres	82
Postal Rules and Rates	83
The Kentucky Meat Shower	84
Correspondence.	
Making and Manufacturing Microscopes	84
Cleaning Thin Covers	85
Our Work Table.	
*Slide for Opaque Objects	85
Professor of the Natural Sciences	86
The New York Aquarium	86
Microscopical Literature	86
Polarization of Living Tissues	86
Experiments on Spontaneous Generation	86
Pritchard's Infusoria	86
San Francisco Microscopical Society	87
Dunkirk (N. Y.) Microscopical Society	88
Recent Books and Articles	88
Exchanges	88
A Useful Tool for Microscopists	88
Stained Vegetable Preparations	88

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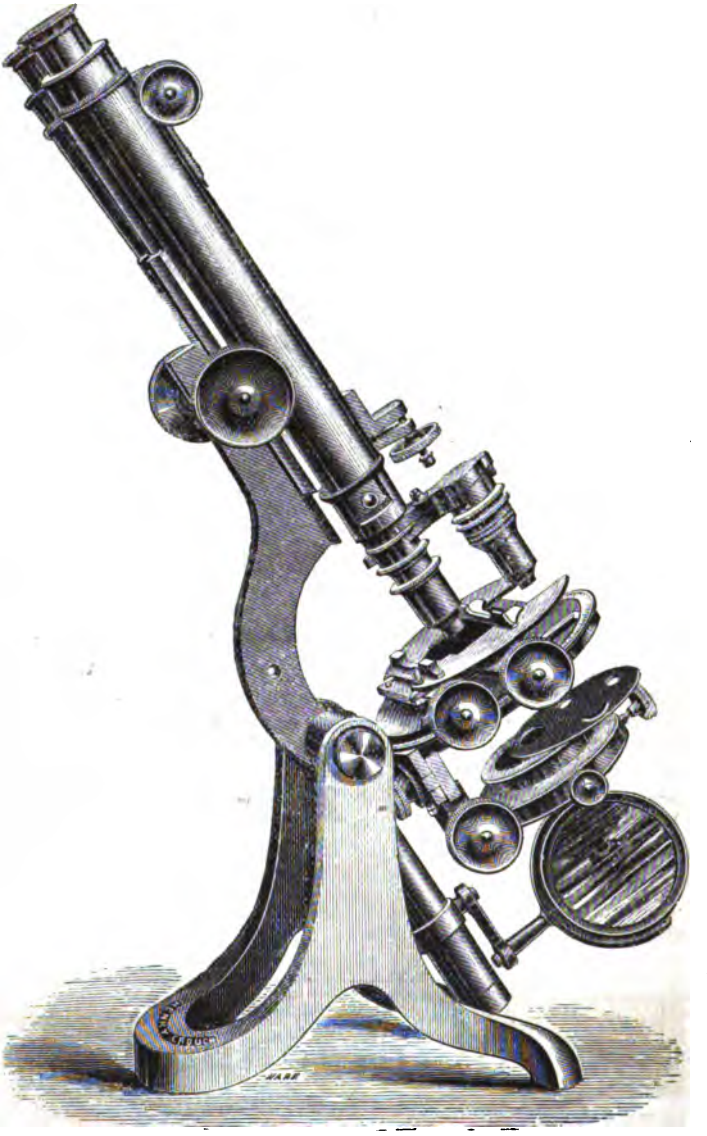

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CONTENTS OF NO. 8.

*Illustrated articles are marked with an *.*

How to Cut Sections of Algæ..... 89
On the Mode of Viewing the Seconds Hand of a Watch through a Beetle's Eye..... 91
A Compact Collecting Case..... 91
*On the Aperture of Object-Glasses..... 92
*Micro-Photography..... 94
Photogenic Powers of Different Lights..... 95
Arranging Diatoms..... 95
Polarization of Living Tissues..... 95
*A New Oblique Light Illuminator..... 96
The Angular Aperture of Objectives..... 97
The "Challenger" Expedition..... 97

Correspondence.

Localities of Microscopic Objects..... 97
Our Book Table..... 98
San Francisco Microscopical Society..... 98
Exchanges..... 99
Books Wanted..... 99

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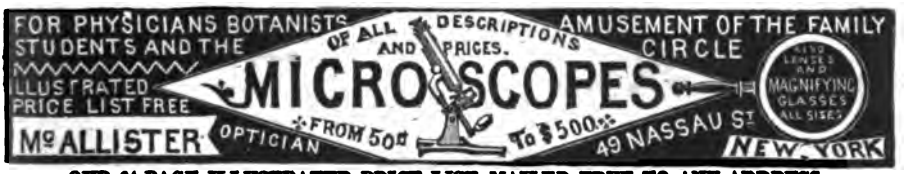

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VOL. I. NEW YORK, AUGUST, 1876. No. 9.

CONTENTS OF NO. 9.

*Illustrated articles are marked with an *.*

Microscopes at the Loan Collection of Scientific Apparatus of the South Kensington Museum... 101
Double Staining of Muscular Tissue with Picric Acid and Carmine... 102
*Description of Agaricus Tridens... 103
Foraminifera from Chalk... 104
*Diatoms as Food for Plants... 105
Personal... 108

Correspondence.

Aperture of Object Glasses... 109

Current Notes.

Another Shower of Flesh Reported... 110
Zoological Gardens for New York... 110
Newspapers at the Centennial... 110
Trophies of the Challenger... 110

Our Work Table.

Filtering Water... 110
New Mode of Mounting Opaque Objects... 110
San Francisco Microscopical Society... 111
Exchanges... 111
Books Wanted... 111

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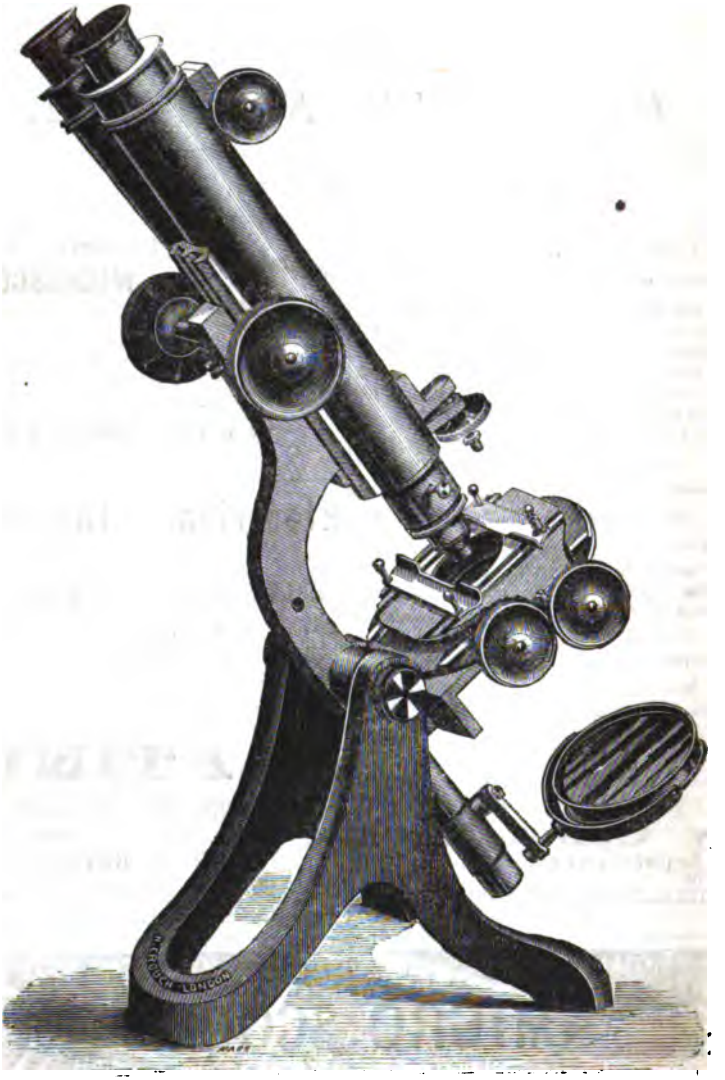

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VOL. I. NEW YORK, NOVEMBER, 1876. No. 12.

CONTENTS OF NO. 12.

*Illustrated articles are marked with an *.*

How to Distinguish between Edible and Poisonous Fungi 137
Transparency of Flames 139
Power of the Eye 139
Poisonous Mushrooms 140
End of Vol. I 140
Personal 140
Shockoe Hill Diatoms 141
New Optical Experiments 141
The Nature of Monads 141
Lead Boring Insects 142
Obituary 142

Correspondence.

Angular Aperture of Objectives 142
Diatoms as Food for Plants 143
Transactions of Societies 143
Exchanges 144
Publisher's Column 144

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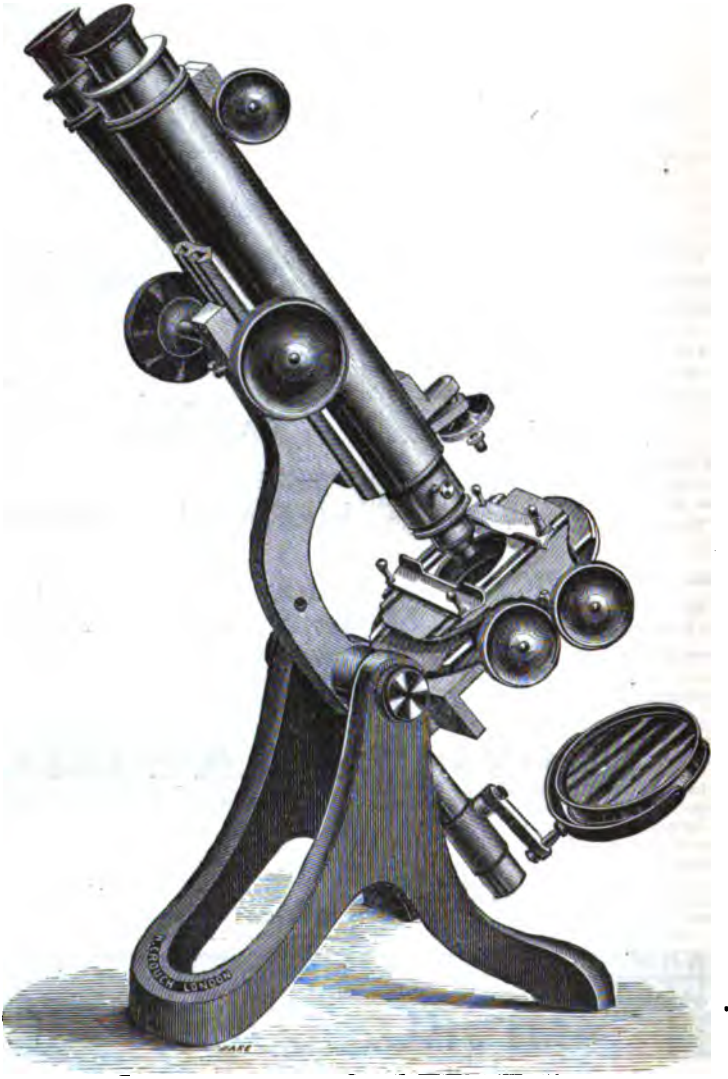

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CONTENTS OF NO. 2.

*Illustrated articles are marked with an *.*

	PAGE
*Our Textile Fibres	13
Learning to Use the Microscope	15
Publisher's Announcement	16
Where we Stand	16
Moeller's Test-Plate	16
Correspondence.	
Eye-Pieces and Objectives	17
Volvox Globator	18
Food for Fish	19
Mud-Wasps or Clay Daubers	19
Restoration of Life after Freezing	20
Our Work Table.	
*Watch-Glass Holder for Field Use	20
Preserving Fungi	20
*Cover Forceps	21
*Growing Slide	21
Trichinæ in Wild Hogs	21
Useless Extravagance	21
How a Swarm of Bees is Suspended	22
Fungi in Disease	22
Our Book Table.	
The Microscope and its Revelations	22
Vision: Its Optical Defects, etc	22
The American Naturalist	23
Recent Books and Articles	23
Literary Announcements	23
Notes and Queries	23
Exchanges	23
Publisher's Department	24

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CONTENTS OF NO. 3.

*Illustrated articles are marked with an *.*

	PAGE
Work for Cheap Microscopes	25
*Silk as Seen Under the Microscope	27
Greensand and its Origin	28
Counting the Blood Globules	29
Science in the Court Room	30
A Valuable Contribution to Natural History	31
Correspondence.	
Postal Micro-Cabinet Club	31
An Optical Illusion	31
Measurement of the Velocity of Light	32
Curious Experiment with a Cock	32
Our Work Table.	
Improved Method of Examining Blood Stains by the Micro-Spectroscope	32
*A Simple Collecting Bottle	32
Counterfeiting in a New Field	33
*Substitute for Rotating Stage	33
Test for Estimating the Proportion of Chicory in Coffee	33
Hardening Tissues	33
Prof. Tyndall on "Germs"	33
Interesting Optical Experiment	34
Transactions of Societies—San Francisco Microscopical Society	34
Our Book Table	35
Recent Books and Articles	35
Notes and Queries	36
Exchanges	36
Publisher's Department	36

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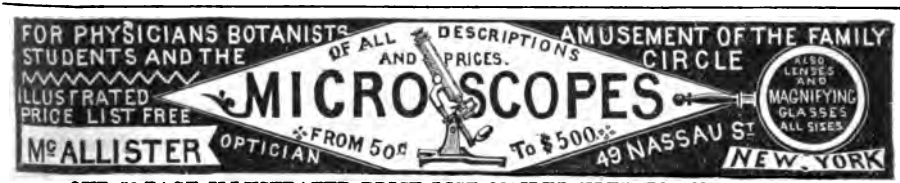

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POPULAR SCIENCE.

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CONTENTS OF NO. 5.

*Illustrated articles are marked with an *.*

	PAGE
*Crystallization of Silver	53
The Kentucky Shower of Flesh	54
Learning to Use the Microscope	55
Snow Crystals—Natural and Artificial	57
Use and Abuse of the Imagination	58
Recent Improvements in the Turn-Table	59
Correspondence.	
The Microscope in Summer	60
Preservative Fluids	60
Microscopic Gymnastics	60
Our Work Table.	
Bacteria in Perspiration	61
New Process for Staining Tissue	61
A New Method of Staining	61
Ready Method of Preparing Sections for the Microscope	62
Our Book Table.	
Anatomy of the Invertebrata	62
Field, Forest and Garden Botany	62
Literary Announcements	62
Notes and Queries	62
Transactions of Societies—San Francisco Microscopical Society	63
Exchanges	63
Survival of the Fittest	64
Microscopes at the Centennial	64
Labeling Specimens	64
Micro-Photographs	64
Books Wanted	64

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CONTENTS OF NO. 6.

*Illustrated articles are marked with an *.*

PAGE

*Color in Microscopic Objects 65
The Origin of the Greensand 67
The Kentucky Meat Shower 69
Our First Half-Volume 70
The Duty on Imported Microscopes 70

Correspondence.

Measuring the Focal Length of Objectives 71

Microscopical Societies in the United States and Canada 72

Our Work Table.

Cabinet of the Quekett Microscopical Club 73
A Good Mucilage 74
*Holder for Hot Slides 74
Sections of Bone 74
Photography in Medicine 74
Schweitzer's Solvent for Cellulose 74

Our Book Table.

Orchids 75

Transactions of Societies—San Francisco Microscopical Society 75
Notes and Queries 76
Personal 76
Microscopes and Microscopic Objects at the Centennial 76
Exchanges 76
Books Wanted 76

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INDEX TO VOLUME II.

PAGE

Accessories and Objectives, Elementary Papers on 162
Achromatic Condenser, Swinging Sub-Stage and... 121
Address, Change of..... 106
Algæ, Mounting..... 154
Algæ, North American..... 117
American Association, Microscopy in the..... 141
Amœba, Cannibalism of the..... 87
Amplifiers..... 59
Angles, High *vs.* Low..... 58
Angular Aperture and Central Illumination, 110, 132, 156.
Angular Aperture, Wide *vs.* Narrow..... 24
Ants, Black, Destructiveness of..... 89
Fossil..... 56
Aperture, Angular and Central Illumination, 110, 132, 156.
Apparatus, Laboratory for Country..... 69
Bacillariæ, the Siliceous Shelled or Diatomaceæ, 29, 36, 41, 65, 80, 97, 127, 164.
Barbadoes Earth..... 36
Beatty, Dr., Death of..... 153
Beetle, the Carpet..... 56
Bermuda Earth..... 141, 157
Beginners, Hints to..... 10
Bibliography, Microscopic..... 23
Blood Stains, the Detection of..... 1

BOOK TABLE.

Plain and Easy Account of the British Fungi. By M. C. Cooke, M. A..... 13
Manual of Structural Botany. By M. C. Cooke, M. A..... 13
Contemporary Evolution. By St. George Mivart..... 13
Principles of Human Physiology. By William B. Carpenter..... 13
The Art of Projecting. By Prof. A. E. Dolbear.. 25
A Manual of the Vertebrates of the Northern United States. By David Starr Jordan, M. S., M. D..... 25
Botanical Hand-Book. By C. E. Hobbs..... 25
Report upon the Invertebrate Animals. By A. E. Verrill and S. J. Smith..... 25
How to choose a Microscope. By a Demonstrator..... 37
The Microscopist..... 37
Life of a Scotch Naturalist. By Samuel Smiles 49
A Brief Paper on the Use and Educational Value of Simple Microscopes..... 49
Report to the Executive Board in the City of Rochester, N. Y., on the Hemlock Lake Water Supply. By S. A. Lattimore, Ph. D., LL. D.. 59
A Course of Practical Histology. By Edward Albert Schafer..... 59
Annual Record of Science and Industry for 1876..... 75
A Practical Treatise on Lightning Protection. By Henry W. Spang..... 89
Tables for Systematic Qualitative Analysis. By John H. Snively..... 120
Catalogue of Plants. By Oliver R. Willis..... 120
The Locust Plague in the United States. By Chas. V. Riley, M. A., Ph. D..... 120

BOOK TABLE. PAGE

Practical Hints on the Selection and Use of the Microscope. By John Phin..... 154
Light. By Alfred M. Mayer and Chas. Barnard. 154
Practical Directions for Collecting, Transporting, Preserving and Mounting Diatoms. By Prof. A. Mead Edwards, M. D., Prof. Christopher Johnston, M. D.; and Prof. Hamilton L. Smith, LL. D..... 154
Pollen. By M. Pakenham Edgeworth, F. L. S., F. A. S..... 169
Captain Waters, and Bill, his Bo'son. By R. O. Sault, (Chas. F. Swim)..... 169
Fret Sawing for Pleasure and Profit. By an old Amateur..... 169
Books Wanted..... 16, 40, 52, 64, 108, 124
Bramhall Illuminator..... 48
Brewer's Microscope..... 135
Brush and Comb of the Hymenoptera..... 77
Bulloch's Improvement in Microscope Stands..... 73
Butter, Detection of Oleomargarine in..... 89
Carpet Beetle, the New..... 56, 116
Cell, an Easily Made..... 138
Cement, Adhesive..... 38
Cements and Varnishes..... 103
Central Illumination, Angular Aperture and, 110, 132, 156.
Cleve and Moller's Diatoms, Notes upon.....149, 153
Collecting Outfit, a Compact..... 12
Coorongite..... 153, 169

CORRESPONDENTS.

Arnold, E..... 59
Atwood, H. F..... 155
Bell, Jas. T..... 36
Blackham, Geo. E..... 9
Bulloch, W. H..... 121
D. S. K..... 75
Farnell, W..... 9
Hamlin, F. M..... 142
Hitchcock, R..... 58, 73, 86, 149, 156
J. C. M..... 105
J. H. S..... 141
Michels, John..... 87
Moore, Allen Y..... 24, 169
Reddots, Carl..... 24
Smith, J. Edwards..... 156, 169
Stodder, Chas..... 142, 157
Subscriber..... 59
Worker, an Old..... 10

Covers, Cleaning Thin..... 144
Crystals, Method of Preparing for the Polariscope.. 38
Diatomaceæ. (See Bacillariæ.)
Typical Specimens of the..... 7
Diatomaceous Earth, Richmond..... 17
Diatoms..... 153
Bermuda..... 157
Mounting in situ..... 142
Disinfectant, Earth as a..... 105
Earth, Bermuda..... 141, 157
Earthworms, Spermatozoa of..... 75
Educational Tour of the Lakes..... 49

PAGE

Enlargement of the Journal ... 152
Entomological Preparations ... 145
Eosin—A New Staining Fluid ... 35
Erysiphe or Wheat Mildew ... 83
Examination of Objectives ... 129
Exchanges, 16, 28, 40, 52, 64, 76, 92, 108, 124, 142, 159,
Exchangers, to Our ... 6, 23
Exhibition, the Permanent ... 44
Expedition, Scientific, Around the World ... 118

Finder, the Maltwood ... 115
Finger, Mechanical ... 85
Fish Culture in England ... 71
Foraminifera and Barbadoes Earth ... 23
from Chalk ... 7
Fungus, a Willow ... 8

Grain Rust, Trichobasis or ... 70
Gundlach's Stands ... 95

Hairs, Certain Intra-Vascular ... 125
Hand-Marks under the Microscope ... 89
Histological Staining, new Process for ... 109
Hitchcock, Prof. R. *vs.* High Angles ... 103
Hymenoptera, the Brush and Comb of the ... 77

Illuminating Glasses, two New, for the Microscope 46
Illumination, Central, and Angular Aperture, 110, 132, 156.
Illuminator, the Bramhall ... 48
Illuminator, a Modification of Wenham's Reflex ... 167
Industry, a Queer ... 89
Information Wanted ... 75
Ivory, Bleaching ... 47

Journal, Enlargement of the ... 152

Laboratory, Apparatus for Country, ... 68
Laboratory, Mica in the ... 22

Magascope, a New Form of ... 83
Marks of Hand, under the Microscope ... 89
Matter, the World of ... 32, 86
Merriman's Method of Preparing Crystals for the Polariscope ... 38
Mica in the Laboratory ... 22
Microscope, Care of the ... 119
in the Examination of Wine ... 38
Stands, Bulloch's Improvement in ... 73
the Brewer's ... 135
Two new Illuminating Glasses for the ... 46
What I Know About Late Improvements of the ... 93
Working with the ... 5
Microscopes, Desire for Inclining ... 36
Microscopical Societies. (See Societies.)
Microscopy at Nashville ... 86
Classes in ... 59
Instruction in ... 49
in the American Association ... 141
in the United States ... 53
Milled Heads *vs.* Screw-Drivers ... 72
Mineralogy, the Microscope in ... 22
Mounting, Remarks on ... 146
Mucilage, Tragacanth ... 38

Nose-Piece, Centering ... 144

Objects, Localities of ... 9
Objectives and Accessories, Elementary Papers on. 162
Objectives, the Examination of ... 129
the Performance of ... 155
Resolving Power of ... 9
Wide *vs.* Narrow Angular Aperture ... 24
Oleomargarine, Detection of in Butter ... 89
Outfit, Compact Collecting ... 12
Oysters, Green ... 18
Penikese, a Successor to ... 106

PAGE

Performance of Objectives ... 155
Peronospora, a Fossil ... 161

Periodicals and Pamphlets Noticed.

Nature ... 12
Anthony's Photographic Bulletin ... 12
The Sanitarian ... 13
Monthly Microscopical Journal ... 13
The Canadian Entomologist ... 13
Journal of the Quekett Microscopical Club ... 13
Magazine of American History ... 105
The American Naturalist ... 106
Newspaper Directory for 1877 ... 106
Journal de Micrographie ... 120
Rural New Yorker ... 144
St. Nicholas ... 154
The Doctrine of the Immortality of the Soul Sustained by Modern Scientific Discoveries ... 154
Phosphorescence due to Crustaceans ... 49
Polariscope, Method of Preparing Crystals for the ... 38
Polycystina ... 57
"Post Centennial Notes," a French Criticism of ... 113
Preparations, Entomological ... 145
Priority, a Question of ... 57

Readers, to Our ... 6
Remitting Small Sums ... 139
Richmond Diatomaceous Earth ... 17
Rotifer Vulgaris, Reproduction of ... 44

San Diego, Report on a Sample of Water from ... 8
School at Penikese ... 106
Screw-Drivers, Milled Heads *versus* ... 72
Section Cutting ... 3
Societies. (See Transactions of).
Societies, Microscopical ... 6, 49, 139, 140
"Species Typicæ Diatomaceæarum," Notes on Cent. I. of the ... 99
Spermatozoa of Earthworms ... 75
Stands, Gundlach's ... 95
Improvement in, by Mr. W. H. Bulloch ... 73
Important Improvement in ... 169
Staining, a New Process of Histological ... 109
Stamps, Foreign ... 57
Sub-Stage, Swinging and Achromatic Condenser ... 121

Tapeworm in Cucumber ... 49
Tingis Hyalina ... 24
Tour of the Lakes, Educational ... 49

Transactions of Societies.

Academy of Natural Sciences, Philadelphia ... 63
Boston Amateur Scientific Society ... 16, 143
Boston Microscopical Society ... 60
Buffalo Microscopical Society ... 60
Dunkirk (N. Y.) Microscopical Society ... 15, 28, 158
San Francisco Microscopical Society, 13, 26, 39, 51, 61, 90, 106, 121, 157, 170.
State Microscopical Society of Illinois ... 170
Tyndall Association of Science ... 159

Trichobasis, or Grain Rust ... 70
Turn-Table, a Self-Centering ... 34
The ... 19
Zentmayer's New ... 144

United States, Microscopy in the ... 53

Volcanic Dust, Microscopic Examination of ... 10

Water, Report on a Sample of from San Diego ... 8
Water Strainer, a Simple ... 11
Wenham's Reflex Illuminator, a Modification of ... 167
Wheat Mildew, Erysiphe or ... 83
Wheat Root Disease in Virginia ... 117
World of Matter, the ... 32

THE AMERICAN

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POPULAR SCIENCE.

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The Detection of Blood Stains.

THE possibility of distinguishing between the blood of man and that of some other animals has, as most of our readers are aware, been a subject of somewhat warm debate between certain microscopists during the past few years. Some of those who have taken the most active part in this discussion claim that they have been misunderstood in regard to certain important points. The following discussion, which recently occurred at the meeting of the Biological and Microscopical Section of the Academy of Natural Sciences, of Philadelphia, is therefore of importance, as giving an authoritative expression af the views of Dr. Richardson, Dr. Wormley, and others. We reprint from the *Medical Times:*

On motion, Prof. T. G. Wormley, of Columbus, Ohio, being present, was invited to exhibit his improved double slides, displaying two kinds of blood-corpuscles, human and dog, also human and cat, in the same field.

Prof. Wormley placed a preparation of human and dog's blood beneath one of the microscopes, and stated that it was prepared by his assistant, Dr. C. L. Mees, by spreading a thin film of human blood upon the slide, according to Prof. Christopher Johnson's method (with the edge of a strip of glass), and then scraping off part, say the right-hand half of the film, with a sharp knife, leaving a vertical row of good fields near the centre of the slide. A thin glass cover, similarly prepared with dog's blood, was then inverted on the slide, and so arranged under the microscope as to bring the sharp boundary line on the (actual) left of the human blood in exact contact with the like well-defined edge on the right of the group of dog's blood-corpuscles, and cemented in that position.

Dr. Richardson remarked that he first contrived a plan for thus demonstrating the contrast in size between the corpuscles of human and certain animal bloods in January, 1874, his method being to spread with narrow strips of metal or glass, two streaks of blood intersecting each other at a very acute angle, near which point would be found (in successful preparations) fields displaying red disks of the two different kinds in close juxtaposition. The one disadvantage of Prof. Wormley's slides seemed to him to lie in the fact that, when photographed, they gave the appearance of having been made from a patched-up negative or double print, and would therefore be less convincing to a jury if used in a criminal trial.

Dr. James Tyson thought there was not much force in Dr. Richardson's objection, and, indeed, had often thought there was scarcely any use in taking a microscope into court, as anything shown with it could add but little to the reliability of the evidence.

Dr. Wormley observed that his preparations were intended for illustration chiefly, and that, in his experience, courts had very properly, in general, ruled out evidence by

the microscope, holding that the reliability of the expert himself must be the support of his testimony.

Dr. Seiler inquired what practical use these double slides could be put to, if they were not to be exhibited in court to demonstrate to jurors the difference between the two kinds of blood upon which the question in any particular case might turn.

Dr. Tyson replied that it might be quite proper to use as evidence photographs, which every one could comprehend, but improper to employ a microscope, which no one could understand unless he were specially educated.

Dr. Seiler suggested that, in that case, Dr. Richardson's objection would hold good.

Dr. Richardson remarked that he did not intend to make objection to Prof. Wormley's very ingenious method, which he considered a decided improvement over his own in most respects. He would like, however, to ask Prof. Wormley whether he had ever seen slides prepared in this way before he showed them to him at his office in Philadelphia during January last.

Dr. Wormley replied that he had not, but did not think that the mere arranging of two varieties of corpuscles close together upon the same slide, as had often been done with diatoms previously, was of much importance.

Dr. Richardson suggested that, although needles had been used from time immemorial, Howe was generally allowed some credit for originality in contriving the sewing-machine, just as Watt was for the steam engine.

Dr. Wormley did not consider the idea under discussion was comparable to these examples.

Dr. Richardson said he did not intend to apply for any patent, but nevertheless claimed for the idea, as furnishing a mode of convincing demonstration, a small yet definite value, which remained with the originator in spite of minor changes in the method of putting it into practice.

After inspecting Dr. Wormley's beautiful specimen of human and dog's blood in the same field, Doctors Ruschenberger, Tyson, Seiler, Pierce, Ludlow, Buckingham, Schaeffer, and Richardson, all agreed that the corpuscles upon the left side of the field (human blood) were on an average decidedly larger than those upon the right side (dog's blood). Dr. Kenderdine, however, declared that the corpuscles were equally large on the left and on the right.

Dr. Seiler asked Dr. Wormley whether he had noticed any difference in various kinds of blood as to their action upon light, making this inquiry because he had observed that human blood-corpuscles differed slightly from those of other mammals in appearance.

Prof. Wormley replied that there was a peculiar physiognomy, character, or outline of the corpuscles in human blood, which cannot be expressed in words, and yet may very generally be recognized by an observer familiar with the study of the circulating fluid.

Dr. Seiler suggested that this peculiarity consisted partly in the fact that the corpuscles of the dog, ox, cat, etc., were more lenticular than those of man.

Dr. Tyson remarked that this peculiar physiognomy of the human blood-disks spoken of by Prof. Wormley, was evidently the "cachet" of the corpuscles alluded to by Prof. Christopher Johnson in his paper on the "Microscopy of the Blood," discussed before the Section on Biology of the International Medical Congress.

Dr. Ruschenberger stated that by the word "cachet" was meant the trade-mark, or rather the *stamp of individuality*, of the corpuscles in question.

Prof. Wormley then exhibited another double slide, of human and cat's blood, in which the contrast was very obvious, and Dr. Kenderdine remarked that it was sufficient to hang a man if a decision turned upon the difference.

Dr. Tyson inquired of Prof. Wormley whether this strong contrast, which was so evident in the specimen beneath the microscope, could be demonstrated with equal clearness in corpuscles from blood-stains which had been dried and moistened again.

Prof. Wormley replied that, by the use of suitable menstrua, the corpuscles could be re-obtained from blood-stains with little or no alteration of their magnitude.

Dr. J. G. Richardson fully confirmed this statement from his own observations in an immense number of experiments.

Prof. Wormley mentioned that he intended very soon to publish his method of investigation, together with the results of an extended series of observations.

Dr. Richardson remarked that his statement, published seven years since, having been to some extent misunderstood, he would just say, while the subject was under discussion here, that he had never claimed to be able to distinguish the corpuscles of human blood absolutely, but only to make a diagnosis between ox, pig, or sheep's blood and the blood of man, when the query was narrowed down to this question, so as to disprove in a criminal case the false statement

of a guilty prisoner. Perhaps he could best illustrate the exact point at issue by repeating his observation to Prof. C. Johnson, of Baltimore, in the late International Medical Congress, when that gentleman mentioned that he found it impossible to discriminate human from dog or guinea-pig's blood in some specimens submitted to him by Dr. J. J. Woodward, to wit: "This is precisely what I should expect; but I wish to ask Prof. Johnson whether, if Ananias (by way of complete antithesis), instead of Dr. Woodward, should submit to him an unlabelled slide of blood, declaring that it was that of sheep, yet on which the corpuscles were to average 1-3200th of an inch in diameter, could he not say without hesitation, 'Ananias, you lie'?"

Dr. Kenderdine suggested that such a reply would be induced by the well-known character of Ananias for untruthfulness, but he would ask Dr. Richardson what could be said if he (Dr. Kenderdine) brought forward a similar slide and statement in regard to it.

Dr. Richardson answered that would not make the least difference, because, if he should advance such a misstatement (of course an impossible thing for Dr. Kenderdine to do), the inevitable conclusion would be that he had become a disciple of Ananias.

Prof. Wormley inquired whether Dr. Richardson would decline to attempt the diagnosis of human blood from that of animals whose corpuscles approximate more nearly to it in size than do those of the ox or pig; and if so, why he had adopted these magnitudes as limits beyond which discrimination was impossible.

Dr. Richardson replied that, in his paper published in the *London Microscopical Journal* for May, 1875, he had explicitly stated that, when the life of a fellow-being was at stake, he believed stains of human blood could not be distinguished with absolute certainty from those of blood from any animal whose corpuscles averaged more than 1-4000 of an inch in diameter. He admitted that this limit was an arbitrary one, and that in suggesting it he had perhaps been unnecessarily cautious, but believed that, if erroneous, the error was on the side of safety.

Dr. Tyson could understand that such discrimination might be made in carefully preserved spots on glass or highly-glazed paper, but thought stains upon cotton or woollen fabrics, where the fluid portions of blood were rapidly absorbed, would present much greater difficulties, especially after being freely exposed to the atmosphere for long periods of time.

Prof. Wormley stated that he had measured a series of seven human blood-corpuscles, the same referred to in Dr. Richardson's paper of July, 1874, at intervals during the space of three years, and was satisfied no variation in size had occurred.

Dr. Richardson said he had made numerous investigations upon blood-stains on muslin, linen, and cloth, after at least a year's exposure, with entire success, and inquired of Prof. Wormley whether he had ever detected any difference in the size of blood-corpuscles soaked out from stains on linen, wood, etc., and those from spots upon paper or glass.

Prof. Wormley replied that he had not found any variations in corpuscles from blood-stains dried on a great variety of objects and kinds of fabrics. He then exhibited another slide, displaying circular bodies about 1-3400 of an inch in diameter, and strongly resembling human blood-corpuscles partly acted on by water. They were, however, quickly pronounced by Dr. Seiler fungous spores, and Dr. Kenderdine remarked that they resembled to some extent the spores of Ustilago.

Section and Section Cutting.

HAVING read with much interest Mrs. Merrifield's remarks on cutting sections of algæ, it occurs to me that a few notes on cutting sections of vegetable structures in general may prove not uninteresting to some of your readers.

Mrs. Merrifield must, I think, have been unfortunate in her experience of section machines, if she discarded them for the more primitive method described in her paper, inasmuch as I have found the machine advertised in this journal as the "*Science Gossip* Section Machine" all that can be desired, and the price (7s. 6d.) is very reasonable.

The needful appliances for all ordinary sections are:

A *Science Gossip* or other section machine.

A keen-edged razor.

Sundry slips of glass, 3 in. by 1 in., and their glass covers, either round or square.

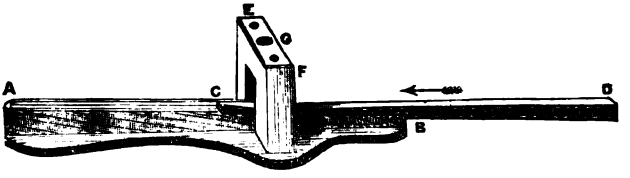
A pair of needles set in wooden handles (those used for camel-hair pencils will do.)

A couple of small china saucers (those supplied in the cheaper descriptions of paint-boxes are, perhaps, best).

A camel-hair pencil.

A carrot.

The *Science Gossip* machine, to which I give preference, as I am much better acquainted with it than with any other, consists of two long narrow inclined planes of nearly equal inclination, some 12 or 14 inches in length, the upper sliding in a groove in the lower. Over the middle is a small bridge of wood faced at the top with a level plate of brass, and pierced with a cylindrical hole about ¼ inch in diameter. In this hole is a piston, the rod of which rests on the upper plane. The object of which it is desired to cut a section is placed in the hole on the piston. It is evident that, if one plane be slid over the other, it will urge the piston upwards; but, as the inclination of the planes is nearly equal, the vertical motion will be very small as compared with the horizontal motion.



Science-Gossip Section Machine. A B, C D, two inclined planes of nearly the same inclination, C D sliding over A B; E F, bridge faced with brass, and pierced with a cylindrical hole, G, in which is a plunger, which urges upwards the object to be cut, which is placed in it supported by pith, carrot, etc., when C D is moved in the direction of the arrow. A small piece of hard wood is placed between the rod of the plunger and the plane, C D, to prevent injury to the latter.

The mode of use will be best explained by an example. Suppose we desire to obtain a transverse section of a leaf. Draw out the two planes to almost their fullest extent; press down the piston till its rod is resting on the upper plane. A piece of hard wood is usually interposed to prevent injury to the plane. Next, cut a piece of carrot to fit the hole stiffly, and come, when resting on the piston, nearly level with the brass top of the bridge. Now cut the carrot nearly through vertically; place the leaf to be cut between the two halves, which, when placed in the hole, will support it firmly. Having fixed it in the hole, with a razor thoroughly wet, cut the carrot and contained leaf exactly level with the brass; then push forward the upper plane say ¼ inch, and make a second cut level with the brass. This will give you a very thin slice of the carrot and of the leaf along with it. With the mounted needles carefully push the slice altogether into the little saucer previously filled with water; move it about a little, when it will part from the leaf, which may be picked up on a point of a needle, or with the camel-hair brush if it be very delicate, and placed on a glass slip in a drop of water. Cover with a bit of thin glass, and place under the microscope. In this way, with a little practice, it will be found that the only limit to the thinness of the section is the sharpness of the razor; a thickness of only 1-300 or 1-400 is readily obtainable. Carrot appears to be the best supporting material; turnips are too coarse, and potatoes are full of starch grains, which are very hard to get rid of. Elder pith is also, I believe, a good bedding material, but I have had no personal experience of it.

To give a list of the objects most interesting for section cutting, would be a vast undertaking, as almost every vegetable object is worth cutting, and without such dissections it is impossible to obtain a correct knowledge of plant anatomy. Still a few may be named, such as prothallia of ferns, various leaves, especially glandular or hairy ones, stems, stamens (anthers), ovaries, and seed-vessels of flowering plants, male and female, inflorescence of mosses (longitudinal section), capsules of mosses, sporangia of

ferns, etc. Should it be desirable to keep a section for more careful examination than can be done at the time, remove the thin glass and the greater part of the water with a fine-pointed glass tube, or a piece of blotting-paper. Put a drop of pure glycerine, and replace the thin glass. Glycerine has the property of not drying up for a very long time, and does not affect vegetable tissues to any appreciable extent. Objects thus temporarily mounted in glycerine should, of course, be kept out of the way of dust. For mounting a section permanently the handiest medium is that known as "Dean's Gelatine," which is a stiff jelly, and is sold in small bottles 1s. each. Place the bottle in hot water till the jelly becomes fluid, put a drop on the section, and cover with the thin glass, cautiously pressing as much of the jelly as will run out. It will set in a few minutes, and after a few hours the superfluous gelatine may be cleaned away with a knife, and a rag moistened with warm water, when the mount is complete. A ring or two of colored varnish improves the appearance and adds to its stability. This gelatine medium has two valuable qualities, viz., that being almost of the same density as sap and water, it does not alter the tissues mounted in it; and also, that it preserves the color of the chlorophyll remarkably well.

In cutting sections in carrot or similar material always see that the razor is well wetted, as it makes it cut much more easily, but it is better dry if pith be used. To explain the structures seen in the various sections no book is better than Sach's, which can be obtained in most good libraries, in either German, French, or English, the last French edition being, perhaps, the best.

Cutting sections of animal tissues I have wholly passed over, as so many involve hardening and preparations in various ways, that few but medical students who have recourse to a suitable laboratory are likely to pay much attention to this branch, albeit a most interesting and important one.—*Science Gossip.*

Working with the Microscope.

THE investigation of the structure and gradual growth of the ovarian egg is so laborious that it will be many years before we can hope to have a complete picture of all its phases. The apparatus required for the task is very complicated, and a long training is necessary merely to prepare the student for the use of his instruments. A superficial familiarity with the microscope gives no idea of the exhausting kind of labor which the naturalist must undergo who succeeds in such work. The glance at the moon, or at Jupiter's satelites, which the chance visitor at an observatory is allowed to take through the gigantic telescope, reveals to him nothing of the intense concentrated watching by which the observer wins his higher reward. The nightly vision of the astronomer, revealing myriad worlds in the vague nebulous spaces of heaven, is not for him; he must take the great results of astronomy for granted, since no man capable of original research has the time to prepare for the uninitiated the attendant circumstances essential to his more difficult investigations, or train their eyes to see what he sees. So it is also with the microscopic observer; the deeper insight he has gained by long training in steadiness of hand and eye, as well as in the concentration of intellect that makes the brain work harmoniously with them, he cannot communicate. He may interest and amuse his friends and visitors with some easy exhibition of specimens under the microscope; he may open the door into the laboratory of Nature, but he cannot invite them to cross the threshold or to enter in with him. I think people are not generally aware of the difficulty of microscopic observation, or the amount of painful preparation required merely to fit the organs of sight and touch for the work. In old times men prepared themselves with fast and vigil for entrance into the temple; and Nature does not open her sanctuary without exacting due penance from her votaries. It seems an easy matter for a man to sit down and look at objects through a glass which enlarges everything to his vision; but there are subjects of microscopic research so obscure that the student must observe a special diet before undertaking his investigation, in order that even the beating of his arteries may not disturb the steadiness of his gaze, and the condition of his nervous system be so calm that his whole figure will remain for hours in rigid obedience to his fixed and concentrated gaze.—*Agassiz.*

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An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the AMERICAN JOURNAL OF MICROSCOPY. This certainly demonstrates the value of the journal as an advertising medium."

Our New Volume.

WITH this number we begin another volume of the AMERICAN JOURNAL OF MICROSCOPY. Our purpose is to continue the same general course that we have pursued during the year that is past. We hope, however, to improve the journal materially, and we base this hope upon the fact that we have secured several able contributors, and that our facilities for obtaining illustrations have been greatly increased.

During the coming year we shall pay special attention to what may be called the *News* of this department of science—new books, new instruments, new facts, new theories, will have our special attention.

The department of correspondence has become an interesting and an important one. We intend to accord the widest liberty to our correspondents, but beg our readers to remember that we in no instance hold ourselves responsible for the opinions expressed, or the facts stated.

We would again request our readers to renew their subscriptions promptly, and to exert themselves to extend our circulation. Every new subscriber enables us to improve the journal that we give to our old ones, and the price of the journal is so low, that we must depend entirely upon our subscribers and not upon news agents or the trade.

Microscopical Societies.

WE intend to publish, in an early number, as complete a list of the microscopical societies of the country as can be obtained. To this end we beg our friends and subscribers to send us, at as early a day as possible, the facts connected with any societies of which they may have cognizance. Such facts as will enable us to fill out a notice after the following form, are what is wanted:

San Francisco Microscopical Society, San Francisco, Cal. Organized 1872. Meets first and third Thursdays of month at 531 California street; President, Prof. William Ashburner; Vice President, Henry C. Hyde; Rec. Secretary, C. Mason Kinne, 422 California street; Cor. Secretary, Charles W. Banks; Treasurer, Chas. G. Ewing.

It will also give pleasure to receive a report of the meetings of any of our socities. The reports which have appeared from time to time in regard to the San Francisco Microscopical Society, are good models. While we do not desire the minutiæ of mere business details, we think it of advantage to publish everything that relates to the progress of such societies, and this for the example and encouragement of others.

Members of societies who desire to have, for reference, copies of the number containing this list, can obtain them *free* by sending us their address.

To our Exchangers.

WE have hitherto confined our exchangers to offers of exchanges of specimens for specimens. We find, however, that cases arise where persons who are studying some subject, and are anxious to procure material, have nothing acceptable to offer except money or its equivalent. We have therefore concluded to allow our exchangers to offer money for material or *for* specimens, but not material or specimens *for money*. The first tends to advance the

interests of science, the latter that of trade. We trust that our new rule will prove of service to workers.

Forminifera from Chalk.

THROUGH the kindness of a gentleman who is well known as a thorough microscopist, we are enabled to send to any of our subscribers that may desire it, a small quantity of washed forminifera obtained from chalk. Many of the species found in this material are very beautiful and interesting, and they are quite numerous. They may be mounted in several ways. 1. Picked out singly and attached to some dark background, they form very fine opaque objects. To ordinary dark backgrounds they may be fastened with gum, but the neatest way of mounting them is after the method devised by Prof. H. L. Smith, and described on page 110 of our volume for last year. 2. Mounted as opaque in balsam they show very well. Take a small quantity of dry material, place it on a slide, add one or two drops of gum water, spread evenly on the slide, dry over a lamp, cover with balsam dissolved in ether, place a thin cover on, and boil to required hardness. 3. To mount as transparent objects in balsam, soak the foraminifera in ether for about a week, place some of them after being thus treated on a slide, and cover with cold balsam; cover with thin glass and lay aside to harden. Boiling would in most cases fill the foraminifera with air.

To all who send us their address, plainly written, and stamp for postage, we will send a small quantity of this material as long as our supply lasts.

Typical Specimens of the Diatomaceæ.

WE have just received from Professor Hamilton L. Smith, of Hobart College, Geneva, N. Y., the first century of his "Diatomacearum Species Typicæ," and have rarely had a greater treat than was afforded by the examination of this collection. Most microscopists are familiar with the celebrated "Typen Platte" of Möller, an exquisite production of artistic skill. The collection before us is an effort in the same direction, but is of a different kind, and in many respects far more efficient and satisfactory. It consists of one hundred slides (the entire collection will probably reach five hundred), each containing typical specimens of a species. With the exception of a few diatoms, such as *Arachnoidiscus Ehrenbergii* and *Aulocodiscus formosus*, there are a large number of frustules on each slide, and in general there are several genera or species present. Thus, on the slide before us, marked *Aulocodiscus Oregonus*, we find several beautiful specimens of a *Hyalodiscus*. The value of this collection, therefore, does not depend upon the mere manual dexterity exercised (which is the most remarkable feature of the "Typen Platte") but upon the authoritative character of the identifications, and in respect to this point, we have no hesitation in saying that Prof. Smith stands at the head of living diatomists. Instead of a single frustule of each species, carefully reduced to its mere silicious elements, we have here a number of frustules; and these, although perfectly clean are mounted as nearly as possible in the condition which they presented while living, unless this should render them unfit for study. Thus the curious *Bacillaria paradoxa*, instead of being mounted as a mere assemblage of striated rods, is put up in that singular, connected condition from which it obtains its name. From all this it will be seen that these slides are put up to be *studied* not to be merely *looked at*. They are not intended for those who have never seen a diatom; but on the other hand to those who have even the most elementary knowledge of the subject, they cannot fail to prove a reliable and easily followed guide in the determination of species.

To gather the material for this collection has been the work of many years, and has involved the expenditure of much labor and considerable money. The famous collection of De Brebisson has been transferred entire to Prof. Smith's laboratory, and has furnished many rare ecies, and it migh

perhaps be safe to say, that in addition to the Professor's own gatherings, there are few diatomists of note that have not furnished him with contributions, either by way of exchange or otherwise.

The manner in which the collection before us is put up is worthy of notice. Each century, or collection of one hundred slides, is arranged in five pasteboard trays, each slide having a compartment for itself, and the whole being enclosed in a simple but convenient pasteboard box. To the lid of this box is pasted a catalogue of the species, which are arranged in alphabetical order and numbered. Each slide is, of course, labeled, and the label is numbered to correspond with the catalogue. But to prevent any danger of confusion, if the slides should accidentally lose their labels by exposure to moisture or otherwise, each slide has its proper number written in with a diamond. The compartments for receiving the slides are also labeled and numbered, thus affording the most perfect security against misplacement.

The labels afford a very large amount of valuable information. First of all we have the catalogue which gives the specific name and the authority for the same—for example, *Achnanthes exilis*, K. Turning to the slide label we find: "*Achnanthes exilis*, K. *In aqua dulci*. H. L. Smith." This gives us not only Kutzing as the authority for the name, but tells us that the species is found in fresh water. Passing to the label in compartment No. 2 (to which the slide in question belongs) we find: "*Achnanthes exilis*, K. A. minutissima, Ralfs. Couvrigny, France. S. B. D. XXXVII, 303," whereby we learn one of its synonyms, (that under which it was described by Ralfs), the locality from which it was procured, and the place where a full description may be found (Smith's British Diatomaceæ). In addition to this, we have, as previously noted, its habitat, whether fresh, brackish or sea water.

The genera are arranged alphabetically, so that the collection serves the purpose of a dictionary, and we feel certain that it will do much to correct the nomenclature of several much-talked-of species.

The number of sets which will be published is, of course, very limited, for Prof. Smith gives his personal attention to the authentification of every species, and when we consider the exceedingly low price, which has been fixed for each century, (making the slides cost about one-third of what is usually charged by dealers), those who by early application secure one of these sets, should think themselves fortunate.

Report on a Sample of Water from San Diego.

A careful microscopic examination revealed only the lower animal forms usually present in fresh water.

There is an absence of diatoms and other vegetable forms, which is peculiar.

The water was filtered off and examined chemically. The only noticeable feature was the presence of an unusually large quantity of ammonia.

The dried sediment was weighed, calcined and again weighed. The loss (organic matter) was forty-three per cent., and the inorganic residue fifty-seven per cent.

The examination of this sample has but little significance without more information as to the quantity of water filtered to obtain the sample, and the conditions under which it was collected.

The presence of so large a quantity of ammonia is a subject worthy of attention. If it should be proved to result from the decomposition of organic matter, it would lead to grave doubts as to the purity of the water and its fitness for domestic use.

HENRY G. HANES.

San Francisco, Nov. 2, 1876.

A Willow Fungus.

The following letter, addressed by Dr. Harkness to the Secretary of the San Francisco Microscopical Society, explains itself:

I have to-day sent you, for the Society's Cabinet, a slide—No. 283—together with some willow leaves, infested with a fungus. These diseased leaves are found at the present time in the greatest profusion upon the willows skirting the Sacramento River. You will observe that the fungus appears both upon the upper

and under surfaces of the leaves, in bright yellow heaps (*sori*), which are formed by the aggregation of the spores. This fungus is the *Melampsora salicini* (Lev.) belonging to the order *Œcmacei*. The *sori* are scattered, of a bright orange color in the autumn, becoming dark or nearly black in the winter. The mounted slide exhibits a section of a leaf with the spore *in situ*. These, it will be seen, are crowded into a dense, compact mass, of a bright orange color. The spores are, in many instances, globose; in others oblong, and are filled with granules. The sample I send you is but one of very many varieties of leaf-fungi to be found at the present time throughout the valleys of California.

H. W. HARKNESS.

Sacramento, Nov. 1, 1876.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Resolving Power of Objectives.

Ed. Am. Jour. Microscopy—Whatever may be the variety of opinion as to the value of *resolving power* in objectives, there can be no question that the resolution of difficult tests is a matter of great interest to a very large number of microscopists. An amateur who has recently purchased a costly objective is generally anxious to compare its performances with the reported performances of other lenses of similar focal length. Sometimes the most contradictory results are obtained. In one case he may be surprised and delighted to find that he can easily resolve a test which has been pronounced very difficult by good authority, or, on the other hand, may be disgusted to find that he can make nothing of a test that has been reported "easily resolved" by some writers in the magazines. Of course, a large margin must be allowed for differences in the skill of the observer, and in the comparative difficulty of various slides nominally the same. These differences cannot be stated with any degree of accuracy, but there *is* one important condition which affects the ease or difficulty of resolution in a very marked degree, which can be stated, but which is often entirely omitted from reports of tests of objectives. The condition referred to is the method in which the test is *mounted*. Diatoms mounted in balsam or dammar are much more difficult of resolution than the same objects mounted "dry." An omission to specify the way in which tests are mounted, throws a veil of uncertainty over the entire report. Conspicuous instances of this may be found in Mr. W. J. Hickie's elaborate article on the Zeiss immersion (1-25) published in a late number of the London *Microscopical Journal*, and in the recent fuss made by the San Francisco Microscopical Society over the wonderful performance of a Nachet No. 5, in resolving *Nitzschia Curvula*, No. 18 of the "Möller Probe Platte" into beads. I am credibly informed that in the latter case the Platte was not one of those mounted in balsam, to which reference is usually made, but one of the *dry platten* recently introduced, and that the diatom in question was not *N. Curvula* at all, but *N. Linearis*. I see, however, that Mr. Hyde, of the San Francisco Society, now claims that it *is* a true *curvula*, but unusually easy of resolution. The lesson is the same in any event, viz: Reports of the performance of objectives, in order to be of use for future comparison, should state accurately not only what the tests employed *really are*, but also the method in which they are mounted—*i. e.*, whether *dry* or in balsam, or dammar, etc. It would be well also, when possible, to state the locality from which the specimens were procured, as diatoms bearing the same name but from different localities often differ widely in the fineness and difficulty of their markings. Thus the *Grammatophora Subtilissima*, of Providence, will often utterly defeat a lens that will show the markings of the *G. Subtilissima* from the coast of Spain.

Yours Truly,

GEO. E. BLACKHAM.

Dunkirk, N. Y., Aug. 17, 1875.

Localities of Objects.

Ed. Am. Jour. Microscopy—At the commencement of my studies, I was at a loss to know where to find Infusoria, Desmidiaceæ, Diatomaceæ, etc. I have many times spent half a day or more in the country searching for a suitable pond, and have sometimes returned without finding any; and if I chanced to find one near some public road, or near some farm, then I was sure to attract the attention of all passers-by. Any one seeing a man with a good coat playing in the water with a bottle and a stick, is apt to have his curiosity aroused, and

will come to see what one is about, and we feel rather small to be looked upon as a little insane. But the beauty and interest of the objects that may be found more than repays one for the trouble and annoyance.

The most prolific ponds I have met with are in Prospect Park, Brooklyn, N. Y., especially the miniature lake, which is surrounded by vegetation. There I find many interesting objects, and have met with 9 kinds of Desmids, 18 kinds of Diatoms, 7 kinds of Entomostraca, 23 kinds of Infusoria, 11 kinds of Rotifers, 14 species of other kinds of Confervoidaceæ, as well as two or three kinds of Entozoa. Several times I have met with the water bear (*Tardagrada*). It is a very interesting object under a two-third objective and No. 2 eye-piece. It has eight legs, with four claws on each foot, turned backwards. It is a clumsy-looking animal, much like a puppy-dog, and is in constant motion, but makes little progress. It has no tail, a round blunt head, and sometimes I have seen what might be taken for two eyes. The body is transparent, and exhibits an immense number of globular particles of various sizes in constant motion, but not in circulation. In some I have noticed a number of eggs, sometimes eight or ten, and once or twice I have seen them in the act of casting their skin, and their eggs go with it, but how the eggs are hatched I have not ascertained. There is a kind of sac full of green matter, which I suppose is the stomach, and also a gizzard at work. I have not met with a good description of it. Perhaps some of our microscopical friends can describe it more fully. W. FARNELL.

Brooklyn, N. Y.

Microscopic Examination of Volcanic Dust.

Professor Nordenskiold has carefully examined the dust which was recently brought down by a snow storm on the hot-beds of one of the Royal Swedish residences, and which is supposed to be of volcanic origin. It was found to consist for the greater part of small translucent or transparent, angular, uncolored, glass-like particles, which formed elongated filaments, bent sabre-fashion, or sharp-cornered flat bodies, partly plain, partly connected together in the form of Y or T. They show no special action with polarized light, and are supposed to be the broken up remains of small masses of lava, suddenly cooled from a melted condition. This might result from their being carried out of the volcano in a highly heated condition by the sudden outburst of steam and hot gases, and their being suddenly cooled by contact with the upper strata of the atmosphere, they would acquire the property of the well-known Bologna phials, and fly to pieces on receiving the slightest scratch.

Hints to Beginners.—No. I.

It has been well said that a record of failures would be quite as valuable as the story of a success, since it is almost as important to know what to avoid as to know what to do. And besides this there are many hints and scraps of advice, the value of which has impressed itself upon all workers, but which are not generally found in the books, because most authors have thought it beneath their dignity to allude to them. Looking back over an experience of many years, we can call to mind many failures which a little sound advice would have enabled us to avoid, and a few successes which depended upon very trivial points; and for the benefit of the younger readers of the AMERICAN JOURNAL OF MICROSCOPY, we propose to commit them to paper.

There are two notable classes of unsuccessful beginners in microscopy. The first is those who get a microscope—oftentimes a very good one—look at a few slides which they have procured ready mounted; attempt to prepare a few simple objects, meet with no great success in the effort, and then never look through the instrument again. Failures of this kind are due to want of energy and that interest in the subject without which success is not to be expected. We know of no hints or precepts that can possibly prevent the failure of such persons.

Another class fail because their methods are wrong, and because they commit numerous errors, which a little forethought and knowledge would enable them to avoid. Such persons, however, rarely become total failures. They do some work; if wealthy they patronize the instrument makers, and help to support them, so that they may do good work for poorer and better men, and they form useful and important members of our microscopical societies. But they never become microscopists. It is chiefly for the purpose of preventing beginners from falling into this class that these lines have been written.

The besetting sin of most young microscopists is attempting too much. We do not mean that they attempt to do their work too thoroughly, or that they do too much of it, but that they spread themselves over too wide a field, and their labor is lost because it is not concentrated. It will in almost all cases be found that with such persons the microscope is an *end* instead of a *means*. Their object is to collect an extensive cabinet, not to thoroughly study up some special subject. They make immense collections of material, of which they know comparatively little, and which they never work up. Their talk is ever of fine objects, never of great truths; and so long as their slides are pretty it is a matter of indifference whether or not they teach anything. Some of this class do a great deal of work at mounting, at which they become tolerably expert, and they are great for exchanges. With them "any well-mounted object will be acceptable," if it is only pretty.*

But the majority of the class neither study nor mount to any great extent. Their efforts end in collecting material. It is true that they *begin* to prepare a great deal, and their shelves are filled with macerated insects, which have long since gone to decay, because not attended to in time, and flasks of diatomaceous earth, which have remained for months half boiled. There is neither work nor study here.

With many the cause of this state of things is not that they become careless, but that they have laid out too much work for themselves—so much, in fact, that it would be a physical impossibility for them ever to finish it. They will learn this in time, but only after their best years have been wasted and their ardor cooled. Their reading has made them enthusiastic in regard to every subject to which the microscope can be applied, and they want to do a little at all—botany, animal physiology, entomology, mineralogy, everything—and the consequence is that they do nothing at anything.

AN OLD WORKER.

(To be continued.)

*We do not mean to say that all who are willing to accept "any well-mounted object" belong to this class, because all well-mounted objects are, to a certain extent, valuable for study, but we have found that this class are always very eager for *any* objects. Some of our best workers offer exchanges for things outside their specialties, for the purpose of adding variety to their collection, they not having time to work up objects unconnected with their special studies.

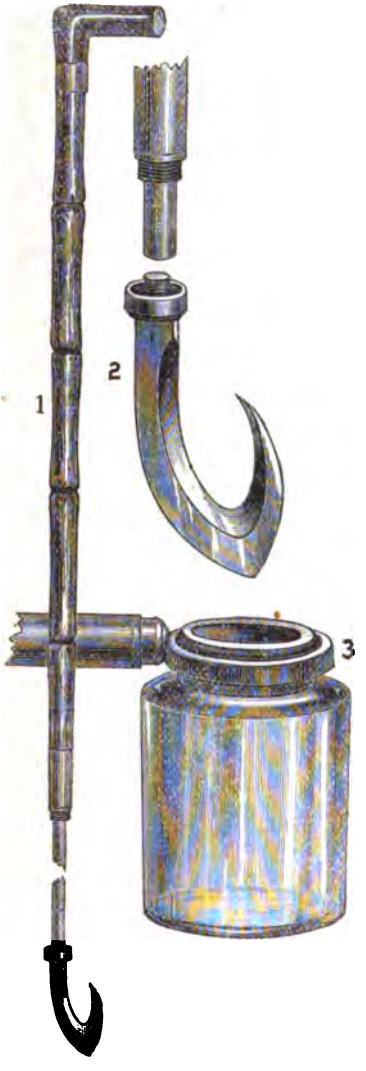
Our Work Table.

A Simple Water-Strainer.—The collector who desires to make a thorough examination of the microscopic flora and fauna of any pool or stream, must not rest satisfied with infinitesimal quantities of material. It is not necessary, however, to lug home a gallon of water for the sake of the objects contained in it, and so fully have microscopists been impressed with this idea that the devices which have been prepared for straining out the valuable portions are almost endless. The best and simplest that we have seen is a modification of an arrangement figured in Beale's work on the micro-

WATER-STRAINER.

scope. It consists, as shown in the engraving, of a bag or net of some light material, to the bottom of which is attached by means of a rubber ring, a wide mouthed bottle. Any quantity of water may be poured into the bag, and all the objects which it contains will roll down the sides of the bag and fall into the bottle, while the fluid escapes through the sides. Delicate objects are consequently not exposed to pressure, rubbing, or any other violence, as they would be in an ordinary filter or bag, and the whole affair is so simple that any one can make it. We have used it with the most gratifying results.

Compact Collecting Outfit.—It is an old saying amongst sportsmen that the best game generally presents itself when the means for capturing it have been left at home. What is true of the larger game of the sportsman, is too often the case in regard to those minute objects so much sought after



COMPACT COLLECTING OUTFIT.

by microscopists. We recently came into possession of a very complete and compact arrangement for searching ponds and streamlets, and as we have found it of great use, we concluded to give a figure of it.

The main part forms a very convenient walking cane of ordinary appearance. Like many fishing rods, however, it is hollow, and contains a second rod by which it may be extended to twice its length. This enables the user to reach the bottom of any ordinary pond, and to reach as far as is necessary from the shore. Accompanying the cane are the hooked knife (Fig. 2), and the ring and bottle (Fig. 3). These are made with a double screw, so that they may be attached either to the end of the cane itself, or to the inner rod, and in this way we can have either a short and stout handle, or a longer and more slender one, as circumstances may require. The bottle is made so as to screw into the brass ring, and the same screw enables us to fit a wooden cap on it, which thus encloses the contents tightly. The hook is made of fine steel, and has a sharp cutting edge, as seen in the engraving, so that it is easy to cut off a piece of weed, drag it out of the water and secure it.

Those who carry such a cane do not attract attention by any unusual paraphernalia, and at the same time they are at all times ready to secure any valuable material that may present itself. Several bottles may be carried in the pocket, and screwed into the ring as required.

Our Book Table.

Nature: A weekly Illustrated Journal of Science. London and New York: MacMillan & Co. $5 per year.

This journal has now reached its fifteenth volume, and has become the accredited organ of the leading scientific men in Europe and America. While thoroughly sound and reliable, it is always popular to as great an extent as the subject treated will allow. Hence it is just the paper for those who desire correct views of the current progress of science. The excellence and beauty of its illustrations are beyond all praise.

Anthony's Photographic Bulletin. Published by E. & H. T. Anthony & Co., New York. Terms $2 per year.

Photography has now become an important aid to most sciences. In it the microscopist finds an easy method of rendering fugitive appearances permanent, and of multiplying to a certain extent preparations which would otherwise remain unique. Those who desire to do their own work, and thus acquire a certain degree of independence, will find the journal before us valuable, as giving the new improvements which are continually arising.

The Sanitarian, and Organ of the Medico-Legal Society. A Monthly Magazine Devoted to the Preservation of Health, Mental and Physical Culture. A. N. Bell, M. D., Editor; J. Y. Culver, C. E., Associate Editor. New York: Campbell & Co.

The November number of this ably conducted journal contains an excellent article in regard to "Sanitary Requirements in School Architecture." Also one on the "Ventilation of Dwellings," together with reports of the proceedings of the American Public Health Association, and the Medico-Legal Society. The journal deserves the attention and support of those who are interested in the prevention of disease, and that means everybody.

Monthly Microscopical Journal. November, 1876. I. Microscopical Structure of Amber; by H. C. Sorby, (plate). II. Diatomaceæ in Slides of Santa Monica Deposit; by F. Kitton. III. Curious Fact in Connection with certain Cells in the Leaves of *Hypericum Androsæmum;* by W. Hinds. IV. the Present Limits of Vision, Further Elucidations; by Dr. Royston Pigott. V. Comparative Photographs of Blood-Disks; by G. Gulliver. VI. The Structure and Development of Connective Substances; by Thomas E. Satterthwaite, (two plates).

Journal of the Quekett Microscopical Club. No. 32. I. The Principles of Illumination in Connection with Polarization; by W. K. Bridgman, L. D. S., (illustrated). II. A New Method of Mounting Microscopical Objects; by Prof. H. L. Smith. III. A New Process of Histological Staining; by Dr. Frances E. Hogan. IV. *Tubicolaria Najas;* by James Fullagar, (illustrated).

The Canadian Entomologist. London, Ontario, September, 1876. Edited by Wm. Saunders. $1.25 per year.

New Books.

"Plain and Easy Account of the British Fungi," with especial reference to the Esculent and Economic Species. By M. C. Cooke, M. A. New and revised edition, with colored figures of thirty-four varieties and numerous woodcuts. 8vo., 6s. London: Hardwicke & Bogue.

"Manual of Structural Botany." By M. C. Cooke, M. A. A new edition, with Chemical Notation. 200 woodcuts. 1s. London: Hardwick & Bogue.

"Contemporary Evolution." An Essay on some recent Social Changes. By St. George Mivart. 12mo., 254 pages. $1.50. New York: D. Appleton & Co.

"Principles of Human Physiology." By William B. Carpenter, M. D., F. R. S., F. G. S., F. L. S., Registrar to the Univ. of London, etc. Edited by Henry Power, M. B., London, F. R. C. S., Examiner in Natural Sciences, University of Oxford, etc. A new American from the eighth revised and enlarged English edition. With Notes and Additions by Francis G. Smith, M. D., Prof. of Institutes of Medicine in the University of Pennsylvania, etc. Illustrated. 8vo. $5.50; leather, $6.50. Philadelphia: H. C. Lea.

NOTES AND QUERIES.

Ed. Am. Jour. Microscopy.—Is there any process by which adipocire can be removed from bones? I have occasion to clean bones frequently, and am troubled at times by the formation of this disagreeable substance, which I have found no means of removing, except by the laborious process of scraping. I have talked with many persons on the subject, and get no information. Perhaps among your subscribers you may find some one who can tell me some way of removing the deposit easily.

H. V. H.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—The regular meeting of the San Francisco Microscopical Society was held on Thursday evening Oct. 19, with a large attendance of members, and A. L. Sobey as a visitor. President Ashburner was in the Chair, having returned from quite an extended tour among the microscopists over the mountains, and during the evening gave an interesting and full report of what he had seen and learned.

Under the head of "Additions to the Library," there were announced the *Cincinnati Medical News* for September, *American Naturalist* for October, AMERICAN JOURNAL OF MICROSCOPY for August and September, two copies of *Flora*, six of *Nature*, and a "Monograph of the Cirrepedia," Darwin.

Mr. J. P. Moore presented the Society with two volumes of "Spencer's Biology," and Prof. Ashburner stated that he had purchased for the Society, while East, one of Tolles' one-sixth immersion objectives, one each of Tolles' solid one-half and one-quarter inch eye-pieces, and a Wenham reflex illuminator, the latter of which was tested during the evening for oblique illumination while resolving some test diatoms, and it was satisfactorily proven that one of the greatest advantages of the accessory was its use with the ordinary thick stages, which preclude the obliquity of light necessary for tests with high powers. While speaking of this, President Ashburner stated that in his interview with Prof. J. Edwards Smith, of Ashtabula, Ohio, he noted the fact that his stage was of extraordinary thinness, and was one of the apparent essentials when nothing but illumination from the mirror was used. He also took occasion to state that his *seance* with Prof. Smith was highly interesting, and that all that was promised was done. The Society's duplex one-tenth of Tolles' was used, and the Society's balsam Möller proof-plate, and Prof. Smith showed Nos. 18, 19 and 20 clear and distinct within fifteen minutes, although he admitted that the Society's glass was not equal to his.

President Ashburner has proved an apt scholar

in the manipulation of the objective, and from a subsequent interview with Mr. Tolles, and with the tenth overhauled and refitted, he is equal to the emergency, being able to show members of the Society the lines on 18, 19 and 20 as plainly as the pickets on a fence. The new Tolles' sixth also resolves in his hands the same tests without difficulty, on a balsam plate, and which is just what it represents to be.

Mr. J. P. Moore made a further statement regarding the grapevine fungus which he had examined and reported on at a previous meeting, to the effect that the same Erysiphe he had found since on the native vines.

Mr. G. W. Barnes of San Diego, sent a communication to the Society, accompanied with a bottle of sediment obtained from the water supplied to that city from the bed of the San Diego river, and desired a statement as to its characteristics microscopically. It was handed to Mr. Hanks, who promised a report at the next meeting.

Dr. Wythe exhibited a photograph of Zentmayer's new model, and during the evening Mr. Banks filled one of the revolving tables with instruments just from the Centennial Exposition. Among them was Crouch's standard microscope, with new centering arrangement, which was most perfect; one of Walmsley's binocular stands, and a Holmes' class stand. A little scientific apparatus in the way of Crooke's Radiometer attracted the wondering attention of all.

Owing to the increase of members, and interest in the meetings, it has been thought for some time that a change to more commodious quarters would be of advantage, and to this end it has been decided to move on the first of the coming month to a fine suite of rooms in the new building on the southeast corner of Kearny and Sutter streets.

The regular meeting of the San Francisco Microscopical Society was held on Thursday, Nov. 2, with Vice-President H. C. Hyde in the chair. As this was the first meeting since the decision to seek more commodious quarters, there was a good attendance of members. Mr. W. C. Hendrie was present as a visitor.

Additions to the Library were announced in the way of the September Number of the *Journal Queketi Microscopical Society*, October number of *Quarterly Journal of Microscopical Science*, October numbers of *Monthly Microscopical Journal*, *Nature*, and *Flora*. Mr. J. P. Moore presented the Society with two volumes of Herbert Spencer's "Principles of Biology."

Mr. H. G. Hanks donated a quantity of material for mounting in the way of Cinnabar crystals, showing double termination, from Sulphur Bank, Lake county, California. He also exhibited a specimen of beautifully crystallized Polybasite, from Austin, Nevada, which silver mineral is rarely found so interesting.

Referring to the sample of water handed to him at last meeting, Mr. Hanks presented a paper, published elsewhere, embodying the facts ascertained in his examination.

Mr. Attwood presented to the Society four slides, with the statement that the alluvial gold marked No. 1, from Sea Margin, Otago, New Zealand, very closely resembles that which he had examined from this Coast, the gold presenting the same scaly and laminated character, with a beautiful, clean and bright surface, rendering it so easily acted upon by mercury, and apparently so well fitted for amalgamation.

No. 2—Section of Smaragdite rock from Gilroy. An exceedingly beautiful section, the smaragdite forming a compact matrix, in which crystals of garnet are porphyritically enclosed.

No. 3—Section of Smaragdite rock from Bavaria.

No. 4—A section of trachytic greenstone from the C. & C. Shaft, Virginia City. It is the same character of rock as that met with in No. 4 Shaft, Sutro Tunnel, the smaragdite having small particles of magnetite embedded in it.

Mr. Attwood also exhibited nineteen specimens of alluvial gold from New Zealand, which had been presented to him by Doctor Hector, Director of the Geological Survey of New Zealand. Small portions of each specimen were mounted on slides for microscopic examination, and were from the following localities: No. 40, Torrent washed, Otago; 14, Lake Margin, Otago; 16, Sea margin with iron sand, Otago; 8, Tertiary sea beach, Nelson; 39, Tertiary Lake beaches, Otago; 17, Tertiary River Terraces, Otago; 33, Re-Wash of River Terraces by Sea, Otago; 29, Re-Wash of Lake Beach by Sea, Otago; 23, Re-Wash of lake or stream gold, Otago; 34, Older gold drift of Otago, Eocine; 8, Older gold drift of Westland, Pliocene, 180 feet below the sea; 6, do. 1,700 feet above the sea; 15, torrent bed in mesozoic rocks; 2, from old conglomerate (cretaceous age) coal measures, Westland; 21, creek placers; 2, Silurian; 4, Devonian; 3, hydraulic sluicing of gravels in base of mountains; A, native crystals of gold alluvial from Mica Schist.

This series of slides attracted a large share of the attention of the members during the evening, and to the geologically inclined were found of great interest.

Dr. Harkness, who is hard at work up country, sent the Society some leaves with a fungus found on them, and also a slide, mounted by him, with spores of the same, which was accompanied by a paper on the Willow fungus, published in another column. Apropos of funguses and the many forms assumed by them in their development, which are noticeable to even the most casual observer, that of the *Phalloidæ* is, perhaps, the most marked,

though rare.* Mr. Kinne exhibited one found by Dr. Wythe in Oakland, growing in the open lawn, though their usual *habitats* are woods and hedges. This fungus, which is highly poisonous, was identified as *Phallus impudicus*.

The new rooms of the Society deserve more than passing notice, and are situated in the Thurlow Block, corner of Kearny and Sutter streets, and is the suite composed of Nos. 43 and 44, located on the fourth floor, to which the elevator conveys the visitor speedily and without fatigue. The meeting-room is handsomely carpeted, well-lighted and fitted with book-cases and cabinet, which contain the rapidly increasing library and objects. The working-room is also fitted with all the necessary conveniences for the use of microscopists, either amateur or veteran, and, altogether, they form a pleasant spot for the scientifically-inclined to read, study or work, and, no doubt, the list of members will be increased by the change of base.

Dunkirk (N. Y.) Microscopical Society.—Special meeting, Tuesday evening, Oct. 31, 1876, George E. Blackham, M. D., President, in the chair. Circumstances having rendered it inconvenient for the society to meet in their rooms at the City Hall, George P. Isham, Esq., invited the society to meet at his residence. The invitation was accepted with thanks.

The attendance of members and visitors was unusually large, and there were present by special invitation the following gentlemen: L. M. Kenyon, M. D., Henry Baethig, M. D., Henry Mills, Esq., George E. Fell, Esq.

The President, after a few words of welcome to those present, introduced Prof. J. Edwards Smith, of Ashtabula, Ohio, who proceeded to read a long and highly interesting paper on "the Use and Abuse of the Microscope as an Instrument of Precision." The paper was too long and exhaustive for justice to be done it in a summary. It is sufficient to say that Prof. Smith took a position radically opposed to many of the received ideas, and in favor of lenses of the widest angle of aperture for all kinds of work, even going so far as to express his opinion that most of the work in histology and pathology done with the so-called "working lenses" of narrow angle, would require further attention, and with wide-angled objectives, which recent advances of the optician had put at our command.

After the reading of the paper, the meeting was resolved into a conversazione for the examination of the various instruments, objectives, and specimens, which had been brought by the members of the society and their guests.

Mr. Mills, of Buffalo, exhibited a beautiful specimen of Crouch's large binocular stand, and various lenses, among them an immersion No. 10, (1-16th) by Hartnack. The exhibition of the circulation in *chara*, by Mr. Mills, under the binocular, with a power of 75 diameters, attracted much attention. Dr. Kenyon exhibited a Powell & Lealand 1-16th, of recent construction, with dry and immersion fronts. Mr. Fell exhibited a late immersion 1-16th, by Gundlach. Prof. Smith exhibited a Zentmayer army hospital stand, with extra thin stage of his own design, Tolles's 1-10th and 1-6th duplex objectives of 180° air angle; Tolles's ½ and ¼ inch solid eye-pieces, amplifier &c. Also a microscope lamp of new construction. The flame of this lamp is only about 2½ inches above the table—kerosene oil is burned. There is no chimney, the draft being supplied by a fan driven by clock work. The lamp burns with a perfectly steady flame of great intensity.

The President exhibited a Queen's Student's stand with three eye-pieces—Tolles' one-inch objective of 30° aperture, and Tolles' 1-6th duplex immersion objective of 95° balsam angle. The following severe tests were exhibited by Prof. Smith to convince the doubting ones (of whom several were present) of the correctness of the positions assumed in his paper. 1: *Navicula* (*pleurosigma*) *angulatum*—resolves into hexagons, direct light—central illumination being secured by a diaphram plate perforated with an aperture 1-200 of an inch in diameter, and accurately centered. 2. The transverse strise of *Amphipleura pellucida*, (*navicula acus*)—the No. 20 of the Möller *balsamed* plate, illuminated by Wenham's "reflex" (in this case *direct*) illuminator,—amplication 2,000 diameters. 3. Nos. 18 and 19 of same Probe Platte, with same amplification and illumination. 4. Resolution of the 19th band of Nobert's 19-band test-plate (lines 112,600 to the English inch) with ordinary oblique illumination 75° from axis. (All of the above with Tolles' duplex four system wet 1-10th of 1875.) 5. Resolution of the 19th band of Nobert's 19-band test-plate, with Tolles' 1-6th immersion (duplex) objective of 1876; B eye-piece, amplification 540 diameters, illumination as in No. 4. 6. Resolution of the third band of the same Nobert plate, 22,500 lines to the inch, with Tolles' one-inch objective of 30° aperture, ¼-inch solid eye-piece, amplifier, and draw tube. Amplification 740 diameters.

In view of the unusual nature of some of these tests, and the acknowledged difficulty of showing them by lamp-light, and in a crowded room, a statement that each and all had been shown, and that the resolution in each case was palpably strong and decisive, was drawn up, and has been signed by all the members of the society, and their guests, who were present.

Mr. Mills presented the society with a beautiful slide of *Stephanodiscus Niagara* and a quantity of living chara.

*[Owing, doubtless, to the very dry character of the California climate.—Ed. A. J. M.]

After a vote of thanks to Prof. Smith for his paper and demonstrations, and to Mr. Isham for his hospitality, the society adjourned.

Boston Amateur Scientific Society.—Mr. Charles Stodder of the Boston Microscopical Society, gave a very interesting talk on the Microscope at the rooms of the Boston Amateur Scientific Society, on Saturday evening, Nov. 25. He exhibited four beautiful microscopes of American, English, German and French models, for comparison, including one made some seventy-five years ago, which was quite a curiosity compared with those of modern make. A large number of objects were examined, including a mounted slide of diatoms from Richmond, Va., which was, without exception, the finest that any of the members had ever examined. This will be followed by other talks on the same subject, and a microscopical section is contemplated.

E. F. Sawyer, Secretary.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. Exchanges only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Wanted, one of the famous Barton buttons; must be in good condition. Will give either money or good exchange. E. W., Box 4,885, New York.

Isthmia nervosa, etc., *in situ*, on sea weed, in exchange for other interesting mounted objects. Address Jos. McKay, 24 Liberty street, Troy, N. Y.

For Daphnia pulex, send other unmounted objects—Polycystina especially—to A. Y. Moore, P. O. Box 68, Coldwater, Mich.

Wanted, good slides of vegetable or other objects, for sections of Japanese coniferous wood from Japanese Dwelling, Centennial Exhibition. E. Pennock, 805 Franklin street, Philadelphia.

For Carboniferous Limestone Sand containing fossil polyzoa, etc., send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Mounted scales of Lepisma saccharina, and of Polyzoa, a very handsome variety, in exchange for other well mounted objects. Address N. C. Small, 37 East Springfield street, Boston, Mass.

Slides of diatoms containing Stauroneis Phœnicenteron, Cymbella Ehrenbergii, Circular Gonphonems, Navicula, etc., in exchange for any well mounted object. William Beadio, Garnerville, Rockland County, N. Y.

Wanted, slides of pathological or anatomical preparations, in exchange for diatomacean fossil and other well mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Wanted to exchange, periodically, filterings from the water supply of Buffalo for the same of any other city. D. S. Kellicott, 119 Fourteenth street, Buffalo, N. Y.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Slides of pollen of Agave Americana and other southern United States flowers, for any well mounted objects. Mat. Stuart Beard, Box 1817, New Orleans, La.

For spines of Echinus send objects of interest, Polycystina especially, to F. F. Stanley, 40 Pearl street, Boston.

Pure guano, containing diatoms, in half-ounce packages. Has been washed in pure water. Anything of interest accepted. E. W., Box 4875, New York city.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Stained petals, leaves, and sections of some common plants to exchange for other mounted objects. Address F. H., Box 98, Cherokee, Iowa.

Wanted, well-mounted specimens, for slides of American Podura mounted whole, and scales of same. Address Geo. W. Fries, Friendship, N. Y.

Wanted in exchange, well mounted specimens for mounted sections of either lung or kidney specimens, showing perfect minute anatomy of these organs. Also, injected sections of human stomach, mounted, for other histological specimens. C. E. Nichols, M. D., 14 Fourth street, Troy, N. Y.

Slides of fossil diatoms from Nova Scotia, for any other mounted objects. G. C. G., Box 2055, Rockford, Ill.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 355, Milford, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield, Mo.

Wanted, slides of diatomaceæ or foraminifera in exchange for pathological preparations. Geo. A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

BOOKS WANTED.

Dr. Fleming's book on "Blood Stains in Criminal Trials"—Pittsburg, 1861. Also any other work on detection of blood stains.
Pritchard's Infusoria. Edition of 1861.
Brunet, Manuel de Libraire. Last edition.
"Micrographic Dictionary." Second edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Faraday's "Electrical Researches." 3 vols.
"Botany of the State of New York." 2 vols., 4to.
Holtzapfel's "Mechanical Manipulation."
Ehrenberg's "Mikro Geologie."
Ehrenberg's "Die Infusions Thierchen."
Williamson's Recent Foraminifera.
Pritchard & Goring's Works (any vols.)
Hook's "Micrographia."
Carpenter on "Foraminifera."
Beck on the Microscope.
Address, stating price, (which must be low) E.W., Post Office box 4,875, New York.

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POPULAR SCIENCE.

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The Richmond Diatomaceous Earth.

HE stratum of fossiliferous earth underlying the cities of Richmond and Petersburg, in Virginia, when first discovered by Professor Wm. B. Rogers, in 1842, was supposed to be peculiar to those localities. The further investigations of geologists have shown it to be a material constituent in various parts of the great tertiary formation which bounds the continents of North and South America, and, perhaps, those of the Eastern Hemisphere also. I am indebted to Mr. Charles Stodder for the interesting fact that a stratum of diatomaceous earth, apparently the same as the Richmond deposit, has been found at a depth of five hundred feet at Fortress Monroe, in boring an artesian well.

The deposit at Richmond has long been famous with micro-geologists for the great variety of beautiful forms it contains, the illustrious Ehrenberg having assigned to it one hundred and twelve species—nearly double the number to be found at any other place on the Atlantic coast; and the subsequent researches of microscopists have shown it to be perhaps the richest deposit of the kind in the world, every new preparation of the earth revealing some forms not before noticed, many of the most interesting remaining unnamed or described to the present day. The stratum varies in thickness from twenty to forty feet; and Major Bolton, engineer of the Church Hill Tunnel, at Richmond, (which pierces the deposit for three-fourths of a mile), informed me that at certain points of that excavation it reached a maximum thickness of eighty feet. In addition to an inexhaustible supply of the diatomaceous earth, that work brought to light thousands of fossil remains of gigantic marine monsters, that, long ages ago, swam in the deep ocean that must have covered the spot where the the city now stands. An observation of the sections made by the various water courses which cut through the plateau on which Richmond is built, shows the deposit to be nearly level—its upper surface about fifteen or twenty feet below the top of the ground, and perhaps one hundred feet above tide-water. The Petersburg deposit was regarded by Prof. Tuomey as belonging to a different geologic era from that at Richmond, this conclusion being based upon the fact of his finding the casts of certain species of Pectens and other miocene fossils below that deposit, while at Richmond they are found above. The great difference in the character of the two deposits would also

indicate this, the Petersburg diatoms being generally much more transparent than the Richmond forms, and differing also materially in species. Upon exposure for some time to the weather, this earth assumes an almost snowy whiteness, and crumbles to a fine powder; but as first dug from the depths of the earth, it resembles bituminous coal in color and solidity—so tough and hard is it, that in removing it from the tunnel it was blasted with gunpowder, just as any other rock. Its composition, as nearly as can be estimated in a general way, is: 10 per cent unbroken forms of the diatomaceæ, 25 per cent fine white sand, and the balance fine clay, formed, perhaps, mostly of the decomposed and broken diatoms—the whole mass interspersed with many sponge spicules, and a few polycystina, and so strongly impregnated with alum that many of the wells and springs in Richmond are injured by it. To the microscopist this deposit is a source of unfailing interest, whilst the most inexperienced in such matters, upon being shown the wonderful forms found in it, are struck with surprise and delight. In looking at these different forms, one is struck with the wonderful resemblance which they bear to things of everyday use, as among them may be found models of almost all the implements used by savages, whether for war, the chase, or in domestic life; witness, for instance, his stone hatchets, arrow and spear heads, knotted clubs, boomerangs, etc.; a catalogue of such matters used by civilized people would embrace plates, dishes, cups, saucers, gridirons, pins, balls, tops, spectacles, watches, anchors, dumb-bells, cannon, coin, musical notes, and many other articles—the investigator being constantly startled by the strange resemblance which hundreds of these ancient natural forms bear to articles used in our houses and workshops. Certain varieties, however, predominate, and their distribution varies with level and locality, the upper portion of the stratum being comparatively poor in forms, while they increase in number and variety as we descend to the middle, falling off again towards the bottom. The genus *Coscinodiscus* seems to characterize this earth, and of it there are dozens of varieties varying from the (microscopically) enormous *C. Gigas* to the minute and elegant *C. Subtilis*, which resembles closely a finely polished opal, requiring a lens of wide aperture and considerable power to show its revelations. *Orthisira Marina* is abundant, whilst many beautiful forms of *Navicula* are found in every gathering. Amongst these we may note two kinds of *Pleurosigma*, one of which, *P. Angulatum*, is a favorite test diatom, and the other, which it is proposed to call *P. Virginica* (as it is the most common form of *Pleurosigma* in the Virginia earths), is remarkable for the beauty of its contour, which exactly copies a willow leaf, and the want of uniformity in its striæ, which are much coarser in the middle than at the ends of the valves. It is easily resolved with a ⅛-inch objective, without the aid of oblique light. The genus *Triceratium* is also well represented by many beautiful varieties, the most interesting of which is *T. Obtusum*, which can be resolved about as easily as *P. Virginica*. *Isthmia Enervis*, *Biddulphia Turmegii*, *Terpsinoe Musica*, *Aulocodiscus Crux*, *Navicula Lyra*, *Gonphonema*, *Heliopelta*, *Asterolampra concinna*, *Asteromphalus Brookeii* and *Synedra* are comparatively rare.

From the great variety of its species, and the wide range in the character of their markings, the Richmond earth forms one of the best and most interesting tests for the performance of objectives of almost every power. On some, for instance, the areolations may be seen with a simple triplet, magnifying 25 linear; on others a first-class twelfth or sixteenth of wide angular aperture, aided by all the modern refinements of illumination, is needed to show them.

C. L. Peticolas.

Green Oysters.—Mr. F. Buckland states that the color of the green-bearded oysters which are found not far from Southend, Essex, England, is due to sporules of the seaweed called "crow-silk," and not to copper, as has been hitherto generally believed.

The Turn-Table.

THE turn-table, although not an indispensable instrument for the making of cells, is one of very great value, since it enables us to do the work better and more neatly in a quarter of the time that it could be done by any other means. No wonder, therefore, that it has been the subject of a great many attempts at improvement, some of which have been directed towards merely

Fig. 1.

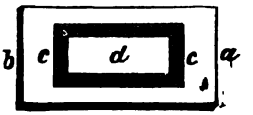

Fig. 2.

cheapening it, while by others it has been sought to render it more easily worked or more efficient. Notwithstanding its obvious usefulness, however, the turn-table is quite a modern instrument, and was unknown even at the time when Quekett published the first edition of his book—the preface to which bears date Nov. 11th, 1848. And as Quekett was at that time a professional microscopist, and Conservator of the Museum of the Royal College of Surgeons, it is to be presumed that if any device of the kind had been in use, it would have been known to him. The methods in use at that time for forming cells were extremely crude, and although they enabled one to mount an object, yet the process was slow and the result inelegant. One plan was to mark, with a writing diamond, on the glass slip, two circles enclosing a ring the size of the cell, which was then painted in by hand by means of a fine brush. This method is sometimes used at the present day, when no turn table is to be had, and a simplified form of the process is given in "Practical Hints on the Selection and Use of the Microscope." Another plan was to mould a small "pond," as it was called, on the slide by means of a wooden trowel. The walls of the pond or cell were made of white lead, and in Fig. 1 we give a picture of the trowel, and in Fig. 2 the appearance of the "pond," both accurate copies of the figures given by the originator. Such cells would hardly satisfy the microscopists of to-day.

The earliest form of the turn-table was that shown in Fig. 3, which was devised by Mr. Shadbolt. This particular form may have fallen into disuse, but it embodies the most important principles of the best instruments, and hence the honor of inventing the turntable is justly attributed to Mr. Shadbolt. It is the only form figured by Hogg, even in the latest edition of his work on the microscope.

The construction and mode of operation

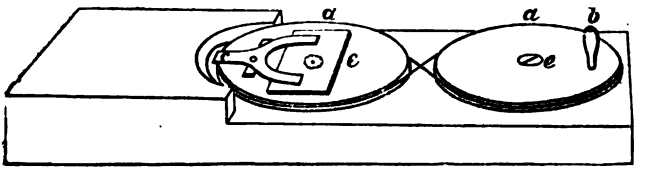

Fig. 3.

of this turn table is obvious. The slide is fixed on one wheel by means of a fork which is pressed down by a spring. The other wheel has a handle, *b*, by which it is rotated, and being connected with the first wheel by means of a band, that too is caused to turn. A block of mahogany, which partially surrounds the wheel carrying the slip, serves as a rest for the hand. The pressure of the fork on the

slide may be relieved by pressing down the single end, *c*.

The more modern form shown in Fig. 4 is the invention of Mr. Jackson. In this one of the wheels is dispensed with, and the wheel which carries the slide is turned by drawing the finger rapidly over the milled projection on the spindle. This form is much simpler than that shown in Fig. 3, but in our experience it is not so steady.

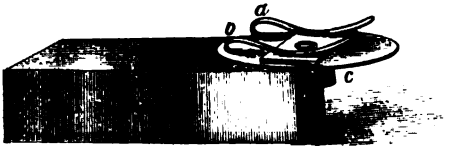

Fig. 4.

In order that the wheel may revolve by its own momentum for a sufficient length of time, the spindle which carries it must fit very loosely on the upright pin which supports it, and this allows a slight lateral motion.

The double wheel and handle are, however, so inconvenient that numerous attempts have been made to devise something more convenient than this primitive form, and something more steady than that shown in Fig. 4. A well-known microscopist of New York employs a clock movement to give motion to his turn-table, and finds it a great improvement. An old clock movement does not cost much, and it will drive a turn-table for an entire evening with one winding. The motion is easily regulated, and is very steady, which is a matter of great importance. In the common turn-table, the speed of the wheel is never the same at any two successive moments, since it steadily decreases from the time the finger leaves it until it stops, and this circumstance precludes our attaining the best results.

Successful attempts have also been made to drive a turn-table by means of electro-magnetism, and the writer has an instrument of this kind which is driven with great steadiness and power by a single sulphate of copper cell. It is exceedingly convenient and does excellent work.

The means used for driving the wheel are, however, of less importance than the methods employed for centering the slide and holding it in its place. In the earlier forms of the instrument the slide was simply held against the wheel by means of two spring clips, and the sole guide of the operator in the process of centering was a few rings turned or marked on the wheel. In the hands of experts this was quite sufficient, for one used to "chucking" or "centering" objects in a lathe can centre a slide with the utmost exactness in an incredibly short space of time. But for the generality of microscopists this simple arrangement was soon found to be insufficient, and the next step was to supply a guide, in the shape of three pins inserted in the wheel, the *sides* of the slide resting against two of these pins, while the end abutted against the third. The position of these pins was such that when an ordinary 3 by 1 slide was pressed firmly up against them, the centre of the slide coincided accurately

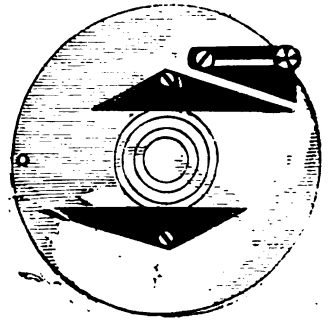

Fig. 5.

with the centre of the wheel. After a careful examination of a gross of slides, we find that none of them vary more than a sixteenth of an inch in length, or a thirty-second in width from the standard, and this variation is imperceptible to most eyes, except when the cells are very large. But in order to get rid of even this error, C. F. Cox, Esq., of this city, has devised an ingenious adaptation of a common form of

lathe chuck, in which, by means of a right and a left-hand screw, two jaws are moved simultaneously to or from the centre, and so clasp the slide and hold it absolutely central. If the slide should be truly rectangular, it will be correctly centered every time, no matter what its size, and as slides which vary from the standard 3 by 1 size, have recently come into very extensive use in some special departments of natural history, Mr. Cox's turn-table will prove of great value.

Another and a very ingenious self-centering turn-table has been devised by Mr. Schrauer, microscope maker, of this city. He arranges two triangular plates of brass upon the surface of the wheel, as shown in Fig. 5. These plates rotate upon pins placed at

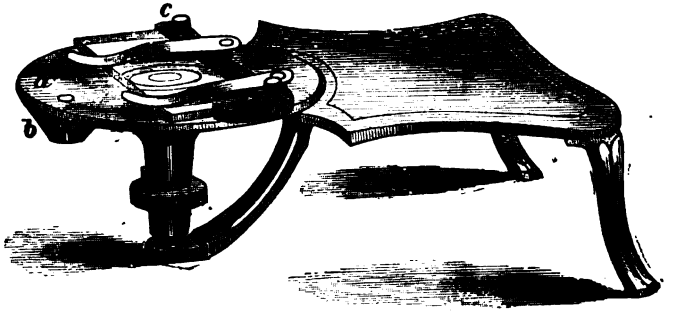

Fig. 6.

equal distances on each side of the centre, and as the plates are of the same size, whenever their inner faces are parallel these faces must be equi-distant from the centre. Hence, when a slide with parallel sides is placed between them, and the plates turned so as to press upon the sides of the slide, the slide will be truly centered so far as its width is concerned. It is centered for length by a stationary pin, against which the end is always brought. Slides of irregular size are therefore centered only one way. In the Cox turn-table, the slide is grasped by the corners, and is consequently centered *both* ways.

To both of these forms, however, as well as to the simple form with stationary pins, there is this serious objection, that slides which have been worked on other turn-tables cannot easily be re-varnished or re-sealed on them. In other words, if the cell be originally placed out of centre on the slide, it cannot be re-coated on these improved turn-tables, and as it frequently happens that a leaky or disfigured cell by other makers, has to be repaired, the microscopist is compelled to have recourse to an ordinary turn-table, with simple clips. To avoid this difficulty, the writer has devised the following arrangement, which is shown in Fig. 6:

The construction of this turn-table is in general the same as those ordinarily made, the support being a cast iron table, and the wheel revolving on an upright steel spindle. Motion is communicated by means of the usual milled collar. The slide is held in its place by two spring clips, and it is brought to the centre by means of a guide or bar, c, with a square projection. This is carefully arranged, so that a slide 3 by 1 shall be accurately centered. Hence it follows that all the slides put up by the owner may be instantly and accurately centered by simply placing them on the table and bringing them up to a firm bearing against the guide. This bar or guide may, however, be instantly removed when desired, and when this is done, *any* cell may be truly centered by the usual methods. We have here, therefore, a turn-table which enables us always to bring cells of our own make to a perfectly accurate centre, while other cells can be centered at any time with very little trouble.

To most turn-tables there lies the objection that the devices for centering and holding the slide make one side heavier than the other, and consequently, as every mechanic knows, irregular and eccentric motion is the result. On many otherwise well-made instruments it is, from this cause, impossible to make a true cell, particularly if we attempt to work at a high speed. In the turn-table just described, provision is made to obviate this difficulty. A heavy-headed screw, of the precise weight necessary, is screwed into the under surface of the table, and gives a perfect balance to the wheel. It then runs smoothly and true.

Attempts have frequently been made to produce a low-priced turn-table—one that would come within the reach of those who own the simplest forms of the microscope. Perhaps the most successful effort in this direction is that made by Mr. Marshall in connection with the "Field Dissecting and Mounting Microscope." Instead of a circular table, Mr. Marshall employs a strip of stout brass of the exact size of a 3×1 slide. This is supported on a vertical spindle, which fits into a hole in the microscope stage, and the slide is attached to it by means of a couple of small rubber bands. We have seen these turn-tables, but confess that we do not like them. A circular block of hard wood would be quite as cheap as the oblong brass strip, and a great deal more easily used. J. P.

The Microscope in Mineralogy.

IT is only within the past few years that the importance of the microscope in the determination of minerals has been fully recognized, and standard works of comparatively recent date, make no mention of its application, or if they do it is only as to the employment of simple magnifiers. Now, however, the microscope has attained almost as much importance as the blowpipe, and no laboratory can be considered well-equipped if it does not contain a good compound microscope, with polarizing attachments and the necessary appliances for preparing rocks and minerals for examination. The subject has received great attention at the hands of those having charge of our Territorial surveys. Amongst others Mr. Julien, of Columbia College, has paid special attention to the means for preparing rocks and minerals for examination. A few evenings ago he read a paper upon this subject before the New York Academy of Sciences, and not only showed clearly the advantages of careful microscopical examination, but also described the best methods of attaining the desired results. We hope to give at an early day an abstract of his paper.

Mica in the Laboratory.

In a paper read before the American Chemical Society, W. L. Lane suggests several important applications of mica. He says:—Our best analytical balances of 200 grammes capacity are usually fitted with a pair of movable glass pans, or watch-glasses, of three inches diameter, and weighing about 30 grammes. To relieve the delicate bearings of the instrument from this unnecessary weight, and also to increase the capacity of the same in a commensurate degree, I employ as a substitute for these glasses a pair of three-inch mica disks, which weigh less than two grammes, the "gravity bob," if necessary, being adjusted to this change. After three years' daily use, I find these mica pans as good as at first. The abrasion of the mica surface by a platinum spatula (used in weighing), during this period is scarcely visible. The mica used for this purpose is a pure, hard article found in North Carolina. It is as clear or transparent as flint glass, when split sufficiently thin for the purpose to which it is here applied. Another great advantage of the mica is found in its flexibility, which enables one to dispose of weighed material with rapidity and exactness, as by bending the mica into a semi-cylindrical form it can be adapted to the mouth of a flask, crucible, etc., with the greatest ease. Small discs of this material also form excellent transparent covers for platinum crucibles and capsules, where the heat applied does not exceed low redness, as in the conversion of oxalate into carbonate of lime, etc. I feel confident that no member of this society will ever abandon the use of mica scale pans, after a thorough trial of the same.

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In Preparation—Microscopic Bibliography.

THE subscriber has in preparation an attempted bibliography of books relating to the microscope and microscopic work. An effort will be made to have it tolerably complete as regards works in the English language, and it will include many in other tongues. It will be something more than a mere catalogue of size, date, price, etc. Where possible, a description of contents, and a note regarding the special value of each work will be given, and in the case of rare books there will also be a memorandum of where copies may be found. In short the aim of the compiler will be to give such an account of all the books relating to the microscope as will enable any one to select the best books upon any given subject, and to consult such works as may be needed in any special study. He has been urged to this by the numerous requests for lists of books upon different subjects—requests with which it has been utterly impossible to comply. He would be glad to receive notes of any rare books in the possession of the readers of the JOURNAL OF MICROSCOPY. Copies of catalogues and monographs will also be acceptable, and whenever such favors are used full acknowledgment will be made. Address

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Box 4875, New York.

Foraminifera and Barbadoes Earth.

WE have sent out, to all whose requests have reached us, a small sample of chalk, rich in foraminifera. If any have failed to receive it, we will be glad to send another sample on receipt of a request to that effect.

About the middle of May we intend to send out to all who accompany their request with a stamp a small quantity of the famous Barbadoes Earth. Foreign stamps are acceptable, and those to whom it is not convenient to send stamps (and we have subscribers in very out-of-the-way places) can obtain a specimen by sending us their address and directions for transmission.

To Our Exchangers.

SEVERAL complaints have reached us that some of those who use our exchange columns do not respond promptly, and that others send specimens which cannot, in any sense, be considered a fair equivalent for either good materials or objects. We hope that all those who avail themselves of the easy means of intercommunication which we freely place at their disposal, will consider themselves in honor bound to render a full equivalent promptly. To do otherwise is to inflict a great injury upon the study of microscopy, as it destroys that confidence which should exist between those cultivating the same branches of science.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Tingis Hyalina. (*H. Sch.*)

Ed. Am. Jour. Microscopy.—The antennæ of this very beautiful insect are clavate, the eyes are compound, and the beak reaches to the end of the under surface of the thorax; the legs are slender, and the tarsi are composed of two joints. The head, thorax and wing covers are beautifully veined. To show it in its full beauty, it should be examined as an opaque object, and illuminated by means of daylight or lamplight concentrated by means of an ordinary condenser; the upper and under sides should both be shown. In mounting, care should be taken that the background used is a dead black.

During the autumn of 1876 it was very abundant in this locality, on the under surface of the leaves of buttonwood trees, where it could be found in various stages of development.

Dr. A. S. Packard, Jr., in his "Guide to the Study of Insects," says (p. 552) that it is abundant on the willow, but I have not found it so here.

ALLEN Y. MOORE.

Coldwater, Mich,

Microscope Objectives—Wide vs. Narrow Angular Aperture.

Ed. Am. Jour. Microscopy—I find the following in the report of proceedings of the Dunkirk Microscopical Society, in this journal for January, 1877:

"Prof. Smith took a position radically opposed to many of the received ideas, and in favor of lenses of the widest angle of aperture for all kinds of work, even going so far as to express his opinion that most of the work in histology and pathology done with the so-called 'working lenses' of narrow angle, would require further attention, and with wide angled objectives, which recent advances of the optician had put at our command."

This question about the comparative *utility* of lenses of wide or narrow angle is one of the greatest importance to all engaged in, or intending to engage in, any of the branches of the study of pathology, histology or biology; to all who own lenses, or who are intending to own more. It is a question on the decision of which depends the reliability of the claimed results obtained in all those branches of science, and affects seriously the purses of those who purchase instruments. For while it requires *comparatively* but little skill and time to make a fair working objective of small angle, the construction of a high angle objective, *well* corrected for the chromatic and spherical aberration, is one of the greatest triumphs of human skill. Mediocrity in this case is failure.

Now, as is said in the report, there is a wide divergence of opinion among microscopists on this subject. While a few support Prof. Smith, the great majority advocate and recommend the use *only* of small angle lenses, and the lowest cost makes at that.

The object, then, of this paper is to call out the experience, judgment and opinion of those of your readers who have the information and means for the mutual benefit of all students. It is, of course, needful for any one that passes judgment that he should be well accustomed to the use of both kinds of lenses. The opinion of one who has in the course of years used only one, and obtained results satisfactory to himself, can be of little value when contrasted with that of another who has long and fairly tried both. Instances have repeatedly occurred where parties have failed to use to advantage high angle glasses, simply because they did not know how; but when the same glasses were in the hands of one who did know, the results were satisfactory.

It is principally to the teachings of the histologists of Germany and France (where wide angle lenses were unknown until a recent date) that the idea of the superiority of narrow angles is due. In testing and comparing lenses, there are these questions to be answered: Which kind will show what was invisible with the other? Which will show what was visible best? These two points cover the whole performance of a lens.

Dr. W. B. Carpenter has the credit of being one of the most influential advocates of the small angles. The writer of this is in possession of information that, within a few months, an objective of the highest possible air angle was shown to Dr. C at his own house, and he asserted that he saw a certain histological subject *better than ever before.*

Rev. Mr. Dallinger, of Liverpool, and his associate, Dr. Drysdale, have been for some years making the most important contribution to biology ever made. The writer has seen a

letter from Mr. Dallinger (not yet published) that the flagella of a certain monad had been invisible to *all* objectives *save two*, both of the highest attainable angular air aperture. Here we have one case of more and one of better. Will our American histologists contribute their facts?

Let us hear from Dr. J. G. Hunt, Dr. Richardson, Dr. Christopher Johnston, Dr. Blackham, Prof. Morly, Prof. Dr. Wiesiger, Dr. J. M. Rich, Dr. J. R. Webster, Dr. A. F. Holt, Dr. Calvin Ellis, Dr. Fitz, Dr. H. P. Bowditch, Dr. W. H. Rollins, Dr. Eph Cutter, Mr. F. Habirshaw of New York, Mr. Geo. W. Morehouse, Dr. J. B. Treadwell, Rev. E. C. Bolles, and the veteran microscopist, Prof. John Baran. These are a few of those scientists who can speak by authority. If they and others will give their opinion, we shall have the most valuable contributions yet offered to inquirers.

CARL REDDOTS.

Our Book Table.

The Art of Projecting: A Manual of Experimentation in Physics, Chemistry and Natural History with the Porte Lumiere and Magic Lantern. By Prof. A. E. Dolbear, Tuft's College. Illustrated. Price $1.50. Boston: Lee & Shepard.

Every teacher and lecturer is aware of the difficulty of making visible to large classes and audiences many of those more delicate experiments and illustrations, which are absolutely indispensable to the imparting of clear ideas upon scientific subjects. Aside from those objects which are more peculiarly suited to the projecting microscope, such as crystallizations and the minute forms of animal and vegetable life, there are many delicate actions (those of the galvanometer, for example,) which can only be obtained by means of small and very finely constructed apparatus, which is entirely invisible at even moderate distances. The magic lantern, however, enables us to throw figures of these movements upon a wall or screen, so that they may be distinctly seen from the furthest corner of the largest hall. And in addition to this it enables us to use small but clearly-drawn diagrams, which may be enlarged to any extent, and thus, during a single lecture may be shown a series of pictures for which it would have been impossible to find room on any ordinary wall.

The use of the magic lantern (in its various forms of solar and gas microscopes, megascopes, etc.,) is a subject with which many able teachers are comparatively unfamiliar, and the volume before us will do great good by the clear, minute and accurate directions which it gives in regard to almost every point upon which information is needed. The book is evidently the work of one who has had great practical experience, and we have no doubt that any one who will follow his directions will secure success.

We would call the attention of the author to one or two points which it might be well to correct in a future edition. 1. Referring to page 9, we would say that magneto-electric machines, capable of giving a most brilliant and steady light, with a comparatively moderate expenditure of power, are now made in this country (at Newark, N. J.) 2. Page 12. The light produced by an alcohol flame, urged by pure oxygen and thrown upon lime, is not the *Bude light*. The *Bude light* is produced by passing a current of oxygen through the centre of an argand lamp fed either with oil or gas. 3. Page 18. The standard given for illuminating power should be made more definite; as it now stands it reads too much like "a yard of buttermilk."

A Manual of the Vertebrates of the Northern United States, including the District east of the Mississippi River and north of North Carolina and Tennessee, exclusive of marine species. By David Starr Jordan, M. S. M. D., Professor of Natural History in N. W. C. University, and in Indiana State Medical College. 1 vol., 12mo., 342 pp. Price, $2.00. Chicago: Jansen, McClurg & Co.

Every student of natural history knows the absolute necessity which exists for artificial keys whereby the names of plants, animals or minerals may be discovered with certainty and a moderate degree of rapidity. The volume before us attempts to do for the vertebrates of the Northern United States what the ordinary botanical "keys" do for the plants, and so far as we have been able to examine, Dr. Jordan has done his work thoroughly and well. To naturalists in general, as well as to travelers and sportsmen, it must prove invaluable, as by means of it the name of any specimen can be at once determined. And as it is a handy and comparatively inexpensive volume, we predict for it very general favor.

Botanical Hand Book of Common Local, English, Botanical and Pharmacopœial Names arranged in Alphabetical Order, of most of the Crude Vegetable Drugs, etc., in Common Use: their Properties, Productions and Uses, in an Abbreviated Form. By C. E. Hobbs. Somerville, Mass.: A. C. Hobbs.

This work has been prepared for the special use of druggists and apothecaries, but it cannot fail to prove valuable to medical men, and to all who are interested in practical botany. It consists of three alphabetical lists, the first giving the common name with the English and botanical synonyms; in the second the botanical names are arranged alphabetically, each being followed by the common name

and the properties of the plant; the third list gives the names of the pharmacopœial substances derived from the vegetable kingdom with the common and botanical names of the plants from which they are obtained. This mere statement of the scope and interest of the work is sufficient to show its great value.

Report upon the Invertebrate Animals of Vineyard Sound and Adjacent Waters, with an Account of the Physical Features of the Region. By A. E. Verrill and S. J. Smith. Extracted from the Report of Prof. S. F. Baird, Commissioner of Fish and Fisheries, on the Condition of the Sea Fisheries of the South Coast of New England in 1871 and 1872. For sale by Naturalists' Agency, Salem, Mass.

This report is quite elaborate, filling nearly five hundred closely printed pages. It is thoroughly scientific, but it is at the same time eminently popular, as it contains simple and pleasant descriptions of many of the animals, together with an account of their habits and peculiarities. As the report is addressed specially to those who are interested in our coast fisheries, it contains a very full account, not only of the fish themselves, but of those animals that occasionally become their food. To the scientific naturalist, however, as well as to those persons of a more practical turn of mind who desire information in regard to the sources of our "fish harvest," the book will prove of great value.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—A stated meeting of this society was held December 21st, with a good attendance of members, and a number of interesting matters came up which served to entertain those present till a late hour. Mr. E. A. Burdick, of Janesville, Wis.; J. M. Bunting, of New York; and Isaac Lea, LL. D., of Philadelphia, were present as visitors. Prof. Adrian J. Abell, of New York City, was proposed for corresponding membership.

Additions to the library were announced in the way of two copies of *Nature*, two of Regensburg *Flora*, and the December number of *American Naturalist*, by subscription; "Origin of Species," by Darwin; "Descent of Man," Darwin; and "All About the Phylloxera," by purchase. Mr. Isaac Lea donated to the cabinet a sheet of Phlogopite Mica from Canada, and another of Muscovite Mica from Chester county, Pa. Mr. Lea also exhibited a new micaceous mineral known as Hallite, a film of which he placed on the stage of the microscope, and called attention to its characteristics.

Mr. Hanks presented a sample of diatomaceous earth from a newly-discovered deposit in Ione Valley, Amador county, Cal. A small portion hastily prepared showed several forms, mostly *dialoma* and *navicula*.

Four slides, being sections made in different directions of a hard deposit showing woody stucture, found in the body of the Mount Diablo coal vein, and termed "Nigger Head" by the miners, were donated by Mr. S. B. Christy. On examination, the wood fibres were clearly shown, and their general appearance was that of the oak.

Mr. Hanks presented a slide mounted with the matter referred to him at the last meeting, and handed in the following report on a sample of (so called) silver mud from Oregon:

"I have made a careful examination of the sample referred to me at the last meeting of the Society. A fire assay showed it to contain 7.4 per cent of silver, or 184 pounds avoirdupois to the ton of 2,000 pounds, being $3,468 to the ton. Examined microscopically, it was found to contain free silver, mixed with finely-divided mud. A few minute crystals were found with the silver when concentrated by washing, some of which are very interesting. The appearance of the silver does not indicate its source. It is not filings. It is not precipitated by copper from a solution, as it is not crystallized. It has the appearance of having been introduced as an amalgam, but no trace of mercury remains. I have prepared several slides, showing the silver and its associates, some silver precipitated by copper from the nitrate for comparison; silver washed from the sample; also, a specimen of wet mud sent to me for assay by a commercial house in San Francisco. These samples are on the table for examination. The wet mud loses eighty per cent in drying, and the dry residue contains eighty-nine ounces to the ton. Another sample, handed to me to-day by Mr. G. L. Murdock, did not contain a trace of silver. I consider this a remarkable substance. If the silver has been added for fraudulent purposes, which I can scarcely doubt, it is still remarkable, as the person who prepared it has so skilfully covered his tracks that I cannot with certainty declare it a fraud."

The slides were examined, and seemed to fully corroborate the opinion that other hands than those of nature had been instrumental in enriching the sedimentary deposit, which has caused hundreds of people to hasten northward and already stake out some twenty miles of claims.

Mr. Kinne exhibited several slides of diatoms mounted by Prof. H. L. Smith, of Hobart College, Geneva, N. Y., which had been received in the way of exchange, and called especial attention of the members to the preparations of Professor Smith and his authentic series of diatoms.

Mr. J. P. Moore handed in a new fungus, which he described at length, and has named *Lentinus Aurantius*. Pileus dimidiate, or sub-dimidiate, fleshy, coriaceous, depressed, occasionally ap-

proaching cyathiform, 2 to 6 inches broad, orange yellow, sometimes shading to pale umber, covered with large floccose, oppressed ferruginous scales; margin sometimes involute, with remains of white veil attached, cleft at times, or deeply lobed, spliting in drying; stem, eccentric or lateral, short, solid, tough, becoming woody in age, much flattened at pileus, round at base, several stems often coalescing, deeply ribbed and sulcate near pileus, then squamulose, the scales reflexed and for the most part of the same color as the gills; gills of a rich, deep umber, edge entire, obtuse, deep, close, unequal, descending but not truly decurrent. Pilei sometimes two or more together, one overlapping the other, the underlying ones richly colored by the dark brown spores. Found growing in shaft of Prospect mine, Gold Hill, Nevada, where steam from shaft strikes the timber.

President Ashburner referred to the formation of a class in microscopical instruction, being a series of lectures on biology by Mr. X. Y. Clark, son of the late Prof. James Clark, of Boston, and a number of members present handed in their names. Mr. Clark is spoken of as a thorough student, and others of the Society will no doubt avail themselves of this opportunity to improve their microscopical and general knowledge.

The regular meeting of the San Francisco Microscopical Society was held January 4th, with a fine attendance of members, Dr. Harkness being present during the evening. Dr. H. H. Behr, of San Francisco, and Dr. H. P. Babcock, of Oakland, were present as visitors.

Prof. Adrian J. Abell, of New York city, was elected a corresponding member of the society.

The Secretary announced the addition to the library of three volumes of Johnson's Encyclopedia by purchase, copies of *Monthly Microscopical Journal*, *Grevillea*, Cincinnati *Medical News*, and *Nature*, by subscription, and three monographs donated by Dr. Eisen on "Oedegonium," Wittrock; "Umbellula," Lindahly; and "Neomenia," Tullberg. Mr. Attwood presented a complete catalogue of minerals, by Foote, with reference numbers to Dana.

Mr. Ewing donated a slide of phlogopite mounted in balsam for the polariscope, while Dr. Behr presented a number of specimens of Aleurodes, an aphis covered with floccose white filaments. The Doctor stated some of the characteristics of the species during the examination of one of the insects under the microscope.

The society will soon have in its cabinet a complete series of Prof. H. L. Smith's diatom slides, including the five "centuries" issued by him, which will be a valuable acquisition.

The feature of the evening was a lecture by Dr. Gustaf Eisen, Professor of Zoölogy, University of Upsala, Sweden, one of the Society's corresponding members, who called attention to a collection of worms of the family *Euchytræidæ*, order *Oligochæta*, sent to him by the eminent Arctic explorer, Professor A. E. Nordenskisold, in Sweden. The worms were collected during the last Swedish expedition to Siberia and Nova Zembla, and especially from the neighborhood of the River Jenissej. Dr. Eisen exhibited some twenty plates of drawings containing about one hundred and fifty different figures of the various organs of said worms, and illustrated his descriptions by various microscopical slides. The principal points of interest were the following:

The collection contained about eighteen species, or perhaps more, as the whole of the material was not as yet worked up. Of these species, none were previously known or elsewhere described. From Germany three or four species of the same genus have been sufficiently well described to be identified, but none of them have been identified with any in the collection from Siberia.

In the course of his remarks, Dr. Eisen stated that the inner organs of said worms differed very much in size and shape, and furnished the only characteristics by which the species could be distinguished from each other, as no external characters of sufficient value existed. One of the best characteristics is furnished by the size and shape of the nervous system, and especially by the foremost part of the supra œsophagial ganglion or brain. By studying the organization of the different species, one could guess at or even form an idea of the development of the whole genus. For instance, the brain of said worms must originally have consisted of only a slight swelling of the ventral ganglia or nerves, of which the two parts had not as yet grown perfectly together or been differentiated to any higher degree. In such a state of development was yet one of the exhibited species called *Enchytræus primævus*. In fact, by looking at the different species, a perfect series could be seen of the different states of the development of said ganglion or brain. In *Enchytræus nasutus* the differentiation was larger, as the two halves of the brain here were wholly grown together, but still leaving some traces of their former state by being concave, both in front and behind. In *Enchytræus stuxbergii* the differentiation was perfect, as the brain here was convex in front. Said worm was also considered to be more highly developed and organized than any of the other species of the same genus and family. Accordingly, he separated the many species into three tribes, of which the first or lowest had the brain concave in front and behind; the second had the brain concave behind, but even in front; and again, the third or highest standing tribe had the brain convex both in front and behind.

In the worms which were hermaphrodites were

found organs of generation of two kinds—male and female. The female organs consisted of, first, ovaries containing eggs in different states of development, and second, of a pair of receptacles for the spermatozoa, peculiarly shaped, and varying in size and form in different species. The ovaries were generally found in the twelfth segment, the receptacles again always in the fourth segment of the worm counted from the head or the mouth. The male organs consisted of, first, testes producing the spermatozoa, and, second, of a pair of efferent ducts through which the spermatozoa were carried to the outside of the body, and from there to the receptacles in the front part of the worm, where they were stored up in large quantities for future use. The testes were situated in or near the eleventh or twelfth segments, the efferent duct was always found in the eleventh segment.

The minute anatomy and histology of said organs was shown partly by drawings, partly by microscopical slides previously prepared. The shape and development of the receptacles for the spermatozoa furnished good characters by which the different species could be recognized.

The system of circulation was very simple, and consisted only of a single ventral vessel uniting itself with a dorsal one in the front part of the body. The blood was either red or white, the last the most frequent. The lymphatic system was simpler yet, as here no vessels at all occurred, the lympha floating free in the perivisceral cavities of the body. The lymphatic fluid contained corpuscles resembling the blood corpuscles of the higher animals, and in each species a different form of said corpuscles existed, giving good characters for the distinction of the species.

Dr. Eisen stated that he had also found several species of the same genus *Enchytræus* in California, and called the attention of the members of the Society to the value of even the smallest contributions to a collection of California *Enchytræi*, which he was forming, and soon intended to work up. The said worms were frequently found in moist earth, in flower-pots, under decayed seaweeds, etc., and were generally of a pale whitish color, and in size seldom exceeding that of a common pin. The worms could best be preserved in alcohol.

The Doctor's drawings from the microscope were works of art, and with a facile use of the blackboard during his lecture, he illustrated the subject thoroughly, and interested all present.

Dunkirk (N. Y.) Microscopical Society.—The regular meeting of this Society was held Dec. 8th, 1876, the President, Dr. Geo. E. Blackham, in the chair. In spite of a severe storm, there was a good attendance of members and visitors.

After the transaction of routine business, correspondence was read from Prof. J. Edwards Smith, Henry Mills, Esq., and Geo. E. Fell, Esq., corresponding members, and from Saml. Lockwood, Ph. D., Secretary New Jersey State Microscopical Society. The President spoke of his visit to the Buffalo Microscopical Club, and of his kind reception.

The Secretary, Dr. Alling, reported contributions to the library and cabinet of *Field and Forest* for May, July and October, 1876; *Tribune Extra*, No. 36, containing Huxley's American lectures; Buffalo *Med. and Surg. Journal*, December, 1876; also, from Prof. J. E. Smith, a quantity of *Tingis Hyalina*, unmounted, and peristomes of *Funaria Hygrometrica*.

The scientific session was opened with a lecture by Prof. E. L. Marks, Ph. D., on "The Protista," which he described as the lowest form of living things, belonging to neither the animal nor vegetable kingdoms, but partaking of the characters of both. The difficulty of classifying has been in a measure overcome by Prof. Hæckel, who has suggested the creation of a new kingdom to be called the "Protista." Several typical specimens of this kingdom were described. The *Protamœba Primitiva* is the lowest known type of organism; it walks without feet, eats without a mouth, digests without a stomach, feels without nerves, and without procreative organs reproduces its kind.

The speaker went on to describe several other forms in the order of their degree of development, up to the form in which differentiation of cell structure and functions are fully established. He then described the development of the sponge from the ovum to the perfect animal, and pointed out the parallelism existing between the various stages of the development of the sponge and the various forms of the Protista, and the bearing which this has upon the doctrine of evolution. While Darwin has demonstrated the probable existence of a law governing the variations of species and genera, Hæckel has pointed out the manner in which variation is actually accomplished.

The lecture, which was extremely instructive and interesting, was fully illustrated with large drawings on the blackboard and colored diagrams.

A vote of thanks was unanimously voted to the Professor for his lecture.

C. P. Alling, M. D., Secretary.

EXCHANGES.

Polycystina from Barbadoes, very fine, mounted, in exchange for any good object. E. W., care Am. Jour. Microscopy, Box 4,875, New York.

Slides of diatoms containing Stauroneis Phœnicenteron, Cymbella Ehrenbergii, Circulare Gonphonema, Navicula, etc., in exchange for any well mounted object. William Beadle, Garnerville, Rockland County, N. Y.

Slides of fine sand, consisting of quartz, garnet, magnetite, hornblende, etc., from beach at Lake George, very beautiful, for other mounted objects. Wm. W. Griffin, Lynn, Mass.

For specimens of Comstock ores (15—25), or crystals of rare chemicals for polariscope, mounted, send diatoms or foraminifera to F. H. Engels, M.D., Virginia, Nev.

THE AMERICAN

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AND

POPULAR SCIENCE.

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The Siliceous Shelled Bacillariæ or Diatomaceæ.

HISTORICAL INTRODUCTION.

ALREADY for over a thousand years had the mind of man searched the wonder works of creation, yet a vast field remained unexplored, closely connected with the numerous forms of that endless Nature which the unaided eye had recognized, and the higher probing mind had arranged; then, in the commencement of the 17th century, a compound microscope was invented by Zacharias Janson and his son, in Middleburg, and with that men ventured upon the unknown, and till then, invisible field of smallest organisms, the discovery of which opened an entirely new world in miniature.

The Diatoms, or Bacillariæ, whose natural history is given in this work, belong to these minute microscopical objects.

Although it is uncertain what particular forms of the diatom group, the first observers found, and endeavored to represent, by description and picture, yet it may be taken for granted, with great certainty, that they must have met with isolated specimens, since they are so numerous and widely distributed.

For the first discovery of forms belonging here, which are, in some measure, given with certainty, we have to thank O. F. Müller, who described and figured a *Gomphonema* in 1773 as *Vorticella pyraria*, and in 1783 a *Fragilaria* as *Conferva pectinalis*, also a *Melosira* as *Conferva armillaris*. A much greater sensation was made by the discovery of the so called staff animalcules (*Vibrio paxillifer*) by Müller, and which the discoverer, at first, did not know where to classify, but later embodied it in the genus *Vibrio*, in his large work on Infusoriæ.

Gmelin, in the 13th edition of Linne's "*Systema Naturæ*," correcting the mistake, founded a special genus upon this form, to which he gave the name *Bacillariæ*, and from this, the whole group received from Zoologists the name of *Bacillariæ*, or staff-animalcules.

The great resemblance of several *Bacillarian* forms to conferva, soon caused the Algologists to pay more attention to them; already, indeed, O. F. Müller, himself the first of living infusoria investigators, had declared his *Conferva pectinalis* and *C. armillaris*, to be Algæ.

The lower Algæ had, at the end of the last century, very zealous friends in Germany, in Mertens, Trentpohl, Roth, Weber,

and Mohr; in England in Dillwyn. and in France in Girod-Chantrans and Draparnand; and several forms, now distributed among the genera *Fragilaria*, *Melosira*, *Tabellaria*, *Diatoma*, and *Schizonema*, were described by these naturalists as confervæ.

The knowledge of these forms at the beginning of this century, was increased almost entirely by the Algologists, and among the illustrations furnished in the *Flora Danica*, the *English Botany*, and the large copper-plate work of Dillwyn, were several Bacillariæ mentioned as conferva; but while the figures of Dillwyn, and the *Flora Danica*, left room for many improvements as to the representation of the exacter microscopic proportions, those of the *English Botany* were better; and were especially good on the figures of *Conferva stipitata* (Tab. 2488 = Achnanthes longipes), *Conferva obliquata* (Tab. 1869 = Isthmia enervis), *Conferva Biddulphiana* (Tab. 1762 = Biddulphia pulchella).

Although De Candolle, so well known, made no special study of these organisms, yet he was the first who separated the form previously known as *Conferva flocculosa*, as a special genus which he called *Diatoma*. Agardh followed DeCandolle in this, inasmuch as he incorporated this genus into his "*Synopsis Algarum*, 1817," but he combined with it other species, (*D. Swartzii*, *D. pectinalis*, and *D. fasciculatum*), which are now distributed among as many different genera.

For the most important investigations, however, which were made of the Bacillariæ the same year, we have to thank Nitzsch, and rightly does Ehrenberg call them "classic." He furnished in his little work, long since out of print, "*Contributions to the Knowledge of Infusoriæ, or a Natural History of the Zerkariæ, and the Bacillariæ, with six colored copper-plates*, Halle, 1817," the first really good pictorial representations, and recognized first the prismatic shape of these forms (which he mentions as a principal character of the group). He carefully observed the propagation of the staff (Stäbchen) through length division, from which he explained quite correctly, the separation of certain forms in the peculiar zigzag-like chains, as also the production of ribbon-like forms from an imperfect separation. He showed the unchangeable character of the external parts, after death, and also distributed several new species, associating however, very different forms, from his personal dislike to minute distinctions. All these forms he placed in two main groups, viz.: vegetable and animal, the former containing those which appeared to him immovable; later observations, however, have shown that most of his vegetable species, possess also voluntary motion. Two years later, 1819, appeared Lyngbye's "*Tentamen Hydrophytologiæ danicæ*," a work which, for that time, was of the greatest importance. In this, more Bacillarian forms were described, and figured, than had been done hitherto in any other work. Twenty-five different forms were distributed among the genera *Diatoma* *Fragilaria*, (a new arrangement of Lyngbye) and *Echinella*. The name of this last genus had been previously given by Acharius (in Weber's *Aid to Natural History*, 2d Vol., p. 240) and incorporated for several years in the "*Systematic Handbooks*," and had even been given out by me in my "*Decades of Fresh Water Algæ*," to a form which, in the following year, 1835, was recognized as insect eggs; but the genus of Lyngbye of this name did not contain the true form of Acharius, from which the name had been transferred to quite a different plant form; also the remaining *Echinellæ* of Lyngbye were foreign to, and only a few exhibited the prickly aspect of, the form of Acharius. Soon after, 1820, Link (In the *Horæ Physical berol.*) described two genera, *Lysigorium* (=Melosira) and *Hydrolinum* (=Schizonema.)

Bory de St. Vincent wrote for the "*Dictionaire Classique d' Historie nat.*" the article "*Arthrodiées*" which appeared in 1822, and besides *Oscillaria*, *Conferva* and *Zygnema* treated also of some *Bacillariæ*. In this article, the *Echinella stipitata* was described, and figured, as *Achnanthes stipitata*;

he placed however in this genus other forms not belonging to it. The genus *Fragilaria* of Lyngbye he described as *Nematoplata;* the genus *Diatoma* was enriched by a new species, and a fourth genus constituted under the name *Syllaria*, which contained chiefly Gomphonema forms. In the article "*Bacillariées*," by the same author, the genus *Navicula* was constituted, and in the article "*Confervées*," which appeared in 1823, he described the genus *Gallionella.*

But while Bory de St. Vincent founded his genera chiefly on the researches of other students; and the few investigations of his own conveyed mainly the impression of superficial work, the labors of C. A. Agardh in the same group appear to much better advantage. He, in his *Systema Algarum*, 1824, mentions the Bacillariæ as a special order of the Algæ under the name "*Diatomeæ*," and better and in a more thorough manner than his predecessors, he arranged them in the genera: 1, *Achnanthes;* 2, *Frustulia;* 3, *Meridion;* 4, *Diatoma;* 5, *Fragilaria;* 6, *Melosira* (= Gallionella, Bory); 7, *Desmidium* (which we however exclude); 8, *Schizonema;* and, 9, *Gomphonema.*

In the year 1827, C. A. Agardh described in the Regensburg *Botanical Journal*, Nos. 40 and 41, several diatoms newly discovered by him in the Adriatic Sea, and at Carlsbad, on which occasion, he mentions for the first time, the genera *Micromega*, *Licmophora* and *Homœocladia.* The same Algologist wrote most particularly on this family in four condensed theses which appeared with a common title, "*Conspectus Criticus Diatomacearum.*" In the first and second (1830) he described a great number of forms, partly already known, partly new, under the genera: 1, *Cymbella;* 2, *Schizonema;* 3, *Micromega;* 4, *Berkeleya* (which was first brought forward by Greville in 1827); 5, *Homœocladia;* 6, *Gloeodictyon*; 7, *Hydrurus* (which genus is excluded by us here); and, 8, *Gloeonema* (under which the author united very different organisms). In the following, third part, (1831) he gave the genera: 9, *Gomphonema;* 10, *Syllaria* (= Podosphenia, Ehr.); 11, *Meridion;* 12, *Lichmophora;* and, 13, *Frustulia;* in the last part (1832) the genera: 14, *Isthmia;* 15, *Odontella;* 16, *Desmidium;* 17, *Achnanthes;* 18, *Striatella;* 19, *Fragillaria;* 20, *Grammonema* (belonging to the Desmidieæ); and, 21, *Melosira.* In the whole the author described (excluding the forms without siliceous shells, and not belonging here) about 116 species. It should be remarked, however, here, that before the appearance of this last work by Agardh, some very good investigations were published by Leiblein in the Regensburg *Botanical Journal*, concerning several diatoms, which Agardh incorporated into his conspectus. While Greville had already described, (1827) in the 5th Vol. of his "*Scottish Cryptogamic Flora*," the genera *Exilaria*, *Monema*, and *Berkeleya.* Turpin founded the genus *Surirella* in 1828, and Gray in 1830 the genus *Biddulphia*, from *Conferva Biddulphiana*, and *C. Obliquata* of the *English Botany.* Thus, till the year 1832, stood the systematic labors on these microscopic organisms; most of the writers mentioned considered them partly as animals (the moving forms), and partly as plants (the fixed forms). Only Agardh, Lyngbye and Leiblein declared more decidedly for their vegetable character; but besides Schrank, there was not one who decidedly advocated their animal nature; of their inner constitution, and of their life-relations, nothing was known, beyond the thorough communications by Nitzsch, already mentioned, and some superficial observations by Gaillon, that might have brought the question, as to their nature, nearer its solution. In the same year (1832) appeared the second "*Contribution to the Knowledge of the Minutest Organisms*," by C. G. Ehrenberg. In this the Diatomaceæ were considered as decided animal forms; the 43 species observed by the author himself were distributed among the genera: 1, *Navicula* (= Frustulia, Ag.); 2, *Bacillaria* (= Diatoma. Ag.); 3, *Fragilaria;* 4, *Exilaria* (= Meridion, Ag.); 5, *Synedra* (= Exilaria, Grev. = Diatoma and Frustulia, Ag.); 6, *Gomphonema;* 7, *Coconema;* 8, *Echinella* (= Licmophora, Ag.);

they were all incorporated with the infusoræ under the family of "staff animals," "*(Stabthierchen)*" (including the *Desmidieæ*) in the class of "stomach animals" *(Magenthiere)*.

But at that time, stomachs were as little recognized by the author, as mouth, entrails or rectum; but a bivalve shell, (*panzer*) and a changeable foot (as in the Gastropods) was mentioned, and said to stretch out of the longitudinal cleft of both valves. Another communication from the same author, followed in 1834, being his third "Contribution," in which were described 16 newly observed forms. The descriptions communicated in these observations are of the greatest importance, and are given with a care hitherto unknown in this field. The author had this advantage over most of his predecessors, that in his investigations he could make use of the best microscopes. Within *Navicula Amphisbæna*, he considered the colored substance as an ovary, and took the lighter cysts appearing therein as polygastric stomach sacs; at the same time he pointed out that a bivalved, grooved shell, as Turpin has shown it in *Surirella Striatula*, "was in plants, something without analogy, but allying itself easily to animal forms," and yet, just this circumstance had decided Turpin, who knew right well that there were also striped and manifold marked plant cells, to consider the form mentioned among the "vegetabilia." Lastly, he called attention to an essential characteristic of the Bacillariæ which had already been correctly understood by Nitzsch, but falsely represented by Agardh and other Algologists, namely: Agarhd supposed that in a diatom the little staves (*Stabchen*) united themselves lengthwise by twos in the beginning, then separated, and cohered only at the ends, but Nitzsch had already shown that the forms united at the edges were produced by imperfect self-division, an opinion which was pronounced also by me in 1833, and which Ehrenberg confirms.

In the year 1838, appeared the great work by Ehrenberg, "*Die Infusionsthierchen als Vollkommene Organismen.*"—"The Infusoria as perfect organisms." The author had, already, previously published several observations on the diatoms, which we here consider with the others. He was the first who showed openings in the hard valve, (*Schale*) (the central one was interpreted in many frustules as mouth openings). Under *Navicula*, the snail foot-like organ of motion was again mentioned, and which in most cases, is said to protrude from the valve. The larger, brighter cysts in the colored ovarian mass, were decided to be "stomach cells" because the author, after many years of experimenting, succeeded at last in observing the reception of color in them. Lastly, he mentioned also, egg-like colorless granules, which he thinks are to be taken for sexual organs. The ribbon-formed and other combinations of individuals into a whole, he compared with monads, or Polypi stems.*

(To be continued.)

The World of Matter.

WHILE the question of the size of the ultimate atoms or molecules of matter is one that curious physicists have ample opportunity to speculate on—and the enormous differences in their professed results show that their speculations have but very poor foundations on which to build—as yet their speculations have little or no practical value, except to show the ingenuity and skill in the use of words and figures of the speculators. The question of the limits of visibility is an eminently practical one, of great interest to all microscopists and physicists. On this question Mr. Sorby says: "The highest powers of our best modern microscopes, he assumes, will enable us to see objects an eighty-thousandth part of an inch in diameter." This sentence hardly represents Mr. Sorby's position. After referring to Helmholtz's principles of interference fringes, or diffraction, he says, "It appears to me that we cannot do better than to adopt these principles in forming some conclusion as to the size of

*One need scarcely to remark that all these observations of Ehrenberg are wholly fanciful.—*Translator.*

the smallest object that could be seen with a theoretically perfect microscope. Looked at from this point of view alone, with a dry lens this could not be less than one 80,000th of an inch." This passage, it will be at once seen, is limited to the "*dry* lens," and while he says the "smallest object," the context shows that he means the separation of lines and not a single object, for he at once goes on to show that closer lines may be separated by the use of blue light and immersion objectives, and also says, "The size of the smallest bright point that can be seen depends on entirely different considerations, and might [may] be considerably less."

All these speculations of Sorby and Helmholtz (and Abbé may be included) are based on theoretically perfect microscopes. (In this case the "microscope" means the *objective*, the all-important part of the instrument.) Now who ever saw a "theoretically perfect" microscope? Who can ascertain that one is theoretically perfect? How can it be ascertained that one is perfect? The only possible way of measuring the approximation towards perfection is by the performance. So long as the performance of the best microscopes falls short of what a theory says is possible, the theory may be accepted as correct; but when the microscope has done *more* than theory says is possible, theory must be in fault. For years microscopes have been made, and are in use, that do more than Helmholtz's theory will allow.

The difficulty with Helmholtz and Abbé is that they had not seen and experimented, in 1872, 1873, and 1874, with all the microscopes that had been made at that time, but only with such German instruments as came in their way; and that made their theories to agree with the performance of *those* instruments. That the theories are wrong is proved by the fact that Nobert's lines, finer than 112,000 to the English inch, have been seen repeatedly by numerous observer's, whereas Helmholtz fixes the theoretical limit at 110,000. On the other hand, as yet no lines so fine as 114,000 to the inch have been seen. Nobert has ruled lines that he claims are 224,000 to the inch. Until something finer than 112,000 is actually seen, it must be an open question whether the failure is the fault of the microscope or of the ruling. Nobert himself has not seen his own finer lines, and always pronounced it impossible to see any finer than 80,000 to the inch, until he saw 95,000 to the inch with a Tolles' immersion lens. The writer saw 90,000 to the inch with a dry lens more than ten years ago.

As to the size of a single object which may be seen, there is but little known. The limit is undoubtedly in the perfection, or rather want of perfection, in the microscope. The best experiments in this direction have been made by Mr. W. A. Rogers, of the Cambridge Observatory. Various writers have assigned different values to the angle at which an object can be seen, varying from 6″ to 120″. This is, of course, a physiological matter. Mr. Rogers says, "Even the smallest value named is much too large. I will at any time undertake to rule a single line one 30,000th of an inch in breadth, which can be seen the distance of seven inches from the eye. This corresponds to an angle of about 1″. Comparing minute particles of matter which can be *seen* under a Tolles' one-tenth objective with those that can be *measured*, in the way indicated above, there is every reason to suppose that the limit of visibility falls beyond one 400,000th of an inch. But that light is of 'too coarse a nature' to enable us to see particles of matter as small as one 200,000th of an inch is a conclusion which can be refuted without the slightest difficulty." A few years ago Mr. Huxley said in substance, at a meeting of the London Microscopical Society, that if the opticians could not supply microscopes that would enable one to see spaces between objects one 100,000th of an inch apart, naturalists were at the end in that direction of their work. It was replied that American and London opticians had already supplied instruments that had separated lines but one 224,000th of an inch apart.—*Boston Journal of Chemistry.*

A Self-Centering Turn-Table.

THE space given an article by "J. P." on turn-tables, in your February issue, and his comments on their respective merits and deficiencies, warrants me in saying a word in reference to one which I have devised. It lay in my drawer in the shape of drawings for nearly a year before I had one made, which was about the time Mr. Cox introduced his to the attention of microscopists through the medium of the *American Naturalist*. While the main principle of grasping the slide by the diagonal corners is the same as that used by Mr. Cox—and probably both ideas were obtained from the chuck-lathe—the method of manipulation in mine is entirely different from that in his, and I think advantageous in many important respects, some of which I note below, giving diagrams to show the mechanism and mode of using.

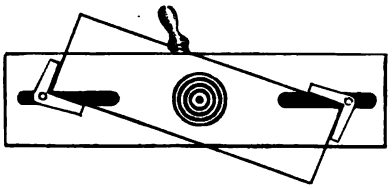

Fig. 1.

As will be readily seen from the engravings, Figs. 1 and 2, which are reduced one-half, the slide will be grasped automatically, upon removing the finger from the lever, the spiral spring causing the clutches to instantly clasp the slide, and retain it in a central position, without the tedious delay

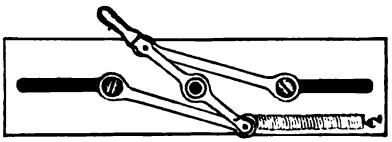

Fig. 2.

of the right and left screw. One corner of either end of the slide projects sufficiently for the purpose of taking hold with one hand, while the other is pressing the lever, and can be fixed or removed without pushing along a circular disk to its edge.

The slots are made to allow movement enough so that the clutches can grasp any piece of glass from 1½ to 3½ inches in diagonal length, and the table is made of brass about a quarter of an inch thick, which gives weight sufficient to secure stability of movement. The whole rests on a small spindle 4 or 5 inches long, screwed into the centre of the brass stud, which is the fulcrum of the lever, and can be removed at pleasure to pack away. The pointed lower end of the spindle is stepped into a counter-sunk metal rest, and with a collar placed at a suitable distance above to allow of free movement of the hand, I find that a steady motion can be obtained with the thumb and finger, of any required velocity, and is under greater control than with any milled-head device.

The spindle can be fitted into any appliance, primitive or expensive, at the option of the worker, and I find that an old cigar box, with a portion of one end removed, is just as useful as anything else, though if made for sale, a cheap varnished box could be furnished, and in which the table and spindle could be packed when desired. If fitted up with the cast iron stand, the whole might present a neater appearance, but the additional expense would not add to its utility. I have tried almost every variety of turn-table, and feel that I am competent to judge of their merits, and have compared Cox's table with mine, as I consider his the better of all the others, confident that the points I have stated will commend themselves as advantages.

In justice to both the Cox and Kinne turn-tables, I wish to allude to what "J. P." calls a "serious objection" to tables which grasp the slides by the corners, while he admits that they do centre both ways, that is, *accurately*. He says that "slides which have been worked on other turn-tables can not be easily re-varnished or re-sealed" on these, and he has devised a very pretty affair to obviate the trouble.

Now, in the first place, his guide, no

matter how carefully arranged, *will not centre* all slides, for slight as it may be, they do vary in size, and his finish will always be just such a distance from one end and one side. Removing the guide he goes back to first principles, the simple springs and the eye, to adjust de-centred slides. Neither is the device needed, for Fig. 3 shows how self-centering tables can be utilized to re-varnish an imperfect slide by the use of two

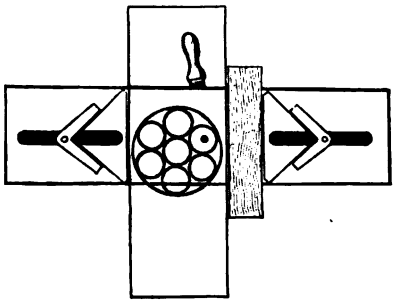

Fig. 3.

rectangular triangles and a little wedge. I use the corners of a broken slide and a piece of match, and slides are as readily adjusted as with the springs. Further, by grinding down the triangles together to insure uniformity, a small cell can be turned in the centre as in Fig. 1, then one turned on each side by adjusting as in Fig. 3, and moving the slide longitudinally (without the little strip of wood), while inserting a wedge of the correct width on either side will enable one to complete a neat and accurate group of seven cells as shown, over which a large cover can be fixed after mounting with as many varieties of blood, pollen, diatoms, etc., thus placed in juxtaposition for ready comparison. I usually turn the cells on a large cover, attached to a slide by a little gum for the purpose, then removed and laid aside to be ready when wanted.

Adding that those who have any of the many other styles of turn-table can utilize them by simply placing the mechanism of the Kinne table, without the spindle, over theirs, fastened together by two screws from the under side running through separating standards, made long enough to admit of the working of the lever, and clear the old springs—which was the manner in which my first one was fitted—I will close with the assertion that as most cell finished slides have to be manipulated half a dozen or more times, I regard the self-centering turn-table to be as essential to the comfort and dispatch of the neat and accurate practical preparer of microscopic objects, as the universal or Society screw is to the objective.

C. MASON KINNE.

Eosin—A New Staining Fluid.

DR. DRESCHFELD states in the *Journal of Anatomy* that a solution of eosin, of 1 part to 1,000 of water, forms an admirable staining fluid. The sections to be stained, having been immersed in this fluid for one minute to a minute and a half, are put for a very short time into water slightly acidulated with acetic acid, and can then be mounted in glycerine or in Canada balsam. The advantages claimed for this fluid by the author are these: 1. The time required for perfect staining does not exceed one to one and a half minutes. 2. The solution can be kept without altering, and remains perfectly clear for any length of time. 3. Eosin has the property (probably owing to its fluorescence) of clearing tissues. 4. It differentiates the component parts of a tissue, which renders it particularly applicable to complicated structures, as tumors. Dr. Dreschfeld finds it particularly useful in the examination of nervous tissue. The nuclei, nucleoli, and processes of the ganglion-cells, and the axis-cylinder of nerve-fibres, are stained light pink; the areolar tissue takes a much deeper color; the medulla of the nerve-fibres, on the other hand, is not stained at all.

—A new nematoid worm has been found by Dr. Normand in the bodies of those who have suffered from diarrhœa in Cochin China.

THE AMERICAN

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AND

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An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the AMERICAN JOURNAL OF MICROSCOPY. This certainly demonstrates the value of the journal as an advertising medium."

Kutzing's Bacillariæ.

THERE exists at present a very general interest in regard to the diatomaceæ, while at the same time ordinary readers find at their command but a very limited amount of information in regard to the subject. It is true that slides of diatoms are very common amongst owners of microscopes, many of whom spend a great deal of time in "resolving" the lines upon what are called "tests objects." But with the life history of these curious forms of vegetable growth, ordinary microscopists are too frequently unfamiliar. It is not many years since a professor in one of our oldest and most noted colleges, stated that a certain deposit consisted of the siliceous skeletons of diatoms and *desmids!!* Nor was this a mere slip of the pen, for when his attention was called to the point, he attempted to justify his first statement by misapplied extracts from some of our standard works on natural history.

The very general desire which exists for information upon the subject, has induced us to give our readers a translation by Prof. Hamilton L. Smith, of Kutzing's introduction to his work on Bacillariæ. The first part of this translation appeared in the *Lens*, which unfortunately suspended after two instalments of the translation had been issued. In order to make our edition of the work complete, we republish, from the *Lens*, the first parts of Prof. Smith's translation.

Barbadoes Earth.

OUR readers will please bear in mind that the distribution of this material will not take place until after the issue of our May number. All letters received will be carefully filed and the specimens sent out immediately after the issue of the May number of this journal. Those who do not hear from us before that time need not conclude that they are forgotten.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

An Ingenious Contrivance.

Ed. Am. Jour. Microscopy—On page 50 of your first volume I find a description of a contrivance for rendering an old-fashioned upright instrument available for use in an inclined position. About two years ago I became the owner of an old, but good instrument, by Pyefinch, of London, England, when I adopted the very same method you describe, but with a modification which is so decided an improvement upon the unhandy mode of a wedge and elastic band, that I have concluded to describe it for the benefit of those who may need such an expedient in future.

I unscrewed the stand from its wooden support, and screwed it on to a block of black walnut 4½ inches square, and five-eighths of an inch thick; this I hinged across the middle of

another block 4½ by 9 inches, just as described. I then bored a hole through the upper block near each of the front corners with a very fine bit, and passed through each a piece of stout brass wire bent into an arc of a circle, the radius of which was equal to the distance from the hinge to the hole, the wire forming a little more than a quadrant of the circle. I then fixed the under ends of these wires firmly into the lower block, and the work was complete.

I have used the instrument for nearly two years with perfect satisfaction, as I can set it at any angle between vertical and horizontal as readily as one of the hinged stands, and it stands quite steadily where it is set, until altered by hand. JAMES T. BELL,

Prof. Mining and Agricul., Albert Univ.

Belleville, Ont., Jan. 22, 1877.

Our Book Table.

How to Choose a Microscope. By a Demonstrator. With 80 illustrations. London: Hardwicke & Bogue.

This is an octavo pamphlet of 32 pages by one who has evidently had a great deal of practical experience of the subject which he undertakes to discuss. The author, whoever he may be, has studiously avoided giving a recommendation to the work of any particular maker, and has confined himself entirely to general principles, and his little book is on the whole a guide which may be safely followed.

To some of his conclusions and statements, we think most microscopists of general experience would take exception. For example he regards the binocular microscope as a mere plaything; Carpenter considers it one of our most valuable means of acquiring a correct knowledge of the form and structure of some objects, and we entirely agree with Carpenter. It is true that in order to secure reliable results with the binocular it must be properly used, and after reading the section devoted to binoculars in the pamphlet before us, we are inclined to believe that the author has not had a very large experience with this class of instruments.

We feel sure that this useful little *brochure* will soon reach a second edition, and we trust that the author will render it less ostentatiously technical than it is at present. To capitalize, italicise, and place within quotation marks nearly half the book, defeats its own end. We hope also that he will distinguish between "loss of time" and want of smoothness of motion. The first is a defect which a screw-driver will often remedy; the last is an evidence either of bad usage or radically defective workmanship.

The criticism at page 9 on tripod stands contains evidence of the danger of basing general conclusions upon one or two special cases. Our author says: "If a foot were made with two points of support turned towards the observer (such *are* to be met with!) they would stand in a straight line, and so form a hinge-like arrangement; then on the body being turned down at right angles to the stand (as for the requirements of making drawings with the camera lucida) the leverage would cause any such defectively constructed foot to overbalance."

We have before us at the present moment a stand in which the foot may be turned round so that either one or two points of support may be towards the observer. When used in a vertical position we secure steadiness by having the points turned forward (away from the observer). In this condition the microscope is very steady, but when the body is turned down horizontally it becomes very unsteady, a defect which is instantly and thoroughly rectified by turning the foot half round, so as to bring the two points towards the observer.

The Microscopist: A Manual of Microscopy and Compendium of the Microscopic Sciences, Micro-Mineralogy, Micro-Chemistry, Biology, Histology, and Pathological Histology. Third Edition, Rewritten and Greatly Enlarged. With Two Hundred and Five Illustrations. By J. H. Wythe, M. D. Price $4.50. Philadelphia: Lindsay & Blakiston.

The first edition of this work was one of the earliest books on microscopy, published in America, so that the author is by no means a neophyte in the science. This fact has no doubt tended to render the book unequal in its parts, for on those subjects which the author has made his special study, he has given us clear and excellent chapters, while on the other hand, where he has depended for outside information the chapters are meagre and imperfect. The application of the microscope to medicine and pathology is well-handled, while the chapters on micro-mineralogy and micro-chemisty are at least ten years behind the times.

The illustrations are very beautiful and costly—more so we think than there is any need for. Thus we find that all the plates are printed in two or more colors—such objects as the fly's tongue, diatoms, etc., being printed in bistre, with the titles in black. Now, it is worse than useless to print the fly's tongue in bistre, for this is not the natural color of the object, and the extra expense is here entirely thrown away. It would have been much better to have had the plates printed in plain black and white, and reduced the cost of the book.

Dr. Wythe has evidently not kept *au courant* with the tide of recent discussion in regard to microscopical matters, or he would not have told us that

the *Amphipleura pellucida* had been resolved by Powell & Lealand's 1-16th, aided with the blue cell. The one-fourth of the same firm, and also the one-fourth of Mr. Tolles, have done the same thing. We should also have expected that the fact of Mr. Gundlach's having been in this country some seven or eight years would have been known to Dr. Wythe.

As a book which gives a general but popular view of all the different departments in which the microscopist will probably work, the volume before us will prove useful and valuable, but it can scarcely fill the office of a guide in any special section of microscopic study. As a popular work, however, it has the advantage of great simplicity of style and a fulness quite sufficient for the wants of ordinary amateurs.

NOTES AND QUERIES.

Ed. Am. Jour. Microscopy—Is there any place in New York city where the experience of a practical microscopist can be had in learning to handle the microscope, and if not, would it not materially excite a desire for such a knowledge, and thereby promote the general interest in that science if, on one or two evenings of the week, and for a small price of admission, there was such a place where the inexperienced could gratify a desire to learn something about the instrument which cannot be got from books? The knowledge of such a place would gratify more than ONE SUBSCRIBER.

New York, Jan. 2, 1877.

We know of no such teacher or classes at present, but if any competent person will undertake to give such instruction for a moderate compensation, we will insert his card in this journal without charge. We see that the son of the late Prof. Clark, author of "Mind in Nature," has opened a class in San Francisco. We knew him some years ago as an earnest, thoroughgoing boy, and we hope he will meet with abundant success.

Current Notes.

Mr. Merriman's Method of Preparing Crystal for the Polariscope.—1. The solutions must be made in distilled water and carefully filtered. 2. Solutions of gum arabic must be added to the crystalline solution until the drop will dry on the slide without crystalizing. The drop on the slide is to be held over steam till one or two or more points of crystalization appear. Then at once dried over an alcohol lamp; then held over the steam again till the crystals have grown a trifle larger; then dried; and so on till the specimen suits the operator. Salicine is a very simple and easy substance to operate with, and is well preserved under Canada balsam. Asparagine with oxalic acid, when so mixed that there is no excess of either over the chemical combination which is formed, is a most interesting substance to experiment with. The specimens (contributed to the Postal Micro-Cabinet Club) I have covered first with a film of colodion, put on with a camels' hair brush, and then mounted in old Canada balsam. I have specimens ten years old perfectly preserved. But again, others have undergone further crystalization after mounting, and so are spoiled. Great care and much experimenting is needed to do this successfully.

Tragacanth Mucilage.—Pour 16 ounces of boiling water over one ounce of gum tragacanth, and macerate for twenty-four hours. Add a teaspoonful of glycerine, and triturate until quite smooth. Then press through linen.

Adhesive Cement.—Intimately mix finely pulverized gum arabic with its weight of very finely powdered calcined alum. When mixed with a small quantity of water, it forms a cement which unites wood, paper, porcelain, glass and crockery very firmly. Must be kept dry in powder, and moistened only as needed.

Lecture and Soiree.—On the evening of March 19, an interested audience of about 500 persons were entertained at the First M. E. Church, Hoboken, by Mr. Chas. S. Shultz, with a "Talk on the Microscope, its Revelations, Uses, etc.," illustrated with projections of a number of objects interesting to students of natural history, by means of the excellent hydro-oxygen microscope of Prof. Morton, in charge of Messrs. Geyer and Donaldson. There was also a fine display of microscopes upon the platform, and the whole affair was a most enjoyable one. The interest which intelligent people are taking in the microscope is increasing every day.

Value of the Microscope.—A competent judge declares that Professor Pasteur has saved enough to France by his discoveries to pay the entire indemnity to Germany. He is a great chemist, and one of the most skillful experimenters in the world. For many years he has been subjecting the theory of spontaneous generation to the most severe scientific tests, and is positive in his conviction that all life, so far as we know it, springs from living seed or germs. The experience of the best dealers in wine has been baffled in seeking a remedy for a difficulty. Professor Pasteur put some of the spoilt wine under the microscope and soon discovered the cause of the trouble. Minute organisms were found in the wine in every instance, and the change of quality was due to their presence and growth. Of course they grew from germs, and if the germs could be destroyed the mischief would be averted. Judging from experiments in other liquids that heat would be fatal to the germs, he subjected the wines to a degree of heat which they could bear without injury, and found that all the germs were destroyed. The wine makers profit by the science

of the chemist, and save millions of dollars formerly lost by the spoiling of the wines. Having been successful in making wines unalterable, he turned his attention to vinegar. This was subject to changes, which made it putrid and worthless. He detected another kind of organism in vinegar, and taught the dealers how to destroy it in germ and keep the vinegar unharmed.—*Mining and Scientific Press.*

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—A regular meeting of this society was held on Thursday evening, March 1, with President Ashburner in the chair, and a good attendance of members. The library was added to by the following donations: "Wythe's Microscopist's Manual," from the author, Rev. J. H. Wythe, M. D.; Monographs on the Diptera, Lepidoptera and Neuroptera of North America, 3 volumes, from Dr. Mouser; "Bulletin des Séances de la Societe Belge de Microscopie," for 1874-5, and "Annales de la Societe Belge de Microscopie," for 1875-6 from Mr. C. Mason Kinne; and "The Naturalist's Directory."

By purchase and subscription there was received: The Depths of the Sea," Thompson, 2 volumes; "Observateur au Microscope," 1 volume and atlas, Dujardin; the February numbers of *Cincinnati Medical News* and *Monthly Microscopical Journal*, *Nature* and *Flora*, Regensberg.

"The Microscopist's Manual," by Dr. Wythe, is the third edition of the work, and in order to meet the request of the publishers for this, it was found necessary to rewrite the entire book, and it comes out in a shape that well illustrates the progress of microscopic science, by comparing it with the first edition, which was placed before the public a quarter of a century ago. Its 205 illustrations are fine works of art, and the book will no doubt hold its place as of yore, among works of reference, though surrounded by larger and more pretentious volumes. It is "Respectfully dedicated to the San Francisco Microscopical Society, as a testimony to the zeal and industry of its members, in the prosecution of microscopic science."

The donation of the proceedings of the Belgian Microscopical Society, of Brussels, by Mr. Kinne, was accompanied by the reading of the communication informing that gentleman of his election as a member of the Society, and from which the following extract was made, in order that any one interested may correspond, as is desired. The Secretary says: "We desire to exchange publications for any published by your Society, and our members would also willingly exchange with any of your individual members, any papers they have published on scientific subjects in general. We desire also to enter into direct correspondence with specialists in all branches of microscopical researches, in view of exchanging ideas and specimens. Several of our members are actively working at foraminifera and diatoms, recent and fossil, histology and pathology, fresh water algæ, infusoria, etc., and would be very happy to intercommunicate with their American brethren. Let us add that the hospitality of our rooms will always be freely tendered to any member of your Society who might be visiting Europe."

The proceedings show that there is a lively interest in the pursuit of microscopical study, and that many valuable papers and interested discussions were read and listened to at the meetings of the Belgian Society, which are held monthly. They have some sixty active members, and their Government aids them financially from time to time, to enable the Society to purchase instruments, etc., while ours is diligent in collecting duties on all scientific apparatus any one may order from makers outside the United States.

Prof. Ashburner donated a slide mounted by him with exfoliations from glass vases found in old Greek tombs, which showed some very curious features.

Mr. Kinne donated a slide mounted by him with the scale of salmon as a polarizing object, which was found to be of a character that would cause it to rank high among those beautiful and instructive objects. Mr. Kinne also presented two varieties of siliceous sponges from Oakland and Pescadero Beach, and a series of slides mounted by him with sections and fragments of the same, as well as the spicules cleaned from any extraneous matter to show their peculiar forms. Mr. Kinne stated that while they could not be called glass sponges in the strict sense of the term, from the fact that a certain amount of the frame work or skeleton was composed of horny material, still the latter seemed to have only been used as a cement to hold the points of the acicular spicules together in one case, and as a very slight integumentary deposit about masses of spicules arranged in a filamentous form which anastomosed and spread in every direction, in the other. He called attention to the manner in which spicules in the Oakland specimen were placed at their point of juncture, under one and over another, in a way that served to strengthen the whole fabric, and then exhibited a slide of the leathery or horny sponge of commerce in the way of comparison.

Mr. Hanks presented the Society with nine species of fossil corals, fossil crinoids, and crinoid stems, from various localities.

Dr. A. Mead Edwards, who was present, exhibited a slide of *Volvox Globator*, which he mounted in a saturated solution of salicylic acid some years

ago, which had not changed a particle since it was first stained and immersed in the medium. Upon examination under a quarter and an eighth objectives, the cilia were seen protruding from the membranous envelope, as well as the delicate radiating processes extending from the sides of the gonidia within the globe. Dr. Edwards also exhibited a section-cutter, fitted with various-sized holders for the object, and a super-stage of his invention. He explained the advantages of a growing cell, which he had satisfactorily used for many years, formed of a square piece of glass, cemented to a thicker one, perforated with an aperture from one to two inches in diameter. Placing upon this receptacle for water a glass to cover the opening, in which two minute openings had been drilled, a common thin cover could be placed over the living desmid, diatom or protococcus, and watched while it passed through its various stages of development.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Wanted, in exchange for diatoms from northern Wisconsin and Michigan, any well-mounted objects; marine diatoms preferred. W. H. Titus, M. D., Shawano, Wis.

Bott's eggs, upon horse hair, mounted, (pretty objects); also kangaroo and other hair, mounted, in exchange for other interesting mounted matter; send list. Chas. S. Shultz, Hoboken, N. J.

Polycystina from Barbadoes, very fine, mounted, in exchange for any good object. E. W., care AM. JOUR. MICROSCOPY, Box 4,875, New York.

Slides of diatoms containing Stauroneis Phœnicenteron, Cymbella Ehrenbergii, Circulare Gonphonema, Navicula, etc., in exchange for any well mounted object. William Readio, Garnerville, Rockland County, N. Y.

Slides of fine sand, consisting of quartz, garnet, magnetite, hornblende, etc., from beach at Lake George, very beautiful, for other mounted objects. Wm. W. Griffin, Lynn, Mass.

For specimens of Comstock ores (15—25), or crystals of rare chemicals for polariscope, mounted, send diatoms or foraminifera to F. H. Engels, M.D., Virginia, Nev.

Wanted, one of the famous Barton buttons; must be in good condition. Will give either money or good exchange. E. W., Box 4,885, New York.

For Daphnia pulex, send other unmounted objects—Polycystina especially—to A. Y. Moore, P. O. Box 68, Coldwater, Mich.

Wanted, good slides of vegetable or other objects, for sections of Japanese coniferous wood from Japanese Dwelling, Centennial Exhibition. E. Pennock, 805 Franklin street, Philadelphia.

Wanted, slides of pathological or anatomical preparations, in exchange for diatomacean fossil and other well mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Slides of pollen of Agave Americana and other southern United States flowers, for any well mounted objects. Mat. Stuart Beard, Box 1817, New Orleans, La.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Stained petals, leaves, and sections of some common plants to exchange for other mounted objects. Address F. H., Box 98, Cherokee, Iowa.

Wanted, well-mounted specimens, for slides of American Podura mounted whole, and scales of same. Address George W. Fries, Friendship, N. Y.

Wanted in exchange, well mounted specimens for mounted sections of either lung or kidney specimens, showing perfect minute anatomy of these organs. Also, injected sections of human stomach, mounted, for other histological specimens. C. E. Nichols, M. D., 14 Fourth street, Troy, N. Y.

Slides of fossil diatoms from Nova Scotia, for any other mounted objects. G. C. G., Box 2055, Rockford, Ill.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 355, Milford, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield. Mo.

Wanted, slides of diatomaceæ or foraminifera in exchange for pathological preparations. George A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

BOOKS WANTED.

Dr. Fleming's book on "Blood Stains in Criminal Trials"—Pittsburg, 1861. Also any other work on détection of blood stains.

Pritchard's Infusoria. Edition of 1861.

Brunet, Manuel de Libraire. Last edition.

Hassall's "Fresh Water Algæ."

Smith's "Synopsis of the British Diatomaceæ."

Faraday's "Electrical Researches." 3 vols.

"Botany of the State of New York." 2 vols., 4to.

Holtzapfel's "Mechanical Manipulation."

Ehrenberg's "Mikro Geologie."

Ehrenberg's "Die Infusions Thierchen."

Williamson's Recent Foraminifera.

Pritchard & Goring's Works (any vols.)

Hook's "Micrographia."

Carpenter on "Foraminifera."

Address, stating price, (which must be low) E. W., Post Office box 4,875, New York.

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The Siliceous Shelled Bacillariæ or Diatomaceæ.

(*Continued from paye* 32.)

URTHER on we shall notice the merits which the author has gained by his diligent investigations of the fossil forms, and the influence which these minute organisms still exercise upon our earth; here, only a few words must be added on the systematic arrangement of the group as contained in the great work on the Infusoria. Since the first attempts to bring the diatoms into several genera, the outward form of the shell-covered body, the manner in which the single individuals united, and the presence or absence of a stipes whereby they are attached, have been principally taken as the foundation in the classification, and Ehrenberg introduced also, the presence or absence of the shell-openings, for the distinction of genera, but the main groups were arranged according to the presence or absence of a stipes; a mistake which caused the author to mention Lyngbye's *Diatoma arcuatum*, not only as two different species, but also under two different genera, viz.: as *Tessella catena*, and *Striatella arcuata*. His 154 species, contained in the work already mentioned, and mostly accompanied with very carefully drawn figures, form, with him, the group "*Naviculacea*," and are distributed among the following genera: 1, *Pyxidicula*, (=Cyclotella, Kg.); 2, *Gallionella;* 3, *Actinocyclus*, new; 4, *Navicula;* 5, *Eunotia*, new; 6, *Cocconeis*, new; 7, *Bacillaria;* 8, *Tessella*, new; 9, *Fragilaria;* 10, *Meridion;* 11, *Isthmia;* 12, *Synedra;* 13, *Podosphenia* (= Stylaria, Ag.); 14, *Gomphonema;* 15, *Echinella*, (= Licmophora, Ag.); 16, *Cocconema;* 17, *Achnanthes;* 18, *Striatella;* 19, *Frustulia;* 20, *Syncyclia*, new; 21, *Naunema* (=Schizonema); 22, *Gloeonema*, (=Encyonema, Kg.); 23, *Schizonema;* 24, *Micromega.*

Of Ehrenberg's works, published subsequently, giving an account of his continued investigations of the siliceous shelled diatoms, the following are particularly of importance: 1st, "*The formation of the European, Libyan and Arabic Chalk Rocks, and the Chalk Marl from Microscopic Organisms*," (contained in the "*Proceedings of the Berlin Academy of Sciences*," 1839). In this communication the new genera *Coscinodiscus* and *Dictyocha*, with several species, and some new fossil species of the genera, *Actinocyclus*, *Cocconema*, *Denticella*, *Fragilaria* and *Navicula*, were described. 2d, "*On Numerous, still living Species of Animals of the Chalk Formation*," (also in the *Proceed-*

ings of the Berlin Academy, 1840). In this pamphlet, Ehrenberg showed that many diatoms hitherto found by him only in the fossil condition, were living in sea water, especially in the slime of the coast. Most of them he had gathered near Cuxhaven. Of great importance, however, was the observations of the organs of motion in the *Navicula gemma*, which shall be mentioned presently. At the same time the genera *Amphitetras*, *Cerutoneis*, *Grammatophora*, *Lithodesmium*, *Podosira*, *Triceratium*, *Tripodiscus* and *Zygoceros*, were newly established, and a considerable number of new species described, which are partly represented in the appended copper plates. 3d, "*Brief account of 274 newly observed Species of Infusoria, since the completion of the plates of the larger work on the Infusoria*," in the reports of the Berlin Academy of Science, 1840, in which about 100 new species of diatoms were described, and the genera *Amphipentas*, *Campylodiscus*, *Discoplea* and *Himantidium* were established. 4th, "*Extent and influence of Microscopic life in North and South America*," 1840; without doubt, the richest of the last named works, and at the same time furnished with many figures, on four copper plates.

Prof. Bailey, of West Point, had already, in 1838, given the outlines of American Bacillariæ in *Silliman's Journal of Science and Arts*, Vol. 41, No. 2, and Vol. 42, No. 1, and had also especially reported on the fossil forms of North America. Abundant material was sent to Ehrenberg from this continent, from thirteen different localities, and at the same time, he received contributions from South America, through his brother, Carl Ehrenberg, and besides this, he knew how to obtain samples of earth from different other points of that continent, which were brought to Europe in the transportation of lumber, so that he obtained a view of the forms from 44 different localities in America, from the Falkland Islands to the Kotzebue Sound. Lastly, some forms from Spitzbergen and Iceland are given. The number of species described as new, is pretty large, several American species, however, mentioned as new ones, could have been reduced to European species, and also from these communications it is proved that in the remotest places, the same forms of Bacillariæ are usually repeated, and the remarkable differences appear only singly, and seldom.

The genera *Actinoptychus*, *Amphiprora*, *Climacosphenia*, *Goniothecium*, *Mesocenia*, *Rhizosolenia*, *Sphenosira*, *and Terpsinœ*, are mentioned as new, also the separation (not happily) of *Pinnularia* from *Navicula*, and besides, 227 new species are described, most of them figured; and also incorporated into my own plates. I shall, however, have frequent opportunity to refer to these, and all other labors of Ehrenberg, wherefore for the present I finish my notice of the great industry of this man, who has at command in his lucky position, all possible means for the prosecution of his scientific investigations.

The same year in which Ehrenberg's large work on Infusoria appeared, A. de Brebisson published his "*Considerations Sur les Diatomées.*" Brebisson had diligently studied the Algæ of his neighborhood, (*Falaise,*) and had spent much time in hunting up the little diatoms. Of many of the new species whose names only he mentions in that brochure, he has given specimens to his friends in Germany; by the use of the specimens I was enabled to get the necessary information regarding them. Upon the whole, his classification is very near that I had made in my *Synopsis Diatomearum*, 1833, only some subdivisions of my genera he made into independent genera, as for instance, *Cymbophora* (= Cocconema, Ehr.) *Cyclotella*, (= Pyxidicula, Ehr.) and besides that, *Epithemia* (which corresponds with the genus Eunotia, Ehr.) and *Surirella.*

Besides these, also Greville (in Hooker's *British Flora*, II) and Harvey in the "*Manual of British Algæ*," have lately become coworkers among the Diatomaceæ, but in a manner which still reminds of the times of Lyngbye and Agardh, so that their labors are almost entirely useless for our purpose, because they lack the necessary strictness. The latest discoveries remained quite un-

known to these men, at least they had no influence on their labors.

Ralfs has furnished the most recent work on British diatoms, in single monograph, which is printed, and accompanied with figures, in the 12th Vol. of "*Annals and Magazine of Natural History.*"

Ralfs excels his predecessors in his knowledge, and better representations of separate forms; he has also used the publications of others better than his countrymen just named, but the figures on most of his plates, (only with the exception of Pl. 8, which contains beautiful and successful representations of the genera *Amphitetras, Biddulphia,* and *Isthmia*) are pretty crude; it seems, however, as if this was more the fault of the engraver than of the author.

Now, at the conclusion of these short historical outlines, I will pass on to my own labors. The already mentioned treatise of Leiblein in the *Regensberg Flora,* for the year 1830, gave me the first impulse for the investigation of these little organisms. I examined the diatoms of the neighborhood of Schlensingen, and found, not only most of the forms described by Leiblein, but also others, not yet described. On this occasion I must thankfully acknowledge how kindly Prof. Leiblein answered my first questions for instruction, and how very much I was aided in my earlier studies by the use of his collection of algæ, gathered near Würzburg, among which were also diatoms. But I am also not less obliged to the Herr Pastor Frölech, in Boren, near Schleswig, and Von Martens in Stuttgart, who furnished me, most kindly, plentifully with material from their collections. In the following years I continued my investigations of these microscopic forms, just as diligently as I had begun them, and in the year 1833, while I lived at the University of Halle, I was enabled to publish, that year, seven decades of my "*Algæ aquæ dulcis germanicæ,*" with dried specimens, among which several diatoms were also given. In the same year I published in the *Linnæa* the *Synopsis Diatomearum,* of which I had special impressions struck off, that I gave in commission to Schwetschke in Halle. These bear erroneously the date 1834. In this pamphlet, I, for the first time, separated the true Diatomaceæ, with shell (schale) already designated as hard and glassy (p. 3), from the softer shelled forms, which I called *Desmidieæ.* This work has been estimated very differently. Meyen (Weigm. Archiv., 1835, § 210) complains that everywhere a too great desire for new species was manifested, and yet, it afterwards appeared, that not only all the species established by myself stood proof, but even many a form, mentioned by me as a variety, was established by others as distinct species. Ehrenberg took the trouble in his third "*Aid to the knowledge of larger organisms, in the direction of the smallest space,*" to reduce most of the forms established by me in the Synopsis, to such forms as were known to him; but later, he has established the same forms as distinct species in the larger Infusoria-work, although often with suppression of the names given by me, designating these as synonyms of forms known before, and where they did not belong.* The proof of this will be given at the respective places. I had however without knowing of Ehrenberg's labors, already in the first pages of my Synopsis correctly represented the structure of the frustules (Panzers) as two plates, and had also mentioned the frequent striæ in many forms. The openings of the *Frustulieæ* (Naviculeæ) were then indeed as unknown to me as to Ehrenberg, who mentions them later. The want of a good microscope at that time, prevented me from carrying out my investigations with the necessary promptness.

*This conduct of Ehrenberg has already been censured by others. Thus speaks Ralfs ("On the British Species of Gomphonema," in the Annals and Magazine of Natural History, Vol. XII, Dec., 1843, p. 462): "It is greatly to be regretted that Ehrenberg has in so many instances disregarded the names previously affixed by Agardh and Kützing. To alter a name once bestowed is not only discourteous to the first describer, but creates confusion and tends to encumber the science with synonyms; for if it be allowable for one writer to alter a name because he fancies that a new one is more appropriate, succeeding writers have an equal right to alter his names, and in the absence of a recognized rule, some naturalists may prefer one name, and some another.

Only a short time before the printing of my *Synopsis*, I had the opportunity, through Herr Von Schlechtendal, to use a Schiek's instrument, and by its help to make some improvements in my drawings. These are figures 12, 31, 21, 22, 23, 32, 33, 35, 41, 43, 45, 53, 54, 55, 57, 60, 61, 62, 63, 64, 65, 66, which, however much they have been censured, still give a faithful representation of the objects, and are better than the then existing representations of Bory St. Vincent, Turpin, Lyngbye, and even of Nitzsch; nor do Ehrenberg's figures, made at the same time, in his large Infusoria work, surpass them. That the remaining figures are, in fact, very insufficient, I myself confess, but I content myself the more easily since I can correct that mistake here, and as I know that Ehrenberg did not fare better than myself with his first representations. If one looks, for instance, at Ehrenberg's figures of the *Echinella Splendida*, (Taf. 19, II,) of the *Gomphonema discolor*, and *rotundum*, (Taf. XVIII, VII, VIII,) of the *Bacillaria Cleopatræ*, *Seriata flocculosa*, and *Ptolemæi*, (Taf. XV, III, VIII, IX, X,) in the large Infusoria work of 1838, it will be confessed that it is quite as difficult to decipher these forms, as those mentioned in my Synopsis. It is also true, that Ehrenberg has mentioned one and the same object several times, and under different names; this is certainly the case with *Fragilaria rhabdosoma*, *multipunctata*, *bipunctata*, *angusta*, *scalaris*, and *diophthalma;* if the drawings are correct, all belong to one and the same species.

To be continued.

The Permanent Exhibition.

THE Permanent Exhibition at Philadelphia, in the Main Centennial Building, is assuming shape, and seems destined to be a success. Nearly three thousand would-be exhibitors have already filed their applications, and demand more space than there is to give them. As an advertising investment, the placing of any article in this Exhibition is one of the best that can be made.

Reproduction of Rotifer Vulgaris.

I HAVE some water which has been replenished so often, from different sources, that it is impossible to say how long I have had any particular portion of it, but it has contained, for nearly eighteen months, a large colony of *Cyprides*, which have interested me much. The special point of interest in them is their tenacity of life, and the facility with which they, or their ova, adapt themselves to widely varying circumstances. The jar containing them hung out of doors, swung by a string to a birdcage hook, when the winter began, and the water was frequently frozen and thawed again. Finally, one very cold night, it was frozen solid, the jar was whisked about by the wind until the string broke, and the whole thing fell to the ground and rolled some distance from the house. Next morning I picked up the lump of ice, put it into a fish-globe, and stood it on a mantel-piece near a stove, where it has since remained.

I did not then notice in it any signs of *Cyprides*, except some dead and empty shells scattered through the dirt and débris at the bottom of the globe; but now this aquarium is swarming with the little crustaceans, both old and young apparently, though I have not happened upon anything like an egg or an immature or larval form, unless some egg-like bodies on a little piece of moss, which I have had under observation for about a week, are really the ova of Cypris, as I suspect.

Upon this same piece of moss, in my "growing cell," I have had a very large and prolific family of *Rotifer vulgaris*. When first observed, I could easily count a dozen of them in the field of an inch-and-a-half objective. Twenty-four hours later I counted more than forty in the same field, and they actually crowded one another when expanded and feeding. The dozen that I started with, however, were well advanced in pregnancy when first seen. This rapidity of reproduction was perhaps exceptional, but, inasmuch as it was apparently occasioned merely by the artificial Spring

which I had created, it may be the common order of things whenever the "winter ova" are waked to life by the natural change of the seasons.

My attention was called to the process of reproduction by seeing, in the larger rotifers an extra "gizzard" below the one to which each individual seemed properly entitled, and by observing the independent movements of the imprisoned embryos. But a simple egg-shaped vacuole-like ovum is to be seen in every rotifer, even at its birth, I believe.

Subsequently the embryo develops its ciliated lobes, its proboscis, its eyes, and its foot or leg, and for a short period before birth a slight ciliary movement may be seen, and a slow working of the gizzard. At this time its head is close to the gizzard of the parent, and the appearance is as if the fœtal rotifer were actually sharing the food of the mother and remasticating it. This, however, finally ceases, and the fœtus, generally with some difficulty, turns itself within the parent, in order to present its head first at the time of parturition. If the operation is interrupted, or the parent much disturbed, the fœtus may turn back again, and this vacillation is in many cases repeated several times before birth is effected.

Some writers state that the nascent rotifers "creep out of their envelopes, extend themselves, and put their wheels in motion, while within the ovary," but I am convinced that motion of the "wheels" is impossible at this time, both from the size and from the position of the young, and the rest of the statement quoted seems to me highly imaginary. The slight ciliary motion observable at this time is produced, I think, not by the large cilia upon the infolding head-lobes, but by a ciliary system lining the throat of the animalcule, analogous to the ciliary system which I have discerned in the throat of Floscularia. From this motion's being seen so plainly in the nascent rotifer, I am inclined to believe that it is by this means that food is taken from the parent's supply, as already suggested. The movements of the fœtus do not seem to trouble the parent in the least degree, although she is, as usual, extremely sensitive to any external motion. The whirling of her cilia and the working of her gizzard are interrupted by the reproductive process only at the very instant of parturition.

The ovarian sac opens into the cloaca, or rectum, of the rotifer, and the young is extruded from the anus, which is just at the lower edge of the upper segment of the foot-stalk or leg, and is what is rather indefinitely termed, by some authors, the "contractile vesicle." At the critical moment the parent draws herself violently together, so as to force the head of the young rotifer through the anus, and then the latter actively liberates itself and crawls away. At first it is somewhat awkward and undetermined in its movements, but, after creeping about for a few minutes, it attaches itself to some fixed object and opens out its ciliary wreaths, which it whirls as accurately and as gracefully as any *old* animalcule could do.

Frequently a mother rotifer, containing a well-advanced embryo, also contains several partially developed ova, one of which may be seen to be undergoing a sort of segmentation or differentiation, the gizzard being about the first organ to make its appearance.

I have several times seen a large rotifer, which had been killed in some way, lying drawn up into a rounded mass, in which a lively young one was making frantic but ineffectual efforts to break through the enveloping corpse and escape. This suggests the conclusion that the development of the fœtus, after it has reached a certain point, is dependent upon the parent only for food; and this supports my belief, already expressed, that the fœtal rotifer actually and actively feeds, and does not merely passively imbibe.

On seeing so many rotifers containing young as I have happened upon in the last few days, I am astonished that their reproductive process has not been oftener the subject of observation and description than it seems to have been. *All* the rotifers I

now see are in the interesting condition described, and yet, according to "the authorities," no males of *Rotifer vulgaris* have ever been discovered. Analogy, however, seems to indicate that this rotifer, like *Hydatina*, *Brachionus*, *Melicerta*, *Floscularia*, etc., is dioecious. The earlier steps in its mode of reproduction are, therefore, an inviting subject for investigation.

By the way, why do Pritchard, Carpenter and others, persistently describe and draw *Rotifer vulgaris* with spined or hooked margins to the segments of the foot-stalk or leg? I think I have never seen it with such segments. The foot-stalk, as far as I have observed, is simply telescopic, like that of *Actinurus*, and consists of more segments than are usually drawn or described—probably six. Can it be that there is a difference in these respects between the common rotifer of England and that of this country?

C. F. Cox.

New York, Feb. 15, 1877.

Two New Illuminating Glasses for the Microscope.

BY ERNST GUNDLACH.

CONVERGING rays of light, falling upon the convex surface of a plano-convex lens (Fig. 1) in the direction of the centre of curvature of this surface, are not refracted thereon, and therefore sustain no kind of aberration. They are, however, refracted on emerging from the plane surface, and this refraction causes the rays, passing through the peripheric part, to meet sooner than those of the central part. The distance between the points at which these different rays meet determines the degree of aberration. This distance varies with the thickness of the lens; if the lens is thick, the distance between these points of meeting is small; if, on the contrary, it is thin, there is a large distance between these points of meeting of the central and of the peripheric rays, and the aberration is in the same ratio. The colored rays undergo an analagous aberration, and in such a manner that the violet rays meet sooner than the red ones; the distance of the points of meeting becomes less in the same proportion as the lense grows in thickness. If the plane surface of the lens lies near the centre of curvature of the convex surface (see Fig. 2) the distance apart in the points of meeting is infinitely small, and consequently also the degree of aberration, spherical as well as chromatic, in the same ratio.

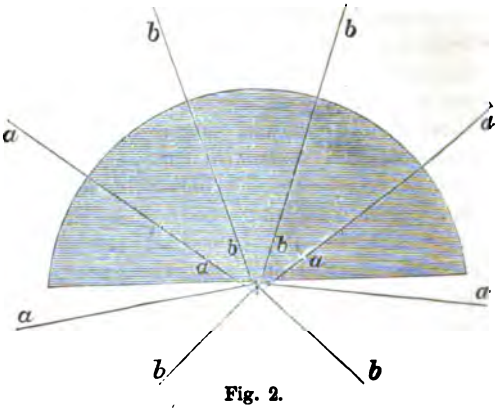

Fig. 2.

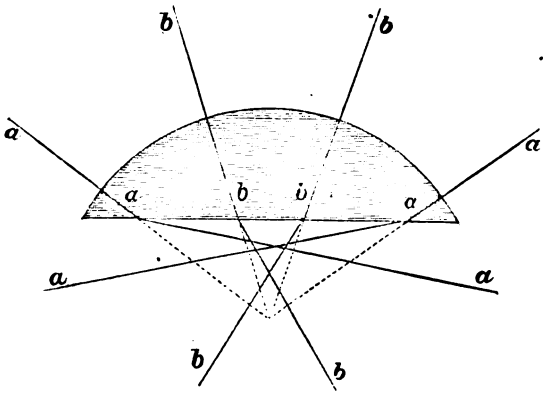

Fig. 1.

The so-called immersion objectives of the microscope corroborate this in a most remarkable manner. The refraction which a ray of light undergoes on the plane surface of the lens lying nearest the object, is more than twice the sum of the refractions on the surfaces of the

other lenses. This shows that the aberrations taking place at this surface are very considerable, but they decrease with the increase in thickness of the front lens, and are infinitely small, when the object from which the rays emanate lies infinitely near to the plane surface, as shown in Fig. 2. This explains the advantageous effect of immersion, thick glass covers, etc. As the angle of refraction at the plane surface is not changed by the increase of the thickness of the lens, the magnifying power remains the same.

This mode of correcting aberration by increasing the thickness of the lens (or by the application of immersion, instead of the former,) *is perfect, as it leaves no remnant of aberrations of the higher order.*

On this principle, or after this method of correcting aberration, the new hemispherical condenser is constructed, which is represented in Fig. 3.

It consists of a single piece of crown glass, and is inserted from below in the

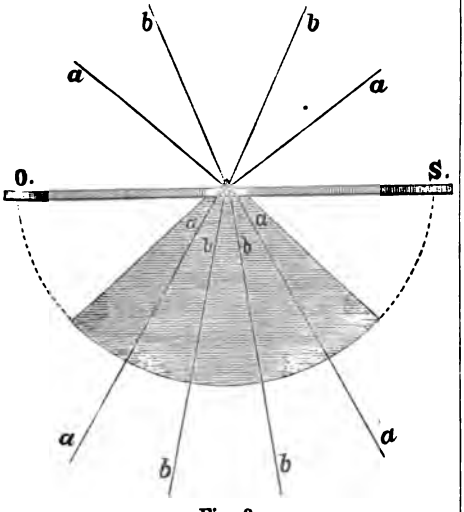

Fig. 3.

stage. The uppermost surface is plane, and lies as close as possible to the object slide, and may be connected with it by a drop of water or glycerine for greater effect. The lower surface is convex, and lies as far distant as possible from the upper one, that is, the glass is as thick as allowable, and the centre of the curve coincides with the point where the optical axis of the microscope cuts the plane of the object,

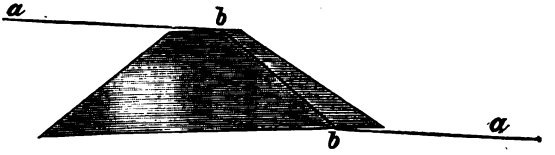

Fig. 4.

and where the light from the mirror also concentrates.

The converging rays of light undergo no refraction on the convex surface. On emerging from the plane surface, however, (or, better still, from glycerine, when this connects the surface and object slide, and therefore as close as possible to the object), a still more condensing refraction takes place, which, as explained above (illustrated by Figs. 1 and 2) is almost perfectly free from aberration. The aperture of the condenser is so large that by using oblique light, the refraction on the plane surface can be brought to its maximum, and rays coming directly from the mirror can be led to the furthermost edge of an objective of the greatest possible angle of aperture. This condenser is therefore well adapted to be used in connection with oblique light, the light being at the same time condensed thereby.

The same purpose is effected without condensing the light (which may sometimes be very desirable), by my new oblique light projector (Fig. 4), which is only distinguished from the condenser by the fact of the lower surface being plane instead of convex, and parallel with the upper one. The illustrations render further description superfluous.

BLEACHING IVORY.—It is said that pieces of apparatus made of ivory, such as rules, etc., which have become yellow by age, may be bleached by dipping them in turpentine and exposing them to sunlight.

THE AMERICAN

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AND

POPULAR SCIENCE.

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We can no longer supply complete sets of Volume I in sheets, but offer all the numbers except Nos. 1 and 4 for 25 cents, by mail, postpaid. We have on hand a few complete copies of Volume I, handsomely bound in cloth, with gilt title, price $1.25. Volume I, bound, and the numbers of Volume II (as issued) we will furnish for $1.50 as long as our supply of Volume I lasts.

The following gentlemen have kindly consented to act as agent for this Journal, and are authorized to receive subscriptions and advertisements:

MR. CHARLES STODDER, 131 Devonshire Street, Boston.
S. E. CASSINO, Naturalists' Agency, Salem, Mass.
J. G. LANGGUTH, Optician, 88 State Street, Chicago, Ill.
JAMES W. QUEEN & Co., 924 Chestnut St., Philadelphia.

The Journal as an Advertising Medium.

An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the AMERICAN JOURNAL OF MICROSCOPY. This certainly demonstrates the value of the journal as an advertising medium."

The Bramhall Illuminator.

THIS little piece of apparatus, which was fully described in a former number, is receiving great favor in England, many of the microscopists there declaring that by its means they are enabled to resolve objects which were previously entirely beyond their reach. It seems, however, to have been known to several American microscopists, some of whom now lay claim to the honor of inventing it, while one microscopist of note, who had employed it some ten years ago, considers it of very little value. It seems to us, however, that if there is any great merit in the device, the only person to whom the microscopic public owe thanks for it, is Mr. Bramhall. The other inventors have taken no pains to give it to their fellows, or to have it manufactured and placed in market. Mr. Bramhall promptly handed it to a well-known microscope maker, and rendered it accessible, in its best condition, to every one. He then published a description, with figures, in a journal of large circulation, and so told almost every one interested, just where they might get it.

The simultaneous invention of a particular device by several different persons is nothing unusual. Neither is it uncommon for an invention which in its earlier form was rude, inefficient or inconvenient, to be brought forward at a subsequent period and and be generally accepted. In one sense there is nothing new under the sun; in a higher and better sense, every day sees something new.

The invention of the nose-piece is generally attributed to Mr. Brookes; it is called by his name, and he gets the credit of having invented and introduced it, and justly so. But we had in our possession, a short time ago, a London microscope, made about the close of the last century, which possessed a very elaborately constructed nose-piece!

We have now before us a book which was published nearly two hundred years ago, in which there is an engraving and description of a binocular microscope. In the same work there are figures of telescopes, or, rather, opera glasses, in which the distance of the two tubes from each other can be regulated to suit the distance at which the eyes of the observer are placed apart—just as we find in the modern binocular microscope. But all this does not detract one iota from the credit of the men who have given us the modern binocular. In order to have the credit of an invention, the inventor must not only present it in a usable form, but he must so publish it that other workers can avail themselves of its advantages. This Mr. Bramhall has done, and this the others left undone.

— An international congress is shortly to be held in Switzerland for the purpose of finding out the best means of destroying the phylloxera, the dreadful parasite which has for some time past ravaged the French vineyards, and is spreading itself into Switzerland.

List of Microscopical Societies.

IN our June issue we will publish as complete a list of the microscopical societies in the United States as we can obtain. Those of our subscribers who will send us the localities of new societies and names of officers, or any corrections in former list, will confer a great favor.

Instruction in Microscopy.

IT gives us great pleasure to be able to say that the notice in our last issue has called forth a response, and that a gentleman who comes to us well recommended as an expert microscopist has agreed to make a beginning provided he can find a class of not less than twelve. We should think that there would be no difficulty in finding that number. According to promise, we publish his card in another column.

—Prof. T. B. Comstock, of Cornell University, proposes to make an educational tour of the lakes, starting from Buffalo or Cleveland about July 5th. Several able teachers of zoology, botany and geology are expected to accompany the expedition, and give the students the benefit of their knowledge. Prof. Comstock may be addressed at Ithaca, N. Y.

—At a recent meeting of the Academy of Natural Sciences, at Philadelphia, Prof. Leidy stated that he had observed a seeming phosphorescence of the water during cloudy afternoons, which he had since found to depend upon the presence of small crustaceans which reflected the light from minute mirror-like appendages.

—At a recent meeting of the Academy of Sciences, at Philadelphia, Dr. Leidy exhibited a specimen of a tape-worm said to have been taken from the inside of a large cucumber. This was the first time he had heard of one of these worms having been found in a vegetable. It had all the characteristics of a true tape-worm, but belonged apparently to an unknown species. The ovaries, containing round yellow eggs, were confined to the anterior extremity of the segment.

Our Book Table.

Life of a Scotch Naturalist—Thomas Edward, Associate of the Linnæan Society. By Samuel Smiles, author of "Self-Help," etc. With portrait and illustrations by George Reid, A. R. S. A. New York: Harper Bros.

Aside from the interest which this book will have as the biography of one whose whole life seems to have been a continuous train of queer adventures, strange misfortunes and ultimate success, it must prove of great value as a study to those who are interested in the education of the young. We have here a boy who, apparently, from pure love of animals of all kinds, watches their habits, observes their peculiarities of form and structure, and through innumerable difficulties becomes a most expert working naturalist. He seems to have been able at a single glance to detect specific differences in the objects which came under his notice, and consequently, while allowing the common specimens to pass by, he was sure to single out anything rare or unusual. The result is that he has added a very large number of species to those before known to inhabit the district in which he resided.

This power to detect different species and varieties seems to be inherent in some men. We have known those who had made a study of natural history all their lives, who seemed to be very deficient in this respect, and others who had had no special training who were very expert. The life of Edwards forms a valuable study for those who are interested in this subject.

But aside from its higher teachings, the book, as a mere story, is a most absorbing one for both young or old. At times it is pathetic to the last degree, while the very next paragraph may be of the most mirth-provoking character. Wherever it is known it will be read.

A Brief Paper on the Use and Educational Value of Simple Microscopes, and the Field Naturalists' Microscope in Particular.

The author of this little pamphlet has done good service to the cause of microscopy, for although his *brochure* is devoted chiefly to the purpose of making known the excellences of a special instrument, this does not detract one iota from the sound common sense which pervades the entire work, the directions in which may be applied to any simple microscope. The term "Field" microscope contains a sort of pun—the instrument being intended for *field* use and being also made by Mr. *Field*, of Birmingham, the well known manufacturer of the Society of Arts Microscope.

The Field microscope is a simple microscope with a stand sufficiently large to be firm and convenient. The lenses are evidently simple lenses, though no

description is given of their character or power. The arm which carries the lenses is moved up and down by means of a rack and pinion, and the instrument is furnished with an animalcule cage, stage forceps and bulls-eye condenser. The price of the whole is £1 5s. in deal (pine), and £1 10s. in mahogany. It must form a very cheap and convenient dissecting microscope, if the optical part is of good quality, which, we have no doubt, it is.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

Buffalo Microscopical Society.—At the annual meeting of the Buffalo Microscopical Club, held at the house of Dr. L. M. Kenyon, quite a large number of ladies and gentlemen were present and the exercises were of the most agreeable kind. The President, Dr. Hadley, being detained at home by illness, Dr. Kenyon was chosen President *pro tem*, and after reading the minutes of the last regular meeting the Secretary presented the following report of the transactions of the club during the past year:

The B. M. Club was formally organized on the 17th of February, 1876, with 12 active members. To this number 16 have been added, the resident fellowship consisting at present of 28 resident members. The regular meetings have been continued without interruption through the year, and have been attended by at least the constitutional quorum necessary for the formal transaction of business. These meetings have all proved interesting and indicate decided progress in microscopical work and study. At each meeting it has been the duty of some member, previously appointed for the purpose, to read an original paper on some appropriate subject, thus securing for each evening some suitable topic for general comment and discussion. The following is a list of the papers thus far produced, and directed to be filed for reference or publication:

By Prof. D. S. Kellicott—1. A systematic view of the growth and structure of the Diatomaceæ. 2. On a new species of Argulus found by him on the Lepisosteus. 3. Some notes on the Diatomaceæ of the Niagara water. 4. Notes on the Spermatozoa of Lumbricus.

By Dr. Lucien Howe on the optical principles of the microscope.

By Mr. Jas. W. Ward. 1. On the penetration and light angle of the high power objectives. 2. On a new method and diagram for measuring the division or refraction angle of light passing through different transparent substances. 3. On Microphytæ, or the minute vegetal forms found in stagnant and running waters.

By Dr. H. R. Hopkins, on human epithelial cells.

By Mr. Henry Mills. On certain vital and molecular motions in living water, and a new chromic method of viewing them.

By Dr. George E. Blackham. On the visibility of the lines of Nobert's 19th Band (× 540), in relation to their usual angle and apparent distance. (This paper has been since published in the *Medical News.*)

By Mr. Geo. Fell. On the life history of the Acarinæ.

All these papers were accompanied by diagrams, and carefully executed drawings, and black-board illustrations, and were the occasion, severally, of considerable instructive discussion.

Perhaps the most interesting occasion in the history of the club was its reception at the rooms of the Grosvenor Library on the evening of the 24th of August last, of the Microscopists and their ladies and friends in attendance at the annual session of the American Association for the Advancement of Science. The invitation of the club threw together on that occasion a numerous and pleasant company, among whom were many distinguished leaders in microscopic science. Many of these favored the club with interesting remarks and original notes, and altogether the conference was in every respect gratifying, fraternal and memorable.

This brief glance at the results of the first year of our organization not only affords us pleasure and satisfaction, in view of the really respectable amount of work we have, in our unobtrusive way, been able to accomplish—besides having put ourselves, as a body, into living and tangible fellowship with kindred associations throughout the country, with whom we stand on cordial and reciprocal terms; but it affords ample promise and confidence for the future success and permanence of our undertaking. It is pleasant to consider, further, that we enter upon the second year of our existence with every assurance of the continuance of that spirit of of harmony and good fellowship which has so far and so conspicuously characterized our undertaking, and as well with every prospect of still more appreciable results from our studies and observations in the captivating field of inquiry to which, by covenant and inclination, we are as individuals and as fellow-students mutually pledged and devoted. JAS. W. WARD, Secretary.

A letter from the Microscopic Club of Brussels, Belgium, was read, inviting exchanges.

The club then proceeded to the election of officers for the ensuing year, and the following gentlemen were selected: President, Dr. Lucien Howe: Secretary, Jas. W. Ward; Advisory Council, Dr. Henry Mills, Prof. D. S. Kellicott and Mr. G. E. Fell.

The regular business being over, the ladies were called in, and viewed a large number of objects through the microscope, among which may be noted: *Demodex folliculorum;* microscopic writing with a diamond; *Arachnoidiscus Ehrenbergii* in situ on seaweed; Chara, showing circulation; section of bone; section of tooth; crystals in cells; polariscope objects; young fish, showing beating of the heart; skin of a dipterous larva; scales of lepisma; equisetum spores; lung of frog; living *Argulus*, (n. s.); spores and seeds of marshmallow; Niagara river diatoms, etc.

After viewing the objects for a while, the company were informed that Mrs. Kenyon wished to see them in the dining room, where they found a collation waiting. This they discussed without the use of the microscope, and with a relish. After returning to the parlor the microscopes were used for a short time, and the company then adjourned with pleasant recollections of the first annual meeting, and very kind regards for the host and hostess.

San Francisco Microscopical Society.—A regular meeting of this Society was held on Thursday evening, March 15, with Vice-President Henry C. Hyde in the chair, and a fine attendance of active and other members.

Acquisitions to the Library were announced by the Secretary in the way of the March number of the *American Naturalist*, February number of AMERICAN JOURNAL OF MICROSCOPY, and copies of *Nature*, by subscription; also "The Germ Theory of Disease," Maclagan, by purchase.

Mr. H. G. Hanks presented a sample of vegetable substance found on the beds of dried-up lakes in the deserts of Arizona and Southeast California. He stated that some parties here had conceived the idea that paper could be made of the material, which was white and cottony in appearance. An examination with the microscope showed the filaments to be composed of cells loosely jointed. The whole mass was but a collection of interwoven filaments of confervæ, which had lived during some flood of water, and as the lakes became dry, were left to be blown about by the winds, and as they are often found apparently descending from the sky, have been named aërophytes, though formerly regarded as of meteoric origin. It would be but a waste of capital to endeavor to manufacture paper of a material which has no fibre, though perhaps a felt-like body might be obtained. A slide, with a portion of the filaments, was examined, and the subject of its being of no value for use as a paper material, being plainly evident from a microscopical examination of its structure, led Dr. Edwards to speak of the popular idea regarding the rice-paper common with us, and to the fact that it was not manufactured, as paper is usually—in fact, not manufactured at all, but only shaved off in thin sheets from the pith of the *Aralia papyrifera*, a Chinese tree. Quekett first discovered that this paper was composed of natural parenchymatous tissue by the application of the microscope, and disproved the assertion of many who even went so far as to assert that they had seen the tissue manufactured as our common paper is made.

This reference to popular fallacies induced Mr. Kinne, later in the evening, to refer to a matter which thousands believe to be true, regarding the production of long, slender worms from horse-hairs. He did so from the fact that but recently an otherwise well-informed gentleman of San Francisco not only asserted that horse-hairs, when placed in water, would undergo a peculiar transformation, and become worms or snakes, but insisted that he had performed the miracle himself, and would do it again and bring them to him as an evidence of the truth of his theory. He has not yet done so; but as the general diffusion of knowledge should be constantly presented through the medium of the newspapers and scientific journals, we give some data that Mr. Kinne mentioned, as an item of general interest:

M. Villot, of France, some time since published a memoir, which entirely cleared up the life-history of these curious beings, and when we state that one of our common species (*Gordius varius*) lays about 600,000 eggs, it will be seen that there is no wonder we find them occasionally creeping through a faucet not supplied with a strainer of some sort. Strings of the ova are noticed in water in Autumn, sometimes fifty feet or more in length, and being swallowed by insects, are encysted therein, in turn to be snapped up with their host by some little fish, or carniverous beetle, where they are set free and encysted again in the intestines. A transformation after some months causes them to be able to reach the water again, where great changes take place, and when about two inches long they turn brown and begin to move. The *Gordius aquaticus*, our common hair-worm, grows to be about a foot in length, and is found in many animals. As it is a popular belief in certain parts of Europe that they live in man, and that they may be introduced into the system in drinking water from pools or brooks, or in eating fish not properly cooked, it behooves every one to be on the safe side, order their fish well done, and strain their Spring Valley or other water before drinking.

Dr. Mouser exhibited one of the most beautiful forms of *nostoc* known, in which the beaded filaments are arranged in a spiral form, and were found floating on the surface of the outlet of Lake Merced.

Mr. Langstroth added to the general interest of the evening by exhibiting a *Serpula*, brought down for the occasion from his marine aquarium. The curious little animal was in good humor and protruded its cirri from the contorted calcareous tube in which it lived in a way to show all the manner of its obtaining food and raiment, so to speak, from its native element.

Mr. Hyde brought up a subject of great interest to all, by exhibiting a number of branches of lupin destroyed by the larva of some insect, which he had obtained from Mr. Pritchard, Superintendent of Golden Gate Park. The ravages of this insidious little foe are becoming apparent in a very alarming manner, some twenty acres of the lupin-covered sand-dunes of the park being destroyed. The blight was first noticed some six weeks ago, and rapidly spread from several well-defined patches. With the infected branches, Mr. Hyde presented four vials, each containing forms of insect life thought to be obnoxious.

The fly found most numerous on the healthy and diseased plants, and supposed by Mr. Pritchard to be intimately connected with the trouble, was at once counted out, as well as the second insect noted. The third, on a casual examination, bore

some of the finger-marks of those pests of the agriculturist, the *Curculionidæ*, of which there are some 10,000 known species; but, on further examination, Mr. H. Edwards decided it to be the active pupa of the second. He further stated that the larva, which was tunnelling its way in such numbers up through the pith of the branches, destroying the shrub and jeopardizing the well-directed efforts of the Park Commissioners to reclaim the sandy wastes, would no doubt be found in July, or thereabouts, to develop into one of the smaller *Noctuidæ*, or night-flying moths, which seem to delight in bad deeds. The cabbage cut-worm is the larva of *Agrotis devastator*, one of the 2,500 species of its kindred, and serves as an example of what trouble they can cause. Feeding, as this new pest does, on the very heart of the plant, there is no way to become rid of the trouble but cutting down every infested plant, burning them, and thus lessen the production. Those already at work are domiciled beyond the reach of the turkey remedy proposed by Mr. Edwards some two years ago, and carried out with manifest improvement to the lupins, at which time the leaves were being destroyed by the larva of a small butterfly.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Bermuda shell sand, composed entirely of foraminiferal and other shells, with coralines and sponge spicules. Very interesting for low powers and opaque specimens. Address C. C. Merriman, Rochester, N. Y.

Slides of diatoms containing Stauroneis Phœnicenteron, Cymbella Ehrenbergii, Circulare Gonphonema, Navicula, etc., in exchange for any well mounted object. William Readio, Garnerville, Rockland County, N. Y.

Wanted, one of the famous Barton buttons; must be in good condition. Will give either money or good exchange. E. W., Box 4,875, New York.

For Daphnia pulex, send other unmounted objects—Polycystina especially—to A. Y. Moore, P. O. Box 68, Coldwater, Mich.

Wanted, good slides of vegetable or other objects, for sections of Japanese coniferous wood from Japanese Dwelling, Centennial Exhibition. E. Pennock, 805 Franklin street, Philadelphia.

Wanted, slides of pathological or anatomical preparations, in exchange for diatomacean fossil and other well mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Slides of pollen of Agave Americana and other southern United States flowers, for any well mounted objects. Mat. Stuart Beard, Box 1817, New Orleans, La.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Wanted, in exchange for diatoms from northern Wisconsin and Michigan, any well-mounted objects; marine diatoms preferred. W. H. Titus, M. D., Shawano, Wis.

Bott's eggs, upon horse hair, mounted, (pretty objects); also kangaroo and other hair, mounted, in exchange for other interesting mounted matter; send list. Chas. S. Shultz, Hoboken, N. J.

Slides of fine sand, consisting of quartz, garnet, magnetite, hornblende, etc., from beach at Lake George, very beautiful, for other mounted objects. Wm. W. Griffin, Lynn, Mass.

For specimens of Comstock ores (15—25), or crystals of rare chemicals for polariscope, mounted, send diatoms or foraminifera to F. H. Engels, M.D., Virginia, Nev.

Wanted, well-mounted specimens, for slides of American Podura mounted whole, and scales of same. Address George W. Fries, Friendship, N. Y.

Wanted in exchange, well mounted specimens for mounted sections of either lung or kidney specimens, showing perfect minute anatomy of these organs. Also, injected sections of human stomach, mounted, for other histological specimens. C. E. Nichols, M. D., 14 Fourth street, Troy, N. Y.

Slides of fossil diatoms from Nova Scotia, for any other mounted objects. G. C. G., Box 2055, Rockford, Ill.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 355, Milford, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield. Mo.

Wanted, slides of diatomaceæ or foraminifera in exchange for pathological preparations. George A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

BOOKS WANTED.

Dr. Fleming's book on "Blood Stains in Criminal Trials"—Pittsburg, 1861. Also any other work on detection of blood stains.
Pritchard's Infusoria. Edition of 1861.
Brunet, Manuel de Libraire. Last edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Faraday's "Electrical Researches." 3 vols.
"Botany of the State of New York." 2 vols., 4to.
Holtzapfel's "Mechanical Manipulation."
Ehrenberg's "Mikro Geologie."
Ehrenberg's "Die Infusions Thierchen."
Williamson's Recent Foraminifera.
Pritchard & Goring's Works (any vols.)
Hook's "Micrographia."
Carpenter on "Foraminifera."
Address, stating price, (which must be low) E. W., Post Office box 4,875, New York.

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On Microscopy in the United States.

BY HENRY CROUCH, F. R. M. S.

I has been suggested to me by our Secretary that some account of the microscopes exhibited at the Centennial Exhibition lately held in Philadelphia, and also of the present condition of microscopy in the United States, would be of interest to our members; and although feeling rather diffident in offering my opinions upon the subject, from the fact of my being an exhibitor, perhaps I may be excused for doing so, in default of any remarks being offered by others better qualified, or having a more extended experience.

I propose, therefore, first to notice the instruments exhibited by makers of the different countries represented—premising that some well-known and respected makers, both American and European, were unfortunately absent—and then to ask your attention to any novelties in detail or construction that occur to me as worthy of remark, taking them in accordance with the respective value and importance of the various exhibits. The countries represented were England, America, France, Germany, and lastly Japan. With respect to those exhibited by English manufacturers, it will not be necessary for me to describe instruments so well known to you as those manufactured by Messrs. Beck, Dallmeyer, Ross, and myself, comprising the English exhibitors. It will be sufficient to observe that Messrs. Ross & Co. exhibited some twenty; Messrs. Beck about twelve; Messrs. Dallmeyer two, and myself sixteen; including, with one exception, every form of stand manufactured in England and together being more than twice the number exhibited by all other countries included.

The American makers represented were Messrs. Zentmayer, J. W. Queen & Co., the Bausch & Lomb Optical Co. (with whom is associated Mr. Gundlach), and Mr. Wm. Wales, who exhibited a few objectives only. Messrs. Zentmayer exhibited some nine microscopes, Messrs. Queen & Co. about six, and the Bausch & Lomb Optical Co. three or four, the latter having but just commenced the manufacture of this instrument.

Amongst the French exhibitors were Messrs. Nachet & Sons, who exhibited some five or six instruments. Those remaining need scarcely be specified individually, the microscopes shown being of that inferior class usually supplied to their unfortunate victims by those whom I may, perhaps, be permitted to term "Shopticians," and which, I am afraid, more often create a prejudice against, than a taste for, the prosecution of microscopic investigation.

The only microscope of German manufacture that came under my notice were those shown by Ploessel, who exhibited a few on the ordinary Continental model.

While examining the wonderful exhibit made by Japan, I was fortunate enough to stumble over a microscope of veritable Japanese manufacture, which, however, had been damaged in transit. As a specimen of workmanship it could not be said to compare favorably with those shown elsewhere. This might possibly be due to the fact that the maker was especially unlucky in the pattern before him; evidently one of the most coarsely made and finished instruments of London manufacture. The optical portion of the instrument was, as could only be expected, of the most rudimentary character. An attempt had been made to imitate the construction of the eye-pieces, and the objectives were roughly made single lenses. The maker, however, had very wisely only provided the fittings for the polariscope, the Nicol prisms being evidently too much for him.

After a careful examination, however, of the admirable educational system, some of the results of which were exhibited by the Japanese Government, there cannot be much doubt that the microscopes next placed on exhibition by Japan will be less open to criticism.

The point, however, which occurs to me as being of the most importance to note, is the direction in which the construction of the microscope is developing; whether, as we are sometimes told, very dogmatically, English microscopes are a mistake, binoculars being an especial delusion, and the Continental model that which is eventually to carry all before it. Well, comparing the respective exhibits, it is somewhat comforting to those who, like myself, have consistently held that the Jackson model and its developments are those which give the best results "all round," to find that the English and American makers—who, I presume, like other manufacturers, make and sell what they find to be most in demand—have almost entirely adopted this form for all instruments to which accessory aparatus is requied to be applied.

It is essential that this distinction should be noted, because, if you enquire of the enthusiastic supporter of the Continental model, you will find that he rarely, if ever—for his particular class of work—requires more than the most elementary form of stand, and he often knows absolutely nothing about the proper illumination of an object, the amount of dogmatism displayed being, as usual, in exact proportion to the observer's ignorance of the subject. He knows that to see something of a transparent object he must make use of the mirror, and that it is of advantage to apply a condenser when examining an opaque object. The polariscope is looked upon as altogether beneath notice, being only fit for the amusement of children. Dark ground illumination! Well, it does not do to profess absolute ignorance, but if you hand our observer a Wenham's paraboloid, and ask him to apply it, his helplessness is at once apparent.

Possibly you may think this an exaggeration, but I can only assure you that such cases have come under my notice again and again, one of the latest instances being that of an eminent German microscopist, who assisted in examining the microscopes on exhibition at Philadelphia, and who from the first loudly proclaimed the uselessness of binoculars, and the absurdities of English microscopes in general, but whom we afterwards found out had never used one, and who also had never heard of dark ground illumination. As the result, however, of his experience there, his views were considerably modified.

In comparing stands of American and English manufacture, there are one or two points of difference in general construction that are worth attention, the most noticeable, perhaps, being that in the American patterns the "limb" is generally supported upon a single pillar; whereas the English makers, with one exception, find the double uprights or pillars more often preferred. The stages of the American instruments are

generally made of glass, and without concentric rotation or mechanical adjustments; whereas, as you are aware, the majority of English microscopes are now made with rotating stages, and a large proportion are also provided with mechanical adjustments. American makers have also generally adopted a mirror stem, hinged, so as to give a lateral movement to the entire fittings of the mirror, thus providing an extremely convenient method of obtaining an exceedingly oblique illuminating pencil.

Mr. Zentmayer and Mr. Gundlach also exhibited a substage arrangement, which was mounted in such a manner as to give a lateral movement to the entire substage and mirror, the advantage claimed being, that as the axis upon which it swings is so placed as to be as nearly as possible level with the upper surface of the slide upon which the object under examination is mounted, better results are obtained where an oblique illumination is required with an achromatic condenser. Messrs. Ross and Mr. Zentmayer both exhibited portable microscopes of extremely ingenious construction, but needing diagrams to render them intelligible. I may, perhaps, here be permitted to state that my own centering adjustments, with which my best stands are now provided, were claimed by two American manufacturers, but in both cases the claim was proved to be without foundation.

The accessory apparatus exhibited being of the usual character, and presenting nothing calling for especial remark, it is not necessary for me to occupy your time by giving any detailed account of it. I had, however, the pleasure of receiving many valuable hints respecting the improvement and modification of some of the accessories from Dr. Woodward of Washington, Dr. J. G. Hunt and Mr. Holman of Philadelphia, Dr. Ward of Troy, and other microscopists, which, when I have had an opportunity of carrying out, I hope to submit to your further notice.

With respect to the objectives exhibited, I cannot but feel that I am here approaching a rather delicate topic, as, if manufacturers of microscopes are a little weak upon any subject, it is upon the point of the immense superiority of objectives of their own production over those supplied by their competitors; and I am sure, therefore, that you will agree with me in referring those requiring further information to the published reports of the judges.

Mr. Walmsley, of the firm of J. W. Queen & Co.; Dr. Beattie, of Baltimore, and Mr. Edmund Wheeler, of London, were, I believe, the only exhibitors of prepared specimens for the microscope. The latter gentleman exhibited an excellent series, including some very fine transparent injections. Mr. Walmsley and Dr. Beattie both submitted some very excellent specimens of the double staining of vegetable tissues, a subject to which considerable attention has been devoted in the United States. I have the pleasure of submitting to your notice some very beautiful preparations of this description, mounted, and kindly presented to me by Dr. Hunt, of Philadelphia, which will be found to illustrate vegetable structure in a remarkable manner. As examples of mounting they are unsurpassed.

In a country possessing such enormous deposits of Diatomaceous earth, it is only natural that considerable attention should be devoted to the collection and preparation of these—to many—fascinating structures. Pond life, however, is a subject with which, to my surprise, I found very few microscopists whom I met in America at all acquainted, *Volvox globator* being an unfamiliar object to the majority. I cannot help thinking this is due, not to a deficiency of material, but to want of training in collecting, such as that afforded by the excursions of our Club.

Micro-photography, no doubt owing to the influence exerted by the example of Dr. Woodward, is much more extensively employed than in England, and, there can be but little doubt, has had considerable influence upon the construction of American objectives, especially in the increase of the angle of aperture of the higher powers. Whether this is an unalloyed advantage is, I think,

legitimately open to discussion. With the opportunities I have had during the past six months, I will only say, for myself, that I think there are other and important directions in which the energies of those engaged in the manufacture of objectives can be more profitably employed.

In conclusion, I think we scarcely realize how closely and with what interest everything relating to the advancement of microscopic science occurring here is followed by our American cousins having similar tastes with our own. From the fact of my visit taking place in the summer and autumn seasons, during the greater part of which time the societies generally are not in session, I had but few opportunities of attending meetings, but I had the pleasure of meeting in course of my stay a large number of the working microscopists from all parts of the Union, and I must say I was surprised to find so thorough an acquaintance with all that is passing amongst us. I also wish to take this opportunity of tendering my hearty thanks for the boundless hospitality displayed, and the anxiety shown to render everything as agreeable as possible, in whatever direction one might happen to travel. To Dr. David Hunt and Professor Sharpless, of Boston (President and one of the Vice-Presidents of the Boston Microscopical Society), my warmest acknowledgments are due, and should any microscopist desire to enjoy an especially good time, I should strongly recommend him to spend his vacation, if possible, in the United States.—*Jour. Quekett Microscopical Club.*

The Carpet Beetle.

THIS destructive pest has become quite common in New York and vicinity. In Paterson, N. J., it has caused great loss and annoyance in many households. Those who have been accustomed to deal only with the ordinary moth, do not always understand the "ways that are dark" of the new invader. In the case of the moth, we see, flying about in the twilight, a little creature which every one knows and is ready to kill, although it is not the *moth* that does the damage, but her progeny, in the shape of a minute caterpillar, which not only feeds upon woolen goods and furs, but forms a case of the same material. In the case of the carpet beetle, it is the larva or caterpillar that is generally observed, and not the parent. Few persons are familiar with the latter, and therefore she often escapes, simply because she is unrecognized. The parent of the carpet destroyer is a small beetle which varies in color, being sometimes spotted with bright red, and at others a dingy brown. When disturbed they roll up into a ball, and resemble grains of ordinary dirt, and in this state they are often swept up and thrown out uninjured, only to make their way again into the house, and prove more destructive than ever. Therefore, we would strongly urge our lady friends who are annoyed with these little destroyers to carefully burn all the sweepings of rooms infested by them. Especially is this necessary when the carpets are taken up or closets cleaned out. If you see a lot of small, dark-colored, egg-shaped bodies, pick one up and examine it. You will find it has head, antennæ, legs, and all necessary organs, and if you value your domestic comfort, show it no mercy. And to make sure of them all, just burn up all the sweepings and dust; or if you object to this, then scald them most thoroughly with boiling water, in which a liberal dose of good washing soda, potash lye, or soft soap has been dissolved.

FOSSIL ANTS.—Mr. S. H. Scudder has been working upon a collection of fossil ants from South Park, Colorado. Heer, in his work on the fossil insects of Œningen and Radoboj, had found that most of the fossil ants discovered were winged females. It seems reasonable that this should be so, as the winged insects were most likely to fall into the water and be drowned, and especially the females, who are much more heavy-bodied than the males. In amber fossils most of the specimens of ants are workers.

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The following gentlemen have kindly consented to act as agent for this Journal, and are authorized to receive subscriptions and advertisements:

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S. E. CASSINO, Naturalists' Agency, Salem, Mass.
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JAMES W. QUEEN & Co., 924 Chestnut St., Philadelphia.

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An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the AMERICAN JOURNAL OF MICROSCOPY. This certainly demonstrates the value of the journal as an advertising medium."

Foreign Stamps.

OF late we have received several foreign stamps from persons in this country who desired some trifling matter. To such we would say that we do not care to accept foreign stamps from those who can procure U. S. stamps. Of foreign stamps we prefer English stamps, as we can use them readily. For others we have very little use.

We are always ready to send any material we may have at our command to any one, whether they send stamps or not. And the same with the JOURNAL itself. Any person that, for any good reason, such as living in an out-of-the-way place, or any other cause, *cannot* remit the subscription to the JOURNAL, will be gladly placed on our free list, if they will notify us to that effect. But to those who are able and willing we would say: Send us U. S. or English money or postage stamps, and if you cannot get these, send money or postage stamps of any nationality.

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Polycystina.

DURING the next ten days we shall send to all who have applied for it a small quantity of Polycystina procured from Barbadoes earth. In the samples sent out, the Polycystina are nearly pure, and the earth forms a very beautiful object when merely laid on a dark back ground. Those who wish to study the subject more carefully should isolate the different species, and mount them, either as opaque objects on a black ground, or as transparent objects. They may be caused to adhere to a glass slide by means of gum water, to which a little glycerine has been added, or they may be mounted in balsam by the process given for Foraminifera in our January number. In the latter case they form exquisite objects for black ground illumination by means of the paraboloid.

A Question of Priority.

IN a recent issue of the Cincinnati *Medical News*, there is published a paper by Dr. Hunt, of Philadelphia, in which he reviews the exhibit of microscopes at the Centennial Exhibition. In this article he claims for Mr. Zentmayer, of Philadelphia, the entire credit of several devices connected with the microscope, amongst others the attachment of the diaphragm and other accessories to the swinging bar which carries

the mirror, and in a note he says: "It is stated in the *Naturalist* for December, that a firm from Rochester, N. Y., 'hinged' the sub-stage bar at the level of the object, but the small stands exhibited by said firm at the *opening* of the Exhibition were not so made, neither had they any facility for registering obliquity. The firm in question did not grasp Zentmayer's idea at all, and hence can justly claim no priority of invention."

In this statement Dr. Hunt is in error in regard to the facts. To none of the *small* stands, by the firm in question, is this device ever applied, and the large stands exhibited at the opening were fitted with the arrangement alluded to. In saying that "the firm in question did not grasp Zentmayer's idea at all," Dr. Hunt seems to imply that they took the idea from the Philadelphia maker, and were unable to appreciate it after they had it.

Dr. Hunt is probably aware that Mr. Gundlach, formerly of Berlin, acts as superintendent for the microscopical department of the Bausch & Lomb Optical Company, and we think that in the minds of those competent to judge, there will probably be no doubt that, as a scientific optician, Mr. Gundlach is quite the equal of either Dr. Hunt or Mr. Zentmayer.

Our own impression is that like many another valuable invention, this one was worked out separately by each of the makers in question.

In the early part of 1876, Mr. Gundlach brought to the notice of the writer a microscope embodying this device, and its merits and defects were fully discussed at that time. We suggested that in order to secure perfection to its working, the stage should be inverted, the upper surface of the slide resting against the lower surface of the stage. But the conclusion was that while such complicated arrangements, including graduation, were very desirable for certain special investigations, they would make an ordinary microscope unnecessarily complicated and expensive. And we still believe such to be the case.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

High Angles vs. Low Angles.

Ed. Am. Jour. Microscopy—In the January number of this journal, there is an account of a meeting of the Dunkirk Microscopical Society, and a short notice is there given of a paper read by Prof. J. Edwards Smith, in which he took the view that the high angles are best for all kinds of work. I regret that the abstract is so short, and while it is far from my desire to criticize a paper, or the views of the writer, from such imperfect knowledge of it as I have now of this one, it cannot be taken amiss if I call in question some of the conclusions.

In the first place, it is very questionable in my mind if the resolutions which the Professor exhibited, point to conclusions in any way opposed to those generally received by working microscopists. Certainly the resolutions were difficult tests for the glasses employed, and no one would expect to make them with low angled glasses. Is it not admitted by all microscopists that the resolution of diatoms and Nobert lines require high angled objectives? I believe it is Carpenter who says, that low or moderate angles are to be preferred for almost every kind of work except resolution of diatoms.

The mere fact that Prof. Smith has succeeded in resolving the objects mentioned with glasses of high angles, does not support his view that high angles are universally preferable, but only confirms the general testimony in this regard.

Unfortunately the abstract in this journal gives us no information as to how Prof. Smith has been led to form his opinions so contrary to those generally accepted. It seems to the writer that it is time for the long fought battle between high and low angled glasses to stop. His own experience teaches him that for ordinary work, penetration is a requisite, but he does not deny the necessity of high angles for certain work. There should be no disagreement in regard to matters which any man of experience can test for himself, and the universal testimony of our best authorities, *i. e.* of men who have spent their lives in microscopical work, is against Prof. Smith.

As already stated, I do not wish to criticize what Prof. Smith has said in his paper, but I

would like to ask him why he thinks that "most of the work in histology and pathology done with the so called 'working lenses' of narrow angle, would require further attention, and with wide-angled objectives?" (I quote from the report in the journal.) If Prof. Smith really means what this passage intimates, viz., that the errors of interpretation are greater with low angles than with high, then it certainly is a novel idea, to me at any rate, and it is well worth the careful consideration of microscopists.

The main object in writing this was to call more attention to the views of Prof. Smith, and suggest that he put them in form so that they may be published in this journal.

R. HITCHCOCK.

8 *Beekman Place, New York.*

Classes in Microscopy.

Ed. Am. Jour. Microscopy—I think the object sought for by "one subscriber" in your last issue, might be accomplished by the formation of a club or society by your New York subscribers, (non-professionals) where the successes and failures of the members, as recorded from week to week, and the preparation of short papers on interesting topics, might help to attain the object sought. SUBSCRIBER.

New York, April 24, 1877.

Amplifiers.

Ed. Am. Jour. Microscopy—The account of the transactions of the San Francisco Microscopical Society, published in Vol. I of your journal, page 98, contains a notice of a communication referring to Dr. Wythe's amplifier, "which consists of a double concave lens * * at the end of a tube about six inches long, at the other end of which is the ordinary negative eye piece." The communication also states that Mr. Tolles has probably made these amplifiers for the last nine years, thus conveying the idea (which seems to be correct) that this application of a concave lens to optical instruments, is of comparatively recent date.

In what respect, however, does this amplifier differ from that long ago applied to the telescope.

In Smyth's "Celestial Cycle," Vol. I, pages 342-3, the author describes the application of an "Achromatic Concave Lens" to his telescope for the same purpose. It was fixed to an adapter 8½ inches long, by which it was interposed between the object glass and its principal focus, and it is stated that the idea was received from the Rev. W. R. Dawes in the summer of 1833. It would also appear from the context that an account of this lens was published in the Phil. Trans. for 1834. E. ARNOLD.

Keeseville, May, 3, 1877.

Our Book Table.

Report to the Executive Board of the City of Rochester, N. Y., on the Recent Peculiar Condition of the Hemlock Lake Water Supply. By S. A. Lattimore, Ph. D., LL. D., Professor of Chemistry in the University of Rochester.

Our neighbors in Rochester seem to have been troubled in the same way that other cities have been annoyed—the water supplied for domestic purposes having "an ancient and fish-like smell." The object of the investigations, of which this is a report, was to discover if possible the cause and a cure. In neither direction, however, has marked success been attained, the cause of the difficulty at Rochester, eluding the search of the chemist, as it has done elsewhere. Upon one point, however, the citizens of Rochester are to be congratulated, and that is upon the purity of the water supply. Prof. Lattimore states that the amount of diffused solid impurities existing in a thousand gallons of this water, amounts only to one or two grains! We could get that amount from a much less quantity of Croton water, and from a still less quantity of Passaic water.

A Course of Practical Histology:—Being an Introduction to the Use of the Microscope. By Edward Albert Schäfer, Assistant Professor of Physiology in University College, London. With Illustrations on Wood. Philadelphia: Henry C. Lea.

This is a neat little volume of over three hundred pages; it is devoted wholly to the *use* of the microscope in the study of histology, and has very little to say either about the optical principles upon which the microscope is constructed, or upon the nature of the preparations displayed. In a word, it is neither a treatise upon the microscope, nor upon histology, but it is a very thorough and practical little handbook of the best methods of making histological preparations, and examining them under the microscope.

This statement will give our readers a clear idea of the scope of the book, and when we add that the author has done his work intelligently and conscientiously, they will be able to form an accurate estimate of its value.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

Boston Microscopical Society.—The second annual reception of the Boston Microscopical Society, which took place April 27, in the Union Hall, at 18 Boylston street, was an exceedingly interesting event. We compile the following report from the columns of several Boston papers:

The programme consisted of an introductory address by Dr. Oliver Wendell Holmes, an exhibition of polariscope objects with an oxy-hydrogen microscope by the Rev. E. C. Bolles, and an exhibition of anatomical, vegetable and mineral specimens and accessory apparatus contributed by various members of the society, about sixty microscopes being on the tables. The following is a partial list of these contributions:

R. R. Andrews, five specimens illustrating the development of the teeth in embryo pig; Dr. Albert N. Blodget, circulation of blood in a frog's tongue, muscular fibre with sarcolemnia and sarcous elements, root of hair in sheath; I. F. Brown, diatoms from Cuxhaven (opaque and transparent); E. C. Brooks, fresh water algæ; Dr. E. Chenery, uric acid crystals and epidermis of frog; W. G. Corthell, sections of vegetable tissue, double stained; Samuel W. Creech, Jr., flower of Claytonia Virginica, various marine algæ; Dr. S. W. Fletcher, of Pepperell, N. H., exhibited an ingenious microtome; E. Fontarive, section of echinus spine, anthers and pollen of malva, crystals of silver; Dr. M. Green, sections of fibroid tumor and sections of emphysematous lung; Dr. Alfred F. Holt, spectrum of lithium, crystals with polarized light, circulation of blood; Dr. D. Hunt, section of eye of embryo pig three-quarters of an inch long; same of pig one-half inch long; retina of pig prepared in osmic acid; Dr. C. E. Miles, epithelioma of lip, large intestine of rat; Dr. G. H. Merkel, typen platte, cacodyllic acid; Dr. Charles H. Osgood, injection of eye and cut of retina; Dr. W. M. Ogden, doryphora decemlineata, plates and anchors synapta digitata, polycystina, flower of Claytonia Virginica; S. P. Sharples, filterings from Cochituate, filterings from Fresh pond, quinine sulphocyanate; C. Stodder, a great variety of beautiful objects upon a number of Tolles microscopes; John H. Thurston, exogeneous stem sections, fungi from bread; Dr. L. M. Willis, dolichopus, capsus tricolor, clubiona brevipes, larva of argya antiqua, section of pearl; Dr. I. J. Wetherbee, human nerve fibre, cornea of beetle, liver cells, blood discs, trichina spiralis; Messrs. Leach and Greene exhibited a number of instruments with a variety of interesting objects; A. Palmer, circulation in aquatic plant, jaw and teeth of spider, sucker disc from leg of water beetle, scale of flat fish—the last two with polarized light; Mr. Samuel Wells, Pleurosigma angulatum, white beads on dark ground, surirella gemma (a test object), diatomaceæ from Jutland, Coscinodiscus excavatus.

Mr. Bolles' exhibit was as follows: 1, Pressed glass, to show tension lines; 2, mica design, to show effect of thickness of crystalline film on color; 3, selenite crystal for do.; 4, selenite do. do.; 5, selenite design (tulip); 6, selenite design (fruit); 7, crystals of quinidine; 8, crystals of salicine; 9 and 10, chemical crystalizations; 11, stilbite; 12, Labradorite; 13, quartzite; 14, right and left handed quartz; 15, silk fibres; 16, section of clematis; 17, ostrich tendon; 18, eagle's beak; 19, living larva of gnat.

An address was delivered by Dr. Holmes, which was mainly an illustration of the progress of microscopy—in the construction of the instruments and in the discoveries by their aid. "To those of my generation," he began, "this modern world, which most of you take as a matter of course, it being the only condition of things of which you have had experience, is a perpetual source of wonder—a standing miracle. Science and art have in our time so changed the aspect of everyday life that one of a certain age might well believe himself on another planet, or in another stage of existence. The wand of Prometheus is in our match-boxes; the rock of Horeb gushes forth in our dressing-rooms; the carpet of Arabian story is spread in our Pullman car; our words flash from continent to continent; our very accents are transmitted from city to city; the elements of forming worlds are analyzed in our laboratories; and, most wonderful and significant of all, the despotic reign of tradition received its death-blow when the angel of anæsthesia lifted from womanhood the worst terrors of the primal malediction."

Dr. Holmes then spoke of the microscope as one of the acquisitions of knowledge coming within his easy remembrance, the conquest of the invisible universe revealed to us by the microscope, and exhibited an ordinary pocket magnifier, which he remembered from the days of his boyhood, and was now principally remarkable as recalling the person from whom it was purchased by his father, it being the Rev. John Pierce, of Salem, who, with the Rev. Dr. Monnossele Cutler, of Hamilton, was noted for uniting the study of science with the exemplary discharge of his clerical duties. When he studied medicine the medical books treated the microscope with disgust or contempt, and from 1835 to 1853, he studied in the best schools of Paris without hearing a word of the use of the microscope, but about that time a Frenchman published an organic chemistry which brought some of its revelations to notice.

Dr. Holmes then stated the history of the growth and perfection of the microscope, and the wonders it had accomplished in scientific research. He also

noted some improvements he had made for his own convenience, and gave his ideas of the most important points which a useful microscope should combine, such as that it should be portable, and so that it could be taken down and set up with the least trouble. He stated his own experience with microscopes, giving some opinions upon the best manufactures. Alluding to the instruments manufactured in Boston, he said that that city might well be proud of the telescopes of Abram Clark, and the microscopes of Robert B. Tolles. He then spoke in a business vein of the estimate which the owners of microscopes placed upon their objectives, and the rivalry that often sprang up, adding: "But studying out a difficult point in vegetable or animal structure is one thing, and fighting objectives is another, the latter as full of excitement as cock fighting, and as different from true scientific work as that is from breeding chickens and raising poultry." He had mainly used the microscope in the class room, and he spoke of the fact that any imperfection, such as a speck of dirt or anything that ought not to be in the focus, caught the student's eye as readily as lovers' hands find each other when the railway train enters the tunnel. He supposed the objects of the society were, in the first place, the exhibition of the most interesting microscopic objects in the various specialties cultivated by different members, and next to that the comparison of interests and the showing up of new inventions and contrivances in microscopic apparatus. Such an association may give much entertainment to its members, and if conducted in a truly scientific spirit, some real instruction. But there is great danger that such a body will lapse into a kind of dilettanteism which will keep the more genuine students of science away from its meetings.

There was such a thing as giving too much prominence to fine instruments, and he plead for the simplest adjustable instruments, affirming that most of the great discoveries of the microscope had been made with instruments of moderate cost. He did not think that sufficient prominence had been given to the use of polarized light and the revelations made thereby. He alluded specially to Spencer and Tolles, the great American manufacturers of microscopes, and said that the Boston glasses were clearer than those made in London, and which retained a trace of the London fog. In saying this he did not mean to flatter that local vanity which was found in Boston, London, Paris, Pekin, Timbuctoo, and all the other places mentioned in Lippincott's Gazetteer.

In speaking of Bostonians who had contributed to microscopical science, he alluded to Dr. Waldo I. Burnett, Dr. John Deans, Mr. E. Bicknell, recently deceased, and to Drs. Lee, Swing, Wadsworth and David Hunt.

Throughout the address there were occasional bits of humor and philosophy, which sounded as if they might have been dropped by the professor at the breakfast table. Here is one which, though without any peculiar connection with microscopy, needs no apology for its appearance here. After telling how he was defeated by Lewis Rutherford in "fighting objectives," he observed: "Next to the pleasure of beating another is that of being soundly and satisfactorily beaten oneself. Any defeat that falls short of completeness is hard to bear, because something in us says, 'Try again,' and we have lost the confidence we had when we first began the contest. But a thorough unequivocal, unquestionable beating leaves us at peace with ourselves, and brings a kind of astonished acquaintance akin to pleasure. Besides, there is something in every one of us which we hate; a second self, who is always flattering us with an idea of our superiority, and our best self rather enjoys the humiliation of our lying and cajoling meaner half when it is left sprawling in entire discomfiture."

The attendance was large, the audience quite filling the handsome hall.

The purpose of this society is to unite those who use the microscope in scientific research, and to furnish those who are interested in the study of microscopical objects facilities for giving and receiving information as to apparatus, manipulation, etc. The society has recently rented and furnished rooms at 29 Pemberton square.

San Francisco Microscopical Society.—A regular meeting of this Society was held on Thursday evening, April 5th, with Vice-President H. C. Hyde in the chair.

Many very interesting matters came up, and the few members who were not present missed one of the best meetings of the many good ones held by the Society.

The Library was added to by the purchase of "Mind in Nature," H. J. Clark, and regular copies of "Nature" and "Monthly Microscopical Journal."

An essay on "Onion Smut," by Prof. W. G. Farlow, of Harvard College, was donated by the author.

The Cabinet received valuable acquisitions, the most important being that of the Second Century of Prof. H. L. Smith's series of typical diatoms. The slides are arranged in convenient trays, with printed labels and references, and is just what every Microscopical Society should have for reference by its members. Dr. A. M. Edwards, who was present, called the attention of the members to some apparent inaccuracies in the nomenclature o two of the species. Regarding No. 166, labelled Fragillaria crotonensis, Edwards, he stated that it was found in Croton water, New York, and sent to Dr. Arnott by him; called by Kitton, in "Science Gossip," May, 1869, F. crotonensis; pointed out by

Arnott in letter and Roper ("Science Gossip," July, 1869,) as F. capucina, var. No. 178, labelled Gephyria incurvata, Arnott = Euplemia, Arnott = Entopila, E., Dr. Edwards stated was from material sent by him, and is No. 108 of microscopic material of California State Survey, and that it was doubtful if it is G. incurvata. Ehrenberg's genus is Entopyla, not Entopila.

Dr. Mouser presented two slides of anatomical objects, beautifully stained and mounted by him in balsam.

Mr. Allen Y. Moore, Coldwater, Mich., sent a communication to the Society, accompanied by a slide of mineral called coorongite, which was sent to him from Dr. Whittell, of Adelaide, South Australia, and is named from the locality where found. It was referred to Mr. Hanks for a report as to its nature.

Mr. Hanks presented three mounted slides to illustrate the substitution of powdered sulphur for the more costly and pure sublimed sulphur. Mr. Hanks was requested by the Pharmaceutical Society to examine microscopically three samples of sulphur sold as sublimed, and obtained at three wholesale drug stores in this city, neither of which was found to be genuine. Sublimed sulphur under the microscope is seen to consist of globular particles and botryoidal and stalactitic masses, characteristic and readily recognized at a glance when known. Powdered sulphur, on the other hand, although similar in appearance to the unassisted eye, is shown by the microscope to be in the form of angular fragments of irregular size. As the pulverized crude material contains a certain percentage of foreign matter, it should be ranked among adulterated articles, when sold for the pure sublimed sulphur, as is usually the case.

Mr. Moore presented the following paper, giving a technical description of a new fungus, Agaricus (Clitocybe) Occidentalis: "Pileus, fleshy, areolate, and also splitting, broadly funnel shaped; cuticle, thin, not easily separable, dry, and of a soft, velvety texture; when young, white; in age changing to light or ferruginous brown. The flesh, which is from two to four inches thick, is at first white, but on cutting and exposure in drying, changes to a yellowish tinge; edge, deeply lobed and wavy, the lobes occasionally involute. Stem, solid, firm, enlarging upward; at junction with pileus it is from three to six inches thick; deeply sulcate and broken into large, revolute scales. Gills, decurrent, deep, moderately distant, much lacerated in age; when young, of a waxy white; then changing to pale straw color; taste and odor agreeable. Found growing among leaves about base of stumps of sequoia sempervirens. It is by no means common."

Dr. H. W. Harkness read a very interesting monograph, which gave a portion of the results of a very elaborate and careful study of Erysiphe, or wheat mildew, a fungal parasite, which is credited with doing damage to the amount of thousands of dollars, and is stated to be more dangerous than the rusts or smuts.* The subject was illustrated by a series of objects prepared for the purpose, and the verbal explanations given of the stylospores, concepticles, pionidia, and zoöspores still held in their gelatinous investment, were listened to with great and interested attention.

The matter of the rust which is also troubling the anxious tiller of the soil, came up in the shape of a paper by Mr. C. Mason Kinne, accompanied by half a dozen slides, prepared to show the fungus. Mr. Kinne took occasion to say, in connection with the subject, that the first real insight he had had in this interesting branch of microscopical study was from Dr. H. W. Harkness, who, it will be remembered, gave the Society such an impetus some years ago by generously going over elementary ground in vegetable histology, in the interest of members who desired it. Dr. Harkness is now hard at work on the fungi of the Pacific Coast, and has made frequent and extended trips of late through various parts of the State. He has but recently returned from Southern California, where, accompanied by Mr. J. P. Moore, he bagged many new species. A previous fungus foray, with the same gentleman, along the North Pacific Coast Railroad, resulted in over a hundred species, many new to science, and laid the foundation for months of indoor work when the season is advanced so as to preclude the finding of specimens of their favorite division of the cryptogamia in such paying quantities. We understand that their collection of fungi has now reached such dimensions as to warrant the issuance of the first edition of a catalogue of the fungi of the Pacific Coast, which promises to be most complete and voluminous.

Some remarks were made by Dr. A. M. Edwards concerning the double staining of animal tissues by a single immersion in a new fluid, and also of large beds of diatomaceous deposits which could be found near San Pablo and other points in Contra Costa county, after which a motion was passed authorizing the Trustees to make all necessary arrangements for the Annual Reception to take place in the latter part of May.

APRIL 19.—The regular meeting of the San Francisco Microscopical Society was held this evening, with President Wm. Ashburner in the chair. In addition to a good attendance of members, there were present, as visitors, Messrs. Christian Febiger, of Wilmington, Del.; W. H. Seamans, of Providence, R. I.; and Oscar Farrar, of San Francisco.

* This paper, as well as that by Mr. Kinne, will appear in our next issue.

Mr. G. H. Williams, of Oakland, was elected an active member of the Society.

Mr. Henry Mills, of Buffalo, New York, sent the Society a slide of Stephanodiscus Niagaræ, which he had mounted as an opaque object, without washing. The slide was examined during the evening, and found to be a fine addition to the Cabinet.

Dr. S. M. Mouser presented a slide mounted by him, with a section of the liver of man, showing cirrhosis. The characteristics of the diseased condition of the liver were pointed out by the Doctor, when the object was placed under an eighth objective.

There was added to the library the following: "Forms of Animal Life," Rolleston, by purchase; the "Cincinnati Medical News," Part 35 of "Greville's American Naturalist" for March, and three numbers of "Nature," by subscription; while Mr. Kinne donated Parts 4 and 5 of the Proceedings of the Belgian Microscopical Society for 1877.

Powell & Leland's new accessory for oblique illumination was exhibited by Mr. Hyde, and Dr. Mouser handed around for examination a spatula which he had designed for the purpose of laying out and mounting sections of animal tissue, and which he found to work finely.

There were no papers read by the members, but Mr. C. Febiger, from over the mountains, spoke of various matters interesting to microscopists, and finally the drift of the evening's discourse, led on by him and Dr. Edwards, ran into the diatomaceous channel, and there held the members till nearly eleven o'clock. Mr. Febiger spoke of many deposits of silicious earth which he had investigated, from his home at Wilmington, in Delaware, to our own Wilmington, in the lower part of the State, and mentioned immense beds which he noted the railroad tunnels cut through some miles north of Los Angeles.

The Trustees reported progress in the matter of the annual reception, but no definite plan or time of holding it as yet.

Academy of Natural Sciences, Philadelphia.—At the meeting of the Academy, held Tuesday, April 16th, Dr. Leidy remarked that, in seeking small animals beneath stones and decaying logs in our forests, and observing the common white ants, *Termes flavipes*, he noticed that the intestine seen through the translucent abdomen appeared distended with brown matter. Feeling curious to know the nature of the food of the insect, on examining the abundant intestinal contents, he was surprised to find enormous quantities of infusorial and other parasites. The brown matter appears to be minute fragments of vegetable matter, mainly decaying wood, but it not only occupies the intestine of the ants, but in some cases in greater part is distributed as morsels of food occupying the interior of the parasites. In many instances the parasites are so numerous as to make up the greater portion of the bulk of the intestinal contents of the ants, and may be estimated by millions. As the discovery was a recent one, he was not able yet to say to what extent these ants were generally infected with the parasites, but he had found every individual that he had examined collected from a single nest containing them.

The, to him, new world of parasites exhibited five different kinds, of which there are infusoria with cilia, and the others are vegetal in character. The latter consisted of a filamentous algous plant, and a spiral bacterium.

One of the ciliate infusoria is a remarkable form, apparently different from any heretofore described, and therefore has been referred to a new genus under the name *Trichonympha agilis*. The animal is about 1-300th of an inch long, and about half the breadth of the length. It is fusiform, and is clothed with cilia of extraordinary length, some of them extending from the head, one-third the length of the body beyond its posterior extremity. The arrangement of these cilia, clothing the body, reminded him of the nymphs of a recent spectacular drama, in which they appeared with their nakedness barely concealed by long cords suspended from the shoulders, and this arrangement suggested to him the name he has applied to the species. This animalcule did not seem to possess a mouth similar to that found in nearly related forms, and yet the presence of solid food in the interior indicates the existence of a mouth. To determine the exact structure of the creature requires more time than he has yet been able to devote to it, but on superficial inspection the interior appears to be composed of two principal portions, an anterior oval finely granular body, connected with a posterior larger and more coarsely granular mass. The animal, although actively and incessantly in motion, remains stationary in position. The chief movement consists in frequent retraction or shortening and bending of the head end, with narrowing and lengthening or shortening of the whole body, with swelling outwardly and waving downward or backward of the long cilia, and waving of the shorter ones at the summit of the head.

The second infusorian, for which the name *Pyrsonympha vertens* is proposed, is larger but less frequent than the former. It is about 1-200th of an inch in length. It is also more active in its motions, less distinctly defined, and of greater delicacy, so that it undergoes rapid destruction, while the other is more persistent. It also remains stationary in position, while actively moving the parts of the body and writhing like a vinegar eel. Ciliary motion is active, and appears as a rapid waivng motion especially visible along the lateral borders, resembling the rise of heated air or the ascent of a flame.

The third ciliate infusorian, named *Dinemympha gracilis*, the smallest and most abundant of all, he suspected to be another form of the one just described, though of this he had discovered no evidence. It is band-like and pointed at the extremities. It is distinctly marked with longitudinal lines, which assume a spiral course in the ordinary motion of the animal which is one of twisting and rotating on the long axis. No mouth could be detected, although the animal takes solid particles of food, sometimes comparatively of enormous size. The ordinary size of this animalcule is about 1-375th of an inch in length. These parasites were examined beneath the microscope in a thin solution of white of egg. Water produces an almost immediate decomposition of them. In Dr. Leidy's communication their specific characters were minutely described and illustrated by beautiful figures and drawings on the board.—*Polytechnic Review.*

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Wanted, a small piece of "Monterey stone," or a small quantity of the Diatomaceous fossil deposit from any part of the Pacific coast. State what is wanted in return. F. F. Stanley, 40 Pearl street, Boston.

Slides of spermatazoa of horse in exchange for any other well-mounted object. C. Blasdale, M. D., Jericho, Queens County, N. Y.

Bermuda shell sand, composed entirely of foraminiferal and other shells, with coralines and sponge spicules. Very interesting for low powers and opaque specimens. Address C. C. Merriman, Rochester, N. Y.

Slides of diatoms containing Stauroneis Phœnicenteron, Cymbella Ehrenbergii, Circulare Gonphonema, Navicula, etc., in exchange for any well mounted object. William Beadle, Garnerville, Rockland County, N. Y.

Wanted, one of the famous Barton buttons; must be in good condition. Will give either money or good exchange. E. W., Box 4,875, New York.

Wanted, good slides of vegetable or other objects, for sections of Japanese coniferous wood from Japanese Dwelling, Centennial Exhibition. E. Pennock, 805 Franklin street, Philadelphia.

Wanted, slides of pathological or anatomical preparations, in exchange for diatomacean fossil and other well mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Slides of pollen of Agave Americana and other southern United States flowers, for any well mounted objects. Mat. Stuart Beard, Box 1817, New Orleans, La.

For sections of Charob Seed, for the polariscope, and of Mowa Seed, showing oleo-resin glands, send other good objects to R. H. Philip, 28 Prospect street, Hull, England.

Wanted, in exchange for diatoms from northern Wisconsin and Michigan, any well-mounted objects; marine diatoms preferred. W. H. Titus, M. D., Shawano, Wis.

Bott's eggs, upon horse hair, mounted, (pretty objects); also kangaroo and other hair, mounted, in exchange for other interesting mounted matter; send list. Chas. S. Shultz, Hoboken, N. J.

Slides of fine sand, consisting of quartz, garnet, magnetite, hornblende, etc., from beach at Lake George, very beautiful, for other mounted objects. Wm. W. Griffin, Lynn, Mass.

For specimens of Comstock ores (15—25), or crystals of rare chemicals for polariscope, mounted, send diatoms or foraminifera to F. H. Engels, M.D., Virginia, Nev.

Wanted, well-mounted specimens, for slides of American Podura mounted whole, and scales of same. Address George W. Fries, Friendship, N. Y.

Slides of fossil diatoms from Nova Scotia, for any other mounted objects. G. C. G., Box 2055, Rockford, Ill.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 355, Milford, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield, Mo.

Wanted, slides of diatomaceæ or foraminifera in exchange for pathological preparations. George A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

Polycystina from Barbadoes, very fine, mounted, in exchange for any good object. E. W., care AM. JOUR. MICROSCOPY, Box 4,875, New York.

Stained petals, leaves, and sections of some common plants to exchange for other mounted objects. Address F. H., Box 98, Cherokee, Iowa.

BOOKS WANTED.

Dr. Fleming's book on "Blood Stains in Criminal Trials"—Pittsburg, 1861. Also any other work on detection of blood stains.
Pritchard's Infusoria. Edition of 1861.
Brunet, Manuel de Libraire. Last edition.
Hassall's "Fresh Water Algæ."
Smith's "Synopsis of the British Diatomaceæ."
Faraday's "Electrical Researches." 3 vols.
"Botany of the State of New York." 2 vols., 4to.
Holtzapfel's "Mechanical Manipulation."
Ehrenberg's "Mikro Geologie."
Ehrenberg's "Die Infusions Thierchen."
Williamson's Recent Foraminifera.
Pritchard & Goring's Works (any vols.)
Hook's "Micrographia."
Carpenter on "Foraminifera."
Address, stating price, (which must be low) E.W., Post Office box 4,875, New York.

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The Siliceous Shelled Bacillariæ or Diatomaceæ.

(*Continued from page* 44.)

HOWEVER insufficient the microscope was with which I at that time undertook my investigation, still I have by it made my most excellent discovery, viz., the siliceous valves of the diatoms, which soon led, through my friend, Herr Fischer, in Pirkenhammer, near Carlsbad, to the other important discovery of the fossil deposits of these organisms. I had already, in my "*Synopsis Diatomearum*," called the substance of which the forms of the diatoms are made "glassy," because I had, indeed, even then, suspected siliceous earth in these frustules (*panzers*). I communicated this supposition to my friend, the apothecary, Bilz, an expert, equally renowned as botanist and chemist, at the same time asking him whether he would investigate, chemically, specimens which I would send to him. Bilz answered that my supposition might be correct, but declined the commission, stating that he had no practice in the chemical investigation of microscopic objects. For a short time I let the matter rest, until again I was reminded of the probable siliceous frustules of the diatoms, on the occasion of investigation of some *Characeæ;* this was the day before Ascension Day, (May 7), 1834. I had placed some *Chara* in very dilute muriatic acid, in order to remove the lime-crust, that was in the way of microscopic investigation. In the course of the examination I found that the soft Chara stems were on the outside garnished all over with diatoms, which were not at all affected by the acids. Notwithstanding the twilight, that had already commenced, I treated these diatoms, in separate watch-glasses, with concentrated acids, applying muriatic, nitric, phosphoric, and fuming sulphuric acids. The color of the internal parts became, under the first influence of the acids, beautifully green; but the further investigations with the microscope had to be postponed to the following day. After a sleepless night, the examinations were continued, at the break of day on the 8th of May, and at 8 o'clock A. M. of the same day I had not only the full certainty of the siliceous character, but also of the iron contents of the diatoms. The results of the investigation I give here in the words written at the time, because they have not been hitherto printed:

"The diatoms which had been brought into contact with the concentrated acid (they consisted of *Synedra splendens, Cym-*

bella gastroides and *maculata*) had not changed, otherwise than that their internal matter had disappeared. Now, as I had preserved dried supplies of other species, too, the investigations were further continued with these.

"1. Experiment with *Melosira varians*. 10 grains of material, dried in the air, were heated in a platinum crucible, over a spirit flame. The gray-green color of the *Melosira*, browned, and became black, as the mass smoked, and emitted an animal smell similar to burnt hair, cartilage, etc. Continuing the glowing heat, the organic remains were totally removed, and there remained a residuum, in which could still be recognized, quite as distinctly as before, the whole portion of the Melosira threads, only they were more decolored, and had assumed a grayish white appearance; but the burning of the organic parts was over very quickly; the rest weighed still 9½ grains, the weight of the organic parts that had disappeared in the burning was therefore, proportionally, very insignificant. Under the microscope, the Melosira members which had been left appeared unchanged, save only that their internal contents had disappeared. They quite resembled those which had been treated with strong acids, only the coherence of the threads which are formed by the multitudes of individuals put together side by side, had become weakened; for whereas, the unheated threads could be boiled in water without losing their coherence, the heated threads were separated into mere single members by the boiling with water. The same happened also to the unheated threads when boiled in water to which had been added considerable muriatic or sulphuric acid.

"A small portion of the heated individuals was next fused with soda in a small platinum spoon before the blow-pipe, but held in such position that neither the reduction or oxidization flame of the blowpipe came into contact with the fusing mass. The solution of the mass in the soda followed completely, and with effervescence, and I obtained a perfectly transparent glass, in which, however, after cooling, a vitriol green color indicated the presence of oxide of iron. Hereby the siliceous earth was unmistakably proved to be the main part of the diatom frustules. In order to separate it in a pure state, a quantity was fused with a large proportion of soda, dissolving this mass in water, I obtained a siliceous solution, from which I separated the silex, transparent, and in a jelly-like hydrate state, by means of sulphuric acid.

"2. Experiment with *Achnanthes salina*, *Synedra ulna*, *Synedra subtilis*, and *Navicula thuringica*. I had collected these diatoms in 1833, in the salines at Artern in Thuringia, and dried them in pretty large quantities. These forms, under influence of the acids, behaved quite like the *Melosira* in the preceding experiment. Treating them with soda, in the platinum spoon, before the blowpipe, with the same care as mentioned above, under No. 1. I obtained a glass, which while hot was colored brown, and after cooling, intensely yellow. The same was the case when borax was used instead of soda, the latter, in the reducing flame, was dark brown during the heating, but after cooling, bottle green. The reaction of iron showed itself here, upon the whole, stronger than with *Melosira varians*, the experiments moreover prove that the iron existed here as a sub-oxyd, and there as an oxyd.

"In order to find out whether the iron was to be looked for in the frustule itself, or in the internal matter of the individual, I repeatedly boiled a quantity with muriatic acid, and then diluted the acid with fresh water. The first boiling indicated a very strong iron reaction, when heated with ferro-cyanide of potassium, for a considerable quantity of prussian blue was obtained. It is, in general, very easy to convince one's self of the presence of iron in the diatomaceæ in the following manner: Some distilled water having been acidified by hydrochloric acid, a few drops of a solution of yellow prussiate of potash is to be added; now, if only a minimum of a diatom is put into this fluid, a girdle of prussian blue will

instantly be formed round about it, especially if the iron, as in the latter case, is present as an oxyd.

"The residue of the siliceous frustules, left after treatment with acid, and which before that treatment had a brownish red appearance, had changed color to a gray green, which became a little lighter when dried. During the heating in the platinum spoon, whereby the same smell of burning animal matter was produced, I also remarked, that a cork wetted with hydrochloric acid, caused over the fuming mass, stronger and thicker fumes, which no doubt came from the formation of sal ammoniac.* The ignited residue, was, after the total burning of the organic matter, pure white, and gave also with soda, before the blowpipe, a tolerably white glass."

From these experiments, it follows:

1. "That the soft internal substance of the diatoms contains nitrogen (from which I at first drew conclusions that they were more of an animal than a vegetable nature).

2. "That the frustule (*panzer*) consists of pure silica.

3. "That the internal part, besides the soft organic constituents, also contains iron in considerable quantity.

4. "That the color belongs only to the internal parts, and is partly dependent upon the amount of iron present, but that the frustule itself is colorless."

These investigations were sent by me to Herr Alex. von Humboldt, for communication to the Royal Academy of Science at Berlin, which commissioned Messrs. Rose and Ehrenberg to examine my statements. It is known that both these scholars confirmed them, but it is perhaps not known, that I expressed in vain the wish to have the results of my investigations printed in Poggendorff's Annals of Physics and Chemistry; all I obtained was, Ehrenberg furnished a poor and short report of my researches, in which only the siliceous frustules were mentioned, but nothing was said anywhere of the simultaneous discovery of iron in the internal parts; therefore, I was somewhat astonished to see in Ehrenberg's large work on Infusoriæ, p. 244, the iron of the *Gallionellæ* mentioned as his discovery, while he does not even allude to the fact that I, in my essay sent to the Berlin Academy, mentioned iron as a *general* constituent of the diatoms. It is easy to believe here in a "*Turpinate.*"* I myself, however, am morally convinced that in reading my paper at that time, Ehrenberg was much too busy with the siliceous frustules to pay attention to the other theory mentioned in my communication, and therefore, that when, several years later, he found the iron himself, whereto he was led through his so-called *Gallionella feruginnea*, he did not remember that I had proved the same in 1834. This collision would at any rate have been avoided, if Poggendorff had published my short article in the Annals of Physics and Chemistry, for which it was quite adapted.

In the following year I began my journey to Dalmatia, Italy, and to Switzerland, on which occasion I became familiar with the diatoms of the Adriatic and Mediterranean Seas. The collections made on this occasion were large; but more important than their forms was the observations of the organs of fructification in the *Schizonematic* forms, which are quite analogous to those of the algæ, and find no analogue among animals. An excellent microscope by Schieck, of Berlin, enabled me to make accurate observations.† At the same time I visited Carlsbad on my return, where already, in 1827, C. Agardh had made a rich collection of diatomaceæ. This locality was of the greatest importance for my researches, since,

* Of the formation of ammoniacal gas during the heating of these bodies, one can be easily convinced when the operation is conducted in a test tube, and a wetted curcuma paper is held at the opening, it will become brown by the escaping ammoniacal gas.

*For *Turpinade?* or *Turlupinade?* = (Ger. Possenreisserei, Witzelei,) = *joke, practical joke, scurvy trick;* from the French *Turlipinade*, a conundrum; which comes from *Turlupins* (Latin *Turlupinus* or *Turelupinus*) a body of French Reformers, about 1372. They correspond to the English Lollards, in a general way. The word is supposed to come from *turpis* and *lupis* or *lupa*.—*Trans.*

†These observations were wrongly interpreted by Kützing.—*Trans.*

only a few months before, I had examined the diatoms of the hot baths in Abano, and Battaglia, in upper Italy, as well as those of Leuk, in upper Wallis, as to the lower organisms. At the same time, I have thankfully to acknowledge that during my presence at the above mentioned baths in upper Italy, I was most liberally aided by my friend, Dr. Biasoletto, in Trieste, who accompanied me there, and Herr Professor Meneghini, at Padua, who received both of us in a very friendly manner, and gave to me several algæ from the Euganean baths. I cannot less praise the friendly reception and assistance I received from Herr Fischer, in Carlsbad, the same who afterwards discovered the existence of diatomaceæ as fossil at Franzensbad. In the year 1839, I made a second journey to the sea-coast, and remained a few weeks on the Oldenburg coast, and the islands Wangerorge, Helgoland, and near Cuxhaven. This journey too was very favorable to my studies, because it procured for me, in addition to the treasures of the sea, the acquaintance of a man, who from his excellent collection of algæ, which, from its fullness, may be called one of the first in Germany, with extreme kindness not only gave to me many rare algæ, of which mention has already been made in my *Phycologia Generalis*, but left to me also for this work, the use of his whole rich collection of diatomaceæ; I speak of Herr Senator Dr. Binder, of Hamburg. With not less thankful feeling I acknowledge the kindness of Herr Apotheker Sonder, in Hamburg, whereby he, in sending to me the sediment of the sea from the mouth of the Elbe, near Cuxhaven, gave me the opportunity to become acquainted with the interesting diatoms of the chalk described by Ehrenberg, which was the more agreeable to me inasmuch as a request I had made to Herr Ehrenberg (to whom I had formerly imparted dried specimens of the forms described in my *Synopsis Diatomearum*, and had also offered the diatoms collected from the Adriatic and Mediterranean), had not been noticed. In my present undertaking I have also been aided by Herr Fischer, of Pirkenhammer; Dr. Philippi, of Cassel; Prof. Phöbus and Dr. Gumprecht, by communication of fossil forms; also, from Dr. Montagne, of Paris, I have received several rare forms described by him, from the open sea and the Antilles sea; also, Herr Berkeley, of Kings Cliff, England, sent me many rare forms described by Ralfs. Some New Holland forms were found in an earth lump mixed with algæ, which Herr Dr. Preiss, of Herzberg, had brought with him attached to a Nautilus shell; other forms I found on algæ in my collection, from the Indian Ocean, from the Cape of Good Hope, from Corea, Japan, Kamtschatka, Peru, Chili, Jamaica, and the Canary Islands. The beautiful *Terpsinoë musica* was, with several other forms, found in the rude hairs of a Marchantia from tropical America, in the collection of Herr Senator Binder; it had been discovered several years previously by Herr Lindenberg, and by him given to Herr Binder, who had referred it to the diatoms. At the same time I also found different, and in part, peculiar forms, in the various collections of algæ sent to me for naming by Burgomaster Jürgens, and Dr. Koch, in Jena, Chief Assessor Römer, in Clausthal, Dr. Rabenhorst, in Dresden, and Major M. Flotow, of Hirschberg. Now, when already, at the end of March, 1844, twenty-nine plates were printed of this work, wherewith I had expected to close it, and also the greater part of the manuscript already finished, I received through Herr Apotheker Sonder, of Hamburg, a collection of diatoms, which Herr Apotheker Krüger had collected in the fresh waters of Trinidad, and at the same time the Herring's collec- of diatoms, which Herr Senator Binder had purchased, were sent to me by this gentleman. Such unsolicited, rare kindness rejoiced me the more when I found that the latter collection was rich in those forms which Herr De Brébisson had described. All the species were collected by Herr Lenormand, and prepared for the collection with a neatness peculiar to him. The multitude of new and authentic specimens

which came before me by these communications induced me to engrave the plate XXX, in addition, and when I had already finished a great part of the admitted figures, a considerable package of dried diatomaceæ came from Herr Meneghini, of Padua, which also furnished some new additional forms, part of which could yet be embodied in the plate XXX. Lastly, I received, during the printing of the manuscript, from Dr. Dickie, of Aberdeen, a very peculiar sea form, from the coast of Scotland, of the Navicula group; it is described as *Dickiea ulvacea*.

(To be continued.)

Country Laboratory Apparatus.

THE following short description of an extremely effective, cheap and cleanly substitute for crucible jackets, etc., may be useful, especially to those who like myself, have occasion to shift their quarters often, and are obliged to work with a necessarily limited laboratory accommodation.

The ordinary crucible jacket being made of sheet iron has in reality but one use—to protect the flame from currents of air. The small concentration of heat which it affords may be regarded as nearly *nil*, since from the nature of the material and its thinness, radiation takes place very freely.

Another drawback it has is, that it soon becomes rusty or coated with scale. It is not only dirty to handle, therefore, but, also presents the inconvenience of dropping some of its scale into the crucible if not carefully manipulated. Then it is an awkward thing to pack, taking up a good deal of space, rusting everything it comes in contact with, and behaving generally in a disagreeable manner; while, as it is not to be obtained in country towns, it may not be left behind.

Now an ordinary earthenware flower-pot answers the purpose in every respect. It is the proper shape, and being of a non-conducting material, it in a great measure prevents loss of heat from the burner. It is extremely cleanly to use, and last, but not least, it can be procured in every town or village at the small cost of one halfpenny or so; and there is no necessity to cumber oneself with it when moving.

The bottom of the flower-pot has a circular hole. This serves for the introduction of the Bunsen burner. As the supply of air would be insufficient otherwise, it will be necessary to enlarge the opening. This can be easily done with a knife and I find it best to cut the aperture nearly in the form of a cross, and not too large. One or two trials will give the happy medium. A current of air is then obtained which not only steadies the flame, but acts in some degree as a blast. The flower-pot may be supported in the ring of a retort stand in the usual way. The chimney is a second flower-pot inverted. To support it the handiest way will be to make three S hooks of stout wire, and having passed the narrow end of the pot upward through the ring, fix the rim within the hooks caught on the ring. It will be found convenient to devote a small retort stand permanently to the purpose.

This will be very handy, as the upper part can be raised to any desired height, regulating the heat and draft; or can be shifted from side to side, whenever it is desirable to inspect the progress of the operation going on.

The apparatus acts admirably as a small gas furnace for crucible operations, such as the fusion of silicates with carbonate of soda—as in the analysis of rocks; while for simple ignition of precipitates it renders the flame of a common glass spirit lamp most effective. The size of the flower-pot required will, of course, depend on that of the crucible and of the burner used. I find the smallest size, three and one-half inches high and about eight inches in diameter at top (internal) most generally useful.

The support for the crucible may be either a triangle of wire covered with pipe shank, the end of the wire being bent upwards and formed into hooks so as to hang on the edge of the flower-pot, or three pipe-covered wires suspended in the position of the ribs of a crucible jacket. The former is necessary for small crucibles.

The flower-pot also makes an excellent lamp-screen, for steadying and concentrating the flame under evaporating basins, etc.; of course a sufficient interval must be kept between the pot and the basin else the light will be extinguished.

A small flower-pot with wire gauze tied over the top is a very effective low temperature lamp when the gas is lighted below the gauze. If the gas is lighted above the gauze we have a capital argand lamp giving a large, clear blue flame. In the latter case a common burner can be used, a consideration when Bunsen's are all temporarily occupied or not available. After a time the pots become cracked from the heat, but as they are easily replaced this does not matter, and even when cracked they will

often hold out for a considerable time. Fireclay flower-pots made rather thick would, however, afford a really good and cheap portable furnace.

It has just occurred to me that by placing the flower-pot inside another just large enough to encase it, loss of heat by radiation would be effectually checked.—*E. T. Hardman in Chemical News.*

Trichobasis, or Grain Rust.*

THAT the microscopic fungi possess charms for the mycologist is evinced by the attention they have received from such scientists as De Bary, Greville, Corda, Tulasne, Leveille, Berkeley, Cooke, Farlow and many others. That many of them possess more than ordinary interest is often brought about by the fact of their parasitical nature, and coming, as they do, constantly before the agriculturist in the shape of stealthy destroyers and pests that are not to be eradicated by any of the ordinary processes, the general student at the microscope is naturally brought to an investigation of a matter of so much commercial moment.

A few days since I had occasion to examine, with one of our members, Mr. E. J. Wickson, of the *Pacific Rural Press*, some samples of grain from near Colusa. While the rust may no doubt be found in that section, the sample sent was only affected with a mildew or blight which was satisfactorily proven, by the aid of the microscope, to be an erysiphe, a fungus which does not penetrate the cell-structure of the leaf, but does its harm to growing plants or vines by a dense growth of mycelial threads spreading over the epidermis, preventing its normal growth, and covering the stomata or breathing-pores, and thus shutting out the air from the leaf. More recently, Dr. Mouser handed me some grain stalks, received by him from Mr. Fowler, of Sonoma, to which I have given some attention, and from which I have prepared objects for examination this evening.

It will be noticed that the leaf is colored with the spores of a fungus, mostly in masses, and others scattered indiscriminately, though with great profusion, over the surface, after breaking through the cuticle from the cellular structure, while a transverse section, under a moderately high power, shows that the latter is filled with a network of searching mycelium which tends to sap the life of its host. Further and more critical examination shows the characteristic features and unilocular uredospore of the true "rust" of the agriculturist, or *Trichobasis rubigo-vera* of the botanist, one of the phases of *Puccinia graminis* or brand. A drop of water applied to another transverse section of a leaf with the darker masses of pseudo spores, I find, will instantly free a profusion of minute motile zoöspores or spermatia, which can be seen gyrating and moving about in great activity in a manner somewhat similar to bacteria.

Though Tulasne has cancelled such genera as Trichobasis, Uredo and others, the latest arrangement adopted by Cooke and Berkeley, and which seems to be the most rational, as the forms are distinct in appearance, places the Trichobasis as a genus of the order *Cœomacei*, which, with its kindred *Ægidiacei* and *Pucciniœi*, all parasitic on living plants, form a conspicuous part of the family *Coniomycetes* (dust-fungi). The orange or reddish-brown color of the pseudo-spores in the example before us, shows their uredinous character, possibly having at some point passed through the form analogous to that of Æcidium, and no doubt, would present the bilocular brand-spore with dark brown integument of Puccinia, as a next stage in their life-history under favorable conditions. There is a mystery about these fungi, which has been and is a favorite field for the ardent investigator in original matter, and which is only to be more carefully elucidated and the fungi extricated from the intricacies of their position by the use of the favorite instrument, for while the *uredo* form, the *puccinia* form and the *œcidium* form possess generic characteristics sufficiently permanent to cause them to be classified separately, they have been traced from one to the other by trails devious, yet distinct enough as to warrant the assertion that they are but different forms of one and the same plant, giving a beautiful evidence of the alternation of generations which is known to the student in the animal kingdom. A notable instance of this is that proven by DeBary, who sowed the spores of *Puccinia graminis* on the young leaves of the barberry, and was rewarded with the *Ægidium berberidis* as indubitable proof of di-morphism.

Neither is it known just how the grain becomes diseased, for microscopic examination shows that the pseudo-spores are too large to enter the leaf through the stomata. Their granular contents, if endowed with reproductive powers, possibly may be taken up through the roots and lodged in the

*Read before the San Francisco Microscopical Society, by C. Mason Kinne, Esq., April 5, 1877.

general structure, or by effecting an entrance through the breathing pores of the leaf, in either case only wait a favorable combination of circumstances to give them an opportunity to germinate in a plant thus infected; or pseudo-spores carried by the winds to the leaf, finding favorable climatic conditions, may there vegetate and the mycelium searching out the stomata, no doubt enter and commence its parasitical life. When it is remembered that from a particle of matter, not the two-thousandth part of an inch in size, a good-sized puff-ball or mushroom will grow in a night, and that a few hours is often time for the *peronospora infestans*, or "potato blight," to do its work, the sudden appearance of the rust in a field of wheat will be understood. Grain standing on rich ground, in a sheltered position from winds, particularly our drying Northers, infected with the germs of the disease, wait but a shower of rain, or warm, moist atmosphere and sunny days, to show evidence of the trouble, though it is fortunate that the exact conditions favorable to the development of the fungus are comparatively rare. Were the spores favored with but a fraction of the opportunities given the grain which furnishes them a habitat, good crops of cereals would be the exception, though not nearly all fields attacked are necessarily ruined.

In this connection it may be well to mention that while the damage from rust is often great, many times there is more of a scare than reality. The white-mildews or *Erysiphei* of the Ascomycetes family commonly are not dangerous to any great extent on cereals, as the leaves have usually performed their work when attacked, though other glumaceous plants cured as fodder may be injured by being rendered unpalatable to the average herbiverous animal. The rust, perhaps, is as much to be feared from its tendency to break up the siliceous coat, which strengthens the stalk, when it makes its appearance there, thereby causing well-filled grain to "lodge" and go to waste, as anything else. Berkeley says, in speaking of this fungus, that "so long as the rust is confined to the leaf, it is, we believe, perfectly harmless. The grain swells in spite of it, and the only effect is that the flag dies a little earlier, which is not undesirable when too luxuriant. If, however, any gets upon the chaff—much more if it attacks the seed itself, as is sometimes the case—it is very mischievous." It would not be wise for our farmers to sell their crops short, or the grain-speculator to "bear" the market on the strength of the simple appearance of this parasite, and the recommendation to at once cut down a field of grain when found to be diseased, and cure the same for hay, as stated in some of the newspapers, is certainly of questionable propriety, for though no serious effects might result from the consumption of the fungus spores along with the forage, the *Ustilaginei*, or smut funguses, have long been known to the medical fraternity and used with marked effect. The practical part of any study into the habits of this pernicious pest is apparent if any means can be devised to cure or prevent the infection, and everything goes to show that to aim at prevention is the only method for the agriculturist. Speaking of *Puccinia*, Cooke says: "It is worthy of remembrance by all persons interested in the growth of wheat, that the 'brand' is most common upon plants growing on the site of an old dung-hill or on very rich soil. As the same *Puccinia* is also found on numerous grasses, no prudent farmer will permit them to luxuriate around the borders of his fields, lest they serve to introduce or increase the pest he so much dreads." Many remedies have been tried as preventatives against rusts, smuts and brands, and it seems that the most effectual is to treat the seed grain to a bath of the solution of sulphate of copper, which kills the spores carried along with the grain, or washing in a strong solution of "Glauber's salts," and afterward, while still moist, dust over with quick lime, from which will be eliminated a caustic soda fatal to the germination of the spores.

English Fish Culture.

The pisciculturists of England are making strenuous efforts to improve declining or nearly ruined fisheries and render them of value as food producers. The London *Times* in a recent article, says: A large and very healthy consignment of salmon and trout eggs from the Rhine, Lucerne and Geneva have lately been received in London. The salmon eggs were all gathered from Rhine fish, collected and packed under the advice of Herr Haack, of the famous fish culture establishment at Huningue. The process of packing is described as very simple. The eggs are counted out into thousands. They are then carefully inclosed in gauze and lightly packed in some well cleaned soft moss. The boxes are tied up all together in handy parcels and sent off to their destination, great care being taken in transit to prevent the eggs from being shaken. In the present instance the ova arrived in fine condition.

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AND

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Milled Heads versus Screw-Drivers.

IN a recent article by Dr. Hunt, of Philadelphia, published in the *Cincinnati Medical News*, there occurs the following passage descriptive of certain features of Mr. Zentmayer's Centennial microscope: "The stage is accurately graduated, and is adjusted by screws which are turned only by screw-drivers, and when once centered is not easily deranged by careless trifling with inviting milled-head screws."

On first reading this passage, we concluded that it was an attempt at humor, and in this opinion we were confirmed when, further on, we came across certain coarse jokes, of which the less said the better. But when we remembered that the following sentence had occurred on the preceding page, we were forced to the conclusion that Dr. Hunt really meant what he said. The passage to which we refer is this: "It is to be regretted that Mr. Crouch allowed his name to be connected with the introduction of the adjustable rotating stage, for it is exclusively an American invention." But one interpretation can be placed upon this sentence, and that is too obvious to require explanation.

The fact that Mr. Zentmayer's stage is "accurately graduated," shows that it is intended for the measurement of angles, and if Dr. Hunt has not been attempting to perpetrate a joke, he shows that he knows very little of the conditions required for success in such work. The idea of attempting to adjust, by screw-drivers, an instrument intended for delicate mathematical work, can hardly fail to bring a smile to the countenance of every one familiar with such operations. Just compare the ease of making adjustments by means of two opposing milled-head screws, (while the eye watches through the instrument the position of the moving parts), with the labor of adjusting by means of a screw-driver! When using the latter we have first to look through the microscope and see which way to move the stage; then, removing the eye from the eye-piece, we adjust the screw-driver in the narrow slots in the screw heads, and turn a little, on the cut-and-try plan; then we look through the microscope, and see how much we have over or underdone the work; then we take away the eye from the eye-piece and after readjusting the screw-driver, give another turn, and so on *ad nauseam* if not *ad infinitum!*

But that part of Dr. Hunt's article which we first quoted is, if not a joke in itself, a grim joke on its author, for it shows that he has violated one of the soundest canons of criticism, which is: Always examine the article you intend to criticize. If Dr. Hunt had done this he would have found that the milled-heads on Mr. Crouch's stand do not invite "careless trifling," for when not in actual use, they are slipped off and packed away in the case, where neat little fittings are provided to receive them.

It may be well to say here that, as we understand the question, Mr. Crouch does not lay any claim to being the first maker of an adjustable concentric stage. In the arti-

cle from his pen, published by us last month, he speaks of "his own centering adjustments," not of his own idea of centering. The idea of centering is a very old one, far older than Crouch, or Zentmayer, or Bulloch. It was used at least thirty years ago in Germany, by Brunner, and consequently is not, as Dr. Hunt claims, "exclusively an American invention." But while the idea itself is old, different methods have been devised for carrying it out. Mr. Bulloch devised one plan, Zentmayer an entirely different method, and Mr. Crouch a still different arrangement. Of these Zentmayer's is certainly the least convenient; Mr. Bulloch's is very good, but we think that few persons will use it and Mr. Crouch's long together, without giving the preference to the latter. Upon this point, however, we do not care to obtrude any mere opinions of our own.

It is certainly to be regretted that Dr. Hunt should have put forward such broad and unfounded claims on behalf of a gentleman to whom the microscopists of this country are under deep obligations. Well may Mr. Zentmayer exclaim: "Save me from my friends, and I will take care of my enemies myself!"

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Mr. W. H. Bulloch's Improvements in Microscope Stands.

Ed. Am. Jour. Microscopy—In the May number of this journal are some remarks headed "A Question of Priority," which seem to justify a more extended consideration of the subject there broached, and also of some other points in the same connection.

The more so does this seem desirable, because it seems that the claims of one of our most ingenious and original manufacturers of stands are entirely overlooked in this, as in many other cases. It is not unfrequently the case that the credit for an improvement is given to the wrong person, merely because he has a more prominent position in the world than the one to whom it is due. My personal knowledge of what Mr. W. H. Bulloch, of Chicago, has been doing for the last few years for the improvement of microscope stands, has induced me to bring a few facts and dates before the readers of this journal, with the hope that they may aid us in giving honor to whom it is due. With this purpose in view, I wrote to Mr. Bulloch immediataly on the receipt of the May number of this journal, requesting him to send me a short account of his improvements for the microscope, with the dates of their introduction.

Having received his reply, together with some photographs of his stands, and a letter from Dr. Ward, written to him, dated May 16th, 1877, in relation to the subject, I proceed to place the matter in as clear a light as possible. In great part I shall quote the substance of Mr. Bulloch's letter. He says: "I for one think Mr. Crouch is rather late in the day to assert that he was the first to make the so-called adjustable concentric stage. He says: 'I may perhaps be permitted to state that my own centering adjustments, * * * were claimed by two American manufacturers,' etc. The question is not, as he puts it 'my own centering adjustment,' as I do not know that any maker has a wish to claim it;* but what is claimed in this country is, that three different makers were making the concentric stages adjustable previous to 1871—R. B. Tolles, J. Zentmayer, and myself—whereas he exhibited his first in December, 1875, five years after they were in common use in this country. I have been making them adjustable since July, 1870; the first one was made for Dr. H. A. Johnson, Ex-President of the Illinois State Microscopical Society. The mechanical stage was centered on a 1-25th objective. I also exhibited at the October meeting of the society (1870) a small stand, and centered it on an objective at the

*[Mr. Bulloch, we think, misunderstands Mr. Crouch's position. Mr. Crouch (at least, so it seems to us) does not claim to be the inventor of the adjustable concentric stage, but of a certain modification of it, which he considers has some points of superiority. So far as the latter point is concerned, opinions will, of course, differ, but the question, whether or not Mr. Crouch is the inventor of the form of concentric stage manufactured by him, is a matter of fact which it ought not to be difficult to settle. As stated elsewhere, adjustable concentric stages are very old. The invention, in some form, must have forced itself upon the first microscopist who intelligently undertook the measurement of angles under the microscope.—ED. A. J. M.]

meeting. It worked with three milled screws working in a ring inside of the main ring, and the stage turned within the inside ring; the stage was made of glass, clamped in a brass frame, so as to be readily replaced if broken."

Accompanying this letter is a cut and a photograph of the stand as made in 1873, and also a photograph showing the latest adjustment for centering the stage. This arrangement is fully equal to any other I have seen, and as to its efficiency, I can speak in the highest terms, as it is attached to my own stand.

Mr. Zentmayer's latest improvement of an adjustable stage is probably quite as good, as far as general design and accurate workmanship is concerned, for it could not be otherwise, coming from the hands of such a man as Mr. Zentmayer; but as Mr. Zentmayer's arrangement requires the use of a screw-driver, I think that Mr. Bulloch has a little the advantage, in that the screws are turned by means of a bit of stiff steel wire inserted through perforations in the screw heads. This adjustment can be attached to a great many stands already made.

With this attachment, and a stage only five inches in diameter, Mr. Bulloch writes that he can obtain 135° of direct light from mirror, while from Mr. Crouch's illustration in the London *Microscopical Journal*, his stands will barely allow of 100°. If any person desires to see this stage of Mr. Bulloch's, I will be glad to have him call at my house, when it will afford me pleasure to exhibit it to him.

In regard to the swinging sub-stage, Mr. Bulloch writes as follows: "There is another question of some importance at the present moment, that is as to the priority of the swinging sub-stage improvement. I made a stand with the above improvement for Dr. Jones, of this city, in 1873. I sent a photograph to Dr. Richardson, of Philadelphia, in 1873, with a request that he would show it to the Philadelphia Microscopical Society, and the instrument was shown to Mr. W. Walmsley in October or November, 1873. I also sent a photograph to Dr. Ward, of Troy, and received an answer in 1873. The sub-stage was centered one-tenth part of an inch above the stage-plate, to allow for thickness of slide. It was worked in the arc of a circle for oblique light; so that I claim to have made this arrangement three years before any other.

"I also claim to be the first to hang the mirror so that it can be used over the stage without the use of a separate stand. It can be used in any direction, back or forward, and on either side. I did not attempt to combine the sub-stage and mirror, as I did not see any advantage, and do not now see anything gained by being able to bring the achromatic condenser over the stage. I mounted the mirror so that it could be used over the stage in the first mentioned stand of Dr. Johnson (1870). Dr. Ward says that Spencer mounted it so in 1871."

It will be seen from this that Mr. Bulloch claims priority for the following improvements:

1. The adjustable stage.
2. The swinging bar carrying sub-stage.
3. The mirror mounted so as to be used above the stage, thus replacing to some extent, if not entirely, the bulls-eye condenser.

In regard to the first, I believe there can be no doubt that Mr. Bulloch was the first to introduce a really practicable plan for centering to high powers. Dr. J. G. Hunt, in the Cincinnati *Medical News*, takes the ground that the concentric adjustable rotating stage was made by Zentmayer sixteen years before any foreign maker conceived the idea. This conclusively gives the credit of the invention to America.

The objection to the old concentric stage of Zentmayer, as compared with recent ones, is that it is not readily adjusted, and has no mechanical movements.

As to the second, I quote a portion of Dr. Ward's letter, as follows: "There is no room for dispute as to your work having anticipated Zentmayer's in regard to the stage, but it fell just one short of accomplishing the whole invention which he has made, and which I think will prove popular and successful."

The difference between the two (Bulloch's and Zentmayer's) improvements is simply that in the latter the bar turns through a greater arc and the mirror moves with it, which is not the case with the former. It seems to the writer that it is an advantage to have the two move independently, particularly when the third improvement is made use of.

As to the third improvement, it seems that, as far as known, Mr. Bulloch anticipates all others by at least one year. The first and third of these improvements are on my own stand, which is the second size of Mr. Bulloch's make. The swinging bar is only placed on the largest

stands. The concentric stage is placed upon his $75 monoculars. The cuts and photographs referred to will be placed in charge of the editor of this journal for a short time, so that those who wish can see them.

As already stated in this journal, the swinging bar is claimed by Mr. Gundlach and by Mr. Zentmayer. It is of frequent occurrence that the same improvement is carried out by two men independently, but it is certainly not usual for three men to do the same thing.

From the facts stated, Mr. Bulloch certainly makes good his claims of priority in this case, and it is hoped that he will receive due credit hereafter from all microscopists.

The editor of this journal deserves great credit for giving the utmost freedom to discussions of this character.

ROMYN HITCHCOCK.

8 *Beekman Place, New York.*

Information Wanted.

Ed. Am. Jour. Microscopy—Will some one inform a beginner in vegetable histology, what preparation of sections is necessary, and give a few standard mounting fluids and combinations for making rings for thin cells?

Brief directions for the *early* steps are deficient in many works, and would please others perhaps, as well as the writer, who is a worker in animal histology.

* * *

Spermatozoa of Earthworms.

Ed. Am. Jour. Microscopy—May I ask, through your columns, some one of your readers to tell me how to preserve the spermatozoa of the earthworm in such a way that they may be satisfactorily examined with a high power?

The fact may not be generally known to those interested that the spermatozoa of the earthworm may be easily obtained as follows: During the communication of these hermaphrodite creatures, which act may be observed in gardens and along pathways at early morning, or on damp, foggy days, from May to November, there may be seen, on either individual, near the enlarged rings, by means of which they grasp each other, a whitish mass; this may be removed by a dextrous touch with a pocket knife; examination proves it to be a lively mass of spermatozoa in their proper fluid.

D. S. K.

Our Book Table.

Annual Record of Science and Industry for 1876. Edited by Spencer F. Baird, with the Assistance of Eminent Men of Science. New York: Harper & Brothers.

To give a really good resumé of the progress of Science and Industry, is such a difficult undertaking that severity of criticism in this case is almost barred. In the volume before us, an attempt is made to give a general view of the progress of Astronomy, Meteorology, General Physics, Chemistry, Mineralogy, Geology, Geography, Hydrography, Anthropology, General Zoölogy, Invertebrate Zoölogy, Vertebrate Zoölogy, Botany, Agriculture and Rural Economy, and Industrial Statistics, and the book is divided into two distinct parts—the first consisting of general articles upon the subjects just named, while the second is little else than a sort of scientific scrap-book, made up of clippings or condensed notes from different journals. After a most careful examination, we confess that we find it difficult to form a just estimate of the value of the book. It seems to us to be neither popular enough for the "general reader," nor sufficiently thorough and minute to aid the scientific man (the latter is certainly the case.) Let us take, as a fair illustration of what we mean, the following paragraph from the article by Prof. Barker on Physics: "Schott has examined the character of the crystallizations which are produced in common glass under various conditions, with a view to elucidate the chemical character of glass itself." This sentence certainly gives very little information that is of value to any one. If the writer had given us the results of Schott's examinations, or even a reference to the periodical in which an account of them appears, the space would not have been wasted as it now is, and if his collaborateur, who did the clipping, had made his selections with special references to the topics discussed in the general treatise, the entire book would have had a double value. As it now stands, however, no one is aided by such bald statements, statements which perhaps make the volume appear profound, but which certainly do not add anything to its real value. The second half of the volume consists, as we have said before, of selections from various journals. It contains some paragraphs of great value, and some that are of very little worth. We are apt to laugh at the man of scissors and paste, but it is a fact beyond dispute, that for one man that is competent to make good selections, ten can be found to write well. The selections here are on the whole very good, though now and then we meet with one which exhibits a lack of knowledge and judgment. Thus, at page 383, we are given, as a recent German discovery (we get all our great

discoveries from Germany; the Germans get theirs from America and England) the fact that the taste imparted to milk and butter by turnips may be removed by saltpetre! The wife of any old farmer in Pennsylvania could have given the learned compiler this information.

One of the most important features of a book of this kind is the chapter on bibliography, and after reading the very severe remarks made upon the untrustworthy character of bookseller's catalogues and announcements, we looked for something especially good. We must confess that we were disappointed. A writer that gives in his list of current periodicals, the names of journals that have been dead for years, while he omits others that are living and painstaking, has no right to talk of the errors of publishers announcements. The list of books also is very defective. These faults are unpardonable for this simple reason: Any literary hack knows where to find nearly complete lists of both books and periodicals, and this being the case, no man with the reputation of Prof. Baird has any right to palm off such shiftless and inaccurate work upon the public. He seems to be conscious of the defects of this part of his book, for he pleads with publishers to send him copies of the books, etc., they issue. The fact that such copies were not sent is no valid excuse for want of thoroughness in this department. It is the business of the bibliographer to find and examine the books that he describes, not to wait for some one to send them to him, and although public libraries may be dilatory in purchasing (and this is the reason given for omissions,) the bookseller's shops are always open.

That the book, as a whole, has great value, every one must admit. Those of our readers who may add it to their libraries will never regret having done so. But when we consider how much better the work might have been made by a little additional conscientious work, we cannot help pointing out its defects.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Slides of fossil and recent Diatomaceæ, etc. Lists exchanged. E. Pennock, 805 Franklin street, Philadelphia.

Slides of Trichinæ spiralis, finely mounted, in exchange for anatomical or pathological mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Slides of cuticle of larva of Macrosila Carolina, showing crystals, in exchange for other objects. E. A. Burdick, Pension Office, Washington, D. C.

Diatoms from Coldwater, Mich., in exchange for other well-mounted objects. Address F. H. Root, Coldwater, Mich.

Palates of mollusca, a great variety, mounted or unmounted, in exchange for mounted slides of interesting objects or good material. C. M. Vorce, 164 Lake street, Cleveland, Ohio.

Wanted, for specimen of bladder of cat, finely injected, other injected pathological objects. J. T. Joslin, Newburgh, N. Y.

Case of algæ, and live fresh water animalculæ, for any well-mounted specimen. Send slides to A. Hobart, Box 581, Penn Yan, Yates County, N. Y.

Wanted, a small piece of "Monterey stone," or a small quantity of the Diatomaceous fossil deposit from any part of the Pacific coast. State what is wanted in return. F. F. Stanley, 40 Pearl street, Boston.

Slides of spermatazoa of horse in exchange for any other well-mounted object. C. Blasdale, M. D., Jericho, Queens County, N. Y.

Bermuda shell sand, composed entirely of foraminiferal and other shells, with coralines and sponge spicules. Very interesting for low powers and opaque specimens. Address C. C. Merriman, Rochester, N. Y.

Slides of diatoms containing Stauroneis Phœnicenteron, Cymbella Ehrenbergii, Circulare Gonphonema, Navicula, etc., in exchange for any well mounted object. William Readio, Garnerville, Rockland County, N. Y.

Wanted, one of the famous Barton buttons; must be in good condition. Will give either money or good exchange. E. W., Box 4,875, New York.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Wanted, in exchange for diatoms from northern Wisconsin and Michigan, any well-mounted objects; marine diatoms preferred. W. H. Titus, M. D., Shawano, Wis.

Bott's eggs, upon horse hair, mounted, (pretty objects); also kangaroo and other hair, mounted, in exchange for other interesting mounted matter; send list. Chas. S. Shultz, Hoboken, N. J.

Slides of fine sand, consisting of quartz, garnet, magnetite, hornblende, etc., from beach at Lake George, very beautiful, for other mounted objects. Wm. W. Griffin, Lynn, Mass.

For specimens of Comstock ores (15—25), or crystals of rare chemicals for polariscope, mounted, send diatoms or foraminifera to F. H. Engels, M.D., Virginia, Nev.

Wanted, well-mounted specimens, for slides of American Podura mounted whole, and scales of same. Address George W. Fries, Friendship, N. Y.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 356, Milford, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield, Mo.

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The Brush and Comb of the Hymenoptera.

BY REV. J. L. ZABRISKIE.

BEES have always been noted for cleanliness of person. It appears to be necessary for them to take particular care in this respect of their antennæ. Any one who has observed bees and wasps, must have noticed how much time they spend in cleaning these mysterious organs; and, perhaps, will remember the singular, almost human-like motions—the careful, dexterous strokes in one direction with which the work is done. One of the fore legs is thrown over the antenna of the same side of the head; the antenna is caught at a certain point of the leg, which at the proper instant is here slightly bent for the purpose; and then, with an outward and downward sweep, the antenna is drawn from its base towards its tip through this bend.

A little attention shows why the antenna is caught at a certain bend of the leg. There is a special apparatus at that particular spot, admirably adapted for the purpose. Fig. 1 is a representation of the fore leg of the worker honey bee, magnified ten diameters. The first large joint of the leg, counting from the body, and here, for convenience, shown as cut off at its largest diameter, is the femur; the second is the tibia; and next is the largely developed first joint of the tarsus. At the junction of the tibia and the tarsus is the apparatus mentioned. It comprises—first, a specialized spine, hinged, movable, brush-like, and projecting from the inner side of the leg; second, a deeply-cut, semi-circular notch, in the upper part of the first tarsal joint, fringed with a row of closely set teeth, like a curved comb. When the leg is bent towards the body at this point, the comb is accurately opposed to the brush, leaving a circular opening, through which the antenna is drawn, and neatly cleansed at every part of its circumference.

Fig. 2 shows this apparatus on the leg of the honey bee enlarged seventy diameters. This developed spine is mentioned as a brush, because of its graceful, brush-like form in other species of the hymenoptera. In the honey bee it appears to have no especial fringe of bristles, but is membranous, thin, of irregular outline, and doubled, like a leaf with the edges curled towards each other, having the concave side opposed to the leg. The stout spines in Fig. 2, above and below the notch, are a few of the usual spines which abound on this part of the leg. The teeth of the comb

are seen in a regular curve, fringing the inner contour of the notch, and pointing towards the centre of the opening.

Fig. 3 represents the brush and comb on the fore leg of a winged red ant, magnified

Fig. 1.—Fore leg of worker Honey Bee.

seventy diameters. The brush, in this instance, well deserves the name. Its back, or convex side, is armed towards the tip with finely pointed projections; and its concave side, from the tip to a large pointed

Fig. 2.—Brush and Comb of Honey Bee.

process in the neighborhood of the base, or for about two-thirds of its length, is fringed with long, closely set teeth, which must render the brush an admirable duster. There is no deep notch in the tarsus, as with the honey bee, but a decided curve, with a gently sweeping and extended comb.

Fig. 4 is the detached brush from the fore leg of a winged black ant. This also is magnified seventy diameters, but it is taken from a much larger species than that of

Fig. 3.—Brush and Comb of Red Ant.

Fig. 3. There are the same sharp projections on the back, near the tip; and the inner surface, which is opposed to the leg, is fringed with two rows of long, close teeth, for about two-thirds of its length; the rows gradually diverging as they approach the central portion, and enclosing an oblong vacant space.

Fig. 4.—Brush of Black Ant.

Fig. 5 represents the corresponding portion of the fore leg of the blue mud wasp (*Pelopœus cæruleus*). The brush is large,

prominent, and of strikingly graceful form, as might be expected from the characteristics of this species. The teeth of the brushing edge, opposed to the leg, begins quite near the base, and extend downwards in a prominent reversed curve to a large, pointed process, and are then succeeded by a close row of sharp spines to the tip. The teeth of the comb are set in a notch, in the upper part of the tarsus, very much like that of the honey bee, only not cut in with such a deep, short curve.

Fig. 6 shows the same portion of the fore leg of the white-horned horn-tail (*Urocerus albicornis*). This insect is one of the

Fig. 5.—Brush and Comb of blue Mud Wasp.

largest of the hymenoptera. It has long, narrow wings, and a long, cylindrical body, giving it somewhat the appearance of a dragon-fly; but it is much more sluggish in its movements than the latter insect. The female is armed with a long, slender borer, hinged to the middle of the under side of the abdomen, with which she bores the trunk of the pine tree to deposit her eggs. In this insect the brush and comb would hardly be recognized, as they have been strangely transformed into what may be called a thumb and knives. The thumb, as seen in Fig. 6, is hinged to the lower end of the tibia, in the usual position of the brush. It is nearly straight, fleshy, cylindrical and ends in a slightly curved spinous tip. Instead of the comb, found on most other members of the great family of the hymenoptera, there is a long row of curious appendages, gradually

Fig. 6.—Thumb and Knives of White-horned Horn-tail.

increasing in size as they extend downwards, and set on the inner side of the enormously lengthened first tarsal joint. Three of these appendages from the middle of the row, enlarged seventy diameters, are shown in Fig. 7. They rise from a somewhat bulbous base, continue for about one-third of their length with a cylindrical trunk, and then suddenly expand in an extremely thin and transparent blade.

Fig. 7.—Knives of the Horn-tail.

They would evidently have formed a good model for the flint knives made by our progenitors of the "stone age." The back of each knife is directed downwards; while the cutting edge, taking a broad sweep from

the handle to the extreme point, is directed upwards towards the thumb. In the individuals which I have examined, the thin upper edge of many of the knives appeared split and ragged, reminding one of the broken and frayed wings of the worker honey bee, after she has passed a few weeks in the severe labors of the honey harvest.

New Baltimore, N. Y., March, 1877.

The Siliceous Shelled Bacillariæ or Diatomaceæ.

II.—THE DISTRIBUTION AND COLLECTION OF THE DIATOMACEÆ.

(*Continued from paye* 69.)

DIATOMS are found in almost all waters, or in wet or damp places. But those who suppose that these organisms occur in every drop of water, are mistaken. In pure river or spring water they are rarely found, but near the banks of the rivers, and in the places where springs flow out, in water tables, and in damp places, around water pumps, and on the stones and plants which are under the water. The fine-threaded marine and fresh water algæ are often very richly covered with them—sometimes so completely that the algæ cannot be recognized. Frequently, also, in summer, they are to be found in the little pools of drying ditches, or in the rain-pools, where, on the slippery ground, they form a more or less slimy skin, generally tender, but sometimes compact, and which is frequently characterized by a brown color. On warm, sunny summer days, bubbles of oxygen are developed in these masses, buoying them up, and bringing them to the surface, where they then appear floating either as a thin and tender brown skin, or as larger, thicker, very slimy and compact, skinny or lumpy masses, from which a notable quantity of oxygen gas can be collected. The microscope shows that in these fine skins, very different forms are associated, usually *Naviculæ*, *Cymbellæ*, *Surirellæ* or free *Synedræ*, with a more or less lively motion. The larger slimy masses consist principally of one species, and if others are found among them, they must be considered as accidental mixtures. The thread-like forms of *Melosira* stick to plants, stones, wood, etc., in standing or flowing ditches, forming tender, brownish, thread-like masses. Others, *e. g. Fragilariæ*, are usually found on rotting tree or other leaves. Also among Confervæ, mixed with *Cymbellæ*, *Synedræ*, and other forms. It seldom happens that one species is found quite isolated from others. The adherent forms are generally found on the fine-threaded marine or fresh water algæ, the former yielding the complex larger attached forms; the latter, especially, the small, isolated, free movable forms. The brackish waters in the vicinity of sea coasts, or where the sea water during high tide flows into the fresh water ditches, or mouths of rivers, are particularly rich in forms of different genera. The tide washes these microscopic bodies loose from the ground, and the water collected near the bank contains them in great abundance. Filtering large quantities of such water, leaves them on the filter, and they can be gathered; a method of procuring them mentioned first by Ehrenberg. I have also practiced the following methods: I have taken off the brown skin, or slime, with a knife, or spatula, pressed the water out, wrapped the remnant in paper, and thus carried it off. In the same way I treated the other forms, which, either as foam, or slime skins, appear swimming on the water. The species found on confervæ, or other algæ, I gathered with these, pressed the algæ, and thus transported them. The separate packages I emptied into as many vials, at home, and poured water on the masses, then subjected them to the microscope, and afterwards preserved them, either in vials with alcohol, or spread out and dried on plates of mica; in the lack of mica plates, one can use little slips of glass for the same purpose of spreading and drying. In this way, all the forms found in one region can be preserved for an indefinite time. The larger, complex forms of the sea, *e. g. Schizonemæ*, *Micromegæ*, which are found attached to algæ, stones and

other objects, may be preserved either in alcohol, or dried like the algæ, on paper or mica plates. In the examination of these, as with all forms, they must first be wetted and softened by water.

The dead individuals sink to the bottom of the water, and since their siliceous shells resist solution, as well as decomposition, they can be found therein, even after thousands of years. And thus it may happen that these siliceous shells may get into the fertile humus, and form a part of it, but their presence therein is, generally, purely accidental, and only common in such places as are frequently flooded, or have in former times been the bottom of a swamp, or standing water, *e. g.* most peat-layers, in which, in addition to the diatom frustules, remnants of different water and swamp plants, and also snail and mussel shells are found. No diatom shells are found in the soil of dry regions. Their presence contributes little or nothing for the manuring of the soil, since they have too little of organic matter. The only advantage they can confer to the clods may, perhaps, be this—that in great abundance they would lighten the heavy soil, for which purpose any fine sand would serve equally well.

III.—THE FOSSIL OCCURENCE OF THE DIATOMS.

That the diatoms do not, like many genera of infusoriæ, undergo decomposition, had already been announced by Nitzsch in 1817. I, too, had observed that characteristic, and the glassy nature of their frustule had led me to discover the siliceous earth in it. With the discovery of the siliceous frustules (*Kieselpanzers*), was also demonstrated their indestructibility, and consequently their presence in the sediment of ditches, rivers, seas, and also in more recent formations of the earth's crust. Proof was still required that they were to be found also in the older formations; the possibility was given by my discovery. Then C. Fischer, in Pirkenhammer, near Carlsbad, announced to the Royal Academy of Sciences, in Berlin, that the siliceous earth found in the peat moor near Franzensbad, not far from Eger, consisted almost entirely of diatom frustules, and seemed to owe its origin to a sea bottom, dried by volcanic heat. The first assertion of Herr Fischer was correct, and was confirmed by microscopical examination of the Franzensbad siliceous earth by Ehrenberg, who found that it consisted chiefly of *Navicula viridis* and *major*, but inasmuch as this form is not found in sea water, but is one of the most frequent inhabitants of land fresh waters, Ehrenberg thus disproved the supposition of Fischer, that the siliceous earth was dried sea bottom.

The discovery of Herr Fischer was accepted with the greatest pleasure, for thereby the fossil existence of these little microscopical organisms, hitherto unheard of, was first pronounced and proved. This induced Ehrenberg to make further examination of fossils allied to the siliceous earth, and thus led to the most brilliant results, which have spread the fame of this industrious scholar into all parts of the world. Next, it was found that the siliceous earth (*Kieselguhr*) of the Isle de France, the mountain meal (*Bergmehl*) of San Fiore in Tuscany, the polishing slates (*Polirschiefer*) of Bilin in Bohemia (which are known also in commerce as ordinary leaf-tripoli), as well also as those of Planitz, near Zwickau, consist entirely of diatom frustules. It is quite remarkable that the principal mass of every one of the above named fossil deposits is constituted of particular forms, so that they can be distinguished readily thereby. Thus, in the Franzensbad *Kieselguhr*, the principal mass is made up of *Navicula viridis* (in other samples of the same, *Campylodiscus clypeus*). In the siliceous earth of Isle de France, of *Himantidium arcus* (not *Bacillaria vulgaris*, as Ehrenberg says). In the mountain meal of San Fiore, of *Synedra capitata*. The Bilin polishing slate consists almost exclusively of *Melosira* (*Gallionella*) *distans*. But in the Planitz polishing slate, the frustules, which also are *Melosira distans*, cannot be recognized so distinctly, because they are filled with siliceous cement, and so united to the

denser stone mass. Subsequently, it was announced by Dr. Philippi, in Cassel, that the polishing slate of the *Habichts-waldes* (Hawks wood), which is found there in thick layers, consists of diatom frustules, among which, one form especially, not found living hitherto, and which is called *Gallionella undulata* by Ehrenberg, can readily be discovered and distinguished; it is represented on our plate 2, Fig. IX. What Ehrenberg says on the Bilin stone formation is important (Poggendorff's Annal, 2 R., 8 Bd. S. 457, u. f.) Herr von Humboldt had sent to him a small collection of Bilin stones, from Dr. Stolz, in Bilin, and a larger, from Dr. Reuss, besides many pieces broken by Herr von Humboldt, himself, accompanied by a drawing of Dr. Reuss, which made plain the relative position of the layers of the formation at that place. Ehrenberg reported as follows: "The Bilin infusoria rock constitutes the uppermost layer of 14 feet in thickness, on the Tripoli mountain, about 300 feet above the Biela; it overlies a gray layer of clay, directly on the chalk marl; below both, gneiss is found, as the basis of all the rock formation of the place. On the west of the Tripoli mountain, the upper stone masses rest against a basalt dyke, which forms the Spital mountains, and on whose other side (west), rough limestones, with many recognizable petrifactions of small, calcareous marine animals (many crinoidea) lie on the gneiss. The denser masses (porous slate and semi-opal), lie in the polishing slate above, towards the surface. The earthy masses underneath are oftentimes much disturbed, but the lower strata are nearly horizontal. By directing the attention especially to the porous slate (*Saugschiefer*), and the semi-opal (*Halbopal*), whose numerous transitions were exposed for classification, the result was arrived at, that the former, as well as the latter, are closely connected with Infusoriæ. The examinations show that the porous slate is evidently only a polish-slate, whose infusoria shells are cemented by amorphorus siliceous masses, and thus filled out; empty, as well as full fossil shells, are found. This is the cause of its greater specific gravity, and other characteristics.

"In the most gradual transformations to semi-opal, it may be seen how the cement mass has increased at the expense of the infusoria shells, which decrease in number and sharpness of outline. The formation of the semi-opal in the polish-slate, in which it is imbedded in lump masses, may be traced in almost imperceptible gradations from the porous slate. A careful microscopical analysis of the different semi opals of Bilin and the Luschützer Valley, near by, has made known that all these stone lumps, oftentimes as hard as flint, and giving sparks, consists mainly of infusoriæ, which are partly connected by a somewhat transparent siliceous cement, and partly contain only larger infusorial forms singly inclosed in them, as insects are in amber.

"Oftentimes it can be seen distinctly that the layers of the polishing slate are changed in the transformation into porous-slate, or semi-opal, in no other way than that something or other ate up or dissolved a part of the infusoriæ shells, especially the smaller ones, and so inclosed another part, generally the larger forms, unchanged. In this process the order of the layers remained just as visible as it was before in the polishing-slate, and it forms the bands of the semi-opal. The white bands, less transparent, are well-preserved layers, generally, of infusoriæ. The medium of solution, therefore, must have worked on the siliceous shells, somewhat like water drops, or steam, on a mass of flour: the parts touched by it have been quietly penetrated, and partly gradually dissolved and changed into opal masses, or, perhaps, the substance that came in and produced the opal, itself occupying no great space, assimilated a greater or less amount of the empty siliceous shells. Inasmuch as it cannot be supposed that the opal substance pressed out the siliceous shells, the conclusion seems feasible that the opal itself is made out of the infusoriæ, through the agency of mere water, or perhaps some other (acid) medium of solution. Just as flour dough, not yet kneaded, con-

tains stripes of flour, so the semi-opal has infusorial bands; both are hydrates."

Ehrenberg believes likewise that the flint nodules are formed, like the semi-opals, out of diatom shells. But I have not succeeded, in spite of the most careful investigations of these, in discovering such shells either in the outer white crust, or in the inner mass. Neither has Ehrenberg shown, satisfactorily, the siliceous frustules, nor has proof been given of their occurrence in the semi-opals of the Dolerite, or the precious opals of the Porphry.

(To be continued.)

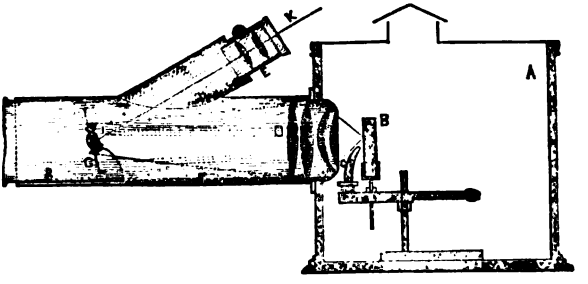
A New Form of Megascope.

By J. B. KNIGHT.

THE projection, on the screen, of the images of small opaque objects, is often a very desirable means of illustrating lectures or papers read before societies, but has not been very largely employed, because of some difficulties attending its use.

As the light for forming the image is only that emanating or reflected from the surface of the object, it is important that it be strongly illuminated. The arrangement about to be described, was devised to secure a better illumination than is obtained with the ordinary megascope, and at the same time save the cost of a special instrument, by utilizing the ordinary projecting lantern with which nearly all our educational institutions are provided.

The arrangement for accomplishing this purpose is shown in the accompanying cut, in which A represents the lantern box; B, the lime; C, the oxy-hydrogen gas jet; and D, the condenser;—all of the ordinary constituents. F represents a tube of sheet metal, of the proper size, to fit snugly over the ring of the condenser, and of sufficient length to reach considerably beyond the focus of the beam of light from it. The object I is held, by the stage G, in the beam of light as near its focus as possible, and yet give the proper breadth of illumination. This stage G is supported by, and hinged across its centre to the inner movable tube R. To the tube F is attached a branch for holding the focussing lens at the proper distance from the illuminated side of the object, with its axis at as small an angle from the axis of the condenser, as will permit the cone of light passing from it to the screen to clear the top or sides of the lantern box. Objects are easily placed on the stage G, by withdrawing the inner tube R, and are easily adjusted by this longitudinal movement, and the angular movement of the stage on its hinges. This attachment is simple and inexpensive, and by it the usefulness of the projecting lantern is greatly increased.—*Journal Franklin Institute.*



Erysiphe or Wheat Mildew *

THE cultivation of wheat, our staple agricultural product, owing to its superior quality and a never-failing market, has already assumed such vast proportions as to astonish the beholder, while the farmer is preparing to increase its production to an almost illimitable extent.

There were, however, thoughtful men in our midst who entertained fears that this over-production would yet engender disease; that nature, so to speak, would become

* Read before the San Francisco Microscopical Society, by Dr. H. W. Harkness. April 5, 1877.

weary of furnishing from earth and atmosphere the elements necessary for its further development; that some pest might with reason be anticipated which should serve to contract our immense fields as well as to greatly diminish the yield.

Until the present season nothing of the kind has occurred to verify these predictions; although in the Spring of 1868 the larva of a fly threatened to do great harm to many thousand acres of wheat within the county of Yolo. This larva took up its abode within the stalk, at the base of the culm, nearly every stalk possessing one or more of these unwelcome tenants. As it proved, however, to be a light feeder, the grain matured without serious damage, and since then it has never been observed. Aside from this, a few low lying fields upon the banks of our rivers, have from time to time been affected by the yellow rust (*Puccinia graminis*); the damage resulting has, however, been so trifling in extent as to excite but little attention. The pest which appears for the first time this Spring, termed by the farmers "white rust," or "mildew," is one which may well excite the fears of the agriculturist. It has already invaded the more mature fields within the limits of four or more of our heaviest grain-producing counties, where at least a half million acres of wheat are in great peril, some of it already destroyed.

The first notice of its existence appeared during the first days of March; but owing to absence in a distant portion of the State, I was unable to procure specimens until the 28th inst.

The fungus appears upon the expanded leaves in closely-felted patches of dirty white color; the patches varying from one-sixteenth to one-half inch in length, following the longest diameter of the leaf, equally on both surfaces. When the leaf still adheres to the stalk, it often extends entirely around it, forming a zone, extending upward for an inch or more. With the aid of a pocket lens numerous black spots are observable, closely enveloped in the felted material.

The more mature spots may be peeled off from the leaf, but the tenacity with which it adheres to it, seems to indicate a union somewhat more intimate than that of mere contact, doubtless owing to some contact with the hairs of the leaf.

On examining sections of the leaf and fungi, no suckers are apparent, while the portion of leaf so denuded appears in no manner distorted or broken, but the cuticle remains as smooth as that of the unaffected leaf.

The leaf at a short distance from the culm soon turns brown and dries, while that portion surrounding the stalk is able to resist, to some extent, the parasite, and when the patches are removed, the surface is still green. In the earlier stages the mycelium is observed creeping over the surface, branching as it extends, its filaments overlying one another, until it eventually forms the felted mass above mentioned.

Growing out of the mycelium, projections are seen, from which the conidia spores are produced. These appear as upright moniliform threads, bearing three or more oval spores.

These when placed in water throw off germinal tubes. On boiling a portion of the fungus in a solution of caustic potash, the mycelium is destroyed, and a clearer view of the reproductive bodies may be obtained.

At the present stage of development but one form of *pycnidia* is observable, which is nearly globular in shape, and of a dark brown color. From this abundant ovate *stylospores* are ejected. No other forms of pycnidia such as Tulasne figures, are at present discernible. Large numbers of other bodies are seen, which prove to be *conceptacles*. These are spherical in outline, gregarious, and in color dark brown or black, with cylindrical appendages, which are slightly curved at their terminal point. On rupturing the conceptacles, from eight to fourteen asci appear through the opening.

These asci are somewhat obovate, with a stout, curved pedicel, by means of which they are attached to the inner surface of the conceptacle. The asci are filled with granular matter, and under the action of iodine are turned of a brownish tinge. All so far examined are immature, no sporidia being formed within the ascus. Enough has been determined, I think, to warrant me in regarding it as none other than the *erysiphe graminis* of De Candolle.

No doubt the sporidia will ere long mature, and then the species may be fully determined.

To what extent the wheat will be damaged by this erisyphe, it is, of course, impossible to say. Adhering, as it does, so closely to the plant, it doubtless appropriates the juices so necessary for the maturing of the grain to its own sustenance, while at the same time shutting off air and sunlight from the tissues. Its visible effect is a weakening of the stalk, thus engendering decay.

Mechanical Finger.

I WISH to call the atttention of the Society, this evening, to a device for picking up and selecting minute objects under the microscope. In other words, to an improvised mechanical finger, which may be easily arranged by any person who possesses a first-class stand.

Feeling the want of such an apparatus to pick out and arrange the interesting and beautiful crystals which occur in the washings from the hydraulic gold mines of California, and in the black, gold-bearing sands of the sea coast, I was led to give the subject much careful study.

The elegant mechanical finger described in the *American Journal*, second series, vol. 49, folio 304, is not only expensive, but must be detached from the microscope and laid away when not in use, being for this reason inconvenient. Considering these defects I thought on a number of ways to simplify the arrangement, and finally hit on a plan to do away with all extra apparatus and still accomplish all that could be desired. The plan is so simple that I am almost ashamed to make it public. For aught I know it may be in use by a host of microscopists in different parts of the world, but I have never heard it mentioned, nor have I seen it described in any of the published works.

As I am sure that the idea is new to our Society, I will describe it as briefly as possible. Let the microscope be placed in a vertical position, and a suitable object-glass screwed on. Fix the parabola in its place in the the sub-stage. Let it be pushed as far in as possible, so that when elevated by the milled heads it will rise through the opening in the stage, with its upper edge above the surface. As it will not be immediately required, it may be depressed, using the milled heads for that purpose. A glass slide, upon which the rough matter is laid, from which it is desired to select an individual crystal or other object, may now be placed on the stage. The sliding pieces of the stage must then be separated as widely as possible, and the stage forceps fixed in the usual position. If the objects to be picked out are small, such as diatoms, etc., a human hair must be placed in the jaws of the forceps, and so arranged that it will appear in the field and near the surface of the slide. The objects to be selected should be as near the centre of the slide as possible. By turning the milled heads of the mechanical movements of the stage, the desired object may be centred, after which the hair must be readjusted without moving the stage. By elevating the sub-stage slightly, the slide will be lifted from the stage, the position of which can be changed by the mechanical movement, while the slide remains stationary.

When the end of the hair is exactly over the object, which is dimly seen out of focus, a turn of the milled head of the sub-stage lifts the slide until the object touches the hair and remains attached to it. When the sub-stage is lowered, the object remains suspended to the end of the hair. The slide may then be removed and another substituted, to which the object may be transferred by simply elevating the sub-stage, the slide rising to meet the suspended object. If the slide has been gently breathed upon, the object leaves the hair and attaches itself to the glass. This applies only to minute objects. When the object is larger and too heavy to be lifted by a hair, it will be necessary to substitute a bristle and to wet the end of it; when the second slide is placed under it, a few minutes will suffice to evaporate the moisture, and the object will fall into the desired position.

The hair may be used to push away worthless matter which may surround the object desired. It is perfectly easy to push any portion quite out of the field, simply by using the stage movements while the slide rests on the parabola.

If a piece of fine aluminium wire, the end of which has been flattened by a pair of steel rollers, be substituted for the hair, and a low power used, a crystal may be lifted with as much ease as a lump of coal on a shovel. To prevent the object from being pushed before the chisel edge of the wire, a small piece of glass may be placed in the direction of the movement, against which the object is held, while the edge of the flattened wire passes under it.

It will be found difficult to place a hair firmly in the jaws of the stage forceps. This difficulty may be overcome by cementing the hair or bristle between two small pieces of thick paper, which the forceps will hold rigidly.

Nothing can be more simple than this device, and I question if any mechanical finger can be more effective. A few minutes will suffice to make it perfectly understood. —*Paper by H. G. Hanks before San Francisco Micros. Society.*

—It is well known that some tadpoles feed freely on flesh. It has been suggested that they might be usefully employed in making skeletons of small animals.

THE AMERICAN
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The following gentlemen have kindly consented to act as agent for this Journal, and are authorized to receive subscriptions and advertisements:

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Microscopy at Nashville.

THROUGH the kindness of Prof Ward, chairman of the Sub-Section, we have been favored with the following note from the advance sheets of *The Naturalist:* "At the Nashville meeting of the American Association for the Advancement of Science, commencing August 29th, and continuing about one week, special arrangements will be made for the care of instruments, and for the convenience of those who wish to use them. The local sub-committee having charge of these arrangements consists of Dr. T. O. Summers, Jr., and Professors G. S. Blackie and Alex. Winchell, who will leave nothing undone that is believed to be for the advantage of this department. As microscopy has been made a permanent sub-section, it is now, in reality, a national society of microscopists, with power to elect officers and continue its organization from year to year, and to avail itself of the great facilities and advantages of meeting with, and as members of the American Association. It was the unanimous and earnest desire of the members present at the last meeting, at Buffalo, that all the microscopists of the country, and especially the officers and members of microscopical societies, should take a hearty interest in the enterprise, and contribute to its usefulness by attending the meetings when possible, and sending contributions to be read if unable to attend personally. Circulars giving particulars of the arrangements for this meeting can be be obtained from Dr. T. O. Summers, Jr., of Nashville, chairman of the local sub-committee, or from the editor of the microscopical department of *The Naturalist,*" [Prof. R. H. Ward, of Troy, N. Y.]

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

The World of Matter.

Ed. Am. Jour. Microscopy—In an article headed "The World of Matter" published in a late issue of your journal, the writer starts off by casting an undeserved slur upon what he chooses to call the "speculation" of "curious physicists," regarding the size of the ultimate atoms or molecules of matter. The article is taken from the Boston *Journal of Chemistry*, but the writer certainly was not cognizant of the immense strides which have been made in molecular physics during the last few years, or at least he does not appreciate their value.

Strange and wonderful as it may seem to the general reader, it is nevertheless a fact, that we may now speak of the absolute size of the molecules of matter, without relying upon the results of mere speculation, but using figures which are the result of long series of beautiful and accurate physical experiments. Surely we have not isolated these molecules to measure them and determine their shapes, but they have been truly measured in spite of this, and we are assured of the accuracy of the results because the numbers from different experimenters, working from totally different data, agree very closely.

None of us in our younger days, blowing soap bubbles, with a clay tobacco pipe, and gazing at the reflections in the transparent film, ever thought that there could be any more beauty in a soap bubble than our eyes could see. But Sir William Thomson saw something more in this film of water, and he has by patient and delicate experiment, determined the size of the ultimate molecules of water by measuring the contractile force of this bubble as it was blown thinner and thinner. We may readily follow the principles involved in these researches when we consider that as the film grows thinner the contractile force remains the same until it becomes so thin that the walls are composed of an appreciably small number of molecules, constituting its thickness. Thus the contractile force of a film one ten thousandth of a millimetre in thickness, is appreciably the same as a thicker one. If the film be now reduced to one twenty millionth of a milimetre, the contractile force will be found greatly diminished. Now, we find that the heat, equivalent to the mechanical force required to reduce the film thus far, is much greater than the amount required to convert the water into vapor, *i. e.*, to destroy the water as such. Hence we must conclude that before the film reaches the twenty millionth of a millimetre in thickness, its contractile force must greatly diminish, and since such a diminution cannot take place with several molecules in the film, there cannot be several molecules in the twenty millionth of a millimetre. For fear of making this communication too long, I shall not attempt to condense the methods employed by other workers to reach this same result. Suffice it to say, that the above course of experiment thus crudely condensed is only one of a number of courses, all of which demand the most careful and accurate physical experimentation, which few are sufficiently gifted to undertake.

We may feel certain that the molecules of solids and liquids must measure between the ten millionth and two hundred millionth of a millimetre in diameter. One millimetre = .03937 inch. Considering the molecule to be one twenty millionth of a millimetre, the size in fraction of an inch would be about one five hundred millionth of an inch.

A good clear exposition of this subject, by Prof. G. F. Barker, of Philadelphia, may be found in the *American Chemist* for last November. Such numbers are small beyond our conceptions. But we have not yet reached the limits of divisibility of matter. The chemist recognizes still another particle of matter, the atom, of which these molecules are composed. This atom is indivisible as far as we yet know, (although the spectroscope has indicated that some of our atoms may be compounds) and has a constant size and weight.

We see then, that the measures of the wave lengths of light are much larger than the diameter of the compound molecules of matter; in fact some 10,000 times greater. As the microscope becomes more perfect, we will no doubt be able to see much that is now perfectly invisible. But we can never even approach the study of molecules. Even now we frequently see fine particles suspended in a liquid so minute that even the highest powers of the microscope cannot show the particles when placed on the slide. We see them as a cloudiness or turbidity in the liquid viewed in quantity, and recognize their presence by the colored light reflected from them. Already, then, we have divided matter to an extent that it is invisible by the microscope, but these particles are infinitely larger than the molecules.

R. Hitchcock.

8 *Beekman Place, New York.*

Cannabalism of the Amœba.

Ed. Am. Jour. Microscopy—In reference to Dr. Leidy's observation of an alleged act of cannabalism on the part of the Amœba, and described by him before the Academy of Sciences,

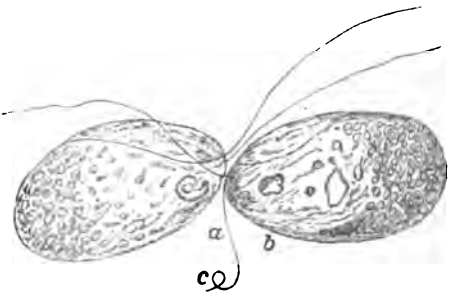

Fig. 1.

at Philadelphia, I would make a suggestion, and inquire, was it really an act of cannabalism, or one of a sexual character?

As I incline to a belief in the latter alterna-

tive, I beg to offer my reasons for forming that opinion.

The attention of some of the best observers have been directed to the Amœba, but its life history has yet to be written, and its actual mode of reproduction is still a perplexing question. The most simple mode is that by "fission," when the creature merely contracts the middle of its body, until the two ends be-

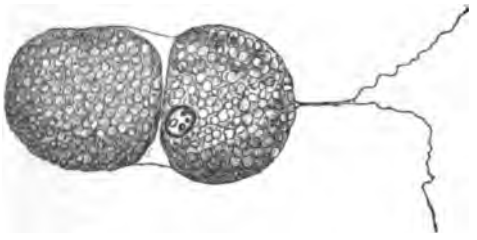

Fig. 2.

come separated, and the divorced parts sail away to pursue an independent existence. *Or*, instead of its dividing into two nearly equal parts, a single pseudopodium may become detached in a similar way.

Another mode of reproduction has been noticed, which is by a segmentation of the nucleus, which results in the wholesale production of a brood of young Amœbæ. And, lastly, Dr. Wallich has shown that the Amœba undergoes a process of encystation, which is followed by the segregation of the sarcode granules into what has been called sarco-blasts, but the ultimate process of reproduction by this mode has not been accurately followed out.

I must now direct attention to the very interesting united researches of Messrs. W. H. Dallenger, F. R. M. S., and Dr. J. Drysdale, F. R. M. S., into the Life History of the Monads, observed continuously for over three years, which will bring me to the point I wish to make. They found the modes of reproduction with monads to be equally as varied and remarkable as those known to occur with the Amœba. But there was one method which attracted their particular notice, and in this case the creature threw off its external appendages, became oblong and rounded, granular, sluggish in motion, and at length stationary, and at last its edges broke up and a cloudy mass poured forth, consisting of myriads of minute points, which were observed until they became perfect monads, like the parent.

This mode of reproduction was found to be preceded occasionally, but very rarely, by an actual sexual contact, or "congress of genetic element"—and was found to be the *primary* method of multiplication of these species.

It was only after three years of close observation that this sexual contact was noticed, and these gentlemen found it so rare that they concluded that it probably served for hundreds of generations. This form of sexual contact is thus described: "Two of the monads, in no way distinguishable from one another, at times met and touched at their anterior ends, swimming freely together. The normal flagella rapidly disappeared, *and the bodies melted into each other*, and the whole assumed a granular condition."

Now, sir, there appears to me to be so close an analogy between the *blending* of the bodies of the Amœbæ, as seen by Dr. Leidy, and the *melting* into each other of the monads observed by Messrs. Dallenger and Drysdale, that I cannot resist the conclusion that they had reference to one and the same act.

I beg to make this, as a mere suggestion, with no desire to disparage Dr. Leidy's interesting observations, but rather to offer a rational solution to what he himself considered an abnormal act.

I submit copies of Messrs. Dallenger and Drysdale's drawings, which will make the parallel I describe very clear. JOHN MICHELS.

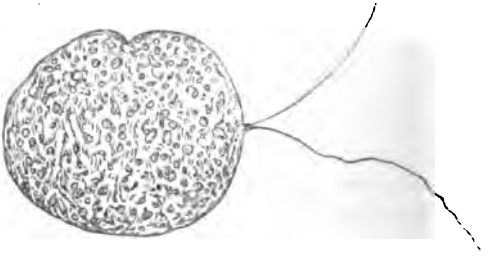

Fig. 3.

[The engravings are reproductions of the plates in the *Monthly Microscopical Journal*. Fig. 1 shows the first act of sexual contact; Fig. 2 the earliest result of the blending; Fig. 3 the still condition which follows.—ED. A. J. M.]

Our Book Table.

A Practical Treatise on Lightning Protection. By Henry W. Spang. With Illustrations. 12mo. cloth, $1.50. Philadelphia: Claxton, Remsen & Haffelfinger.

This work has evidently been written for the purpose of advertising a special earth-termination for lightning rods, which it seems the author has patented, and is now engaged in selling. It is very doubtful, however, if the patent claim could be sustained, as the principle involved has been long known, and directions for this special application were given in a little work, published by the editor of this journal many years ago.

In getting up his work, the author has depended more upon his scissors than upon his pen, and consequently the reader will fail to find any points explained in a manner clearer or more direct than that found in ordinary text books on electricity. Any intelligent reader that will examine this book will find, however, that Mr. Spang has in some cases made a rather unwarrantable use of his scissors, and that he has taken, without acknowledgement, matter and cuts which are the property of others. His cut, Fig. 5, is a mere copy, slightly altered for the worse, of a cut given at page 12 of our little book. This cut was drawn by us, and engraved, for the purpose of illustrating an original experiment, demonstrating the proper form of lightning rods, and Mr. Spang cannot point to any publication in which it can be found prior to the publication of it by us.

The same is true of his Fig. 20. Prior to the issue of our book (in 1871), certain principles which affect the protection of barns and similar structures had never been fully and popularly explained. We discussed the subject at some length, and illustrated the article by means of original drawings and engravings. Mr. Spang has transferred them to his work without the slightest acknowledgement.

We are not the only parties, however, upon whom he has thus trespassed. His Fig. 12, is a reproduction of one of the plates of Knight's valuable "Mechanical Dictionary"—taken without the slightest acknowledgement. It is true that Mr. Spang has added and altered a little, just enough perhaps to protect him from the law, but not enough to protect him from the contempt of all honest men.

As we said before, the present work has been issued for the purpose of advertising a patent lightning rod. It is well known that in the construction of lightning rods one of the most important points is the faithfulness and care with which the work of construction and erection is done. It is to be hoped that in the construction of his rods, Mr. Spang will be more honest than he has been in the compilation of his book.

A Queer Industry.—A peculiar industry has recently come to grief in Paris. An establishment was organized for the purpose of breeding maggots. The means by which the "god kissing carrion" was encouraged in the process were very simple. Over the soil there were spread large quantities of stale fish, dead lobsters, odorous poultry, and other refuse of the markets, as much as half a ton of large fish being taken on the premises in a single day. This stuff was soon attacked by the maggots, which in turn were carefully picked out and packed in casks of galvanized iron, and finally were sold for fish bait and chicken feed. The remaining refuse was converted into manure. It may well be supposed that the neighbors objected to the odoriferous character of the establishment. Moreover, the production of maggots was not confined to the premises; the flies roamed around and deposited their eggs with impartiality on exposed provisions in the vicinity. There was a little doubt as to whether the flies came within the scope of the sanitary laws, but at last the authorities ordered in the police and stopped the manufacture.

Destructiveness of Black Ants.—Hitherto the white ant only has been regarded as a dangerously destructive enemy to timber, but at a recent meeting of the Philadelphia Academy of Sciences, Rev. Dr. McCook called attention to the destructive effects produced upon timber by the black ant (*Formica pennsylvanica*). His attention had recently been called by Judge Allison to a rafter in the roof of the porch of his house, which had been honeycombed by these insects to the extent of five or six feet. He urged the importance of frequently examining the timber of bridges and other structures which sustain heavy weights, for the purpose of preserving them against the attacks of these ants and similar destructive agents.

Hand Marks Under the Microscope.—In a recent lecture, Mr. Thomas Taylor, microscopist to the Department of Agriculture, Washington, D. C., exhibited on a screen a view of the markings on the palms of the hands and the tips of the fingers, and called attention to the possibility of identifying criminals, especially murderers, by comparing the marks of the hands left upon any object with impressions in wax taken from the hands of suspected persons. In the case of murderers, the marks of bloody hands would present a very favorable opportunity. This is a new system of palmistry.

Detection of Oleomargarine in Butter.—Prof. G. Lechartier states in the *Chemical News*, that fresh genuine butter which has not been melted appears under the microscope composed of ovoid granules, and contains no crystals. The artificial product obtained from tallow contains crystals. Artificial butter does not melt at once, like genuine butter, to a clear oil, but fuses gradually, a whitish "sauce" being first formed.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—The regular meeting of this Society was held on Thursday evening, May 17, with a large attendance, called out, perhaps, from the fact of the distribution of tickets to the coming reception.

President Ashburner was in the chair, and in addition to the members, Messrs. John B. Clarke, of the University of California, and Charles E. Blake, Sr., of San Francisco, were present as visitors.

After the reading of the minutes, Dr. David Wooster was elected an active member of the Society.

There were added to the Library, by subscription, the *Monthly Microscopical Journal* for April, *Quarterly Journal of Microscopy*, AMERICAN JOURNAL OF MICROSCOPY for March and April; *Cincinnati Medical News* for April and May, *American Naturalist* for May, *Popular Science Monthly* and supplement for May, and five numbers of *Nature*. By purchase, "Lay Sermons," Huxley, and "Demonstrations of Microscopic Anatomy," Harly and Brown, were added, while Prof. H. L. Smith, of Geneva, N. Y., donated two pamphlets, being on "Diatoms from the Arctic Sea," and "Examination of Diatoms found on the Surface of the Sea of Java," both by Prof. P. T. Cleve, and were communications to the Royal Swedish Academy of Sciences, in 1878. The technical descriptions of the diatoms were supplemented by several plates, which showed the marked characteristics of the various species.

Col. C. Mason Kinne presented some curious forms of insect life, which were obtained by Mr. Thos. F. Eyre, from a tree and rose-bush under the same, growing at Mazatlan, Mexico. They were mistaken by the casual observer for the thorns which are the proverbial necessary evils of the sweet-smelling rose, from the fact of the thorax being raised into a sharp-pointed crest, which had the appearance and feeling of a veritable rose-thorn. Mr. Kinne remarked that the tree hoppers (*membracididæ*) furnish many varieties of this peculiar form of raised thorax, but the variegated sharp crest curving upward and backward from the head of this, gives, perhaps, as beautiful and pointed an illustration as is often found of the genus. In the struggle for existence which has gone on for ages in the animal kingdom, the "mimicry of nature" plays an important part, and this little tree-hopper, from its appearance and known habits, is a good example of the theory.

Prof. Davidson presented a sample of carbonate of magnesia which was obtained from the Golden Gate, Bay of San Francisco.

Dr. S. M. Mouser donated two slides mounted by himself, showing finely a vertical section of the human skin and the striated muscular fibre of man.

By purchase, there were received from Cole & Son twenty-four injected anatomical, and the same number of pathological objects.

Mr. C. W. Banks exhibited a fine specimen of the *Dionœa muscipula* or Venus' fly-trap, with some of the leaves expanded; others fulfilling their purpose in the way of holding a number of unwary flies which had been enticed within the trap-like jaws of the plant. Mr. Banks also exhibited a box of slides which he had just received from Mr. Charles Zentmayer, of Philadelphia, who has succeeded in doing good work in the way of the double staining of vegetable tissues, as the objects were found to preserve the peculiarities of the cell structure, and the color was distributed excellently.

Mr. H. C. Hyde, who has the matter of the coming reception in charge, and finds the office of Vice-President not a sinecure just about these times, reported that the list of exhibitors and objects was nearly completed, and that the reception would be held in Mercantile Library Hall, on Thursday evening, May 24th. The requests for just a few extra tickets would seem to show that those fortunate enough to be acquainted with members of the Society were clamorous for invitations.

Mr. Hanks presented a slide mounted with crystals, to illustrate a paper by him, on a mechanical finger, which paper is published in another column.

The fifth annual reception of the San Francisco Microscopical Society was held on Thursday evening, May 24th, at Mercantile Library Hall, and was largely attended by an appreciative and intellectual assemblage of ladies and gentlemen, who left the hall feeling that the efforts of the courteous exhibitors had culminated in an evening of pleasure and interest to them.

There is a latent feeling in the minds of all, to reach out into the unknown, and, if possible, become informed of what is apparently mysterious; and while the microscope has become a necessity to the special or even general student of to-day, it is also one of those optical instruments that is the most fascinating to the general public. The before unseen world is penetrated by its seaching powers, and a universe hitherto unknown to them is found teeming with life and wonders, while beauties of nature are unfolded in a manner that is at once convincing of the existence of a law that governs the little with the large—the infinitesimal as well as things of a magnitude appreciable without magnification.

At the reception on Thursday evening, which was, as usual, a gratuitous offering on the part of the Society to the intelligent curiosity of the acquaintances of the members, there was arranged a programme of three objects for each of the exhib-

itors to present, and most of the slides were selected from specialties cultivated by the members. On a number of tables arrayed about the hall were placed twenty-two fine instruments, most of them first-class stands, and as the audience moved from one table to the other, the gentlemen in charge took occasion to explain the objects exhibited, and reply to the many questions propounded.

The President of the Society, Prof. Wm. Ashburner, was at the first table, with vegetable structure, of which, perhaps, the most interesting was a leaf of the insectiverous plant known as *Drosera Rotundifolia*, with its tentacles and other parts. Darwin's exhaustive researches into the habits of this plant have made it world-wide, and it was a fitting introduction to the vegetable tissues shown by Mr. C. W. Banks, which had been doubly stained for the purpose of better defining their structure. Other objects of a similar nature were exhibited by this gentleman, as opportunity offered, though most of the members found that their three objects well explained, were all they could get through with to advantage.

Vegetable tissues—polarized—formed a beautiful series of objects, shown by Mr. X. Y. Clarke, and the starch grains, redwood bark and raphides took a new interest in the minds of all, as the polariscope added its effects to the natural beauty of the most useful kingdom in nature, the vegetable. Mr. E. J. Wickson continued in vegetable structures, showing the relative position of the exogens and endogens, and supplemented by the anatomy of a leaf. The pollen of Rose and hairs of Deutzia scabra, by Mr. G. L. Murdock, and varities of the cryptogamia, in the way of ferns, fungi and algae, by Mr. J. Z. Davis, brought us in natural sequence to some of the lower living forms, which were finely shown by Henry C. Hyde, Esq. The protococcus and diatoms, which were motile, were almost animal in their popular characteristics of locomotion, and it was only the positive assertions of the gentlemanly exhibitor that could convince some of the observers that there was not a mistake in their classification.

Mr. J. A. Langstroth also favored the audience with living objects, in the way of such animals from his marine aquarium as *Parypha crocea*, *Laomedia amphora* and *Lagunoula repens*, all of which were on their good behavior and showed themselves to advantage.

Mr. H. K. Moore favored those present with some of the most interesting forms of diatoms, and also spicules of Gorgonia, displayed on a dark field, which was a new feature to those who had properly passed on from table to table in the order as laid down, and elicited many expressions of approbation.

Mr. C Mason Kinne selected for his exhibit the respirator organs of insects, plants and shell-fish, for the purpose of comparing the methods in which different orders managed to breathe. He found that the stomata and ducts of the one, the spiracles and tracheæ of the other, and the ciliary action of the branchial plate of the third, were but texts from which he had to frame short discourses in explanation, and in reply to queries as numerous and varied as those who placed their eyes to the tubes.

Mr. W. F. Myers displayed several whole insects, the one attracting the most personal interest being a flea, though this one was that which claims the mole as its host and has no eyes. Mr. G. H. Williams exhibited a beautifully mounted proboscis of blow-fly, and other parts of the same insect. Dr. S. M. Mouser, in his exhibition of the circulation of blood in the mesentery of a frog, united with the natural showing of the red and white corpuscles, certainly attracted his share of attention. The frog had been considerately rendered insensible by the use of chloroform—for Dr. Bergh has a branch Society out here—and comfortably stretched out on a plate of cork arranged with a little device of the Doctor's invention, which succeeded well in holding the mesentery in place and perfectly flat, so that the whole field could be in focus at once.

The capillaries and larger blood vessels were shown as well as we have ever seen them, and the question asked by each visitor of the other, "Have you seen Dr. Mouser's frog?" implied more than a little, and evinced the interest he had awakened.

Dr. S. W. Dennis, in the sulci of several human teeth, showed plainly the normal condition, and incipient and advanced caries of those tegumentary organs, which was found to appeal to the feelings as painful reminiscences of the past, swept across the brain. Dr. E. H. Woolsey gave an idea of the structure of the human skin, and also how the fungus of a skin disease played havoc with the tissues. Dr. J. W. Winter had something to say of odontology, and with interglobular spaces, sulci and secondary dentine shown in sections of teeth prepared by himself, he found that information regarding the matter was not wanted from small sources, but from facts which covered metaphorical acres.

Rev. J. H. Wythe, M. D., as usual with him, indulged in a fine showing of minute anatomy and drew upon the brain, spinal cord and nerves, for subjects. Mr. John Hewston, Jr., had perhaps, the most beautiful exhibit of the evening, though not tending so much toward the general diffusion of knowledge as some of the others. Polarized light when applied to such chemicals as Salicine, Æsculine, and Platino-cyanide of Magnesium, cannot fail to draw out the encomiums of all lovers of the beautiful, of whom the ladies are not the least. The flashing rays of light emitted from the crystals, moved many to exclamations of delight, and the

verdict that *ecru* and gas-light blue were defeated in the struggle for ascendancy among colors was unanimous.

At table number 21 we found not Mr. Attwood, who could not attend, but Mr. W. H. Lent, whom we had missed at number 8, as per list, and also found that he was struggling with the task of showing Mr. Attwood's slides of rock sections from the Comstock Lode, as well as his own marine objects, and doing both very well.

Mr. J. R. Soupham, in minerals, had some crystals of native gold and silver, as well as copper, which he explained to those around him, and passing on to Dr. A. Mead Edwards, we were told something about the formation of coal, and shown a series of objects from carboniferous deposits, embracing Newcastle coals, fossil pines and recent pine wood.

Cogitating on the force and mechanical energy gathered together in the coal fields, which is the condensation, so to speak, of the Sun's power, we felt like going over the whole list again, a list which embraced so many departments in the economy of nature; but the tired gentlemen who had presided at the tables so well, were found to be packing things away, and we left with the rest who were fortunate enough to have been invited, wishing the members of the Society could see the propriety of having their meetings oftener. The whole affair was a complete success, and those who participated may well feel a pride in what they have shown, and gratified that they have aided a little in popularizing science, trusting that the world may see that there is an evolution in mind as well as matter.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Wanted, foraminifera, polycystina and zoophites, in exchange for histological preparations, crystals of herapathite and other crystals, various starches, stained sections of old cypress stump from Centennial, and other slides of interest. R. Hitchcock, 8 Beekman Place, New York.

Slides of fossil and recent Diatomaceæ, etc. Lists exchanged. E. Pennock, 805 Franklin street, Philadelphia.

Slides of Trichinæ spiralis, finely mounted, in exchange for anatomical or pathological mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Slides of cuticle of larva of Macrosila Carolina, showing crystals, in exchange for other objects. E. A. Burdick, Pension Office, Washington, D. C.

Diatoms from Coldwater, Mich., in exchange for other well-mounted objects. Address F. H. Root, Coldwater, Mich.

Palates of mollusca, a great variety, mounted or unmounted, in exchange for mounted slides of interesting objects or good material. C. M. Vorce, 164 Lake street, Cleveland, Ohio.

Wanted, for specimen of bladder of cat, finely injected, other injected pathological objects. J. T. Joslin, Newburgh, N. Y.

Case of algæ, and live fresh water animalculæ, for any well-mounted specimen. Send slides to A. Hobart, Box 581, Penn Yan, Yates County, N. Y.

Wanted, a small piece of "Monterey stone," or a small quantity of the Diatomaceous fossil deposit from any part of the Pacific coast. State what is wanted in return. F. F. Stanley, 40 Pearl street, Boston.

Slides of spermatazoa of horse in exchange for any other well-mounted object. C. Blasdale, M. D., Jericho, Queens County, N. Y.

Bermuda shell sand, composed entirely of foraminiferal and other shells, with coralines and sponge spicules. Very interesting for low powers and opaque specimens. Address C. C. Merriman, Rochester, N. Y.

Slides of diatoms containing Stauroneis Phœnicenteron, Cymbella Ehrenbergii, Circulare Gonphonema, Navicula, etc., in exchange for any well mounted object. William Beadle, Garnerville, Rockland County, N. Y.

Wanted, one of the famous Barton buttons; must be in good condition. Will give either money or good exchange. E. W., Box 4,875, New York.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Wanted, in exchange for diatoms from northern Wisconsin and Michigan, any well-mounted objects; marine diatoms preferred. W. H. Titus, M. D., Shawano, Wis.

Slides of fine sand, consisting of quartz, garnet, magnetite, hornblende, etc., from beach at Lake George, very beautiful, for other mounted objects. Wm. W. Griffin, Lynn, Mass.

For specimens of Comstock ores (15—25), or crystals of rare chemicals for polariscope, mounted, send diatoms or foraminifera to F. H. Engels, M.D., Virginia, Nev.

Wanted, well-mounted specimens, for slides of American Podura mounted whole, and scales of same. Address George W. Fries, Friendship, N. Y.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 355, Milford, Mass.

"Bough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield, Mo.

Wanted, slides of diatomaceæ or foraminifera in exchange for pathological preparations. George A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

Stained petals, leaves, and sections of some common plants to exchange for other mounted objects. Address F. H., Box 98, Cherokee, Iowa.

THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

VOL II. NEW YORK, AUGUST, 1877. No. 8.

What I Know About Late Improvements of the Microscope.*

A RECENT paper, by our fellow-member, Dr. J. G. Hunt, entitled: "Post-Centennial Microscopical Notes," read before this section, and published in the Cincinnati *Medical News*, has provoked† considerable discussion, especially that part relating to my "American Centennial Microscope." As some of these important improvements have been claimed by other makers, I propose to bring the subject before you for investigation, with the endeavor to right the matter satisfactorily to all concerned.

In order to make the investigation a thorough one, it will be necessary for me to call your attention to the so-called Grand American Stand, made for this academy in October, 1859, and which now stands before you. The novel points of this stand, which I claimed at that time, were: 1st. The stage, with graduated revolving plate to serve as goniometer. Although very firm, it is only three-sixteenths of an inch thick, and is, even at the present date, the thinnest mechanical stage made. 2d. The graduated revolving base for measuring the angular apertures of objectives. 3d. The hanging of the mirror to a joint as near as possible to the plane of the stage.

Early in 1860, I made three stands (Nos. 13, 14 and 15) precisely like the Grand American, but somewhat lighter to accommodate Dr. Francis W. Lewis, also a member of this section. One for himself, one for Dr. John L. Le Conte, and the third for Mr. S. Weir Roosevelt, a lawyer of New York, since deceased, (which was ordered for him by Dr. Francis W. Lewis.) The latter instrument, as I am informed, is now in possession of his son, James W. Roosevelt, of New York. Mr. Roosevelt was not in favor of mechanical stages, and desired me to design for him a revolving stage, the object to be moved by hand, and it was for him that I constructed the first of my graduated stages, giving a complete revolution in the optical axis, in a large ring, which is adjustable within another by three screws, in order to have the axis of the stage coincident with the optical axis of the instru-

*A paper read by Mr. Joseph Zentmayer before the Biological and Microscopical Section of the Academy of Natural Sciences, Philadelphia, June 4th, 1877.

†[It is proper to note that this discussion was not "provoked" by any mere statements of facts made by Dr. Hunt, but by the unwarranted insinuations contained in his article, which has since been reprinted in the form of a small pamphlet, and distributed quite extensively.—ED. A. J. M.]

ment, exactly the same as the one before you, which I made for our President, Dr. R. S. Kenderdine, early in 1866.

This stage has been for years extensively copied, in France by MM. Nachet, and in England, among others, by Mr. Crouch, who first (likely in order to make it cheap) left off the centering adjustment, to adapt it a few years later, claiming it as his invention.

The hanging of the mirror by a joint as near as possible to the stage, I adopted long before I made the Grand American Stand. The first large stand I made for Dr. Joseph E. Parker, since deceased, now in possession of Dr. John H. Packard, also a member of this section, has such a swinging mirror.

The microscope, to which I will now call your attention, is one which I made in the fall of 1864 for Mr. E. Furber, 253 Market street, Philadelphia, who kindly loaned it to me for this evening. The accompanying photograph, which he presented to me about that time, he says was made on Thanksgiving Day, 1864. It is one of my Army Hospital Stands, almost the same as made to-day, except that a sliding sub-stage is attached to the prismatic mirror bar, to receive the accessories. In the photograph you see an achromatic prism for oblique illumination (an apparatus which since then has also been brought out as new). Although handy as a mechanical contrivance, it is not of much importance; the mirror stem is only jointed near the stage, and has not the object under observation as its precise centre. If it had, it would be exactly the same as the swinging sub-stage and mirror of my new "Centennial Stand." About two years ago, in a conversation with Dr. J. G. Hunt, he pointed out the importance of having an arrangement for illuminating the object by an achromatic condenser in an oblique position. I explained to him how I would make a stand, in which this idea would be carried out in the most complete manner. The design and drawings were made soon after, but the instrument was not brought out, as I intended it for the Centennial Exhibition. Some of you had seen it before, and previous to bringing it to the exhibition, you recollect, it was shown at our meeting here, in April, 1876.

The Bausch & Lomb Optical Co., of Rochester, N. Y., exhibited at the Centennial, a microcope stand with glass stage (a modification of mine); the mirror was hung to a swinging arm, and a diaphragm was attached to the mirror stem, quite similar to the instrument and photograph before you, made thirteen years ago. The joint was *not* in a plane with the object, but below the surface of the stage, and the diaphragm was attached to a lateral slide, in order to make use of it when the mirror was hung obliquely, which is a clear proof that the joint was not in a plane with the object. I admit that in the way they accomplished it, they could have placed the joint higher, as they did in instruments brought into the Centennial Exhibition at a later time, but at a loss of extreme obliquity. To bring their mirror over the stage is utterly impossible. Mr. Gundlach, the designer of this stand, who is in the employment of the Bausch & Lomb Optical Co., since Jan. 1, 1876, might have hung his mirror higher, but he did not "grasp the idea." Their instrument involved nothing new in relation to the swinging sub-stage, that you do not see in the instrument made for Mr. E. Furber thirteen years ago, which now stands before you.

A few days ago Dr. J. G. Hunt showed to me a letter received from Mr. W. H. Bulloch, of Chicago, accompanied by cut and photographs. Dr. Hunt had the kindness to hand the photographs and cut over to me, and I lay them before you. One photograph shows that Mr. Bulloch has adopted my circular, graduated, adjustable glass stage, claiming this old invention of mine as his own. According to his statement he made it first in July, 1870, just ten years after I introduced it.

The large cut and the other photograph represent his large binocular stand, also with adjusting screws to the adjusting revolving stage. The mirror stem is apparently stationary, and the mirror is attached

to it by a double joint, permitting of some oblique illumination. But the most important part of this instrument is an arc below the stage, which is traversed by the sub-stage. The centre of the arc is evidently in the plane with the object, and therefore the sub-stage can be placed radial to the object, provided the somewhat complicated mechanism is made and used with care. The angle of obliquity is, of course, a limited one, and even with a stage as small and thin as my diatom stage, it would not be possible to obtain, either with the mirror or condenser, an angle sufficiently great for the present requirements. As the mirror does not swing with the sub-stage (which, strictly speaking, cannot be called swinging, except to identify it with mine,) it is difficult to get the mirror centered with the condenser. The photograph is marked September, 1873, making it evident that it is the first attempt to place the achromatic condenser in an oblique position to the optical axis. But comparing this arrangement with mine, as designed and adapted to my stands, the difference in the results, although involving the same principle, will be seen at once. The design of Mr. Bulloch is a heavy, costly attachment, limited in its movements, and unhandy, as the mirror does not follow the sub-stage, and when the mirror is used alone it is of no use whatever. In mine the mirror and sub-stage movement is only limited by the body of the microscope, and can be used below or above the stage, *always* having the object as its centre, and in such a simple way that not a single extra piece is added to an instrument with the ordinary swinging mirror; hence we can adapt it to our cheapest microscopes. Mr. Bulloch claims to be the first to use the mirror above the stage instead of the bulls-eye, according to his own statement, in 1870. I can only say, if Mr. Bulloch did not accomplish it before that time, that he is the last one I know of, who invented it. Spencer, Tolles, others and myself did the same thing many years before; and the little so-called candlestick stand, made and presented to our section by Mr. Ed. Tilghman, about eighteen years ago, is capable of doing the same thing. Some accomplish it by detaching, others by adding, joints to the mirror. If accomplished in this way it is not worth the sacrifice of stability which is incurred.

But with my swinging arrangement, un obstructed by any part of the microsco but the body, it is an unsought, natural result of the thoroughness and simplicity of the mechanical contrivance, which constitutes the value of my patent.

Gundlach's Stands.

THE following letter, published in the Cincinnati *Medical News*, explains itself:

To the Bausch & Lomb Optical Company:

GENTLEMEN—I think I owe it to myself, as well as to you, not to permit the remarks contained in a foot note to Dr. Hunt's article on Microscopes at the Centennial Exhibition in Philadelphia, which appeared in the Cincinnati *Medical News*, of March, to pass without a few remarks on my part. The note in question is as follows:

"It is stated in the *Naturalist* for December, that a firm from Rochester, New York, 'hinged the sub-stage bar at the level of the object,' but the small stands exhibited by said firm at the opening of the exhibition were not so made, nor had they any facility for registering obliquity. The firm in question did not grasp Zentmayer's idea at all, and hence can justly claim no priority of invention."

For obvious reasons, the "firm from Rochester, N. Y.," mentioned in the above note, can be no other than the Bausch & Lomb Optical Co., of this city, and as the microscope department of your company has been under my sole superintendence since you began making these instruments, it must be myself individually who, in the opinion of the writer of said note, failed to "grasp Zentmayer's idea." Feeling thus my integrity called in question, I beg leave to submit to you, and to the public generally, the following statement:

As early as towards the close of the year

1875, and before I had the pleasure of forming your more intimate acquaintance, I had already communicated to Prof. Phin my intention to add the construction of improved stands for microscopes to the business I had till then exclusively followed since my arrival in this country, viz., the construction of objectives.

The projected improvements embraced, among others, my now well known fine adjustment, a modification of the glass stages used by many opticians; and finally, the hanging of a swinging bar, carrying the mirror and other illuminating apparatus, in the plane of the object.

The construction of a stand with all the aboved named improvements was begun about the end of January, 1876, in the factory of the Bausch & Lomb Optical Co., after my arrangement with your company had been effected. In the construction of that stand I had in view the employment of a solid glass stage (not open in the centre) expecting to gain thereby the advantage of very oblique illumination in consequence of the refraction at the surfaces.

In order to obtain practically the optical object I had in view in placing the centre of rotation of the illuminating apparatus in the plane of the object, I had to take this refracting power of the solid glass stage into consideration, and consequently had to place the central point of rotation as much under the actual (mathematical) plane of the object as the glass stratum of the stage would have lifted the ray.

Convinced, however, by the criticism of competent judges, and by my own observations, that the solid glass stage (without central opening) offered optical disadvantages which neutralized to a great extent the benefits which could be derived from it, I subsequently abandoned glass stages of that construction, not, however, before a number of stands had been either constructed, or were in the course of construction, arranged in regard to the hinging point of the illuminating apparatus, in such a manner as to suit a solid glass stage. The point selected by me for the centre of rotation of the illuminating apparatus in these stands would have been optically the correct one, if a solid glass stage of my construction had been employed.

The stands whose construction was complete at the time, and those then in process of construction, were not altered, firstly, because it would have involved considerable expense to do so; secondly, because I deemed the deviation from the actual plane of the object so slight as to be of very little consequence, especially as the actual and mathematically correct plane of the object is variable, owing to variations in thickness of the glass slides, and therefore practically unattainable for the centre of rotation, unless said centre can be made adjustable to it.

Of these stands, so made and left unaltered, one was sent, with other microscope stands of our make, to the Philadelphia Exhibition, and was there at the opening of the same, and the examination of this stand may have given rise to the impression that I intended to place the centre of rotation of the illuminating apparatus lower than the plane of the object. The other stands, constructed with a view to using the glass stage, with central opening, and having the swinging mirror bar hinged slightly above the upper surface of the glass stage, were unfortunately not quite finished at the time the Exhibition opened.

What I contend for, and stand ready to prove is, that stands of my construction, exhibited at the opening of the Philadelphia Exposition, had the arrangement of the swinging mirror bar (with diaphragm attached) hinged in the (as near as attainable) optically correct plane of the object, with a view to the use of a solid glass stage without central opening, and the change necessary to fit the same for the use of stages of different descriptions was simply not then effected for want of time.

Other stands were then in process of construction, arranged to meet the altered circumstances, and were afterwards exhibited at the Centennial Exhibition in Philadelphia, all of them conceived by me, and executed under my superintendence, before I

had seen or heard of Mr. Zentmayer's efforts in the same direction.

I may not be the only, nor the first, inventor of this arrangement, and the very moderate amount of inventive faculty involved therein makes it easy to believe that others have conceived the same idea at the same time, or even before me. It is far from me to disparage the honest efforts of others, and to charge plagiarism on any one; but I believe I am pardonably sensitive when such a charge as is contained in the foot note to Dr. Hunt's article, is brought against me, a charge which, as you yourselves well know, is utterly groundless, and entirely inconsistent with the facts in the case. I remain, gentleman,

Very respectfully yours,

E. GUNDLACH.

Rochester, N. Y., May 17th, 1877.

The Siliceous Shelled Bacillariæ or Diatomaceæ.

(*Continued from page* 83.)

SUBSEQUENTLY, Prof. Retzius, of Stockholm, showed the presence of fossil diatoms in the "*Bergmehl*" of the Scandinavian peninsula, in which Ehrenberg found many remarkable forms: also in the "*Kieselguhr*" of Finnland, and the *Polirschiefer* of Zante and Oran. The chalk and flint of north and middle Germany, and of the hill country of northern France and England, do not show any siliceous frustules of fossil diatoms; but the chalk marls of Caltanisetta, Greece, and northern Africa, which Ehrenberg examined with especial care, are distinguished by peculiar forms, not yet observed living, out of which Ehrenberg was obliged to make several new genera. It appears, therefore, that these chalk mountains enclosed diatom generations different from those now living, and thus, the opinions of modern geologists, that only the most recent and superficial layers, and the Tertiary strata, enclose a generation of organisms coinciding with those of the present world, seems to gain a new confirmation. Yet, Ehrenberg had scarcely concluded his important investigations of the above mentioned chalk-marls, which he declared to be the product of diatoms, with a small proportion of the calcareous animals of the chalk,* when, the next year (1840) he reported, in a new communication, "On yet numerously, still living, animal species of the chalk formation," in which many forms were represented, derived from the mouth of the Elbe near Cuxhaven, the sea coast near Kiel, the island of Tjörn, the Cattegat, and other places, which fully agree with the diatoms of the chalk.

Also the *Drysodil*, a species of mineral so named by Cordier in 1808, and which was previously known as leafy "earth-asphalt," and found especially in Sicily, was recognized by Ehrenberg (Annal. d. Physik und Chemie 1839, XII, p. 573) as leaf tripoli, or polishing slate, by chance penetrated by earth-pitch. Under this head belong also, according to the researches of the same investigator, the bituminous coal of *Geistinger Busch*, near Rott, and Sieburg, north of the seven mountains; also the dark brown coal from *Westerwalde*; and lastly a leafy brown coal from *Vogelsberge*, all of which enclose frustules of diatoms.

Besides the fossil remains of these organisms found in the old continent, two extensive diatom deposits were found in Germany, remarkable for their extent, and which in part still increase. They are the layers in the Lüneburg Heath (*Lüneburger Haide*) and in the Valley of the Spree and Havel (*Spree und Havelneiderung*), in and near Berlin.

The Lüneberger layer had already in 1837 been discovered, on the occasion of some boring experiments, which were made for the examination of the sub-soil, in the neighborhood of the farm Oberohe, in Erbsdorf county, as a layer of 10–20 feet thickness, and 1 to 1½ feet below the sur-

*These investigations are contained in Ehrenberg's pamphlet, "The Formation of the European, Libyan and Arabian Chalk-Rocks and Marl out of Microscopic Organisms, 1839," in the proceedings of the Royal Academy of Sciences, Berlin.

face. According to the analysis by Hausmann, the loose white earth that was found proved to be purely siliceous; and in the samples that were sent to Ehrenberg he found nothing but diatom frustules. In the year 1843, Ehrenberg had an opportunity to examine the layer himself, and arrived at the following results*: The layer lies immediately underneath the houses of the farm in the Lüneburg heath itself. The region is hilly, but not closed in, and the farm itself lies in a valley, the borders of which, to the north and south, rise very gradually about 80 feet; while to the east and west it is broadly open. Close by the houses flows the Ohe, a little brook, in the length direction of the valley, bordered by a narrow, swampy meadow. The layer, however, was not discovered first in the valley, but on a hill, at the south, and subsequently found by the owner of the farm under his premises. Seventy boring experiments gave the result that the extension of the layer in the direction southwest to northeast, is about 450 rods (*ruthen*), and southeast to northwest 200 rods, and with a thickness up to 40 feet, of which the 14 to 18 feet above, are snow white; and the 22 feet below, gray colored. It lies 1 to 16 feet below the sandy surface of the heath, and rests on coarse sand. Further investigations showed that this layer was no sediment of a water basin; that here and there, now living siliceous organisms are found therein, and that, therefore, it might have been produced without permanent water covering; and that the snow white color of the upper layer, and its cleanness, was occasioned by a continuous circulation of water in the stratum, and finally, that it was to be considered as a spring formation (by capillary action) through the layer, on a dry elevation, a peculiarity hitherto little observed.

The deposit of Diatomaceæ which was found in Berlin, in 1841, first in Luisen street, and afterwards at many other points, on which Ehrenberg (Annal d. Phys. und Ch., 1841, No. 11, S. 436) reported to the Academy of Sciences, was proved by repeated examinations to be one of the most extensive fresh water formations. In many places it surpasses that of Lüneburg three times in thickness, and in some places reaches a depth equal to the level of the Baltic Sea. Horizontally it stretches not only in the valley of the Spree, but also in that of the Havel. In general the forms are not found as pure in this layer (as far as I can judge from the specimens sent to me) as in that of Lüneberg, but are singly distributed, between clay and quartz grains.

Lastly, I obtained, also, a so-called "infusorial clay," from Klieken on the Elbe, which contains well-preserved frustules of different, partly very excellent, forms, which are represented in the plates of this work, and shall be more minutely examined in the systematic part with other fossil forms; I have not received any further information about this deposit.

While these discoveries were being made in the old world, our western neighbors in North America did not remain behind. The first news that reached them about the occurrence of these fossil microscopic organisms in the old continent, induced the North American naturalists to search for similar appearances also in their own country, and their exertions were rewarded by the most beautiful results.

The first diatom deposit was discovered by Prof. Rogers, near Richmond, in Virginia. He describes it in his "Report on the Geology of Virginia, 1840." It is said to be distinguished by its enormous extension.

Next, the infusorial layer near West Point, New York, is to be noticed. This was discovered by Prof. Bailey, and was found in a low ground—8 inches in thickness, and pretty extensive. Besides this, the same scholar, as well also as the Professors Silliman, father and son, in New Haven, and Hitchcock in Massachusetts, sent to Ehrenberg, in Berlin, sediments from Stratford, Andover, New Haven, (Connecticut);

*Journal für Practische Chemie, von Erdman, 1843, I, S., 54, u. f.

Smithfield, Providence, (Rhode Island); Bridgewater, Andover, Spencer, Pelham, Boston, (Massachusetts); and Blue Hill pond (Maine); and he has reported thereon in his latest work, mentioned above.

IV.—TECHNICAL USE OF DIATOM FRUSTULES.

It follows, of course, that the diatom frustules, regarded as they must be, as pretty pure siliceous earth, are suitable for all those chemical combinations for which the ordinary quartz had been used hitherto; the preparation of glass, stoneware, porcelain, tiles, etc. From the iron they contain it could, however, be concluded beforehand that one could not think of producing white glass, porcelain, etc., without removing the iron oxide. The use of the siliceous meal (*Kieselmehles*) of these layers, for the fabrication of the last-named articles, did not give the desired result.

The experiments which Ehrenberg caused to be made at the Royal Porcelain Manufactory at Berlin, for the production of tiles, proved more successful. Slabs were formed, 10 inches long, 5 inches broad, and 2½ inches thick, which, when burned, weighed 2 pounds. Coated with Japan they floated on water, but they greedily absorbed the water, and had slight coherence. The mass did not contract or warp at all in the oven, and assumed a yellowish color.

The diatom earth of itself is not at all plastic, but becomes so as soon as it is mixed with 5 to 10 per cent clay, and it is not then inferior to the best modeling clay. In Berlin are architectural ornaments, and other things, which, so far as form is concerned, surpass even the figures in burnt clay, since the diatom earth does not warp or contract at all in the fire; wherefore the addition of clay to the mixture must be reduced to a minimum, and only just enough put in to make the mass plastic. With a mixture of 5 to 10 per cent, the contraction is in proportion to the clay added, and the heat employed; but the warping of the lines is very slight, and the cracking very little, even at the heat of melting iron. A stone of 10 inches length, 5 inches breadth, and 2½ inches thickness, weighs 4½ to 5½ pounds, absorbs water but slightly, when burnt in a common tile-kiln, and has the hardness of good white building stone; but if it has been exposed to a glowing heat six hours, the fracture is iron gray, and the hardness greater than that of the hardest clinker, yea, greater than that of granite. Such a stone does not absorb water, and it may be inferred that it will resist not only every influence of weather, but even water and fire.*

To be continued.

Notes on Cent. I. of the "Species Typicæ Diatomacearum."

By Prof. H. L. Smith, Geneva, N. Y.

IN the above named series no attempt has been made at a correction of nomenclature, or of classification, the slides are arranged alphabetically, according to the names most generally received. This will not only facilitate their use for purposes of comparison and study, but will be more acceptable than to adopt any one of the systems of classification hitherto proposed. Indeed the most recent of these is simply impracticable, since it is based upon the arrangement of the endochrome, and therefore only applicable to the examination of healthy, living forms. If one could always have diatoms in this condition, then the two grand divisions proposed, viz: *Placochromaticæ*, or those with the endochrome laminate, and *Cocchromaticæ*, or those with endochrome granular, would, so far as my experience goes, throw together the forms most closely related, and, so far as these two sub-families are concerned, Pfitzer's system is correct. It is useless, however, to extend this system, as M. Paul Petit has attempted, for in the sub-divisions he is immediately obliged to introduce the characters em ployed in the artificial (?) classifications, *e. g.*, alate and non-alate, elliptical, cylindrical, carinate, cuneate, etc., etc. It is, manifestly, impossible to study many of the forms, *e. g.*, those of deep sea soundings,

*Berliner Zeitung, 1842, 21 July.

and of the various fossil deposits, with any regard to this endichrome arrangement; moreover, after the passage beyond the two primary groups of *lammellar* and *granular*, there is no constancy easily definable. I do not wish to be understood as discouraging, on account of fancied or real difficulties, any attempt at a truly natural classification. By all means, the study should be of living forms, and one can, from distribution of the endochrome alone, recognize the very minute Nitzchiæ, *e. g.* clearly distinct from the Synedræ, in living forms, perhaps even more readily than in the prepared frustules, though even here endochrome is not all, but their more lively movement. Since it is evident that the structure of the frustule is, so to speak, co-ordinate with endochromatic arrangement, and that the former is permanent, while the latter is transient, the system, which is based on the *general build* of the frustules, cannot be considered wholly artificial. Indeed, in the parallel case of the animal kingdom, the two rival systems would be, one based on the position of the viscera (scarcely this, as no organs are observed in the diatoms, and so we may say *distribution of the food*), the other on the structure of the skeleton. Few would hesitate which to choose. I have been led into making these remarks from the recent appearance of M. Paul Petit's essay, and his claim for a more natural classification, which, even if correctly based, is wholly impracticable in application, in the manner he has proposed.

The present notes are not intended alone for those who may have the "Typical Species," but they will be found of general interest, as they embody many facts which have been brought out during the examination and preparation of the specimens. I have, in all cases, preferred *authenticated specimens*, named either by W. Smith, Brébisson, Bailey, or others, to mere "handsome mounts," inasmuch as these possess a value far outweighing beauty. Thus, *Amphiprora constricta*, E., which is, beyond question, wrongly figured in the "Synopsis of British Diatomaceæ," is represented by Brèbisson's specimen, though inferior, as a mere preparation, to specimens which I have of W. Smith's form, and which will be given in the supplement, along with many species, which from various causes do not appear in their regular place in the series, *e. g.*, many of the *Chaetocerœ*.

No. 7. *Achnanthidium flexellum*, Bréb. There is no excuse for the change of both generic and specific name of this diatom by Rev. W. Smith, in the "Synopsis of British Diatomaceæ." Certainly Mr. Thwaite's reputation did not need any such indorsement. Brébisson's name is generally received.

No. 9. *Achnanthidium microcephalum.* Misled by the figure in the British Diatomaceæ, I at first substituted a much cleaner preparation, my own gathering, of that form: but as it was not the species of Kutzing, I now give the specimen, labeled by De Brébisson; from Longpré, (France.)

No. 11. *Actinocyclus fuscus* = *Coscinodiscus fuscus*, Norman. T. M. S., 1861, II, *f.* 3. I think there can be no doubt about this diatom, which has long been known; it resembles *Actinocyclus Ralfsii*, but wants the intra-marginal pseudo-nodule. The same form is distributed by Möller as *A. dubius*, of Grunow.

No. 12. *Actinocyclus interpunctatus*, Brightwell. The mistake made in naming this diatom by Möller is inexcusable. He issues it on "Typen platte," and elsewhere, as "*Hyalodiscus stelliger*," Bailey, and a greater error could not be made, since the latter diatom is *Podosira maculata*, W. S., from Prof. Bailey's own gathering, in my possession; and, indeed, any one might perceive that Prof. Bailey's idea of a *Hyalodiscus* was a form with large central umbilicus, whereas the present diatom has none, and, indeed, very little else to correspond with Bailey's description. Such errors are the more to be regretted, as Möller's slides, from their great beauty and carefulness of preparation, are not only justly admired, but have a very wide circulation. I am certain that this is Brightwell's form, as I have a slide of the material, in which

Brightwell found it; and which has also his other new species described as "found in shell cleanings, West Indies." On some specimens, the radial lines of subulate dots are quite conspicuous; it occurs parasitic on the red algæ all along the Pacific coast.

No. 14. *Actinocyclus subtilis* = *Eupodiscus Gregoryanus*, Bréb.; the latter name is the proper one. There can be little question that De Brébisson is in error in supposing this same as *Coscinodiscus subtilis*, W. S. see note on No. 92.

No. 15. *Amphipleura Danica*. There is nothing in Kutzing's figure by which one could recognize this diatom. The present form has at least the sanction of De Brébisson. Careful scrutiny will show on the median line of this very slender lanceolate form, a minute central nodule, often very obscure; the median line is not expanded at the end, as in *A. pellucida* and *A. Lindheimerii*, it is, in fact, a *Navicula*.

No. 16. *Amphipleura inflexa*, Bréb. This is not an *Amphipleura*. Brébisson, in a note accompanying the present specimens, which, unfortunately, were all dried on mica plates, and much crushed and injured, suggests "*Toxonidea?*" I prefer, after some study, to consider it, though doubtfully, as a slender *Amphora*.

No. 19. *Amphipleura rigida* = *A. Sigmoidea*, W. S. This is not an *Amphipleura*, but a *Nitzschia*. As for the change of specific name by W. Smith, Brébisson remarks: "Le nom donné par W. Smith est certainment celui qui convient le mieux à cette espèce; mais le premier a un titre de priorité qui doit être respecté." Diat. Marin. du littoral de Cherbourg, 2d Ed., 1867, p. 18.

No. 21. *Amphiprora constricta*. W. Smith appears to have no hesitation in considering the species described and figured by him, as Ehrenberg's *A. constricta*, which is figured and described in E. A., p. 122, pl. 2, 6 f. 28; figure copied in Pritchard XII, 1, and Kutzing XXIX, 34. I have a very clean gathering of Smith's species, from Hull, Eng., through the kindness of Dr. Van Heurck, of Antwerp, which he sent to me from Dr. Arnott's collection, now in his possession, and it agrees well enough with Smith's figure, only it is much smaller; it is not, however, Ehrenberg's species, as sent out by De Brébisson; the latter has no stauros, neither does Ehrenberg mention one, and the constriction is much deeper, and it is, moreover, a more fragile form. W. Smith's diatom agrees pretty well with the *Amphora membranacea* of the Brébisson collection; certainly it is not an *Amphiprora*. Better specimens may be found in No. 38.

No. 25. *Amphiprora paludosa*, and *A. Pokornyana*. W. Smith's figure of *A. paludosa*, S. B. D., XXXI, 269, is very good, except the strong markings on the alæ. The fact is, the alæ are smooth, quite hyaline, whereas, in *A. Pokornyana*, which is without the deep sinus or indentation of the inner margin of the alæ, near the ends, which is found in *A. paludosa*, has strong, distant striæ on the alæ, though, curiously enough, Grunow does not show them in his figure of *this* species.

No. 36. *Amphora membranacea*. This species, as figured by W. Smith, and also from specimens marked by him, which I have, is really Brébisson's *A. Ostrearia*, the No. 39 of this series. But, as remarked above, there is a form in the Brébisson collection, marked as *A. membranacea*, which agrees with Smith's description, especially as to fineness of striation, and in not being rigidly siliceous (it is quite certain that the form figured and also sent out by Smith does not so agree), that is quite distinct; it is very nearly, if not quite, identical with the *Amphiprora constricta* of the "Synopsis." This is the form labeled *Amphora membranacea* in the "Species Typicæ." Of course it should be attributed to Brébisson, not to W. Smith.

No. 38. *Amphora mucronata*, H. L. S. N. S. Broadly oval, with truncate ends, margins not constricted, valves without a stauros, median line at extremities marginal, at the centre very strongly incurved, central nodule drawn out into a line, so that the strongly inflected centre of the median line appears armed or tipped with a "mucro," a double series of minute points along the

inner margin of the median line; connecting zone with longitudinal lines; structure hyaline, scarcely standing acid treatment, and often warped or twisted in preparation by burning; very finely lined; length .0025 to .003, breadth .001 to .0015. This form is rare; I have only found it in this one gathering, made by Dr. Lewis, which also has in it occasionally, forms described by him.

No. 42. *Amphora tenera.* W. Smith says his species = *A. lineolata*, E. (No. 35 of this series). If so, what right had he to change the name? Certainly the form marked by Brébisson as *A. tenera* (No. 42) does not agree exactly with Smith's figure, but perhaps as closely as does *A. lineolata*, E.

No. 53. *Aulacodiscus Oregonus.* The specimen from Sandwich Islands, is the variety called *A. Orientalis* by Greville. This diatom, which was called *A. Oregonensis*, H. and B., and figured on Pl. IX, f. 6, Algæ, U. S. Exploring Expedition, but afterwards described in "Proceedings of Acad. of Nat. Sciences, Phila., Oct., 1853," as *A. Oregonus*, varies much in appearance according to treatment, and habitat. I have specimens from Eulenstein marked *A. Orientalis* = *A. Oregonus*, and Bailey's own specimens. The normal form, as it occurs on the Pacific coast, shows the radiating lines more distinctly than the variety *A. Orientalis*, but, as the valve is compound, its appearance varies very greatly, some specimens are strongly rayed, others scarcely at all.

No. 67. *Cestodiscus Baileyi*, H. L. S. This form is allied to *Actinocyclus*, especially *A. fuscus*, it has intra-marginal minute lines, processes, or something resembling them, which are much more distinct upon the dry valve, than on the balsam mounted specimens. It is quite probable it may prove to be a *Melosira*, the inner plates are somewhat like *Melosira sol*, E.

No. 74. *Cocconeis major* and *C. pseudomarginata.* These are closely allied to Grunow's *Cocconeis pellucida*, if not the same. There is reason to believe that they are separated valves of one diatom; and yet *C. major* is rare, while the other form is very abundant in this preparation.

No. 79. *Cocconeis Senegalensis.* This specimen was so named by De Brébisson. I cannot find that it has been described by him. I have little doubt that it is *C. Sulcata*, H. and B., Pl. IX., Fig. 5., Algæ, U. S. Exploring Expedition.

No. 82. I am not sure this is Kutzing's *Cocconema Gibbum;* a larger form, but precisely same diatom, has been named by Grunow *Cymbella stomatophora.* One of the two genera, *Cymbella* and *Cocconema* (preferably the latter) should be abolished.

No. 89. This form, marked *Colletonema viridulum* by Brébisson, is one of the varieties of *Navicula rhomboides.* Later, De Brébisson proposed the genus *Vanheurckia* to receive all those forms with central nodule constricted, ends of median line expanded, and valves very finely lined. He also embraced in the same genus other forms allied to *Nav. cuspidata;* but excluding these latter, the group, under the name *Vanheurckia*, including *Nav. Lewisiana, Nav. incomperta, Nav. interposita, Colletonema viridulum, Nav. rhomboides, Nav. crassinervis, Frustulia tofacea, Frust. Saxonica*, and, (not mentioned by De Bréb.) *Colletonema vulgare*, is a very natural one of forms having a great many common characters.

No. 92. *Coscinodiscus concinnus.* I have already stated that De Brébisson was probably wrong in considering W. Smith's *Cos. concinnus* the same as his *Eupodiscus subtilis* (*Gregoryanus*). Certainly so, if Roper's figure is correct. Prof. Cleve found, in material from the Java Sea, a form which he considered as *Eupodiscus Jonesianus*, but it is much more convex, and also very much more finely marked than Greville's form, as it occurs in the Hong Kong gatherings, and distributed in this series, No. 163, though like it in many other ways, *e. g.*, in the variable position of the processes, the presence or absence of irregularly placed spines on the valve, and in having larger cellules, sometimes present at the centre, and sometimes a round, smooth, blank spot, also in the presence or absence of the marginal apiculi. Prof. Cleve states that his form

"when the processes and apiculi are absent, cannot be distinguished from *Cos. centralis*, and I have very little doubt that *Eupodiscus Jonesianus*, as well as *Cos. concinnus* and *Cos. centralis*, are forms of the same species." An examination, however, of No. 91 will show that *Cos. centralis is* different, and much more coarsely marked, but I quite agree with him that his form of *E. Jonesianus* is Smith's *C. concinnus*, and so this is the preparation I issue under the latter name; and with the more confidence, as it not only agrees with Roper's description (his figure shows radiating lines too distinctly), but with a form sent to me by Dr. Greville, and marked by him as "*C. concinnus*, W. S., from stomach of Ascidians. Hull, Eng." The processes, if present, are two, and not symmetrical. Probably the opposite valves of this diatom are unlike, inasmuch as those which want the two processes have only a blank centre, while the others show the umbilical rosette. Bailey's *Coscinodiscus tenuis* (see L. W. Bailey on forms found by his father, from Para River, S. A., Bost. Jour. Nat. Hist., Vol. VII, No. 3) is, beyond question, the same diatom.

No. 100. *Coscinodiscus subtilis.* The genuine form; described by Greville, and figured in M. J., Vol. VIII, Pl. VI, p. 3 × 800, as *Coscinodiscus Normani.* With the apiculi more distinct, it is sent out by Möller as *Odontodiscus subtilis.* The presence or absence of these apiculi, as in *Cos. eccentricus*, is of no generic value.

Cements and Varnishes.

CEMENTS become hard in three different ways—cooling, evaporation and oxidation. Shellac, sealing wax, electrical cement, etc., when melted by heat, furnish examples of the first process. Shellac and sealing-wax dissolved in alcohol, and asphalt and damar dissolved in turpentine, dry by the second process—the solvents evaporating and leaving behind the material which they had dissolved. Drying oil in all its forms, such as gold size, paint, etc., becomes hard by oxidation—not, as is generally supposed, by evaporation.

In the case of varnishes which dry by the evaporation of some of their constituents, it is obvious that if a fresh layer be laid over an old one, the old layer will be softened, and if there should be any tendency to a vacuum in the cell, the softened cement will be unable to resist the outside pressure, and will creep in and spoil the object. So, too, with varnishes or cements formed chiefly of drying oil or gold size. If the different coats be laid on too thickly or too rapidly, the part that is beneath cannot easily harden, but will remain for a very long time in a semi-liquid condition. We have just removed some brass rings from slides to which they were attached four months ago by means of gold size, and although the outer surface of the cement was hard and dry, the interior was quite liquid, freely soiling the fingers.

Prof. R. Hitchcock *vs.* High Angles.

In the May number of the AMERICAN JOURNAL OF MICROSCOPY, I find an article containing a good-natured criticism of a paper read by me before the Dunkirk Microscopical Society last October.

Mr. Hitchcock candidly states that he has only seen a short abstract of this paper, and has but an imperfect knowledge of it. He further suggests that his main object was to call further attention to my views, and he suggests that I put them in form, so as to be published in the AMERICAN JOURNAL.

For the benefit of Mr. Hitchcock, I will state, that my views have been clearly stated in a series of articles, which have been published in the Cincinnati *Medical News* during the past three years, under the caption of "High *vs.* Low Angles," and have thence been quoted from and reprinted in various publications; certainly I cannot be expected to go over the ground anew at this late day. It is true that I exhibited before the Dunkirk Microscopical Society the No. 20 of the balsam Möller probe platte, and also the 19th Nobert band, both so plainly that all who were present saw without difficulty. These tests were *not* difficult for the glasses employed, as was attested by the fact that they were shown in a crowded room, amid the attendant jars and vibrations, my object being to *demonstrate* the facility with which my

Tolles' duplex glasses handled these so-called difficult tests.

To show the work of these same lenses by central light, I selected the same test, *Nav. Angulatum*, which the biological committee at Philadelphia has declared *impossible* to be shown at a less angle than 20 degrees from axis, with any medium power glass. This test was displayed illuminated by light through a central aperture placed close to the object, just large enough to light the field, the diameter of the aperture being about 1-200 of an inch, direct light being used, *i. e.*, without mirror or condenser. The ease with which the duplex handled this test was made amusing and apparent by my picking up the stand, walking around the room, setting it down again hap-hazard before the lamp, when the resolution was found by a gentleman appointed to examine to be unimpaired. This was repeated three times. Will Mr. Hitchcock repeat, using a low angle glass, be it a one-fifth or a one-fiftieth, and report?

I had other tests for central light work, including histological and pathological preparations. It was impossible to show all of these to so many people as were present; as it was the entire evening after the reading of my paper was occupied. Hence, it will be seen that I fought the low angles on their own *chosen* ground, and with the express view of demonstrating that the very best performance of the duplex lenses is seen by central light.

Mr. Hitchcock further says that "the universal testimony of our best authorities, who have spent their lives in microscopical work, is against Prof. Smith."

It was just this kind of testimony that affirmed, a few years ago, the highest *possible* aperture of an object glass to be 135 degrees; that the resolution of the Nobert 19th band was a matter of faith rather than of sight, etc., etc. Mr. Hitchcock is welcome to the witnesses.

Note this fact, to-wit, in original investigations, the advanced worker must necessarily be in a minority. I rejoice that some of Mr. Hitchcock's witnesses have lately found cause to change their opinions. Dr. Carpenter will no longer assert that the resolutions of the Nobert 19th band is a "matter of faith, rather than of sight." On the other hand, he has given unqualified endorsement to the superiority of the duplex glasses.

Mr. Hitchcock desires to ask *why* I think that most of the work in histology and pathology already "done" with the so-called "working lenses" of narrow angles would require further attention, and with wide angled glasses I reply, that in the past four years great advances have been made in the construction of objectives, and in the manipulation of the microscope; what was considered a "good working glass" ten years ago, would *now* be totally valueless for advanced work. We now demand, as near as may be, perfect lenses, and superior dexterity in handling them; and these two conditions are inseparable. The finer the objective the louder the call for expert manipulations. That well-known term, "working lenses of narrow angles" means, when stripped stark naked, easy going lenses, with no screw collar to bother; good working lenses, that a child or sleepy adult without experience can use right along, will work through covers of common window glass, big working distance, and all that, etc., etc. Such *are* admirably adapted to the use of those who use the microscope as a plaything; admirable things, too, to prove that "a little knowledge is a dangerous thing."

Be it known, that I do not condemn an objective simply because it has a narrow aperture; conversely, I do not endorse a glass on account of its wide angle. I have seen scores of wide angle glasses not worth the cost of their brass mountings. As to "errors in interpretation," the more perfect the lens, and the more expert the manipulator, the less chance of error. Under high amplifications, a superior wide-angled glass, *properly handled*, will generally prove the more reliable; and in advanced work *cannot* be dispensed with, be the illumination central or oblique.

Finally, I have to thank Mr. Hitchcock for his friendly criticism. He seems, evidently, to be after the facts. I have responded to his request as well as I could with my limited time and space. Two hours "over the tube" would demonstrate more than volumes of print.

J. EDWARDS SMITH.

Note.—On my last visit to the Dunkirk Society, May, 1877, I showed, I believe, for the first time, the Nobert 19th band as an *opaque object*, with my 'Tolles' one-tenth duplex, Beck's *vertical* illuminator being used. It is obvious that the pencils of light traversing that band were at least centrally disposed. J. E. S.

Cincinnati Medical News.

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THE earnest and cordial support which we have received, both from subscribers and advertisers, enables us to add four extra pages of reading matter to the JOURNAL, and we may now announce that this enlargement will be permanent. In times past we have occasionally added several pages to an issue where it was required, so that our readers have always had more than we at first agreed to give them. Of late, however, the circulation of the JOURNAL has been such that its value as an advertising medium has been fully felt and appreciated by those who have patronized us. This extended advertising has in turn enabled us to issue a more expensive journal, and our circulation has largely increased. The subscription, will for the present remain the same.

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The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Earth as a Disinfectant.

Ed. Am. Jour. Microscopy—Your review of "Rochester Water Supply," in the May number, reminds me of the disinfectant power of earth. Hence, the probability that the absence of the same, as shown by the absence of the solids in the water, may account for the bad flavor of the water in question. River water, duly mingled with inorganic mud, is able to cope with and neutralize all ordinary organic impurity, especially if agitated continuously. Therefore, its proverbial wholesomeness. Add to this admixture with air, and it is good enough for all. J. C. M.

Philadelphia, May 20, 1877.

Our Book Table.

Magazine of American History.—The August number of this periodical (A. S. Barnes & Co., New York, publishers,) is now ready for delivery.

The leader is a long, carefully prepared history of the uniforms of the American army, by Major Asa Bird Gardner, of West Point Military Academy. This article shows extensive and patient research, recites the origin of the uniforms worn in the several colonies, and the origin of the colors adopted by the Continental army. Military men will here find a great deal of novel information, and artists an unerring guide for details of military costumes.

The biographical sketch is of Dr. William Shippen, a Pennsylvania delegate in the Continental Congress. This sketch, prepared by the late lamented Mr. Thomas Balch for the Congress of Authors, corrects many of the errors which have been floating about concerning the Shippen family.

Next appears a new feature in the magazine—the first of a series of *Ana*, a contribution by Mr. Duyckinck, giving some amusing reminiscences of the famous wit and book auctioneer, John Keese.

The diary of Governor Samuel Ward, of Rhode

Island, is continued. The reprint is of a charming letter by Dr. Rush, describing the festivities at Philadelphia in 1782, in honor of the birthday of the unfortunate Dauphin. Some interesting notes and queries follow, and the number is completed with a series of literary notices more than usually full.

The American Naturalist.—The leading article in the August number of the *American Naturalist* is an exceedingly pungent address on Catastrophism and Evolution, by Clarence King, who treats the subject with animation and force. Both evolutionists and their opponents will read the article with interest. Samuel Calvin follows with a paper on Changes of Habit among Woodpeckers, and R. E. C. Stearns makes some comments on a previous paper by F. A. Barber on Aboriginal Shell Ornaments. A fish which bears the droll name of the Long-Jawed Goby is scientifically hashed by W. N. Lockington, and from Andrew Murray's work on Economic Entomology is given some curious facts respecting the museum mite. The same work is reviewed in recent literature, which also contains a notice of Baird's Annual Record. There are very full notes, especially in the departments of Botany and Zoölogy, and an unusual amount of scientific news. The number is one of great variety. Published by H. O. Houghton & Co., Boston. Terms, $4.00 a year; 35 cents a number.

Newspaper Directory for 1877. New York: S. M. Pettingill & Co.

This book contains 376 pages, and embraces an immense amount of valuable information, showing great labor and care in its collection and preparation. It gives all necessary facts for an advertiser to know about eight thousand five hundred and seventy-four separate publications, while it is also interesting and valuable for the general reader, the student of American periodical literature, and the observer of American institutions. The book is sold at the low price of $1.00 per copy.

A Successor to Penikese.

The second years term of the Summer School of Biology at Salem has been proceeding quietly at the Peabody Academy of Sciences in that city for some weeks. The students number twenty, and some ten others attend the lectures who do not take the laboratory course of instruction. Thus far about forty lectures have been delivered, one course on elementary zoology and a special course on spiders by Mr. James H. Emerton, of Salem; a course by Dr. A. S. Packard, Jr., of Salem, on zoological subjects; six lectures by Mr. C. S. Minot on histology; the Rev. E. C. Bolles on microscopy; Professor Wright on sponges; and Mr. John Robinson, of Salem, on botany. After the morning lecture hour, the students repair to the laboratory, where demonstrations in anatomy are given, and the remainder of the day is spent in practical work with and without the microscope. The students are from all regions from Maine to Japan, and among them are teachers, clergymen, physicians and professors. Beside the laboraiory work, collecting trips are made at frequent intervals, and with the aid of Dr. Bolle's micro-lantern, various objects are thrown upon the screen, and described on evenings in the lecture room. This term of the school will close on August 17, previous to which, beside continuing the unfinished courses mentioned above, lectures are to be given by the Rev. A. B. Hervey on "Marine Algæ," and Mr. J. S. Kingsley on "Crustacea." The Peabody Academy is to be congratulated on so successfully maintaining the school through the second season, and it may now be considered as an established work of this institution.—*Boston Globe.*

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—The regular meeting of the San Francisco Microscopical Society was held on Thursday evening, June 7th, with a fair attendance. Owing to the absence of the President from the city, Mr. H. C. Hyde, Vice-President, took the chair.

In addition to the members, Dr. C. L. Anderson, of Santa Cruz, Messrs. W. N. Lockington, H. Richmond and N. T. Smith, of San Francisco, were present as visitors.

Dr. C. L. Anderson was proposed for corresponding membership.

There were laid on the table the *Monthly Microscopical Journal*, AMERICAN JOURNAL OF MICROSCOPY, and *Cincinnati Medical News* for May, the *Popular Science Monthly* for June, and three numbers of *Nature*, as well as Part VI of the Proceedings of the Belgian Microscopical Society.

The California Geological Society donated two samples of diatomaceous earth, one from San Gregorio, San Mateo county, the other from the San Joaquin Valley, about 70 miles from Stockton, and near Pacheco Pass. Both are newly-discovered deposits, and a casual examination shows them to be rich in fossil diatoms.

Mr. C. Mason Kinne presented two slides, mounted

by him, of Aulacodiscus Kittonii (?) from gatherings by Dr. C. L. Anderson. The one mounted opaque under a two-thirds objective, showed them natural, with their characteristics quite prominent, and the one cleaned and mounted transparent under a quarter was found still more attractive, and their markings beautifully shown. Under this head was read an extract from an article by Mr. G. W. Morehouse, on the markings of Frustulia Saxonica, referring to a beautiful photograph of that diatom by Mr. Samuel Wells, of Boston, in which he had succeeded in getting both the transverse and longitudinal markings, thereby displaying finely their true structure. Mr. Wells' work was done with a four-system Tolles' immersion lens.

Mr. H. C. Hyde exhibited a quantity of red roses, with leaves, buds and branches, showing a blight or mildew, preventing the growth of the bud. Mr. Hyde stated it to be the well known blight which has effected the more delicate roses growing on both sides of our bay for some years, and remarked that it was not confined to any season, wet or dry, but attacked the delicate varieties during all alike, and does not appear in the more vigorous kinds. The subject was referred to Messrs. J. P. Moore and C. Mason Kinne for further elucidation.

Mr. Henry Richmond exhibited a beautiful series of photo-micrographs of diatoms and other objects, as well as some fine slides of arranged diatoms, showing unusual care and skill. He invited the members of the Society to a private exhibition with his solar microscope at Scollay's Hall, 1,522 Stockton street, at an early day, which invitation was accepted with thanks.

Mr. Dorsey offered a resolution, which was adopted, asking Mr. H. G. Hanks to repeat his lecture on "Polarization of Light," after which a communication from Mr. William Lighton, of Ottumwa, Iowa, was read, which accompanied by a diagram, gave the members a very good idea of an invention of his in the way of an analyzing eye-piece.

Without the diagram which Mr. Lighton furnished, it is somewhat difficult to clearly describe the device, but can be hinted at by stating that the analyzer is simply a piece of black glass with an accurate and highly polished reflecting surface, properly fixed in a box placed between a tube for holding the ordinary eye-piece and one made to fit the compound body. These tubes must be placed so that if joined they would meet at an angle of 112°, and the black glass reflector should be so fixed between them as to reflect light directly through the body and eye-piece.

Mr. Lighton states that he finds the arrangement in many respects superior to any other form of analyzer. In chemical experiments the stage can be kept horizontal, as the inclination of the device is sufficient without moving the body from its perpendicular, and the many who work with polarized light in connection with chemistry will enjoy this feature. Mr. Lighton further states that in purity of image he considers it decidedly superior to that formed by a Nicol's analyzer, and it allows the entire angular aperture of all combinations to be used.

The regular meeting of the San Francisco Microscopical Society was held on Thursday evening, July 5, with an average attendance of members, and President Ashburner in the chair.

After the reading of the minutes of previous meetings, Dr. C. L. Anderson, of Santa Cruz, was unanimously elected a corresponding member of the society.

By donation there were received from Dr. Mouser a section of human liver, mounted by him, and from Prof. H. L. Smith, of Geneva, N. Y., a pamphlet on diatoms, "Beitrage," by Dr. Leopold Dippel. By purchase and subscription, there were added parts 11 and 12 of "Atlas der Diatomaceen-Kunde," five parts of "Bulletin of the Bussey Institution," American Journal of Microscopy, *American Naturalist*, *Monthly Microscopical Journal*, *Popular Science Monthly*, with supplement, and *Nature*.

Mr. Kinne stated that the diatom which he presented at a former meeting as *A. Kittoni*, had been pronounced by Prof. H. L. Smith, of Hobart College, as undoubtedly correctly named, though it was larger and more coarsely marked than that of Dr. Arnott's. Mr. Kinne stated that he had mounted a large number of slides for exchange.

Mr. Wickson exhibited a hemipterous insect pest which is found in large quantities in some of the vineyards in Sonoma county, and it certainly is provided with implements capable of doing a vast deal of damage. In many respects it resembles the winged form of the Phylloxera, though the wings are shorter and body rounder than the descriptions of that destroyer. This new foe is doing a great amount of harm to the vines, and before the next meeting Mr. Wickson promises to get a supply sufficient for study.

A letter from Professor Bardeen, of Hoboken, N. J., was read, and also one from Professor J. Edwards Smith, of Ashtabula, Ohio, addressed to Mr. Kinne, in which he refers to what he has been able to do by a change in the construction of Beck's patent illuminator, when used with powers up to even 6,000 diameters. The letter was accompanied with a printed copy of Professor Smith's address before the Dunkirk Microscopical Society, portions of which the Secretary read for the information of the members present. It seems from the reports of the Dunkirk meeting, that everything was done as promised, and the resolution of the famous Nineteenth band of Nobert's plate, by reflected light from this illuminator, was exquisitely shown, and it was also found to be no trouble to "go through" the Möller plate, even to No. 20 of those

tests, using the phrase in a scientific and technical sense, and not as literally, as one of our friends did the other evening, when he siezed the coarse adjustment and went through the plate with the point of the objective.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Scales and skin of Anguilla vulgaris in exchange for other objects. Address H. B. Hargreaves, Garnerville, Rockland County, N. Y.

Living Chara, in which the circulation can be viewed, in exchange for any interesting or good mounted object. Address William Readio, Garnerville, Rockland County, N. Y.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., and Aulacodiscus Kittoni (transparent), for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Wanted, slides of stained vegetable tissues in exchange for anatomical preparations. George A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

Stained petal of Anemone patens and other vegetable stainings, for other mounted objects. Address F. H., Drawer 35, Cherokee, Iowa.

Wanted, a section cutter, in exchange for Raspail's simple microscope, rack adjustment, etc., etc. John Nicol, Worthington, Nobles County, Minn.

Wanted, foraminifera, polycystina and zoophites in exchange for histological preparations, crystals of herapathite and other crystals, various starches, stained sections of old cypress stump from Centennial, and other slides of interest. R. Hitchcock, 8 Beekman Place, New York.

Slides of fossil and recent Diatomaceæ, etc. Lists exchanged. E. Pennock, 805 Franklin street, Philadelphia.

Slides of Trichinæ spiralis, finely mounted, in exchange for anatomical or pathological mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Slides of cuticle of larva of Macrosila Carolina, showing crystals, in exchange for other objects. E. A. Burdick, Pension Office, Washington, D. C.

Diatoms from Coldwater, Mich., in exchange for other well-mounted objects. Address F. H. Root, Coldwater, Mich.

Palates of mollusca, a great variety, mounted or unmounted, in exchange for mounted slides of interesting objects or good material. C. M. Vorce, 164 Lake street, Cleveland, Ohio.

Wanted, for specimen of bladder of cat, finely injected, other injected pathological objects. J. T. Joslin, Newburgh, N. Y.

Case of algæ, and live fresh water animalculæ, for any well-mounted specimen. Send slides to A. Hobart, Box 581, Penn Yan, Yates County, N. Y.

Wanted, a small piece of "Monterey stone," or a small quantity of the Diatomaceous fossil deposit from any part of the Pacific coast. State what is wanted in return. F. F. Stanley, 40 Pearl street, Boston.

Slides of spermatazoa of horse in exchange for any other well-mounted object. C. Blasdale, M. D., Jericho, Queens County, N. Y.

Bermuda shell sand, composed entirely of foraminiferal and other shells, with coralines and sponge spicules. Very interesting for low powers and opaque specimens. Address C. C. Merriman, Rochester, N. Y.

Wanted, one of the famous Barton buttons; must be in good condition. Will give either money or good exchange. E. W., Box 4,875, New York.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Wanted, in exchange for diatoms from northern Wisconsin and Michigan, any well-mounted objects; marine diatoms preferred. W. H. Titus, M. D., Shawano, Wis.

Slides of fine sand, consisting of quartz, garnet, magnetite, hornblende, etc., from beach at Lake George, very beautiful, for other mounted objects. Wm. W. Griffin, Lynn, Mass.

For specimens of Comstock ores (15—25), or crystals of rare chemicals for polariscope, mounted, send diatoms or foraminifera to F. H. Engels, M.D., Virginia, Nev.

Wanted, well-mounted specimens, for slides of American Podura mounted whole, and scales of same. Address George W. Fries, Friendship, N. Y.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 355, Milford, Mass.

"Bough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield. Mo.

BOOKS WANTED.

A set of the "Quarterly Journal of Microscopy."

Ralf's "British Desmidiæ."

Dr. Fleming's book on "Blood Stains in Criminal Trials"—Pittsburg, 1861. Also any other work on detection of blood stains.

Pritchard's Infusoria. Edition of 1861.

Brunet, Manuel de Libraire. Last edition.

Hassall's "Fresh Water Algæ."

Smith's "Synopsis of the British Diatomaceæ."

Faraday's "Electrical Researches." 3 vols.

"Botany of the State of New York." 2 vols., 4to.

Holtzapfel's "Mechanical Manipulation."

Ehrenberg's "Mikro Geologie."

Ehrenberg's "Die Infusions Thierchen."

Williamson's Recent Foraminifera.

Pritchard & Goring's Works (any vols.)

Hook's "Micrographia."

Carpenter on "Foraminifera."

Address, stating price, (which must be low) E.W., Post Office box 4,875, New York.

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On a New Process of Histological Staining.

By FRANCES ELIZABETH HOGGAN, M. D.

DESCRIPTION of the following histological process has already been given in a paper which I read before the British Medical Association last year, at its meeting in Edinburgh. Although that paper has been in the hands of the editor of the *Journal* for the last nine months, it has not yet been published, but inadequate, and, in some cases erroneous, accounts of my process, have been largely circulated, especially in the continental scientific journals. Inquiries are still often made of me respecting it, and I have, therefore, considered it advisable to give, as shortly as possible, the details of this very simple and effective process to your Society, whose members will, I doubt not, put it to every variety of test.

The tissues to be stained are principally membranes or soft sections, which may be either fresh, frozen, hardened in alcohol, or hardened by the picric acid and gum process, but such hardening agents as the chloride of gold or any chromate whatsoever, are inadmissible.

The coloring agents required are: a 1 or 2 per cent solution of per-chloride of iron in distilled water or alcohol (tincture of steel); 2, a solution of similar strength of pyrogallic acid in water or alcohol, the latter fluid being preferable in both cases.

The section or membrane to be stained is first treated for one or two minutes with alcohol; the iron solution is filtered upon it, allowed to remain for a couple of minutes, and then poured off. The pyrogallic acid solution is then filtered in a similar way upon it, and in the course of a minute or two, the desired depth of staining having been obtained, the tissue is washed and may be mounted, in the usual manner, either in glycerine, balsam or varnish.

The nuclei and nucleoli will be found colored black, and the cell substance will also be colored more or less, according to the age and other conditions of the cell. A bluish tint may be given to them by washing the section with an alkaline water; the household water of London, containing lime, is suitable for this kind of tinting.

This process is especially useful for photographic purposes, and to those who can only work with the microscope in artificial light, the definition being very clear and distinct. It is probably the best process for staining silvered preparations, as it has

no effect on the black lines, while it makes the nuclei very distinct.

I have advised that the solution be filtered upon the preparation. This, although unnecessary with clean fresh solutions, obviates any chance of foreign matter becoming deposited on the proparation. It is easily effected by taking a piece of blotting paper about two inches square, folding it twice, and pouring into one of the cavities thus formed about a teaspoonful of either solution, or more, according to the size or number of the materials to be stained.

Tne whole process is speedy, simple and permanent. The staining may be accomplished in five minutes, and the staining materials can be bought at any country druggist's shop. The filtering paper should be held with forceps to avoid staining the fingers, as the stain is difficult of removal, except with the binoxalate of potash.—*Journal of the Quekett Microscopical Club.*

Angular Aperture and Central Illumination.

BY ROMYN HITCHCOCK.

THE August number of the JOURNAL OF MICROSCOPY contains an article from Prof. J. E. Smith in reply to a letter of mine published in the May number of this journal. When my letter was written I did not expect to say anything more on the subject of high angles at present. Prof. Smith has replied in such a manner, however, that a few more words seem called for, in order to correct some apparent misapprehensions and define my own position more clearly. It seems hardly proper to carry this discussion into the pages of a medical journal, although it has an ably conducted department devoted to microscopy. I shall, therefore, confine what I have to say to the journal in which the discussion was commenced, as being its appropriate place.

Prof. Smith seems not to have caught the gist of my letter at all. His article, both from its heading and throughout, carries the idea that I am opposed to high angled glasses. This is not a fact, and this was distinctly stated in my first letter. What I did question was the utility of high angles for all kinds of work, or for general work; and after reading what Prof. Smith says in reply, I see no reason for changing my views in the least, as will be explained shortly. Prof. Smith requests me to repeat his experiments and report. I am obliged to decline to do so, because I have not the variety of objectives at command which would enable me to add anything to what is already known. This is rendered unnecessary also by the fact that I have no desire to controvert any of the gentleman's results. We have his plain statements, and we accept them as the results of careful, unbiassed observation. More than this, they are just what we would naturally expect *a priori*. Prof. Smith would claim one of my own authorities in his support, viz., Dr. Carpenter, by saying that he has "given unqualified endorsement to the superiority of the duplex glasses." So does everybody else. But can he bring out anything from Dr. Carpenter which, in any way, would lead us to think that Dr. Carpenter has changed his opinion regarding the relative value of high and low angles for general work? He once said on this subject: "It is commonly assumed that an objective which will show certain test objects, must be very superior for everything else to a glass which will not show these; but this is known to every practical microscopist to be a great mistake, etc." (See his work on the Microscope, fifth ed., London and Philadelphia, p. 200). I ask Prof. Smith has Dr. Carpenter changed his views since?

Once more I bring up the point made by Prof. Smith to the effect that "most of the work in histology and pathology already done with so-called working lenses of narrow angles would require further attention and with wide-angled glasses." In answer to my question, "Why?" he goes on to say that great improvements have been made in objectives in the last four years, etc., and plainly says that this work requires going over because originally done with poor

lenses. I must say that this looks like backing down. He virtually admits that the angular aperture of the lens has less to do with the imperfect work in this case than the faulty construction otherwise. But he should have said this at first; it looks hardly fair to say that the work is of doubtful value, and requires verification with *high angled glasses*, when he really means that it simply needs revision with *more perfect ones*. I will venture to say that at the present day much of the very best class of work is being done with second-class lenses. It may be suggested that it often requires a good workman to exhibit an object with a poor lens, but when once it is seen, I would prefer to trust an interpretation of structure thus obtained, rather than the same appearance with a fine duplex in the hands of a novice. And I cannot allow Prof. Smith's definition of a "so-called working lens." I have a Wales' one-fifth, for instance, which is what would be called a working lens. It has, however, a screw collar which does not remain at the zero point all the time either. For general work it is placed where it suits most covers, but it is not seldom used for work other than the resolution of test objects.

There is certainly one radical objection to the general use of wide angled glasses, and this has been brought out by Prof Smith in his article apparently as a point in their favor, viz., the difficulty of working with them. It is all very well to talk about the skilful handling of a glass before an audience, but this does not tell the story as to how much the glass is capable of doing at home, in the way of adding to our knowledge. Does it truly repay us for the extra time spent in working it? Does it add to what we already know of tissues and cells? Or does it sometimes show us peculiarities which do not belong there?

I have now mentioned the principal points of Prof. Smith's paper, and would like to take a more detailed review of some of them, and record a few experiments.

To go back, then, let us see why a high angle glass is better for test objects made up of fine lines or dots than one of lower angle.

It is simply because the visibility of these lines depends upon the wave lengths of light taken in connection with the angle of divergence of the incident rays. Nobert, in his formula, pays no regard to the angular aperture, hence his results do not correspond with practice. But Helmholtz (Pogg. Annalen, 1874) has studied the question to more advantage, and deduced a formula which enables us to determine the influence of change of aperture with great approach to accuracy. I give in the following table the results of my calculations to determine the limits of visibility of closely ruled lines after Helmholtz's formula. These figures disregard the effect of the central rays, which, of course, would make the resolutions less perfect in practice. The influence of aperture and wave lengths upon the resolution of lines or dots on diatoms is well shown here. The figures are in fractions of an inch:

	Wave lengths.	Angular apertures. 70°	90°	150°	170°
Red rays.....	$\frac{1}{37600}$	$\frac{1}{43100}$	$\frac{1}{53300}$	$\frac{1}{72600}$	$\frac{1}{74900}$
Violet rays.....	$\frac{1}{59000}$	$\frac{1}{68000}$	$\frac{1}{84000}$	$\frac{1}{115000}$	$\frac{1}{118000}$

I leave the figures without further remark, only stating that the results thus obtained agree well with experience.

With these facts in mind, how could I be suspected of having any unfounded prejudice against high angled glasses for their appropriate work? But what is the work most suitable for them, and what is least so? We cannot draw a sharp line of distinction here, but there are a few facts which indicate why a lens which may be good for one kind of work, is not so good for another kind. As we see above, a high angled objective is the best for the resolution of surface markings, whether lines or rows of dots, *i. e.*, such a one is the most suitable for test plates and diatoms, and because to see these we need not go below the surface of the object.

But take almost any other object, and we

need to determine its internal arrangement. Would any one prefer a high angled glass for studying artificial sections of tissues, or for making out the structure of some of the infusoria? I believe the almost universal reply would be in the negative. For such purposes we require what is called penetration: that quality which enables us to focus through a certain thickness of the tissue and bring the internal organs into view. In spite of what Dr. Hunt, in his "Post-Centennial Notes," has said regarding some of Tolles' high angles and their "penetration,"* I must confess that to me the evidence is not yet strong enough to induce me to throw aside the views which are held by the great majority against the few. We have to choose between two glasses, one of which will take a superficial view of an object; the other, owing to its depth of focus, will penetrate its substance, and show us the connection and relative positions of the different parts. Which, now, is the more *generally* useful?

Prof. Smith tells us that he is fighting the low angles on their own "chosen ground." I am at a loss to know just what that means, but he evidently considers that the low angles are believed to show to best advantage with direct light, not oblique. As compared with high angles this is in one sense true, in that they have greater penetration. Nevertheless, it is not right to state the matter in this way; for to obtain the best possible results from an objective, the angle of the illuminating pencil must be the same as the angular aperture of the objective. This is the "chosen ground" for any lens. Now, with direct illumination, *i. e.*, parallel rays, a high angled lens will show more surface markings than a lens of smaller angle. Only this evening this passage from Frey caught my eye, when I was looking for something else, and it expresses what I would say so well that I quote it: "An object glass of very wide aperture, however, will receive, even with ordinary illumination, so many rays of great obliquity that the same kind of effect will be produced as by oblique illumination with an objective of smaller aperture."

Looking now to the demonstrations of Prof. Smith, it will be recalled that he used direct light, which passed through an opening about 1-200 inch in diameter placed close to the object. The effect of this small aperture is to modify the intensity of the light, and at the same time diminish to a certain extent the value of the full angle of the objective. But here, as in other cases, the wide angled lens receives more oblique rays than another of smaller angle; hence the former will do better work on resolutions than the other. This effect may be due to what Mr. Wenham called long ago "radiated light" from the object; whether it is or not, the experiments described below will indicate.

A circular piece of very thin sheet brass was pierced with a hole .016″ in diameter. This was just the size of the field of my one-fifth with an A eye-piece. This piece of brass was blackened and mounted in an appropriate manner on my condenser, after removing the lenses. This allowed of its being accurately centered by means of the screws on the sub-stage, and also raised or lowered by means of the rack work. The illumination with this aperture was exceedingly good, and deserves commendation. After centering accurately to the one-fifth, the objective was removed, and on the front surface of the front lens a drop of india-ink was placed and allowed to dry. The diameter of the opaque spot thus obtained was about 1-50th of an inch. The available face of the lens measured about 6-100″. Its angular aperture was about 110°.

With the fine aperture in position, the one-fifth with the spot was slowly lowered, and, as was anticipated, the edges of the aperture in the brass were brought distinctly into view. This could not possibly be the case if the illumination were strictly direct, and the rays passing to the objective parallel, since the opaque spot on the face of

*The term penetration means, as used here, what is better expressed by depth of focus. Owing to the two very different meanings it has acquired, it would seem best to discard the term entirely.

the objective being three times as large as the aperture in the brass plate, would effectually shut out all such rays.

When the edges were thus in focus, the entire field was lighted with a reddish tinge, thus indicating the correction of the glass for marginal rays. On drawing the objective back out of focus, the centre became dark, and as the motion continued the light became a mere annular ring, which finally disappeared entirely.

As this paper is stretching out to an undue length, I will only add that with an object mounted dry, fine dark field effects can be obtained in this way, which might be made useful in some cases, but as my attention is otherwise engaged, I leave it for any one who will work the matter up more perfectly. I would recommend a smaller spot on the front lens.

The conclusions drawn from these experiments, and from others not described, are very obvious. The use of minute apertures does not afford us direct parallel illumination, and therefore with such apertures high angled lenses would naturally perform better than those of low angles, with suitable objects. Again, the fact that dark ground illumination is obtained as above, indicates that "radiated light" may have much to do with Prof. Smith's demonstrations with wide angled lenses.

In a note at the close of his article, Prof. Smith speaks of showing the 19th band with Beck's vertical illuminator, and says: "It is obvious that the pencils of light traversing the band were at least centrally disposed." They were undoubtedly centrally disposed, for the objective would focus them, but the conditions here are just such as would give the aperture full play. To prove this, let Prof. Smith put a circular spot of india-ink upon the back lens of his objective of such a size as will cut out central rays like the stop of a condenser. On repeating the experiment with such a lens the resolution will doubtless be greatly improved.

Final remarks.—I am not quite prepared to assert just how the angular light enters the objective in the experiments described, and have not now the opportunity to work it out more fully. We know that small apertures form images, and this fact precludes the possibility of obtaining a truly central parallel illumination in this way. How much the diverging rays from the aperture affect the illumination, and how great the effect of the radiated light may be, has not been determined. It was not my intention to undertake a thorough course of experiment to elucidate these questions. I merely desired to show that Prof. Smith has not taught us anything new about objectives, and that his demonstrations of resolutions by "central light" are merely what we would expect from what we already know. There is one statement, however, which takes me a little by surprise, which is that "the very best performance of the duplex lenses is seen by central light." I shall not now dispute it, but give Prof. Smith the benefit of it. Prof. Smith concludes by saying that "two hours 'over the tube' would demonstrate more than volumes of print," and I think it has done so in this case, thanks to his suggestion.

I had no intention of writing so much when I began, but as a long discussion of this question would surely follow short communications, and soon become wearisome to the general reader, I have thought it best to say all I have to say at once, and let it stand for what it is worth. I merely ask critics not to misrepresent what I have written.

8 *Beekman Place, New York, Aug.* 5, 1877.

A French Criticism of "Post Centennial Notes."

THE following article is translated from the new *Journal de Micrographie*, and is by the editor, Dr. J. Pelletan. Its keen wit is equaled only by its thorough scientific knowledge and sound common sense. He says:

In it the author, Dr. Gibbons Hunt, of Philadelphia, expresses squarely his opinion of the microscopes and objectives which we, on this side of the ocean are accustomed to consider the master-pieces of modern optics.

This opinion has appeared to us sufficiently curious to study, and to reproduce, the more so, as Dr. G. Hunt expresses it in a manner characteristically American, that is to say, absolutely without ceremony (*sans façons.*)

The English microscopes find little favor in his eyes. The new form of stand adopted by Ross (the J. Lister model) in which the screw of the fine movement is placed under the body of the instrument, is, he says, better than the old. "The wart is under the nose in place of being above it; that is all;" but, as in all the English microscopes, the distance between the focus and the eyepiece changes every time the fine movement is touched, and consequently the magnifying power varies at each instant; but the stage is too thick; the work is good, but it is not superior.

The instruments of Beck are the most graceful, the best finished, superior to all those which Europe has exhibited—but the stage is defective, it rarely turns in the optic axis, the mechanical arrangement for moving the object is easily deranged, because it is badly designed. "Better renounce racks for the stage movements than lose time in repairing the bad. Besides, it is the common experience in this country (America) that the racks made abroad do not work as smoothly as those made by us."

The stands of Crouch are very well made, the movements are good; but the idea of adapting a concentric stage does not belong to Crouch; it is an American invention, produced sixteen years ago by Zentmayer, of Philadelphia.

The microscopes of Nachet are not elegant; besides it is well known that they do not at all satisfy the requirements of science and are not durable. "I recall the time," says Dr. G. Hunt, "when any French microscope was good enough for Americans, but happily these days have gone by."

Hartnack did not exhibit; the severe critic of Philadelphia knows, nevertheless, that his microscopes are inferior to those of the first class made in America and in England.

Dr. G. Hunt has never seen the large German models—but it is all the same; he knows that in Germany they make only deformed instruments, destitute of precision.

The American microscopes are infinitely superior to all others in design, in workmanship, and "in originality of construction," and the first of constructors is Zentmayer.

This last conclusion we do not wish to contradict, for we, too, think that Mr. Zentmayer is one of the best constructors known, and, above all, very ingenious, as we shall shortly prove to our readers by giving them a description of several of his models; nevertheless we believe that the instruments of Powell & Lealand, Beck, Swift, Crouch, Hartnack & Prasmowski, etc., have nothing to fear, as microscopes of precision, in a comparison with those of Mr. Zentmayer; those of the French and German makers are merely less colossal.

And in regard to the French and German makers, we are tempted to find some foundation for the reproach which Dr. G. Hunt addresses to them: they fall behind, or, at least, they do not advance, while those of England and America are every day making progress. In fact, the latter invent new mechanical combinations, special arrangements, accessories called forth by the new requirements of science and by special processes of investigation, whilst in France and Germany our constructors have adopted models to which they adhere indefinitely; which are, so to speak, unchangeably fixed for an entire generation. In our opinion this is a grave error on their part, and the reproaches which Dr. G. Hunt addresses to them, although exaggerated in certain points, are in many respects justly merited.

Speaking of objectives, Dr. G. Hunt is of the opinion that those of Wenham, in which the correction is obtained by a simple lens of flint, have not any transcendent optical qualities, and that their mounting is not up to the mark.

The same is true of those of Beck, whose mode of correction was good twenty-five years ago (and this remark appears to us nearly just.) In the mean time the 4-10th is *not inferior* to any other of the same power (another remark of which we approve, save that we esteem this superb objective as *superior* to all others of this power, at least that we have seen.)

The objectives of Crouch are very good—for the price; in regard to those of Powell & Lealand, the author is not able to pronounce them bad; the 1-8th is the most superb objective on the continent: "the workmanship of the mounting, the *splendid* finish of this objective, ought to be a stimulant and an advertisement for other foreign makers. But the 1-10th of Tolles is superior in most respects."

We recollect that Hartnack & Prasmowski did not exhibit, but, as we have previously seen, this is no reason why Dr. Hunt should not decry their magnificent objectives, but he has doubtless forgotten them, finding under his hand those of Zeiss. And then he gives it to them to his heart's content. First of all, "he has never seen anything

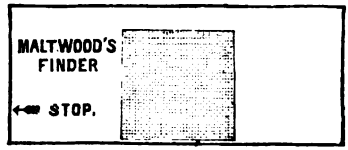
respectable coming from Germany." The lower powers of Zeiss are good for nothing; the 1-25th shows nothing which is not better seen with American objectives of lower power. (We ourselves regard this as an objective of the first class.)

In truth, Dr. Hunt finds in them but little of the mathematics of Dr. Abbe. Besides "mathematics have never made an objective." What ought M. Prasmowski to think of this peremptory declaration, he, who continually works over (*brasse*) sines and tangents, so that he may perfect his formulæ, and who constructs almost point by point the curves of his lenses? What will Dr. Abbe think of it, who has just demonstrated, by calculation, the influence of the angle of aperture upon the nature of microscopic images, and who calculates the curves of the lenses of M. Zeiss! But our author is very much amused to see learned professors gravely define the limit of visibility and the value of the angle of aperture. He declares, too, that it is certain that neither Lister, nor Amici, nor Abbe serve as a guide to Mr. Tolles, whose 1-10th objective is a masterpiece.

Let us hasten to add that we would contest nothing of the high and just reputation which Mr. Tolles has acquired as a constructor of superior objectives; this is to-day a matter of public notoriety, in Europe as well as in America. That which we deny absolutely is the principle laid down by Dr. Hunt as to the uselessness of calculation in the realization of the numerous conditions which an objective of the first class ought to fill to-day. On the contrary we consider it a necessary guide; we know not if the celebrated Boston optician obtains his exquisite results solely by his extreme practical skill, empirically and without any calculation; but if he really operates thus, we think that he will certainly be surpassed one day by a constructor who shall have the same practical skill, and who shall be a better mathematician.

The Maltwood Finder.

THIS is a most important accessory to every microscope, as it not only facilitates interchange of notes between microscopists living at a distance from each other, but it enables observers to make sure of the identity of the objects under examination at different times. It consists of a glass slip, a little wider than an ordinary slide, upon which is a photograph occupying a space 1 by 1 inch. This space is divided into 2,500 squares (50 divisions on each side) and each of these small squares is designated by two numbers, one of which indicates its position from bottom to top, while the other marks its position from right to left. Thus the square which lies on the tenth line from the bottom, and the fifteenth from the right hand side, would be $\frac{10}{15}$. Placing on the stage an object mounted on an ordinary slide, with its lower edge against a ledge of some kind, and its left hand edge against a stop (the stop and ledge being movable as regards the stage), we bring some particular spot into view. Removing the slide, we now place the finder in its place, and read off the double number. It is now evident that if at any future time we should place the finder against the ledge and stop, and bring the



same number into view, then on removing the finder and placing the slide on the stage, the precise spot originally under examination will be in view. We can, therefore, easily register anything of interest, and so be certain of finding it at any future time.

The finder cannot be used with microscopes fitted with clips only. An object-carrier, provided with a ledge and stop, must be used. Such object-carrier may either be the usual form of the glass stage, or, with the plain stage, having clips only, an object-carrier may be made of a thin plate of brass with a hole in the centre, a stop at one end, and a ledge at one edge.

Hitherto the Maltwood finders have been made only by one firm in London. They are now made in this country very successfully. A dozen which we recently examined did not vary as much amongst themselves as those which had been obtained from London.

The New Carpet Beetle.

DR. J. A. LINTNER, the well-known entomologist, of Albany, N. Y., in writing to the *Country Gentleman* about insects of 1876, says of the new carpet beetle, that this destructive insect, hitherto unknown to us by name, has during the past two years presented itself for its share of public notice. Although not invading our gardens or our fields, its insidious depredations within the narrow precincts of our homes, are, or threaten to be, attended by perhaps equal pecuniary losses.

During the past year notices had appeared in several of our papers of the consternation caused in many households by the discovery of a strange and unknown beetle, which was working sad havoc on carpets, eating into them, and cutting through entire breadths as effectually as if done by scissors. If discovered in their habitat, beneath the borders of carpets, their rapid movement carried them out of reach beneath the base-boards, before they could be secured for examination and description. It was not the well-known carpet worm, or in the least allied to it, but beyond that, no one seemed to know what it was. It had been discovered in a few localities in Western New York, and its presence was reported in Schenectady in several dwellings. Upon search being made beneath the carpets of my residence (in Schenectady), the insect was found in nearly every room. It was evidently the larva of a beetle, and I suspected it to belong to the destructive family of Dermestidæ. A number of the larvæ were captured, and fed to their maturity upon pieces of carpet. When they had attained their full size in the fall, and had entered upon their pupal state, as could be seen through a longitudinal slit in the back, they presented characters which led me to refer them to the genus Anthrenus.

In October, the first perfect insects emerged as very beautiful, though small beetles, wing-cases prettily marked in spots of white and black, and with a red line bordering the inner margins of their wing-cases. Being entirely new to me, they were sent to Dr. Le Conte, the distinguished coleopterist of Philadelphia, for determination, if known to him. He returned me answer that they were the *Anthrenus scrophulariæ*—a species well known in Europe for its destructiveness, but now for the first time detected in this country.

Notice of the discovery was communicated by me to the Albany Institute at its meeting of October 17th, and a report of them was published in the Albany *Argus* of October 21st. Owing to the interest attached to the introduction in our country of another addition to the already formidable list of injurious insects of European origin, the paper, or extracts therefrom, appeared in several of the journals throughout this and adjoining States. Through the publicity given it, I became informed of the presence of the insect in many localities in New York and other States. Examples of a beetle, believed to conform to the brief description which I had given of *A. scrophulariæ*, and known to possess the like habit of feeding upon carpets, were sent to me by Mr. A. S. Fuller, of the *Rural New-Yorker*, for comparison. The species had been in his cabinet for some time, under the name of *Anthrenus lepidus* (Le Conte), having received the first examples from Oregon in 1871 or 1872. Later, in 1874, specimens referred by him to the same species occurred abundantly in a dwelling in Market Street, New York, and thereafter in various parts of the city and neighboring localities.

The examples reared by Mr. Fuller from larvæ taken in New York City were clearly identical with *A. scrophulariæ*. Upon informing Dr. Le Conte that examples of this species were in cabinets under the name of *A. lepidus*, and requesting an explanation, he wrote me that the latter name had been given by him to a form which he had found on flowers at San Francisco and San Jose in 1850; that it differed from the *A. scrophulariæ* of Europe in the sutural line being white instead of red; but that in all probability it should only be regarded as a variety of the European species. The *lepidus* var., from its occurring abundantly on blossoms in the imago state on the Pacific coast, as does the congeneric museum-pest (*Anthrenus varius*, Fabr.) in the State of New York, was evidently thoroughly naturalized in that region. Dr. Le Conte suggests that it may have been imported into California from Southern Europe during the Spanish occupation of that country. Our invasion of the insect he believes to have been within a few years, through the importation of carpets at New York.

Should this insect continue to increase until its complete naturalization shall make it as common as *A. varius* (a dozen or more of which may sometimes be seen feeding on a single flower), it is difficult to conceive how, under such a visitation, the comfort of carpets can still be indulged in within our homes. Even now, when it has barely commenced its ravages, it is reported as having inflicted very serious pecuniary losses in several instances, where carpets

have been entirely ruined; and such terror has its presence imparted that prudent housekeepers have abandoned the customary nailing of their carpets to the floor, that they may make frequent examinations during the summer months for the discovery and destruction of the unwelcome guest.

The remarkable invasion of a dwelling in Cold Spring, N. Y., in the summer of 1874, after a twelve months' absence of the family in Europe, was by a larva of Anthrens (as determined by Dr. Packard), which is now believed to have been this species. According to the statement made, "they took complete possession, from the cellar to the attic, in every nook and crevice of the floors, under matting and carpets, behind pictures, and eating everything in their way." From this account we may infer an almost incalculable capability of increase if left to itself, and draw the lesson of the absolute necessity of combating its invasion by every means in our power.

It will unquestionably prove an exceedingly difficult pest to dislodge. The ordinary applications of camphor, pepper, tobacco, turpentine, etc., are powerless against it. An effectual means of destruction, and prevention against new invasions, is still to be discovered. The free use of benzine has been recommended in some of our journals, to be used in the saturation of cotton, with which to fill the joinings of the floors and crevices beneath the base-boards. This is to be done during the winter months, at which time it is believed the insect will be occupying these retreats, either in its perfect beetle form, or as eggs deposited for another brood; to either of these the direct application of benzine would be fatal. To some of my correspondents I have suggested the pouring of kerosene oil in the crevices of the floors, and filling of all places of retreat with cotton saturated with the oil. I would regard this as less dangerous in its use than benzine, and equally efficient.

North American Algæ.—We find in the *American Journal of Science* the announcement of the appearance of "Algæ Exsiccatæ Americæ Borealis; Curantibus W. G. Farlow, C. L. Anderson, D. C. Eaton, Editæ. Fasciculus I. Boston, 1877." Two editors of the volume are of Harvard and Yale, and Dr. Anderson will be recognized as a resident of Santa Cruz, and a contributor to the *Press*. The specimens of algæ thus presented to the public are 50 in number, and Dr. Gray pronounces them "all of real interest and many of them new or next to new, at least in collections."—*Mining & Scien. Press.*

The so-called Wheat-Root Disease in Virginia.

Parties in Northumberland County, Va., having written to the Commissioner of Agriculture in regard to a partial failure in their wheat crops, which was attributed to a diseased condition of the roots of the plant, Mr. Thos. Taylor, the microscopist of the Department, was directed to go to the county named and investigate the matter. After spending some days there, Mr. Taylor has returned, and reports that there is no such disease as has been supposed to exist, About three years ago a farmer observing barren spots in his wheat fields, examined the roots of the wheat at such points, and discovered what seemed to him a peculiar web-like appearance, which he supposed to be of fungoid character; and this explanation of the presence of such barren spots appears to have been accepted without question by so many others that the "root disease" came to be talked about as an established fact.

Upon examining this supposed fungoid matter with a microscope, Mr. Taylor finds it to consist of minute rootlets of the plant itself, and on comparing the wheat taken from the barren spots referred to with that which attained a more vigorous growth, he found that the abundance of the rootlets was proportioned to the vigor of the plant.

Under these circumstances Mr. Taylor is convinced that the barren spots referred to are solely due to the lack of nutritive elements in the soil, and that the failure of the wheat in such places, which really has formed the only ground of complaint, may easily be remedied by the use of fertilizers and by proper treatment of the land. How much may be accomplished by such means is illustrated by the fact that land which has been properly manured is found yielding as much as 37½ bushels to the acre, while adjacent fields, having a soil of the same general character, may produce but five or six bushels.

The correction of an erroneous report which tended to retard the improvement of this portion of Virginia, by keeping out immigration and capital, will be of great benefit to the section interested, and the farmers with whom Mr. Taylor conversed on the subject expressed their gratification at the prompt action taken by Gen. Le Duc in giving the matter the desired investigation.—*Daily Critic.*

THE AMERICAN

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AND

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The following gentlemen have kindly consented to act as agent for this Journal, and are authorized to receive subscriptions and advertisements:

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S. E. CASSINO, Naturalists' Agency, Salem, Mass.
J. G. LANGGUTH, Optician, 88 State Street, Chicago, Ill.
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An advertiser whose letter can be examined at our office writes us as follows: "I have received several letters of inquiry, and it will please you to know that though I have had advertisements in other journals also, *every* letter of inquiry refers to the AMERICAN JOURNAL OF MICROSCOPY. This certainly demonstrates the value of the journal as an advertising medium."

Scientific Expedition Around the World.

MOST of our readers have doubtless heard of the scientific expedition around the world projected by Mr. Woodruff, and which has now made such satisfactory progress that there is very little doubt but that it will set out at the time appointed. The object of the expedition is best stated in the words of the directors: "The purpose of the expedition is to visit points of general and special interest on a route around the globe, to study the arts, archæology and present condition of the better known countries, and the geology, geography, fauna and flora, as well as the history and character of the people of those less known, and to make collections in the various departments of science. To this end the expedition will be absent two years, and will afford opportunities for seeing the greater part of the world, under far more favorable circumstances and at less expense than could possibly be done on a smaller scale or by individual enterprise, and the expedition will also enable schools, colleges, and museums to form collections and preparations of rare, or beautiful, or typical forms to a greater extent, and at less cost than has been hitherto possible. In addition to educational and moral care and guardianship, those who go as students will enjoy all the comforts of a pleasant home, safety, security for health, books, music, exercise, and such an opportunity for extensive travel and observation as could be obtained in no other way."

That the expedition will be a success from a scientific point of view we feel confident. The region to be explored is rich in unworked material, and the management is supplied with every facility necessary for thorough scientific investigation. At the head of the faculty is Wilder, of Cornell, well known as an able zoologist and skilful anatomist, and in all the most important departments, including Languages, Architecture, Physics, Chemistry, Geology, Botany, etc., there are instructors of known ability. Microscopy, we see, is represented by a lady, Miss Louisa M. Reed, of the University of Michigan. The vessel will be under the charge of an experienced professional commander, and will be manned by a full crew of able seamen, so that no dependence is placed upon volunteers or cadets. The time allotted for the expedition is two years, and the charge $2,500. Those of our friends who desire to know more about this interesting expedition would do well to procure an explanatory pamphlet which may be had by addressing the Secretary, Hon. Daniel Macauley, whose headquarters are for the present at the St. Nicholas Hotel, New York.

Careful consideration of the plan proposed must result in a conviction that the management does not hope for too much when they expect that "physical health and development will result from the fine training of fresh, natural life. The powers of ob-

servation and memory will be strengthened, the perceptive faculties will be educated, quickness of eye and ear will be gained, the qualities that make a man and fit him to do the best work in the world, in any condition of life, will be developed. He will learn to be a man for emergencies, prompt to act with precision and judgment. His intellectual powers will be quickened and invigorated by contact with men, contrasting nation with nation and race with race, by actual inspection of all that is rarest and most curious in all lands, by the reading of the great book of the world through eyes well skilled to point out to him all that is best worth knowing in it. Such advantages have never before been offered, and they can be obtained at a cost no greater than the cost for the same time spent at home or at college."

Care of the Microscope.

A MICROSCOPE, when not in use, should always be kept well protected, either in its case or under a suitable cover. There is no more convenient mode of keeping a microscope than to stand it upon a cloth mat, and cover it with a glass shade. It is thus kept free from dust and vapors, and is always ready for use; but when it is kept in its case, and especially if it has to be screwed together, interesting, valuable, or even important objects, will often fail to be examined, simply because too much time and labor are necessary to prepare for the operation.

A good microscope should be so carefully protected, that it shall rarely require to be cleaned or dusted, as this wears off the lacquer, and exposes the metal, which, when thus uncovered, soon begins to tarnish. When dusting or cleaning becomes absolutely necessary, chamois leather, or a very fine old linen or silk handkerchief is most suitable. Never use coarse cloths, or those that have been lying about exposed to dust and dirt.

The lenses should be kept in their boxes when not in use, and when they are attached to the microscope, great care should be taken to keep them from coming into contact with liquids. In order to prevent the latter accident as far as possible, never examine liquids unless when they are covered with thin glass. In the pursuit of micro-chemical studies, the microscopist has frequently to deal with liquids that corrode metals, and even glass. In well-appointed laboratories *inverted* microscopes are used in such cases, but with ordinary instruments, special means must be employed. The object should be laid on a large piece of thin plate glass, and the objective should be coated with oil. The rest of the metal work may be protected with oiled silk or thin india-rubber.

When liquids which corrode glass are used, the front of the objective should be protected by means of a very thin leaf of the best mica, which may be attached either by glycerine or balsam.

These, however, are exceptional precautions. In ordinary work it is sufficient to see that the lenses and metal work are kept free from stains and finger marks.

Never touch with the fingers the surface of any lenses, either eye-pieces or objectives, as this will be certain to soil them. Use soft camel-hair brushes to remove particles of dust, etc. Where dirt adheres more strongly, use fine linen *slightly* moistened with alcohol, and wipe dry with very fine chamois leather. Remember, that alcohol, if used profusely, will attack the lacquer of the brass-work, and even dissolve the cement which holds the lenses together. When objectives are smeared with balsam, the best cleansing agent is said to be kerosene oil. The piece of leather used for wiping lenses should be free from dust, and is best kept in a small box by itself, and used for nothing else. It must be remembered that the glass of which objectives are made is very easily scratched, being soft when compared with particles of sand and grit; consequently, when frequently wiped it soon loses that exquisite polish upon which its excellence of performance so much depends. What, then, are we to think of the directions given

by the author of a popular work on the microscope, in which we are told to use a piece of leather, slightly impregnated with brick dust!! No better method of destroying an objective could possibly be devised. Therefore, see that in wiping, the *slightest* possible pressure is used, lest any particle of grit should make a scratch.

The exposed parts of all microscopes, as well as the objectives and their cases, are lacquered, to protect them from being soiled by handling, but the interior of the boxes which hold the object-glasses are rarely so protected, and the black coating of the interior of bodies, draw-tubes, etc., is frequently not very firmly attached. Therefore, never touch them with the fingers.

After taking an objective out of its box, either screw on the cover of the box, or place the latter with its open end down. Do not stand it mouth up, so that it may catch all the dust.

When exhibiting the microscope to others, great care is necessary to keep meddlesome fingers from soiling the glasses. Some people are never content when merely allowed to look at things: they insist upon handling them, and feeling them. To the young microscopist, we would say that if any of your friends insist upon handling your objectives, eye-pieces, etc., put up the instrument and pack it away. A microscope carefully used is as good after fifty years as when first made, but we have seen an instrument suffer more injury in half an hour at the hands of a thoughtless and dirty person, than it would have sustained in twenty years in the hands of a careful microscopist.—*From Practical Hints on the Selection and Use of the Microscope.*

Our Book Table.

Tables for Systematic Qualitative Analysis. By John H. Snively, Phr. D. Nashville: C. W. Smith.

There is probably no department of practical science in which a bird's eye view of processes and results can be given so well by tables as in qualitative chemical analysis. A few carefully constructed tables enable even the beginner to "hunt down" all the elements in any material, and prove their presence beyond doubt. Hence to others besides regular students of the science, such tables must prove exceedingly useful. Qualitative chemical analysis has now become an important department of microscopical research, and although the tables before us do not refer specially to microscopical work, they will prove exceedingly useful to any one taking up this interesting study. So far as we have been able to examine, the tables before us are the most convenient and accessible now before the public.

Catalogue of Plants Growing without Cultivation in the State of New Jersey, with a Specific Description of all the Species of Violet found therein; Directions for Collecting, Drying, Labeling, and Preserving Botanical Specimens, and a Description of suitable apparatus therefor. With Suggestions to Teachers prosecuting the study of Botany. To which is added a Directory of living Botanists of North America and the West Indies. By Oliver R. Willis, Ph. D. New York: A. S. Barnes & Co.

The copious title page gives a very complete idea of the scope of the book, which seems to be very thorough. Microscopists who are interested in the botany of New Jersey will find this book of great value.

Journal de Micrographie: Histologie Humaine et Comparée; Anatomie Végetale; Botanique; Zoologie; Applications Diverses du Microscope; Optique Speciale, etc., etc. Revue Mensuelle des Travaux Français et Etrangers publiée. Sous la Direction du Dr. J. Pelletan.

The third number of this valuable publication has found its way to our desk. Those who are familiar with the very able and thorough work of Dr. Pelletan—"Le Microscope"—will need no assurance that the editorial work is of the best. The range of subjects discussed in the number before us is very considerable, and all, whether editorial or contributed, are of great value. One, by the editor, we translate in another column. We hope that this new effort will meet with the success which it so richly deserves.

The Locust Plague in the United States: Being more Particularly a Treatise on the Rocky Mountain Locust, or so-called Grasshopper, as it occurs East of the Rocky Mountains. With Practical Recommendations for its Destruction. By Charles V. Riley, M. A., Ph. D. With 45 illustrations. Chicago: Rand, McNally & Co.

From the fact that Prof. Riley has made a special study of the natural history and habits of this insect plague, our readers may rest assured that this little work is thorough and trustworthy. To the purely scientific man it is interesting, from the fact that it gives a complete and illustrated history of the transformations of the insect. Figures are also given of the insect enemies of the locust and their transformations. There is also a map showing the country in which the grasshopper is indigenous,

as well as the region to which it has extended its ravages.

Epithelioma Penis.—Operations by Christopher Johnston, M. D., Professor of Surgery, University of Maryland. Reprinted from the *Maryland Medical Journal* for August, 1877.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Swinging Sub-Stage and Achromatic Condenser.

Ed. Am. Jour. Microscopy—In order to make the swinging sub-stage of any practical use, it will be necessary to somewhat change our ideas of the modern achromatic condenser of high angle of aperture, and go back to a condenser of no angle, or, in other words, a condenser which has a large field glass, and a very small one in front, to send a beam or pencil of parallel light straight and in a known direction. In such there will be little diffraction, except what light is stopped by the object itself. Let us take the case of a Nobert plate; with the achromatic condenser the light is thrown on the object in every direction within the angle of aperture of the condenser. Suppose the condenser has an angle of 90°, and that it is placed at an angle of 25° with the axis of the instrument; taking the case of one distinct line, we find in that case the light would be falling on one side at an angle of 65°, on the other side at an angle of 25°, and on other parts of the same line at every angle within 90°. Any person at all familiar with optics will be able to imagine the kind of shadow a knife blade would make if it was illuminated by, say, a dozen candles, put around within the angle of 90°. Then, with the same condenser of 90°, suppose we were able to put it at an angle of 45° with the axis, the light would pass from one direction parallel (I am supposing the glass or slide to have no thickness) with the under side of slide or at right angles with the line of view, the light from the other side would be in a direct line with the axis of the instrument, so that it would be impossible to say which rays were used in the observation. It is claimed by some that putting a small diaphragm or stop on the front of the condenser will do the same as the parallel light condenser, but all the light from the front of the condenser is best, except what passes through the diaphragm, that is, supposing it is put close to the front glass, and as it is necessary that the condenser must have a long focus to be used at an angle, it will be readily seen that the front glasses must be of large diameter to be of 90° or 75°.

A condenser that I think would be useful and cheap, could be made of one or two convex lenses, such as are used for field glasses of eye-pieces. After allowing the light to come to a focus, place in front a very small convex lens at the proper distance to form parallel light, or a concave lens could be used the same way by putting it in the proper position. The only condition is that the front lens must be very small, say about one-tenth or one-eighth of an inch in diameter. Such a condenser could be placed at an angle of about 60°. Another form of condenser which would be useful might be made as follows: In place of the small lens in front put a small cylindric lens; the light would then be sent in a direct line which could be controlled provided the condenser could be turned at different angles. This condenser could be used with the convex or cylinder immersion lenses in contact with the under side of object slide. When so used the light would pass in a direct line to the centre, without refraction, through the slide and balsam object.

August 6, 1877. W. H. BULLOCH.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—The stated meeting of the San Francisco Microscopical Society was held in their rooms on Thursday evening, July 19th, with Mr. G. L. Murdock in the chair, as both the President and Vice-President were absent.

After reading the minutes of the previous meeting, the proposal for corresponding membership of Prof. H. L. Smith, of Hobart College, Geneva, N. Y., was taken up, and the gentleman unanimously elected.

Acquisitions to the Library were announced by the Secretary in the way of two numbers of *Nature*, No. 36 of *Grevillea*, *Cincinnati Medical News* for July, *American Naturalist* for July, *Popular Science Monthly* and Supplement for July; also Part IX of the "Proceedings of the Belgian Microscopical Society."

The general cabinet received from the California

State Geological Society some important additions of diatomaceous earth from three localities, viz.: Six Mile Cañon, Virginia City, Nev.; Staples' Ranch, 12 miles from Stockton, and from a deposit in Lower California, Mexico, about 40 miles south of San Diego. The first and last samples promise well, but the Staples' Ranch deposit does not present very rich characteristics.

A communication from the Fairmount Microscopical Society, of Philadelphia, announcing their newly elected officers, was received and filed.

A letter was presented from Charles A. Spencer, of Geneva, N. Y., which was received in answer to an inquiry about "Spencer's Objectives," by Mr. E. J. Wickson. Among other things, Mr. Spencer writes: "From notices in the London *Microscopical Journal*, the *American Naturalist*, the AMERICAN JOURNAL OF MICROSCOPY, the Cincinnati *Medical News*, etc., it is quite evident that your Microscopical Society is a live one, and a gratifying fact it is to all devotees of science. I would give a cordial expression to the hope that its future progress may fulfil its present promise of being an honor to us all." In answer to inquiry, Mr. Spencer gave a description of a new series of objectives he is working up, in which he has it as a special aim to produce "a series of objectives of quite moderate prices, yet of a high grade of excellence, and of such almost absolute uniformity of quality that the purchaser need have no fear of disappointment in this respect." It is probable that the Society will have the opportunity of testing Mr. Spencer's new work.

Col. C. Mason Kinne exhibited the luminous larvæ of some more fully developed insect, which emitted, at night, from the under part of the last two segments of the body, a very brilliant light, similar to that of the fire-fly of the Eastern States. They were found by C. S. Capp, Esq., on the ground, close by the flume near Pillarcitos Lake, in San Mateo county, and the trio of glow-worms will be handed to Mr. H. Edwards for identification.

Mr. E. J. Wickson brought before the members a very interesting matter in the shape of some coffee-berries, which were filled with hundreds of active *acari*. He stated, as he placed a fragment of the berry on the stage, that there was received, some time since, from Mr. Morris, the Liberian Commissioner to the Centennial Exposition, a number of capsules containing the ripened seeds of the well-known Liberian coffee. These were planted some weeks ago, and as they failed to germinate, he naturally desired to ascertain the reason, and, removing some of the kernels from the ground and the outer shell, he found the substance of the coffee berry in a soft and decomposing condition. The suspicious appearance of a mealy mass in one caused him to probe the matter further, and by means of the microscope he soon found that the interior of all the capsules were filled with a kind of *acarus* which bore a strong resemblance to the sugar insect.

Under a two-thirds objective, the members could see the young, and also the fully developed acarus, busily engaged in the pursuit of happiness, by absorbing the moisture from the decaying mass. As the berries had been some weeks under ground, there seemed to be considerable ground for conjecture as to how they had become ensconsed in so fruitful a home for them. The acari having received some attention from Colonel Kinne, and the members being desirous of knowing more of the characteristics of this variety, Mr. Wickson handed a kernel to the Colonel, for the purpose of a careful study of the minute parts, by which the species are identified.

Dr. Winter, who has just returned from an extended trip South, stated that the scale insect, and other pests which have received the attention of microscopists and entomologists, he has been able to remove from a hundred orange trees, which he selected for the purpose of the experiment from his grove at Orange, about seven miles from Ahaheim, by a systematic and free use of whale-oil soap and water, applied with a brush. The trees are a third larger than the others, and generally more thrifty, from this system of grooming.

Colonel Kinne alluded to a very pleasant microscopical reception given by Dr. S. M. Mouser, in his new lecture room, built in the rear of his dwelling, at 707 Bush street. Several of the members were present with their revolving tables and instruments, and the audience of friends were seated in groups, first at one, then passing to the other tables. Judging from the encomiums passed upon the affair, we think that this feature of gathering together half a hundred ladies and gentlemen who are interested with the microscope and its revelations, might be made quite common, as it does away with the fatigue and annoyance observed at annual receptions of the Society, caused by a standing position when viewing an object. Dr. Mouser offered the use of the room at any time to any of the members for a similar reception of their friends, whereupon a hearty vote of thanks was tendered him for the courtesy.

The regular semi-monthly meeting of the San Francisco Microscopical Society was held in their rooms on Thursday evening, August 2d, with a large attendance of members. President Ashburner was in the chair, and Prof. Eisen, corresponding member, was present, as well as Dr. Behr, as a visitor.

Under the head of acquisitions, the Secretary announced the receipt of the *Monthly Microscopical Journal*, *Quarterly Journal of Microscopical Science*, Cincinnati *Medical News*, AMERICAN JOURNAL

of Microscopy, *Popular Science Monthly*, and *Nature*. No. 10 of Bulletin of the Bussey Institution, containing "Notes on Some Common Diseases Caused by Fungi," by Prof. W. G. Farlow, was also placed on the table. By donation, from Prof. Gustaf Eisen, there was received a monograph from him, being "Contributions to the Anatomy of the *Polyp*, genus *Renilla*," which also contained a large number of beautifully drawn and colored plates, showing parts of the animal in question.

Mr. Hanks donated a bottle of Beale's carmine injecting fluid, prepared by him, and Mr. Langstroth presented a slide, mounted by him, with a Sertularian from Monterey Bay. These beautiful little zoophytes are plant-like in form, and are often found in arranged gatherings of sea ferns or mosses, the casual observer little imagining he is grouping representatives of two kingdoms.

Regarding the luminous larva spoken of by Mr. Kinne at the last meeting, Mr. Henry Edwards stated that it was that of the *Elkychina Californicus*, a beetle of the family *Lampyridæ*, and that he had raised the perfect insect from similar forms found near Crystal Springs.

Mr. Kinne stated regarding the acarus found in the decomposing kernel of the coffee-berry presented by Mr. Wickson at the last meeting, that a somewhat critical examination of its minute parts had confirmed his opinion of its alliance to the sugar insect. The terminal and other joints of the legs, the mouth parts and disposition of hairy bristles being almost if not quite identical with the true *acarus sacchari*. He alluded to the fact that about fifteen per cent of the coffee bean is sugar, dextrine, etc., and was led to say in this connection that the opportunity which fortunately had been given him to examine many specimens has caused him to believe that most of its kind depended on saccharine matter for food, and should be classed as varieties and not species. The lemon tree acarus, described by him recently, the colony found in the centre of a sugar-cured ham, the barley acarus found in the *debris* of a mass of that grain, which had been slightly moistened and fermenting, and others met with at various times with varying habitats, only were possessed of such slight variations from that of the true sugar insect, that the evidence was of a convincing character enough to warrant the assumption that they were varieties of that acarus, modified by their environment, and should not be relegated to species.

Mr. X. Y. Clark favored the members with some remarks on the crustacea, in the way of explaining and exhibiting the organ of hearing in our local lobster, or crawfish, properly speaking, which is one of an entirely different genus (astacus) from that of the lobster (homarus). He stated generally the characteristics of the several special senses in this crustacean, in which he had been interesting himself in study recently, and alluded to the probable development in the way of organs of seeing, smelling, and especially hearing. The eyes were, no doubt, once but simple feelers, and by a process of evolution had developed into appendages. The organs of smelling were the larger of the remaining pair of feelers—antenna—while those of hearing were located in the smaller pair, or antennules. The parts of the latter were easily dissected out with a pair of scissors, and the lobster's ear, in the shape of an auditory sac, handed about on a needle for examination. Placing a prepared fragment, immersed in glycerine, on a slide, the sensitory hairs were beautifully shown, standing out from a telephonic floor, so to speak, and the previous explanations, by means of diagrams on the blackboard, were rendered still more plain, and the method in which the little hairs would receive sensations from vibrations in the fluid in the sac, made theoretically clear. Mr. Clark also exhibited several slides showing colonies of bryozoans and beautiful little calcareous helices of serpula, on some fronds of a fucus.

Dr. Gustaf Eisen, Professor of Zoology, Upsala, Sweden, a corresponding member, called attention to some minute worms of the Oligochæta, of the family *Tubificidæ*, and exhibited some fine plates of beautiful drawings made by his skilful hand, representing their anatomy. The worms were all found in California, near San Francisco, in the Sierra Nevadas, or in the redwood forests along the northern coast, all inhabiting ponds, lakes, or even clear running streams. Of said family, only five genera are known, viz: Tabifes, Psamorychtes, Phreatotrix, Limnodrillus, and Thelmatodrillus. Of those, all except Phreatotrix were found in California, and one, the Thelmatodrillus, was endemic to the waters of the higher Sierra Nevada. The Doctor called attention to some points in their anatomy, and pointed out some characters by which species and genera could easily be distinguished, as in the Oligochæta generally no external characters are found and the species must be arranged according to the shape of their interior organs. As a genus characteristic, the supraphargagial ganglion is of great value, but as to species characters the generative organs were undoubtedly the best. The organs represented on the drawings were principally the nervous system, the ovaries, the testes, the efferent ducts and the segmental organs, all exhibiting characteristic forms in the different species. The species described were Limnodrilus crinis medusæ, Limnodrilus vejdoorkyi, Limnodrilus corallinus, Tabifes mirabilis, Thelmotodrilus alpestris and Psamoryetes Californicas. Besides these, many new forms had lately been found, but many more yet were likely to occur in our stagnant ponds or rivers. The Doctor expressed his hope that the members of the Society, during their excursions,

would capture and preserve all such worms found, and any contributions, however small, should be most thankfully appreciated. Nearly every large body of water contains one or several new forms, and a perfect collection could only be brought up by a diligent search in different parts of the country.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Microscope wanted in exchange for a very excellent gold watch which cost $150. Address E. W., Box 4,875, New York P. O.

Scales and skin of Anguilla vulgaris in exchange for other objects. Address H. B. Hargreaves, Garnerville, Rockland County, N. Y.

Living Chara, in which the circulation can be viewed, in exchange for any interesting or good mounted object. Address William Readio, Garnerville, Rockland County, N. Y.

Wanted, slides of stained vegetable tissues in exchange for anatomical preparations. George A. Piersol, 1,110 Spring Garden street, Philadelphia, Pa.

Stained petal of Anemone patens and other vegetable stainings, for other mounted objects. Address F. H., Drawer 35, Cherokee, Iowa.

Wanted, a section cutter, in exchange for Raspail's simple microscope, rack adjustment, etc., etc. John Nicol, Worthington, Nobles County, Minn.

Wanted, foraminifera, polycystina and zoophites in exchange for histological preparations, crystals of herapathite and other crystals, various starches, stained sections of old cypress stump from Centennial, and other slides of interest. R. Hitchcock, 8 Beekman Place, New York.

Slides of fossil and recent Diatomaceæ, etc. Lists exchanged. E. Pennock, 805 Franklin street, Philadelphia.

Slides of Trichinæ spiralis, finely mounted, in exchange for anatomical or pathological mounted objects. Chas. Gaylord, M. D., Otsego, Allegan County, Mich.

Slides of cuticle of larva of Macrosila Carolina, showing crystals, in exchange for other objects. E. A. Burdick, Pension Office, Washington, D. C.

Diatoms from Coldwater, Mich., in exchange for other well-mounted objects. Address F. H. Root, Coldwater, Mich.

Palates of mollusca, a great variety, mounted or unmounted, in exchange for mounted slides of interesting objects or good material. C. M. Vorce, 164 Lake street, Cleveland, Ohio.

Wanted, for specimen of bladder of cat, finely injected, other injected pathological objects. J. T. Joslin, Newburgh, N. Y.

Case of algæ, and live fresh water animalculæ, for any well-mounted specimen. Send slides to A. Hobart, Box 581, Penn Yan, Yates County, N. Y.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., and Aulacodiscus Kittoni (transparent), for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Wanted, a small piece of "Monterey stone," or a small quantity of the Diatomaceous fossil deposit from any part of the Pacific coast. State what is wanted in return. F. F. Stanley, 40 Pearl street, Boston.

Slides of spermatazoa of horse in exchange for any other well-mounted object. C. Blasdale, M. D., Jericho, Queens County, N. Y.

Bermuda shell sand, composed entirely of foraminiferal and other shells, with coralines and sponge spicules. Very interesting for low powers and opaque specimens. Address C. C. Merriman, Rochester, N. Y.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Wanted, in exchange for diatoms from northern Wisconsin and Michigan, any well-mounted objects; marine diatoms preferred. W. H. Titus, M. D., Shawano, Wis.

Slides of fine sand, consisting of quartz, garnet, magnetite, hornblende, etc., from beach at Lake George, very beautiful, for other mounted objects. Wm. W. Griffin, Lynn, Mass.

For specimens of Comstock ores (15—25), or crystals of rare chemicals for polariscope, mounted, send diatoms or foraminifera to F. H. Engels, M.D., Virginia, Nev.

Wanted, well-mounted specimens, for slides of American Podura mounted whole, and scales of same. Address George W. Fries, Friendship, N. Y.

Very fine gold-bearing quartz from California, for other well-mounted objects. S. R. Hatch, Box 355, Milford, Mass.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield. Mo.

BOOKS WANTED.

A set of the "Quarterly Journal of Microscopy."

Ralf's "British Desmidiæ."

Dr. Fleming's book on "Blood Stains in Criminal Trials"—Pittsburg, 1861. Also any other work on detection of blood stains.

Pritchard's Infusoria. Edition of 1861.

Brunet, Manuel de Libraire. Last edition.

Hassall's "Fresh Water Algæ."

Smith's "Synopsis of the British Diatomaceæ."

Faraday's "Electrical Researches." 3 vols.

"Botany of the State of New York." vol. I.

Holtzapfel's "Mechanical Manipulation."

Ehrenberg's "Mikro Geologie."

Ehrenberg's "Die Infusions Thierchen."

Williamson's Recent Foraminifera.

Pritchard & Goring's Works (any vols.)

Hook's "Micrographia."

Carpenter on "Foraminifera."

Address, stating price, (which must be low) E.W., Post Office box 4,875, New York.

THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

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Certain Intra-Vascular Hairs.

AT the May meeting of the New Jersey State Microscopical Society, through the kindness of Prof. Samuel Lockwood, I had the pleasure of examining a section of the petiole of Audubon's Lily, (*Nymphæa flava*), recently discovered in Florida by Mrs. Mary Treat. Of the Doctor's preparation I have not the effrontery to write, except as I am compelled to account for the *raison d'etre* for the following. This pleasant little JOURNAL OF MICROSCOPY is distinctively the property of the amateur microscopists of the country, who are not supposed to have had even a little of everything under their instruments, otherwise I should hesitate to "rush into print" with the simple tale I have to tell. However, in the Doctor's section, imbedded in the cellular walls of the tubes, their rays glittering like gems in the flickering light of the gas flame, and extending far out into the vessels, were numerous irregularly stellate bodies, which, on the first and superficial examination, I supposed to be raphides.

Since that evening it has occurred to me that, as our common white water lily (*Nymphæa odorata*) is first cousin to the more aristocratic *Nymphæa flava*, it was just possible that similar radiating bodies might be found within it. A good specimen was obtained, while the ubiquitous small boy sat on the fence and inquired, "What yer ketchin', Mister?" and thrust his tongue in his cheek. A section rapidly made, a drop of glycerine hurriedly added (never mind the air-bubbles), the slide nervously slipped beneath the objective. Oh, what luck! there they are, sure enough, diamond stars sufficiently beautiful to make the young ladies throw up their hands, and cry, "Oh, my!"

That these charming figures are not raphides, a little micro-chemistry readily proves; acetic acid having no appreciable effect, and nitric acid, after a contact of twenty-four hours, only adding a more yellowish tinge to their otherwise almost colorless condition; *ergo*, for want of a better name, we must call them vegetable hairs. But what are vegetable hairs, or any other kind, either, doing on the inside of a closed tube, I should like to know?

In the yellow pond lily (*Nuphar advena*), the same formations exist, but larger and much less delicate. In both these species of the Nymphaceæ every vascular part, peduncle, petiole, sepals, the veins of the

leaf, even those of the still unexpanded leaf beneath the water (Fig. 4), are abundantly supplied with the hairs arranged in two ways. In a transverse section of the peduncle of *Nymphæa odorata* (Fig. 1), the body of the hair is imbedded in the wall of

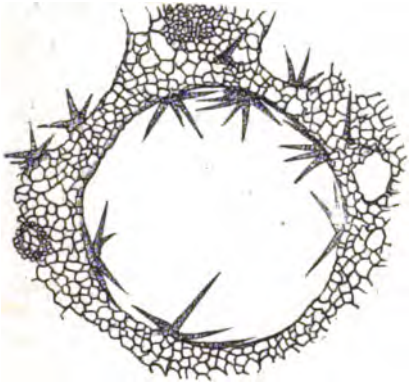

Fig. 1.

the vessel, while the rays extend parallel, or at a small angle, with the course of the tube. The same arrangement also obtains in the petiole. In the peduncle (Fig. 2), as well as in the petiole (Fig. 3), of *Nuphar*

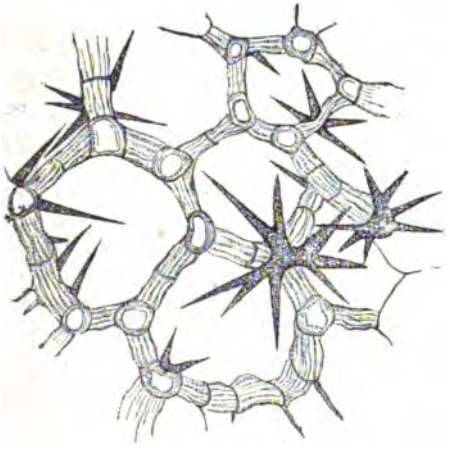

Fig. 2.

advena, the hairs, larger and more robust, are quite regularly placed at the intersection of the cellular walls, the arms extending themselves into the vessel at right angles with its general direction. In several instances I have noticed a perfect specimen apparently suspended in the centre of a small tube, the tips of the rays piercing the walls. They were probably dislocated by the edge of the razor.

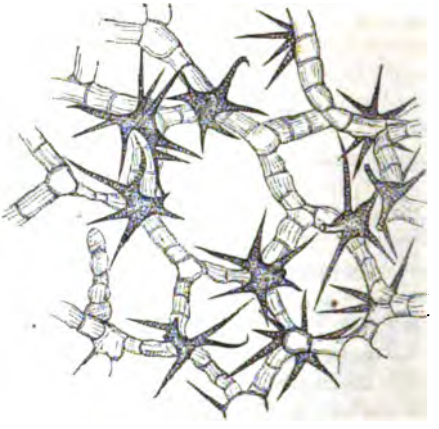

Fig. 3.

Each hair is a hollow body with rays as hollow, and roughened as though sprinkled, by fairy fingers, with grains of crystal. A

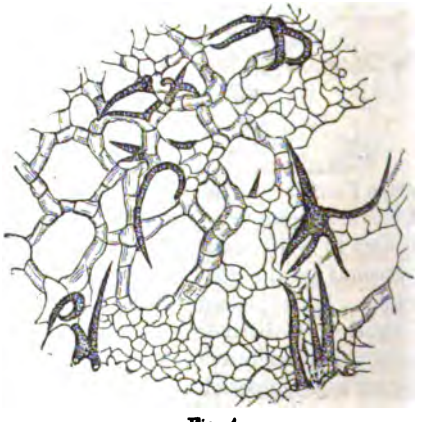

Fig. 4.

transverse slice of the sepals of *N. odorata* will pass through them, and will well show *in situ* how hollow-hearted they are. Examined with polariscope and selenite every section is brilliant. But of what use are these curious formations, so gracefully and beautifully fashioned, and so carefully hid-

den away? To believe that they are of no service to the plants, that they have been created in vain, is impossible. Nature may be lavish, but she is never careless. If we may judge from their position at the junction of the walls of the vessels (Figs. 2, 3, 4,) and from the not infrequent instances (in the midrib, Fig. 4, and elsewhere) in which the rays extend one-half or even three-fourths the distance around the tube, it is at least possible that these stellate structures may be for the strengthening of the long petioles, etc. A still more interesting thought is one suggested by their arrangement within the peduncle and petiole of *N. odorata*. Why may they not be absorbent glands? Is not the supposition plausible?

Lilies are abundant, razors are cheap, hands are steady, or should be, and nothing else but an objective of seventy or a hundred diameters is needed to show a bit of beauty to make one almost involuntarily exclaim, "O Lord, how manifold are Thy works! in wisdom hast Thou made them all; the earth is full of Thy riches." A. C. S.

Trenton, N. J., July, 1877.

The Siliceous Shelled Bacillariæ or Diatomaceæ.

(*Continued from page* 99.)

V.—GEOGRAPHICAL DISTRIBUTION.

THE general result, from a comparison of the diatoms of different parts of the world was, that climatic circumstances have little influence on their production. With but few exceptions, it was found that the same, or at least, similar forms, occur almost everywhere in different regions of Europe, both towards the poles, and towards the Equator; also in the direction of parallels, no remarkable change of forms has been met with. The reason of this may be that these little organisms need only a short time for their growth, and that difference of temperature has little influence on their production. Thus, for instance, several of the Naviculæ live just as well in the hot waters of the Carlsbad and Euganeian Springs, as in the cold waters of other regions, *e. g.*, Navicula appendiculata, viridis, oblonga, arcus; Surirella striatula, etc. On the other hand, the cold mountain and glacier waters have certain and peculiar forms, which are not found in lower regions: *e. g.*, all those belonging to the genus Odontidium. The chemical composition of the waters exercises greater influence than the temperature on the production of certain forms. Marine species exhibit peculiarities which do not appear in fresh water forms, or at best but seldom. The sea forms are, in cross-section, larger; they are more firmly united, and with stronger and more enduring frustules. The Schizonemeæ are all marine, they are but feebly represented in fresh waters by the genus Encyonema, which in turn is not found in the sea. Pure fresh water forms, are the Eunotieæ, Meridieæ, Fragilarieæ, Cymbelleæ, and most of the Naviculeæ and Gomphonemeæ. Pure sea forms are the Licmophoreæ, Striatelleæ, Biddulphieæ and Schizonemeæ. The Melosireæ, Surirelleæ, Achnantheæ, Tabillarieæ, Coscinodisceæ, and the rest, are found in the sea, as well as in salty, and fresh inland waters.

If we consider each country with regard to its peculiar diatom forms, we find: 1. That the marine forms of New Holland resemble most those of tropical America. Peculiar to both is the genus Climacosphenia; the other forms are found more or less on the coast of Europe. 2. To the inland waters of tropical America, the genus Terpsinöe is perhaps peculiar; yet the inland waters of Africa and tropical Asia are scarcely as yet examined. Fresh water forms from Egypt, which I had an opportunity to examine, quite resembled those of our German waters. The forms also which have been found in the North African Chalk marls, are to a great extent found in our waters. 3. The fresh water, and most likely also the sea forms of North America, closely agree with those of Europe in the genera, as well also as in the species. The few forms which I found on fresh and salt water plants of Kamtschatka (Cocconeis

pediculus, Synedra ulna, Gomphonema minutum, Melosira aurichalcea, Synedra gracilis), were those most common in Europe. The few also which I observed on the algæ from the Japanese and Corean Seas, were just as little different from those met with on the European coast; they were Grammatophora marina, Synedra lævis, Cocconeis placentula.

VI.—THE DIATOMS AS PARASITES.

As some forms of diatoms depend on the chemical composition of the waters, so do others on the existence of certain algæ, on which they live as parasites; yea, smaller diatoms are found even on larger ones, and Ehrenberg has called such, infusorial lice. To the latter class belongs Cymbella pediculus (Tab. 6, Fig. vii.,) which, however, is also found on other fresh water algæ, for instance Cladophora fracta (Tab. 5, Fig. viii., 1), and Oedogonium capillare.

The *Cocconideæ* come next to these; they are found mostly on the fine fibrous algæ of fresh and salt water (especially the genera Cladophora, Ceramies, Callithamnia and Polysiphonia) and cover them so densely that the algæ cannot be recognized. Similar to the Cocconideæ is the genus *Epithemia* (Eunotia E., ex. p.,) most of the species of which are given on T. 5, Fig. xii. In the case of *Achnanthes* (Tab. 20), I have remarked that some species are to be observed on certain algæ, and never met with on others, though I have had the opportunity to examine them from different regions. This is the case, *e. g.* with Achnanthus subsessilis (Tab. 20, f. iv.,) which is seen only on Rhizoclonium littoreum (Zygnema littoreum, Lgb.,) and Rhizoclonium salinum, and Achnanthes salina is only found on Enteromorpha intestinalis. Achnanthes brevipes seems to prefer Polysiphonia, and A. longipes Ceramium. On other species no sufficient observations have been made. *Melosira salina* and the closely related *M. concatenata*, I have found especially on Enteromorpha intestinalis; the other species, particularly those of fresh water, are seen on all submerged objects; the same is the case with *Synedra* and *Diatoma*, whose forms are found, not only on algæ, but also on phanerogamic water plants, often in great numbers; and not seldom minute Synedræ are found sessile on the larger.

The large marine algæ, *e. g.* Sphaerococcus, Chondrus, Chondria, Fucus, Laminaria, and the like, are seldom garnished with diatoms; only in rare cases Synedræ are found on them. The genera Cocconema, Gomphonema, Podosphenia, Rhipidophora, Licmophora, Grammatophora, Podosira, Striatella, Rhabdonema, Hyalosira, Isthmia, and Amphitetras, live altogether as parasites on the thin-threaded conferva-like algæ, and seem not to be limited either to single species or genera.

VII.—THE EXAMINATION OF DIATOMS.

In examining diatoms, one has to observe whether they are free or attached, or whether they live in a covering, the latter not uncommon, especially in sea forms; and then, one has to observe again the structure of the covering. The diatom body itself often exhibits different forms according to the position in which we see it. One has, therefore, if these different positions do not offer themselves, to try to turn the little diatom body by moving the water (which can be done by blowing with the mouth on the slide during the observation.) If the dimensions of the planes are not very different, the turning is easy, but if two opposite planes are developed in breadth more than the others, the turning is more difficult. In living specimens, the observation of different sides is easier than in dead, and especially dried ones. If possible, however, living forms should be observed, as well as those in a dead state. The arrangement of the inner soft parts can only be distinctly examined in living specimens; but the structure of the frustules is only to be clearly recognized when the inner parts have been destroyed by glowing heat or otherwise, because these oftentimes conceal

the fine, delicate markings, stripes and openings of the frustule. For this purpose it is best to spread little quantities of the bodies to be examined on a small plate of mica, with some water, very equally and thinly, and then to heat the mass on the little plate over a spirit lamp.* No stronger heat must be used than is just necessary to destroy the inner parts, which is always very quickly done. If the heat is excessive and prolonged, the frustules are often distorted, or become indistinct or fused, especially when they are sessile on algæ, whose ashes (potassa in fresh, and soda in marine algæ,) helps the melting together. When, as in the genera Schizonema, Micromega and others, the little bodies are embedded in a considerable quantity of organic matter, which, after the burning, always furnishes ashes that act readily on the frustule. If these ashes be in great quantity, or the proportion of soda be considerable, the organic matter can be destroyed by concentrated sulphuric acid.†

Many frustules, which in the living condition appear quite smooth, show after the heating more or less distinct furrows, lines, stripes, points, or other markings, which cannot be seen, or are less distinctly seen, on the living organism. The heating just mentioned has, in addition to the advantage which it furnishes for the better examination, also this, that by it a true diatom can be easily and decidedly distinguished from other similar bodies, especially the desmids, which often have much similarity to diatoms, since the desmids are destroyed by the heat.

To be continued.

*One need scarcely to remark that the water must not be salt or hard, and therefore repeated washings in rain or distilled water are necessary. A thin iron plate supporting a bit of thin glass, the latter having the diatoms on it, may be heated red hot, or until the diatoms, which on first heating become black, are again whitened.—*Trans.*

†Boiling in sulphuric acid (*care being taken that no alcohol remains in the water* in which the diatoms may have been kept) until the mass chars, and then dropping in powdered chlorate of potassa, while the acid is boiling, will remove all the carbon, and bleach the diatoms thoroughly. The flocculent matter, if present, may be removed by careful digestion in a cold ammonia or potassa solution.—*Trans.*

The Examination of Objectives.

BY ERNST GUNDLACH.

THE quality of each objective depends upon: A, the degree to which the correction of the spherical aberration has been carried; B, the degree to which the correction of the chromatic aberration has been carried; C, the angle of aperture; D, the working distance; E, the centering; F, the power of transmitting light.

Each of the two aberrations sub-divides again in three parts, viz., A, the spherical, into, 1, the general spherical aberration, resulting from the fact that the rays, passing from any one point of the object through the objective, do not reunite in one point, the point of union for the peripheral rays lying nearer the objective than the one for the central rays. 2. The so-called distortion, which occurs when the rays come from any one point outside of the axis (sideways), and, passing through the objective, do not reunite in one point. This is due to faulty construction of the objective. 3. The spherical aberration of the higher order.

The chromatic aberration (B) subdivides into: 1. The general chromatic aberration arising from the fact that the different colored rays have, on account of their varying refrangibility different foci. 2. The aberrations of the higher order, manifesting itself when the central part is still undercorrected, while the parts near the edges are already over-corrected. 3. The distortion of colors, arising when only the colored rays coming out of the axis reunite in one point, but not those coming from a point lying outside of the axis (sideways), which is the consequence of a faulty construction of the objective.

A1 is, when present, most easily recognized in powerful objectives, especially immersion objectives, by observing therewith objects with fine lines, for instance, the *P. angulatum*, as the lines of these appear to be not exactly in the plane of the outlines of the object, but somewhat below, so that, after the outlines have been sharply de-

fined, the objective has to be approached somewhat to the object by means of the fine adjustment, to bring out the lines in the sharpest manner. If, however, it is necessary for the same purpose to move the objective further off, spherical over-correction is present. This test is applicable with more or less difficulty to *all* objectives, and with all such objects which show fine lines on the surface.

A2. This defect is known to be present when the object, appearing at the edge of the field of view, appears poorly defined, and in such a way as if a number of images seemed to lie one above the other, but displaced in the direction of the centre.

A3. The spherical aberration of the higher order can only be measured by the defining power of the objective. It will be the less, the more the general aberration has been corrected by means of the *front* lens (consequently also by immersion), instead of by a corresponding form of the flint glass lens, as that part of the correction of the aberration affected by the former method leaves no aberrations of the higher order, which latter is always the case for that part of the aberration which is corrected by a corresponding form of the flint glass lenses.

B1. The general chromatic aberration becomes apparent, if the object, when slowly moved out of the focus appears with blue or orange colored borders, these borders appearing blue when the distance between the objective and the object is *increased*, orange when *lessened*. If, however, these colors appear in reversed order, that is, if the edges are bordered with orange when the distance between the objective and the object is increased, and blue when it is decreased, then the objective is over-corrected. It is properly corrected when, on moving the object away from the objective faint yellow-green, and on approaching faint violet borders appear (secondary spectrum.)

B2. The chromatic aberration of the higher order is recognizable in this way, that with oblique illumination, that side of the object-image which is turned away from the illuminating mirror, shows a lively orange border, while the other side shows a lively blue border. It is not present if, in place of the first named color there appears a faint yellow-green, in place of the last one a faint violet. It is the less, the more the general chromatic aberration has been corrected by thickening the front lens (or by immersion) instead of by a corresponding form of the flint-glass lenses. In fact, the thicker the front lens of an objective the less the negative action of the flint-lens is necessary to remove the color phenomena. That part of the correction of the chromatic aberrations which is effected by the thickening of the front lens is perfect, and leaves no aberrations of the higher order, and no secondary spectrum.

B3. The distortion of color is a consequence of faulty chromatic symmetry of the objective. It can be recognized by this, that with the correct achromatism of the image in the middle of the field, the image on the edge thereof has on the side turned towards the centre a blue, on the other side an orange-colored border; or it may be in reversed order, an orange-colored border on the side towards the centre, and a blue one on the other side. In the first case the chromatic aberration of the objective is preponderatingly corrected by that half of it which lies above the plane of the equivalent lens of the objective; in the latter case the reverse. If, however, these corrections are accurately distributed in the objective, that is, if each one of the two halves of the objective have an equal share of it, or, in other words, if the objective is chromatically symmetric, then the image on the edge of the field will appear just as colorless as the one situated in the middle. If, then, the spherical distortion (A2) is also removed, the image on the edge of the field will appear quite sharply defined. With powerful objectives of large angles of aperture, the latter cannot be perfectly accomplished, as perfect spheric symmetry is imposible in such a case.

C. The angle of aperture must be ascertained by actual measurement. The enlargement of the angle of aperture of any

one objective may be effected by merely enlarging the diameters of the several lenses composing it, while retaining their curvatures. But with this enlargement all aberrations and their disturbing effects increase in a triplicate ratio to the aperture. The larger angle of aperture is consequently of value only in case the aberrations have been corrected in corresponding ratio, and in a higher degree, so that the disturbing influences thereof are not greater than in an objective with a smaller angle of aperture. But as the aberrations in the objective of smaller aperture have been corrected, as far as this can be done by means of form of the flint-glass lenses, the increased aberration of the enlarged aperture can only be decreased by correcting a part of the aberrations in the *pure* way, by thickening the front lens, instead of correspondingly forming the flint-glass lenses, and as upon the former depends the working distance, D, the latter is conditioned by the angle of aperture, and higher correction of the aberrations required in consequence.

Perfect centering, E, shows itself in this way, that the growing indistinctness of the outlines, and the indistinct expansion of the image when the latter is moved out of the focus takes place altogether equally over the whole surface, and appears quite concentric. If, under these circumstances, phenomena of a sidewards displacement appear, the centering of the lenses is imperfect.

The power of an objective to transmit light (F) is not dependent merely on the size of the angle of aperture, but also on the number of refracting surfaces, and the clearness and polish of the lenses. The fewer surfaces the greater the power of transmitting light.

Whether the lenses are clear and well polished, can easily be ascertained by looking with a good magnifier (the focus of which is a little longer than the distance of the rear lens from the rear end of the setting) through the rear end of the objective, turning the front end towards the light. Thus all the surfaces can be brought easily into the focus of the magnifier in succession, and the smallest particle of dust resting on them can be seen.

The resolving power of an objective does not depend exclusively on the size of its angle of aperture, but just as much on the degree of correction of the aberrations, especially those of the higher order.

The enlargement of the angle of aperture would entirely fail to accomplish its aim, that is, to increase the resolving power, if the degree of correction of the aberrations were not heightened at the same time, and in the same proportion. The best means to attain this latter purpose consists, however, in the thickening of the front lens, and consequent shortening of the working distance, as I have clearly demonstrated in my theoretical description of my new condenser (this journal, Vol. II, p. 46).

The short working distance of an objective of the highest resolving power is by no means a condition of the size of its angle of aperture, as is often believed to be the case, for with equal sized angles of aperture a great difference in the working distance is possible. The best correction of the aberrations, essential to attain the highest results, demands short working distance.

It follows from the above that with a dry objective the maximum performance requires the minimum of working distance. The immersion system is nothing more than a substitute for the extreme thickness of the front lens, formed by a corresponding stratum of water, to gain with the highest possible performance a tolerable working distance.

In my one-fifth dry objective, the working distance has been fixed at a sufficient length for convenient use, and a corresponding part of its resolving power has been sacrificed for this purpose. The one-sixth, however, is constructed as a dry objective of highest resolving power, with corresponding sacrifice of working distance. I can make any desired variation between these two objectives. But I find it impossible to construct a dry objective having, with equal performance of the one-sixth, a greater

working distance than it has. I am not informed whether other opticians have succeeded in attaining such a result, but my moderate theoretical knowledge leads me to regard this as impossible, and attentive as I have always been to discover whether others have succeeded in a higher degree than myself to unite these two qualities, I have, by observing the performances of others, only found a confirmation of my own theoretical views in this respect. I should feel very grateful to be shown a dry objective, which, with equal performance and equal magnifying power, exceeds my one-sixth in working distance.

Angular Aperture and Central Illumination.

IN my reply to Prof. R. Hitchcock, reprinted in the August number of this journal, I endeavored to respond to his courteous request. My positions had been placed fairly before the public for years, and I was, for the nonce, content in maintaining silence, feeling assured that when attention should be thoroughly aroused as to the claims of high-angled glasses, that I would be better understood. I think I can to-day safely assert that my expectations have been realized, and to a greater extent than I had any reason to anticipate.

Prof. Hitchcock has done me the honor of an extended reply in the September number of this journal. It is noticeable that he still preserves the same courteous bearing which characterized his previous paper; indeed he pays me a compliment ("We have his plain statements, and we accept," etc., p. 110). All this, as an index of his good nature, is very acceptable.

Nevertheless, be it remembered that it has been no part of my purpose to obtain acceptance *per se* of my positions. On the contrary it has been my earnest endeavor to excite attention, and to induce my readers to experiment for themselves. Hence the results of my tedious and protracted experience with the duplex lenses were printed in forcible terms (heterodox as they must have seemed to many), allowing no loop-hole for retraction or qualification on my part. Hence it was, too, that I requested Prof. Hitchcock to repeat some of my experiments; Prof. H. is compelled to decline, because he has not the objectives at command. This I sincerely regret.

Premising that my time is fully occupied, and that it will be impossible to reply directly to Prof. Hitchcock's last, and interesting paper, I proceed to offer a few thoughts suggested by the same.

First, what, in common parlance, constitutes a high-angled objective? I think I understand Prof. Hitchcock—perhaps not—let us see. It may be that in arriving at a mutual understanding on this point, we may get, generally, nearer coincidence. Now, most observers associate with the term "high-angled objectives," some great great display of figures. Thus, 175°, 178°, or the "impossible" 180°. Others might go still further, turning the 180° corner, and thus revel in the balsam angles, say, up to 100° or higher. Such are not exactly my own notions.

I regard as high-angled, all objectives from a 4-inch to a 1-75th, having respectively the highest possible attainable aperture. If this definition be accepted, then it occurs that what was known as a high-angled 1-10th of 180° ten years ago, would now be classed as a medium-angled glass, and further, that an inch objective of 45° would take rank as a high-angled glass, and to the latter class of objectives do I refer as giving me the best results for any and all work, selecting from this class of objectives the one best adapted for the work in hand. Let me illustrate by selecting a case that I almost daily have in practice—to wit:

Suppose, for instance, I am making preparations, say, of malignant growths (notice that this is not a diatom), it would doubtless be desirable first to make a preliminary examination. I should, from the high-angled class of objectives, select the above named inch of 45°. Why?

First. Because it has large working distance, which is not disturbed by high eye-

piecing. I am also enabled to bring the mirror above the stage, and thus easily condense light on the object; and further, the working distance is so large that liftle changes in the same do not disturb the object to such an objectionable extent as would occur had a higher power been selected.

Second. Because this inch will show me structure up to 30,000 lines to the inch. It will not only bear the 1-4th solid eye-piece, but will give with it added force of definition, with increased amplification.

Third (Result of first and second). Because of all glasses I have ever handled, I can get the most work (I have in hand) out of it. For instance, its large reach, due to its working distance (the so-called penetration), enables me to focus through the different planes of the object, while the entire specimen remains fairly in view. I am further enabled to search through my mount, with the least danger of allowing important structural elements to escape my attention—an important item.

Now, should such preliminary examination suggest the presence of structure calling for an objective capable of recognizing lines 100,000 to the inch; the inch of 45° would be removed, and a 1-6th, having the widest aperture known, and working distance of one fiftieth of an inch, substituted. With this superior defining glass I have still working distance enough to illuminate my object by condensing sunlight on top of the cover, thus securing exquisite definition under amplifications of more than 5,000 diameters. Here, again, with said 1-6th, I get better work than I can with any other style of glass.

Again, should it be desirable to cross-question my specimen still closer, it would become necessary to remove the 1-6th and substitute a bran-new 1-10th not yet a month old, the masterpiece of a young American optician. This 1-10th has also the widest aperture known, combining still more exquisite definition with sufficient working distance to allow the use of sunlight as above named, while its glorious performances by central light eclipse, yea, distance the work of any low-angled glass extant, this beyond the ghost of a doubt. (And right here I beg Prof. Hitchcock to be lenient, and to allow me a little margin; it's hard to keep cool over the central-light performance of this new 1-10th.) But, with the employment of this 1-10th, we get into tolerably close quarters, the "difficulty of working" is enhanced. It won't do to put the screw-collar somewhere between "zero" and somewhere else. And then, too, there has got to be a good deal of that "handling" attended to that Prof. H. says will do so well to talk about before an audience. Prof. Hitchcock here applies the great American question, and asks if all this bother will pay. I reply, "Yea, verily!"

I shall be very grateful if Prof. Hitchcock will point me to glasses that will take the place of those above mentioned. It has so happened that those who have thus far undertaken this task (and some have traveled hundreds of miles to accomplish it) have resigned their previous ideas in my favor. In fact, I have scores of friends made in just this kind of a way, and I hope to add Prof. H. to the list.

Having thus given my ideas as to the nature and performance of high-angled objectives, I beg to add that I see no necessity for backing down from my original statements, although challenged by Prof. H. On the contrary, the advent of the new 1-10th serves to clinch the nail that I had previously well driven home with the duplex. And I now place again on record my deep-seated convictions that the use of such lenses as I have described will be of the greatest use in histological observations.

Prof. Hitchcock's remarkable statement that "much of the very best class of work is being done with second-class lenses," is, I fear, a slip of the pen. I, for one, certainly cannot agree with him, even if so be, that I am found in a "minority."

Prof. Hitchcock has, I fear, found out my weak side, and punches me sorely with Helmholtz's formulas. He has got things nicely tabulated, to show at a glance just what can be done and what can't. Now, I

own up that of all the annoying things on this mundane sphere (to me), these confounded tables take the lead. Years after others, as well as myself, saw the Nineteenth Nobert band as clearly as we saw anything, came the tables to prove that the thing was an utter impossibility! It was noticeable too that, year after year, the tables got changed, in fact, improved, to approximate more closely to the facts. *Verb. sap.*

Again, Mr. Hitchcock informs us that "to attain the best possible results from an objective, the angle of the illuminating pencil must be the same as the angular aperture of the objective." This, he says, is the "chosen ground" for any lens.

To put it mildly, this is another most remarkable statement. I dismiss it with the remark that my own experience teaches me that such manipulation would defeat ninety low angled glasses out of the hundred. He also, referring to my exhibition of the Nineteenth Nobert band, with the vertical illuminator, suggests the employment of a diaphragm to the back lens, predicting that the resolution would "doubtless be greatly improved." I had already tried the experiment (and scores of others); the result was *nil.*

Prof. Hitchcock further says that "Prof. Smith has not taught us anything new about objectives." Well, doubtless a little setting back of this kind will be of benefit to me, and may prevent the growth of undue conceit. I confess, that I really did entertain the notion that some of my "shows" before the Dunkirk Microscopical Society *were* novel. For instance, the exhibition of the Nobert 19th band as an opaque object; ditto, the showing of 30,000 lines to the inch with an inch objective, and under an amplification of 740 diameters, etc.

It was my intention to pass over one or two points presented by Prof. Hitchcock, but fearing that silence may be misconstrued, a word or two may not be amiss. Prof. Hitchcock does not deny that Dr. Carpenter has *lately* (note that point) given his unqualified endorsement to the superiority of the duplex glasses, but he adds, "so does everybody else." This, too, must be another slip of the pen, for it is all, yea, more than I have claimed, for at the date of my Dunkirk lecture, the claims of the duplex were *not* admitted by everybody. During the past four years I have, myself, received hundreds of letters from as many sceptics.

Prof. Hitchcock states that he was taken "a little by surprise" by my claim that the "very best work of the duplex is seen by central light," and with singular tact allows the little *fact* to remain intact. This is too bad, for right here I expected the thickest of the fight. It was, in fact, "my chosen ground." Prof. H. is too much for me on tactics!

In this connection, I beg the reader to bear in mind that while Prof. H. admitted the superiority of wide angles for the resolution of "diatoms and Nobert's test-plates," he nevertheless held that this did not support my view that high angles are "universally preferable," (see this journal, May, 1877). To meet this point, I stated in my response (this journal, Aug., 1877,) that I had not omitted such tests as are generally considered "chosen ground" for small apertures, *i. e.*; what is generally understood and accepted as dead central illumination; and further, that among other tests I selected *Navicula angulata* illuminated by central light, because such resolution had been publicly declared impossible. In reply Prof. H. kindly admits, and in complimentary terms, all that I had claimed as to central light work, and he frankly adds, "they are just what we would naturally expect *a priori.*" Having made this full admission, Prof. H. seems to repent a little, and reverts to the subject again (page 112), still yielding that the high angles are superior, both with oblique or central illumination, *but for resolutions only*, because, he says, the low angles have the greater penetration. The nature of this, his residual error, is manifestly indicated in the present paper. *Less* than "two hours over the tube" would convince Prof. Hitchcock that

"the very best performance (penetration, depth of focus, reach, or what not included) is seen by central light. I again invite investigation. The passage from Frey was original with Dr. Carpenter ten years ago. I have no objection to urge.

A word, and let it be with due respect to Dr. Carpenter. His advanced age and failing eyesight, together with his many duties and cares, forbid that he should continue to be the authority he has been in the past. Singularly enough, the doctrines advanced by Dr. Carpenter twelve years ago are still endorsed by many to-day. This operates as a brake to the wheel of progress; surely Dr. C. is not to blame. Mr. Hitchcock asks if Dr. C. has changed his opinion since the fifth edition of his work; in reply, I can say that the latest information I have bearing on this point is this; about eighteen months since a friend of mine was in London attending medical lectures. He sought Dr. Carpenter's advice as to objectives; Dr. C. advised him to go home and purchase the duplex, and my friend did so purchase. Be all this as it may, while I entertain the highest respect and admiration for his medical and scientific attainments—his life of unceasing toil in his profession—I cannot, and for the reasons presented, attach importance to Dr. Carpenter's endorsement of the duplex glasses. In other words, I should prefer the testimony of American experts.

To resume, Mr. Hitchcock further says that "two hours over the tube" has demonstrated something, he don't say exactly what. At any rate he volunteers his thanks, which I joyfully accept. I should have said that "two hours *jointly* over the tube" would demonstrate more than volumes of print. I hope yet to enjoy such a *tete-a-tete* with friend Hitchcock, and promise in advance to delight him with the new wide-angled 1-10th before referred to. The new glass, too, confirms in a truly practical manner the positions I have heretofore taken in print.

In conclusion, I have again to thank Prof. Hitchcock for his good natured review of my previous article, and hope that he will find nothing in this hastily written article objectionable.

J. Edwards Smith.
Homeopathic Hospital College, Cleveland, O., Sept., 1877.

The Brewer's Microscope.

THE souring of ale is due to the action of various organisms of fermentation and putrefaction, the germs of which are almost continuously floating about in the atmosphere. Through the employment of a contaminated yeast for fermentation, and through uncleanness of utensils and bad water supply, these organisms multiply and increase in the suitable medium, and we may, with Pasteur, attribute all the "maladies of beer" to their action. One of the most active of these organisms, and one most commonly found in beer, is the lactic ferment, Penicillium glaucum, and this organism not only has the power of turning milk sour by the formation of lactic acid, but also, if propagated in beer wort, will turn that sour. In fact, when lactic ferment is developed it is often more rapid in its action than alcoholic fermentation, and shorter than the ordinary process; and in cases of the production of lactic ferment in the presence of alcoholic, the predominance of one or other organism, and consequently of its effects, depends on the composition of the medium, and on the neutral state of the liquid. The lactic ferment has the appearance of small globules, or short joints, either isolated or in a mass, forming flakes resembling those of certain amorphous precipitates. If we examine a drop of beer containing this organism, we shall see a long eel-like organism, tossing aside any yeast cells with which it may happen to come into contact, and wriggling more or less rapidly across the microscopic field. A person who may be familiar with one sample of this organism (which from its motions receives the name of "Vibrio") soon detects numbers of them. It is those and other analogous organisms which, by decomposing the saccharine constituents of

the beer render it sour. But probably we shall find on careful examination shorter organisms, sometimes associated with Vibrios, sometimes alone, and often very active in their motions. These are also the agents of acidity and putrefaction, and are called "Bacteria," but under this common name are grouped organisms exhibiting grave specific differences. Keep them and their germs from beer, or any other organic substance, and they will never turn acid or putrefy. When we consider the manner in which the atmospheric germs are propogated and increase, when in a suitable medium, and what changes are wrought by the vital activity of these minute plants, we cannot but consider that it is a case of infection, caused by dirt and uncleanness, and more often from contaminated water. Now, on what does the well-ascertained power of a water to produce disease depend? What confers on it its destructive and lethal power? The answer is not so clear as we could wish—still it is a fact that waters which have been proved to give rise to disease are those in which the organic or albuminoid matters and their derivatives most abound; and it cannot be questioned but that the power of water to disseminate disease arises in most cases from the fact of that water containing the "materies morbi"—possibly the germs of the disease itself. And in like manner the power of a water to produce disease in beer arises in identically the same manner, from the fact that it contains not only the organisms, which are probably killed on boiling in the copper, but the germs of these injurious ferments, which can withstand prolonged boiling, and which eventually are converted into the active organism. A contaminated water must produce unsound ale, no matter about the time of boiling, because Prof. Tyndall has lately shown that it requires hours of continual ebullition to thoroughly sterilize an organic fluid, and he also found that the mere fact of raising the liquid to the boiling temperature for one minute only, every four or five hours, more effectually sterilized the liquid than continued boiling, because in the former case the germs were killed as fast as they were hatched, if we might so term it, whereas in the latter case only the mature organisms were killed, leaving in the liquid germs of various stages of development, ready to form the full-grown organisms at the proper time. So we see that if we use bad water we produce bad beer, and this is why the Burton ales are made to keep so long, not particularly that they are better brewers, or employ better materials, but that they are more fortunately placed than any other brewers, in that they have a water supply entirely free from organic contamination, and not only that, but the water has in solution various valuable inorganic salts which materially help in the production of a fine-flavored ale. But then we may have the very best and purest water supply, and yet, through neglect of the ferment employed, fail to produce a sound and good ale. If we allow the temperature of fermentation to exceed certain limits, then the atmospheric germs will more actively thrive and propagate in the liquid, while on the other hand, if we take measures to control and check the rise in temperature then we prevent the injurious action of these germs from the atmosphere. When once we allow our yeast to become contaminated, through negligence or otherwise, then we shall continue to go on from bad to worse until at last we are thoroughly out of order, the ale unsound, and probably the brewer is dismissed, but without materially making any improvement in the article unless the yeast is changed and the plant thoroughly overhauled. This will not happen if the brewer has some knowledge of the science of brewing, because if he has a bad supply of water, he will, by boiling and the use of efficient filters, so purify the water as to make it far less injurious than it would otherwise be. He will also be fully aware of the dangers attending high fermentation heats, and uncleanliness in the plant, and he will continually examine his yeast microscopically, to see if it be sound, and fit to produce a healthy and good fermentation.

But then the question is—What constitutes a suitable microscope for a brewer's use? Well, what we require is a first-rate instrument at the lowest price possible with excellence of workmanship; and once for all I would impress upon all intending to purchase a microscope to procure a binocular instrument, if their means will allow; for in spite of a good deal of nonsense which has been written on the subject, there is, in my opinion, no doubt of the advantage in possessing the binocular arrangement. I may also remark that I use for my own work Crouch's stand and objectives, and must say that for excellence of workmanship, combined with lowness in price, his microscopes are not to be surpassed. From practical experience, therefore, I would advise an intending purchaser (being a brewer) to get, if possible, one of Crouch's binocular "Student's" microscopes, price £11 11s., and this amount will cover the cost of all the apparatus necessary to commence with. If the above is too expensive, I should recommend the Educational microscope of the same maker, which will not exceed £6 in cost, and will be really efficient in the examination of yeast. The power necessary to employ for yeast examination should not be lower than Crouch's one-fifth in 100°, and may be much more conveniently one-eighth in 120°. For ordinary work I prefer to use the one-fifth objective and No. 3 eye-piece, with a Webster's condenser; and this will generally prove to be the most useful arrangement unless anything very special has to be made out, when the one-eighth may be substituted for the one-fifth objective. The necessary apparatus for a brewer's use is not very great—all that is really required being the stand with 1-inch and one-fifth inch objectives, eye-pieces, two of No. 1, and one of No. 3, Webster's achromatic condenser, a few glass slides, half-ounce covering glasses, and dipping tubes. If we have sufficient money to spare we may conveniently add polarizing apparatus, neutral tint camera lucida—eye-piece and stage micrometers.

Having purchased our instrument, the next thing is to use it, and the way to proceed is as follows: Screw on the one-fifth objective to the stand, and adjust the collar for thickness of covering glass. I always use covering glasses having exactly the same thickness, so that when I have (as I very often do) to examine from twenty to thirty samples of yeast in an evening, I do not require to waste time in re-adjusting the collar. Fit in the No. 3 eye-piece, shift the prism of the binocular arrangement about a quarter of an inch, and the microscope then becomes a monocular one. Then fit the condenser in the proper position under the stage, and arrange the concave mirror so as to throw plenty of light equally over the field. I always arrange to have plenty of light at commencing, and then by means of the stops in the diaphragm under the condenser, I moderate the full force of the light so as not to have it too powerful, for if we have too white and powerful a light, many of the Bacteria will probably not be seen, although when using so deep an eye-piece as No. 3 it generally requires plenty of light. Of course this is soon learned by practice, but I may remark that as a rule beginners generally err in having too strong a light rather than too little. Well, then, having arranged as described, we next proceed to prepare our yeast-slide. A clean glass slide is taken, and also a perfectly clean covering glass, and then about two drops of clean fresh tap water is placed in the centre of the glass slide. (I advise the use of tap water, because generally with good town supplies there is not so much liability of its containing Bacteria as distilled water. Some distilled water that I have examined, and which had become rather old, was quite full of Vibrios and Bacteria in active life.) We then stir our yeast well, and with the end of a needle take up the slightest speck of it, and add it to the water on the slide, mixing it well at the same time. Then gently place the covering glass on to the yeast water, taking care not to inclose any air-bubbles, and after removing any superfluous moisture from the slide, we next proceed to examine it.

Having carefully focussed the slide by using the fine adjustment, we shall find that our yeast consists of a number of little cells, some round, others slightly ovoid in shape; many of them are separate, while others are joined together and looking like sausages. Now these are what cause the alcoholic fermentation, and are called "Torulæ Cerevisiæ," or the true yeast plant. We should arrange so as not to have too many of the yeast cells in our field at one time, otherwise they may prevent us from distinguishing the false ferments which we wish to detect, and lead us to consider as good, a sample of yeast which is really very much contaminated. From twenty to thirty yeast cells is quite enough for a field. Of course if we cannot see anything else but yeast cells, we may then consider our yeast as very first rate, but it is rare that we find yeast entirely free from false ferments. There are generally two or three other organisms to be seen in a field if we proceed carefully, and if they do not amount to over 5 or 6 per cent of the yeast cells, we may be satisfied. But if the yeast be much contaminated then we shall see organisms of various shapes and of different degrees of activity: these are the Bacteria and Vibrios. Some of these will appear like tiny tubes, usually having a little septum or division in the middle. Occasionally they are bent, and generally they are stationary. Others look like the figure 8, formed by two round circles joined together. In some cases three or four, sometimes more than a dozen, will be joined in a line looking like a rosary. Each different species of organism has its own special action on the beer—the one forming lactic acid, another acetic acid, while others may cause putrefaction, or the formation of ropy beer. The greater the number of false ferments, the more evil their action when added to our beer. To attempt to enumerate the different ferments, their names and appearances, would take more room than could be conveniently spared, but we may always consider that what appears in our microscopic field besides the ovoid Torula cells will have a harmful action. After what I have written it must be plainly perceived that brewing requires scientific teaching as well as practical experience: and in fact we may consider that the day is gone by for a brewer with mere practical experience (which often means rule-of-thumb practice) continually to be able to successfully compete with a scientific man. There is no book published on the chemistry of brewing, and the knowledge can only be attained by undergoing a thorough course of instruction under a brewer's chemist.—*Eng. Mech. and World of Science.*

An Easily-Made Cell.

A CELL which we have found very durable, easily and quickly made, and very neat, is constructed as follows: Having procured some good gold size and pure litharge, grind the latter to a very fine powder. Mix the litharge and gold size to the thickness of cream, and color either black or dark olive by adding lamp-black. With this paint, as it may be called, make as many cells as are wanted, and when made, dust finely powdered litharge over them until they are covered a sixteenth of an inch deep; allow them to stand a few minutes, and then shake off all the loose litharge by means of a few smart taps. The surface of the cell will now be quite rough. Allow it to stand a few hours, and then press it against a plate of glass. If this be done carefully, a smooth, solid ring will be left on the slide. If the edges should not be as smooth as they ought to be, it is easy to trim them off on the turn-table by means of a small chisel. Such cells, after a few weeks, become very hard, and may be finished so as to be very neat. For dry objects they leave nothing to be desired, and as we have had them in use for over five years, we can speak as to their durability.

For objects mounted in liquids it will be necessary to coat them with suitable varnish. Thus, for saline liquids, a coating of gold size renders them perfectly impervious. For glycerine use Bell's cement, or a solution of shellac in alcohol.

THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

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ADVERTISEMENTS—30 cents per line.
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Box 4,875, New York.

Important Notice.

We can no longer supply complete sets of Volume I in sheets, but offer all the numbers except Nos. 1 and 4 for 25 cents, by mail, postpaid. We have on hand a few complete copies of Volume I, handsomely bound in cloth, with gilt title, price $1.25. Volume I, bound, and the numbers of Volume II (as issued) we will furnish for $1.50 as long as our supply of Volume I lasts.

The following gentlemen have kindly consented to act as agent for this Journal, and are authorized to receive subscriptions and advertisements:

MR. CHARLES STODDER, 131 Devonshire Street, Boston.
S. E. CASSINO, Naturalists' Agency, Salem, Mass.
J. G. LANGGUTH, Optician, 88 State Street, Chicago, Ill.
JAMES W. QUEEN & Co., 924 Chestnut St., Philadelphia.
W. H. WALMSLEY, 921 Chestnut Street, Philadelphia.

Microscopical Societies.

THE letter of Prof. Hitchcock, in our present issue, states some rather well known but unpalatable truths concerning the Microscopical Societies of the country. We have a few which are doing good work—making careful investigations of new subjects as they arise, and publishing very able papers. Notably we may refer to the San Francisco society, and also to that at Dunkirk. The annual address of President Ashburner, though too long to find room in our columns, was a very valuable review of the year's history of microscopy; and the annual address of President Blackham, of the Dunkirk society, also contained much valuable matter. Our New York society seems to be in a quiescent state at present, but not being a member thereof, we cannot speak for it. The Biological section of the New York Academy of Sciences, of which we have the honor to be a member, proposed to form a microscopical sub-section. This would be an eminently appropriate connection for such a society, but the wants of the city of New York cannot be fully supplied by a society of this kind. In addition to the obvious objection that very many lovers of the microscope cannot join the Academy, it is also true that the work carried on there will be above the reach of beginners and amateurs. What we want is an amateur's society. That there is a large number of persons in New York who are anxious to see such a society formed, we have evidence in the many letters we have received during the past year. Unfortunately, however, all of these letters were anonymous, and, of course, were thrown at once in the waste basket. We hope, however, that those who feel an interest in the subject will send their address to Prof. Hitchcock, or to this office, at as early a day as possible, when measures will be taken to call a meeting.

Remitting Small Sums.

SINCE the Treasury officials at Washington have decided to call in the old convenient "postal currency," which everyhas found so handy to mail in 25 and 50 cent pieces of fractional scrip, to editors, booksellers and others, the substitute for this universal accommodation (silver) has been found too heavy for mailing.

Thousands of people in the country cannot obtain fractional currency now to forward for subscriptions, cheap books, and the numerous small articles they would be glad to obtain. To those who find it difficult to procure fractional currency, we would say that we are at all times ready to accept *postage stamps* at their full value, provided the denominations are not too large. Twenty-four cent stamps are useless to us. Ones, twos, and threes we prefer, but we are always ready to accept fives and tens.

CORRECTION.—In our February issue, page 22 of this volume, a valuable note on the uses of mica in the laboratory is credited to W. L. Lane. This is a misprint for W. J. Land, the well-known chemist, of Atlanta, Ga.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Microscopical Societies.

Ed. Am. Jour. Microscopy—It seems as though the almost universal history of microscopical societies would lead us to believe that it is quite impossible for such organizations to exist for any great length of time.

At first the interest is very great, and the meetings are well conducted, and made attractive to members and others. Before long the interest dies away—it is not the business of any individual member to endeavor to revive it, at least so it appears—and the consequence is that the society either dies, or falls into the hands of those who do not know how to conduct it well, and only a few attend its meetings, and these mostly old fogies.

No one, I think, will insist that this need be so, and no energetic man would let such a state of things come about in a society where he had an influential position. There are many reasons for such failures. Without doubt one lies in the fact that in the majority of cases the man who has the finest instrument, who puts up the prettiest slides, and makes himself most popular by his good nature, and particularly his money, which enables him to do all this, will be placed in the most important position. This is poor policy. If we want good, energetic, thorough, practical microscopists, we must not look for them among the rich. Now and then they are found there, but it is not the rule. No argument is necessary to prove that the head of a scientific society should be a man who is a thorough student. Take our average president in the numerous societies throughout the country, and how many of them are competent to write a really good address on the condition of this science at the present day? And yet, unless the officers are able men, can we expect much from the society as a whole? We want reform in this respect. We want to look out the best men in the community, and give them the place of honor, even if their microscopes are so worn and rusty that they refuse to exhibit them beside the rest. Merit should govern our choice here, not popularity. The latter lives its little day, and is liable to change at any time. Merit alone will endure, and give solidity to what we build. Then the scope of the society should not be limited to one or several branches of microscopy. If medical men want a society of their own, they are welcome to have it, but let it be distinctly understood that in a society such as most of us want, the utmost freedom should be given to microscopical discussions on every subject.

There are men who are so confined to their special studies that they consider time wasted at such meetings. We may feel thankful that we are not like these. The true student of science, even though he be a specialist in his work, takes a very cosmopolitan view of the whole. He sees that no one science is complete, no one exists independent of the others, and while his interest centres in one, he is not oblivious to what others are doing. For this reason, even the specialist is glad to avail himself of the opportunity offered by membership in a good society for hearing about and seeing the work in other branches.

But we need not try to prove that such societies are of great utility, or can be made so; the fact is patent enough. What we do need is a reform in the way above mentioned, and in other ways. We want less show and more work, which necessitates a proper man who is able and willing to direct this work in the proper channels. In this city of New York such a society can be organized, and in a single season more solid knowledge could be imparted to almost any one of us who took interest in it, by two or three working microscopists, than would come from a year's study at home and in books. This is what we want.

I urge the foundation of a new society in the city of New York. In this country there is not a single representative society, such as we should have. It is time we had one here, and the sooner it is under way the better. The few reports I hear of the society already existing here are very discouraging to any one who would attempt to revive it. Probably it is already practically dead (although there may be life enough in it yet to give me a return hit for saying this.) However, the old society certainly does not meet the demand which it is designed to create in such a one as the writer has in view, if once put under way. Here is a city of a million inhabitants,

without a microscopical society to which it can point with assurance or pride. This we want, and steps should be taken at once to secure such a society here as will be superior to all others, and be a sort of headquarters for information connected with microscopy.

The writer feels great diffidence about taking any action in this matter personally, and would be glad to leave it to others better known, and more familiar with what can and should be done.

Will not some one come forward at once, and offer a helping hand, so that a beginning may be made this winter? The writer has merely endeavored, by this letter, to draw attention to the subject, and now hopes to have it taken up and put in form by some competent microscopists, and his own humble efforts will be put forth for their assistance with the greatest pleasure.

R. HITCHCOCK.

8 *Beekman Place, New York.*

Microscopy in the American Association.

Ed. Am. Jour. Microscopy—You are doubtless aware that considerable effort was made to have the department of Microscopy well represented at the Nashville meeting of the American Association for the Advancement of Science. Notwithstanding these praiseworthy efforts, there was a notable absence of those especially interested in that branch of science—a circumstance not to be wholly ascribed to indifference, I am sure, but to various other causes, not the least of which was the disinclination of Northern and Eastern members to come South at this season of the year.

But the few microscopists, however, who were in attendance manifested considerable interest, and did, perhaps, their share of scientific work; and more than their share, for the entertainment of the public, as will be seen below.

The papers read before the sub-section were as follows: "A New Periscopic Eye-piece," Ernst Gundlach; "On Accessories Adapted to Lithological Investigations," Alexis A. Julien; "On Objectives as Illuminators," George W. Morehouse; "On the Use of Ordinary Low Power Objectives for Photography," C. Leo Mees; "On the Cellular Structure of Dentine," R. H. Ward; "On a Modification of Wenham's Reflex Illuminator," R. H. Ward; "On the Relative Values of the Powers of Objectives and Eye-pieces," T. O. Summers, Jr.

One of the most interesting of these (to me) was that of Mr. Julien, in which he described the many important changes necessary in most, or all, stands, to fit them for use in micro-lithology. Dr. Ward's paper, "On a Modification of Wenham's Reflex Illuminator," (invented by Mr. Tolles,) was also of more than common interest. I hope both these gentlemen will present their papers to the public in a form more accessible than the reports of the Association.

On Monday evening, Sept. 3d, a soiree was given which attracted a much larger audience than any session during the meeting. The Hall of Representatives was packed to overflowing, gallery included. Eighteen or twenty microscopes (some of which were kindly loaned by the Bausch & Lomb Optical Company) were arranged on suitable tables, and provided with objects, and by the courtesy of Prof. Chase, the Fish University lantern was secured for a series of projections. The crowd was so great that the latter had to be made to do service for the greater portion of the entertainment, Dr. Ward acting as lecturer.

The business of the Sub-section was closed by the election of Dr. Geo. S. Blackie, of this city, as chairman for the next meeting.

J. H. S.

Nashville, Sept. 14, 1877.

Bermuda Earth.

Ed. Am. Jour. Microscopy—Desiring to avail myself of the benefits of your "exchange column," I thought, while sending the inclosed list of objects for exchange, I would ask for information on a certain point, either from yourself or from the readers of the *Journal*. Ever since I possessed "Carpenter on the Microscope," I have been desirous to obtain some of the Bermuda earth, which he alludes to several times as containing beautiful varieties of diatoms. Last winter, being compelled to seek a warmer climate for my health, I sought "the remote Bermudas," taking along my microscope to examine this earth myself. Judge of my disappointment when I could find no one who knew anything of it, nor could I find it. Nor was I the only disappointed one, for his Excellency, Gov. Lefroy, who has been Governor there six years, told me he had not been able to find any such deposit, although he had caused examinations to be made in places where such a thing might be probable, and had watched the results of excavations for harbor and fortification purposes, some of which

reached to a depth of 42 feet. His Excellency is quite an enthusiastic amateur microscopist, and would not let such a deposit escape his observation.

It is certain recent diatoms are not abundant, for I discovered only one variety in any abundance, *Licmophora flabellata*, and a few *Naviculæ*.

It is a question with me whether it is reasonable to expect an abundance of these siliceous organisms where everything except the sea water is of limestone. I found only one variety of siliceous sponge, and that not frequent.

And it seems to me the geological formation of these islands is against there being such a deposit, for they appear to be of the most recent formation known; and the surface evidently is much less than when discovered in 1515. A description then given says: "The island was 36 miles in length, 48 in breadth, and about 90 in circuit." Now it is a narrow strip of land 23 miles long, not more than three wide, and divided into numerous islands. The evidences of submergence are abundant, such as ship's anchors dragging up roots of trees, evidently from original positions, caves with points of stalactites under water, etc.

It was the subject of conversation with Gov. Lefroy and myself, that possibly Bermuda Hundreds, Va., might be meant, for it once belonged to the Bermuda Colony, hence its name, and is near the great Richmond deposit, but Mr. C. L. Peticolas, of Richmond, informs me he "has searched the country for miles near Bermuda Hundreds and City Point without seeing anything of the infusorial."

This I know is not a subject of vital importance, nor of much interest to any one, except myself perhaps; but I am very curious to know whether it is I or Prof. Carpenter who is mistaken. And if *he* is, where is the deposit from whence he obtained his specimens?

However deficient these islands may be in siliceous deposits or organisms, they are rich in nearly every other form of marine microscopical life. F. M. HAMLIN.

Auburn, N. Y., Sept. 26, 1877.

[It is now, we believe, generally regarded as settled that the famous Bermuda earth, which was first brought into notice by the late Prof. Bailey, was obtained from the Bermuda Hundreds in Virginia. If we remember rightly, Prof. Christopher Johnston, of Baltimore, investigated this subject carefully, and came to the conclusion that the "Bermuda" mentioned was the Bermuda Hundreds.—ED.]

Mounting Diatoms in situ.

Ed. Am. Jour. Microscopy—It is often desirable to mount diatoms *in situ*, as they grow attached to algæ or other aquatic plants, either to illustrate their mode of growth, or to obtain them when in too small quantity for any of the processes of separating or cleaning.

I have never found any method of mounting satisfactory until I tried the following, which with all the algæ that I have tested, gives satisfactory results.

The algæ are thoroughly dried, as usually stuck on paper. It is presupposed that all extraneous dirt has been removed. I have provided a slide with a circle of ink, marking the centre on the reverse side, after the plan of my friend, Prof. C. Johnston, cover glass, a bottle of Canada balsam solution in chloroform, a bottle of chloroform and a watch-glass, all ready, as the operation must be carried through quickly. I select a bit of the sea-weed, just large enough for the mount; put a drop or more of chloroform in the watch-glass, and immerse the bit. The chloroform seems to be as efficient as water in restoring the dried alga to its natural shape. As the chloroform evaporates rapidly, it is well to add more drops to the watch-glass, until the alga is well permeated by the fluid and appears natural; it is then transferred to the slide with a drop or two of chloroform, arranged for exhibition, and then the balsam dropped on immediately before the fluid has evaporated, and then the cover may be applied.

Prepared in this manner, the balsam follows the chloroform, and penetrates the cells of the sea-weed making them translucent, and showing the details of their structure admirably, while the diatoms are displayed conspicuously in their natural connection. The balsam must be hardened slowly, as it will not do to apply heat of a temperature that will shrivel the alga. Of course every algologist knows that in this mode but seldom can the specific marks of a diatom be made out; but the not less important facts, of the mode of growth, can be shown, as they cannot be with cleaned diatoms.

I have now before me a slide holding a Ptilota from the Pacific, which displays finely several species of diatoms that I had seen no trace of until this method was tried. I can heartily recommend it to those who have collections of algæ. CHARLES STODDER.

N. B.—Instead of putting the specimen in a drop of chloroform in a watch-glass, where it

evaporates in a few minutes, when it is convenient it may be better to put several specimens in a very small bottle of the menstruum, and take them out as wanted, transferring direct to the slide, or to the watch-glass, as preferred. In this way they may be well saturated with chloroform. The next important matter is to add the balsam before the chloroform has all evaporated. C. S.

Boston, Sept. 19th, 1877.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

Boston Amateur Scientific Society.—The regular meeting of the above society was held on Thursday evening, Sept. 13, the president, Geo. H. Elson, in the chair, and there was a large attendance of members and visitors. Among a large number of additions to the library announced by the Secretary, the society thankfully acknowledges the regular receipt of the AMERICAN JOURNAL OF MICROSCOPY, a valuable journal for amateurs. The principal event of the evening was the interesting and instructive talk on diatoms given by Charles Stodder, Esq., an honorary member of the Boston Amateur Scientific Society, and the manner in which he handled the subject showed his perfect familiarity with this fascinating branch of microscopical investigation. He not only described fully what a diatom is, but exhibited a large number of beautiful specimens, with the aid of two of Tolles' fine instruments, including slides of living diatoms from Hayward street, Boston, containing Orthosira spinosa, and species of Himantidium, Fragillaria, and others, also slides of prepared diatoms.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. EXCHANGES only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Slides of rare chemicals for the polariscope. Send for list. Send list of exchanges to G. E. Bailey, Lincoln, Neb.

Plumule scales of small cabbage butterfly (Pieris Rapæ), mounted, for good slides. Edw. Pennock, 805 Franklin street, Philadelphia.

For exchange, transparent injections, equal to finest English slides of Thymus and Thyroid glands, stomach, bladder, kidney, mesentary, intestine and tongue of cat. J. T. Joslin, Newburgh, N. Y.

Slides of various kinds of fertile fern fronds, Indian corn, deutzia, citra odora and other leaves, decolorized and stained, exchanged for other good microscopic objects. C. Blasdale, M. D., Jericho, Queens County, N. Y.

Wanted, specimens of various species of sponge, a few in their natural state. Will pay cash for same. R. A., 62 North Third street, Troy, N. Y.

Polyzoa with "bird's heads," foraminifera, polycystina, holothurian plates, synapta anchors, clurodata wheels and young; spicules of sponges and gorgonia, etc., in exchange for foraminifera, pathological, anatomical and vegetable preparations. F. M. Hamlin, M. D., Auburn, N. Y.

One copy "Downing's Landscape Gardening," as good as new, in exchange for slides of well-mounted botanical specimens. Fungi, sea weeds, or sections of woods preferred. James N. Bishop, Plainville, Hartford County, Conn.

Diatomaceous earth from various deposits on the Pacific coast (Santa Monica, Lower California, San Pedro, San Gregorio, Monterey, Petaluma, Santa Rosa, Ione Valley, Ventura County, Virginia City,) and other localities, in exchange for well-mounted slides of the same, or for fossils and minerals, or for mounted objects having a bearing on Geology. Address California State Geological Society, San Francisco, Cal.

Microscope wanted in exchange for a very excellent gold watch which cost $150. Address E. W., Box 4,875, New York P. O.

Scales and skin of Anguilla vulgaris in exchange for other objects. Address H. B. Hargreaves, Garnerville, Rockland County, N. Y.

Living Chara, in which the circulation can be viewed, in exchange for any interesting or good mounted object. Address William Readio, Garnerville, Rockland County, N. Y.

Stained petal of Anemone patens and other vegetable stainings, for other mounted objects. Address F. H., Drawer 35, Cherokee, Iowa.

Wanted, a section cutter, in exchange for Raspail's simple microscope, rack adjustment, etc., etc. John Nicol, Worthington, Nobles County, Minn.

Wanted, foraminifera, polycystina and zoophites in exchange for histological preparations, crystals of herapathite and other crystals, various starches, stained sections of old cypress stump from Centennial, and other slides of interest. R. Hitchcock, 8 Beekman Place, New York.

Slides of cuticle of larva of Macrosila Carolina, showing crystals, in exchange for other objects. E. A. Burdick, Pension Office, Washington, D. C.

Diatoms from Coldwater, Mich., in exchange for other well-mounted objects. Address F. H. Root, Coldwater, Mich.

Palates of mollusca, a great variety, mounted or unmounted, in exchange for mounted slides of interesting objects or good material. C. M. Vorce, 164 Lake street, Cleveland, Ohio.

Case of algæ, and live fresh water animalculæ, for any well-mounted specimen. Send slides to A. Hobart, Box 581, Penn Yan, Yates County, N. Y.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., and Aulacodiscus Kittoni (transparent), for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Wanted, in exchange for diatoms from northern Wisconsin and Michigan, any well-mounted objects; marine diatoms preferred. W. H. Titus, M. D., Shawano, Wis.

Wanted, a small piece of "Monterey stone," or a small quantity of the Diatomaceous fossil deposit from any part of the Pacific coast. State what is wanted in return. F. F. Stanley, 40 Pearl street, Boston.

Bermuda shell sand, composed entirely of foraminiferal and other shells, with coralines and sponge spicules. Very interesting for low powers and opaque specimens. C. C. Merriman, Rochester, N. Y.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

"Rough" material, or mounted slides of Lake Superior Diatoms, for other microscopic objects. Dr. T. U. Flanner, Springfield, Mo.

Publisher's Department.

Fair of the American Institute.—The Fair has opened this year with a large collection of interesting manufactures and products, and as usual several of the processes and machines are exhibited in actual operation. We have always strongly advocated the claims of the American Institute Fairs to a high place as an educational agent. There is certainly no other place within reach where young people can obtain so much valuable practical information in so short a time. As a means of introducing new inventions which possess any value at all, it is without a rival.

Centering Nose-Piece.—Every one that has worked with a rotating stage knows how difficult it is to keep the centre of rotation in the optic axis of the instrument. Where great accuracy has been required in this respect, the stage has been provided with centering adjustments, whereby the rotating part may be readily moved as desired. But these centering adjustments are somewhat expensive, and cannot be easily applied to microscopes that are not provided with them in the first instance. A very good substitute, however, is the new centering nose-piece. This screws on to the microscope at the lower end of the body, and is provided with an internal Society screw to receive the objective. The part which carries this screw is movable in any direction, in a plane at right angles to the axis of the body, and consequently the axis of the objective may be brought accurately over the centre of rotation of the stage. The whole thing is light, easily applied and quite efficient. The cost is only $6.00.

A New Form of Turn-Table.—We have received from Mr. Zentmayer, of Philadelphia, a turn-table which is marvelously simple, compact and convenient. Instead of being mounted on a stand, which renders the whole instrument bulky, this table has attached to it a screw clamp, by means of which it may be attached to any table, and consequently it is very portable. But the most ingenious part of the device is the method of self-centering. This is effected by means of two pins let into the table at equal distances on each side of the centre. By simply turning the slide round, its edges are made to press against the sides of the pins, and consequently the slide must be truly centered as regards its width. It may be centered lengthwise either by means of a pin or a mark.

This table gives precisely the same results as those obtained by the use of the Matthews' table, but by means which are much more simple and less costly. In the table that we have, as in all the products of Mr. Zentmayer's *atelier*, the workmanship is exquisite, and the table turns with great smoothness and perfectly true.

Cleaning Thin Covers.—The difficulty of cleaning very thin covers without breaking them, is very great. It is almost impossible to handle them in the fingers, and when they are rubbed between two plain blocks covered with chamois leather, it is difficult to clean more than one side, since one particular side will always stick to the leather next it, and the other side only will be subjected to friction. A Mr. Jones has devised a very simple method of overcoming this difficulty. Into a brass cylinder he fits a heavy plug, the lower end of which is covered with chamois leather. When a thin cover is placed on a piece of stretched chamois, and the tube placed over it, the under side only of the cover is subjected to friction, and consequently a few rubs suffice to clean it thoroughly. The tube is then raised, the cover turned over by means of a delicate pair of forceps, and the other side is cleaned. The pressure of the plug is so even that there is no risk of fracture, even with the most delicate covers. The cost is trifling, only $1.50.

The Steinau Jewelry Co.'s Imperial Casket appears in this issue of our paper. Having one of these caskets in our possession, we must say, that, while the articles are not solid gold, they are beautiful imitations, and very pretty, each particular piece in the casket being equally as good as are sold in the city jewelry stores. We understand it to be the object of this company to almost give away these goods in order to get their elegant illustrated catalogue of better wares before the public.—*Editors Home and Farm, Louisville, Ky., Oct.* 1, 1877.

The Rural New-Yorker.—This old and well-known journal has recently changed hands, and the new management has taken wise and liberal measures to make success sure. In the last issue the editor announces a series of contributions from some twenty of the most prominent men connected with agriculture in the United States. These papers alone will be worth the cost of subscription for an entire year.

THE AMERICAN

Journal of Microscopy,

AND

POPULAR SCIENCE.

VOL II. NEW YORK, NOVEMBER, 1877. No. 11.

Entomological Preparations.*

BY A. L. DONNADIEU.

THE proper preparation of objects is the foundation of all observations in which the microscope plays a principal part; in micrography, before an object can be conveniently studied, it must be brought into a condition suitable for examination.

Some bodies may be examined at once, and do not need any preparation. A drop of water, or of glycerine, is often sufficient to bring them to this condition. Others require manipulations which are more or less tedious, more or less complicated; and amongst the latter there are none which seem to offer greater difficulties than do insects. I say "which seem," for their direct examination is very difficult, yet very little labor is required to bring them into the best condition. The exterior parts or integuments of a notonecta, a nepa, a spider, a caterpillar, etc., can be studied only with difficulty. By proper preparation, all the parts of the body, and the entire body itself, may be brought into such a condition that nothing will be more easy to study, and the insect, whatever be its size, may be dissected with ease.

To attain these points I employ certain means, which have always given me very satisfactory results, and I believe I can recommend these means to those who desire to form interesting collections, and also impart a knowledge of them.

Insects intended for study ought to be rapidly immersed, as soon as captured, in flasks filled with water, to which acetic acid has been added in the proportion of 5 of acid to 100 of water. It is well, when going on an excursion, to provide oneself with several flasks or bottles with wide mouths. Some are intended for large insects, others for the smaller kinds, others again for larvæ, and in some spiders may be placed; in a word, group together, as much as possible, those specimens which, by their form and structure, are most closely related. The flasks or bottles should be filled as full as possible, so as to avoid shaking.

The bottles may be replaced by stoneware pots, closed by means of a cover fastened with a bayonet catch. These pots may be had of all sizes; they close hermetically, and, from their solidity, it is well to use them.

Alcohol and glycerine are to be avoided, the first, contracting the organs, deforms them and renders it difficult to display

*Translated from the *Journal de Micrographie.*

them, the second renders the small kinds very difficult to manage, and during the process of preparation causes rents which are almost always irreparable. The acetic acid produces effects which are quite opposite; it expands all the appendicular organs, such as the parts of the mouth, the members, the antennæ, etc., and if not too concentrated, the body which is immersed in it, when it is that of an insect with soft integuments, lengthens, expands and is brought into the most favorable condition for preparation. I shall not insist upon the advantages presented by acetic acid of various degrees of concentration; these advantages are well known, and everybody is familiar with the fact that annelides and caterpillars intended for dissection, are killed by being plunged in water to which acetic acid has been added.

Meantime, in some cases I have obtained very good results with alcohol mixed with acetic acid and water in variable proportions, the most constant being

Alcohol	50
Acetic acid	25
Water	25

On returning from an excursion, the first thing to be done is to sort over and wash what has been collected. For this purpose we use a series of small porcelain dishes, of which the best type is the soap-dish, which may be procured everywhere at a cheap rate. With each dish should be placed a small capsule. Each bottle is emptied into a large plate or dish, and either by means of forceps or needles with handles, each specimen is seized and thrown into a small dish, in which pure water has been previously placed. Care is taken to sort out the different species, and in this way a preliminary classification is effected. But it is very difficult, especially when the gathering consists of small species, to keep out of the dish the *detritus*, from which it is quite important that the specimens should be freed. It is for this that the capsule is used, if necessary, the proper amount of water being placed in it, or the objects being very delicately transferred to it by means of needles or a pair of forceps. The use of forceps is to be avoided as much as possible, lest the integuments should be torn or the organs deformed.

These preliminary operations being ended, it is well to consider the special process which the preparation will require, and which I will now indicate. I shall divide the manipulations into two parts; the first, relating to what may properly be called the preparation of the object, I shall call simply *preparation;* the second, relating to the preservation of the preparation intended to be kept I shall call *mounting* (*mise en collection.*)

To be continued.

Remarks on Mounting.

THERE is probably no branch of scientific study which offers to persons of leisure and culture so much satisfaction, with the same expenditure of time, labor and money, as does the study of microscopy. For this reason, many of those who own microscopes have them merely as a means of recreation and amusement, and for this class great numbers of beautiful and costly slides are prepared and sold.

But there is another class, who, without the means to purchase all these fine preparations, find that there is a still deeper source of instruction and pleasure in not merely looking at good preparations, but in studying the structure, life-history and meaning of the organisms thrown in their way by nature. The examination of objects under the microscope led to methods of permanently preserving them, and at the present day the methods and media for mounting objects are almost innumerable. While it is not our province to describe minutely the process of mounting, we would say that much judgment should be exercised by those who are engaged in mounting objects as to the methods they employ. Since, as we have seen, there are two classes of observers, we would naturally expect that, as their aims are different, their methods of mounting would also vary for a given object. The one would strive to pre-

pare it in such a manner as to exhibit all its beauty as a whole, while the other, having more regard to its intimate structure, would endeavor to bring this into prominence, even at a sacrifice of much of its pristine beauty. The question at once arises, which of these two methods is the better? A few hints on this matter, to those who mount for exchanges, as well as for individual use, may not be without benefit. One of the first considerations in mounting should be cleanliness, and this should be carried not only into the preparations for exhibition, but it should also be recognized in the so-called "working slides," or preparations intended only for private study. In fact, with the microscopist, whose work is always in itself of a neat character, cleanliness in mounting should become a habit. It may be that few of us have uncarpeted rooms arranged for this sort of work, and are obliged at times to work where it is almost impossible to keep out every particle of dust from our slides, especially in the summer, but we can do much good work even under such difficulties, by attending to some little points too often overlooked by beginners, it is feared. The most convenient pieces of apparatus for holding objects dry or in fluids preparatory to mounting are salt-cellars, and watch-glasses about two inches in diameter, sold by dealers in chemical glassware. Two of these watch-glasses can be placed together, so that one covers the other perfectly, thus keeping out dust, and they also form covers for the salt-cellars. From the time the object is taken out of its bottle or elsewhere for preparation, until it is transferred to the clean slide, and the thin cover put over it, it should remain covered by a watch-glass. Even in a very dusty atmosphere, it can thus be neatly mounted, and the microscopist will find these watch-glasses of great value.

We now come to the question under consideration, how shall the object be mounted?

No one appreciates or enjoys looking at a fine slide, such as those of Möller, for example, which are marvels of skill, better than the writer, especially those beautiful arrangements of diatoms and wing scales for which he is noted. It is a pleasure to see them, which is enhanced by a desire to know how they are made. These may serve as a type merely of many beautiful slides, prepared by amateurs and others, which need not be mentioned. But at the same time, is it not in a measure a waste of time to make these fine objects? If the microscope is to be a means of instruction, as we all admit it should be, are we not taking it away from its legitimate place when we spend our time over such work as this? It is pleasing to the eye, but how much would we value a colored camera lucida drawing of it? It is instructive, since it shows us what can be done, but in no other sense. Is it possible that a mere piece of mechanical work like this can be looked upon as superior in any way to the work of nature, illustrated in all its minute beauty under the microscope? And yet, whenever an object can be mounted so as to show its structure or its special points of interest, and at the same time be made a pretty object, it should be so mounted. This is, fortunately, often the case, and we may generally consider that a well-mounted object shows all that could be desired in every way. But it is not always so, and often a certain amount of elementary knowledge of the object in question becomes necessary to enable us to judge how it should be mounted. Take, as an example, grains of starch. It is well known that balsam obliterates the markings of starch cells, but nevertheless it is quite a common thing to find them mounted in balsam "for the polariscope." To be sure balsam improves them for this purpose, but it merely makes them better objects for exhibition; beyond this it has made them of little value for examination. To prove this, let any one mount potato starch and Maranta arrowroot starch in balsam, and compare them. With the exception of a slight difference in the size of the largest granules of the two, no difference can be detected, the largest grains of the

potato starch exceeding the largest of the other a very litttle. To a person who desires to become familiar with the Maranta arrowroot starch, and receives for the purpose a balsam-mounted specimen, the result would be a failure. By all means starches should be put up in fluid, carbolic acid water (1 per cent solution) being an exceedingly good medium, when they are wanted for study. For merely displaying their effects upon polarized light, balsam may be used to advantage. The starch of the Calabar bean is a brilliant object mounted in this way.

As another example, and one which has been a source of much annoyance to the writer, because it comes within his special line of study, may be mentioned foraminifera. To find beautiful forms sinking slowly but surely down into the asphalt in the bottom of the cell, which was not sufficiently hardened, is very disappointing. Then, if there be any space left around the edges of the cell, which is covered by the finishing layer of varnish, the little shells will get underneath and out of sight as soon as the slide is inclined.

To show foraminifera to advantage, the shells must be placed in position, and held there by a little gum. They should be so placed that every form is shown in several positions, and the mouth should be placed in good view. This should always be done in the case of the larger shells. Of course, with the more minute forms, it is not expected, and the work would be very tedious. In most cases they are best mounted as opaque objects, but many are well seen in balsam. Never place them loose in a cell, to roll about with every movement. As a rule, the writer prefers to mount the shells for himself, and keep a portion of the material for the examination of selected forms by an arrangement like a stage forceps holding a bristle. These instances show clearly that one should become familiar with the characters most desirable to show in an object before mounting it. More attention to this subject would greatly enhance the value of amateur mounts, and, indeed, those of professionals as well.

Now that the staining of vegetable structures is familiar to most microscopists, there is no reason why any one should be at a loss for beautiful objects to mount, which at the same time afford instruction. Perhaps no kind of work which is so easily done can be found to give the same satisfaction. Many are making these preparations, but comparatively few are studying them.

It may not be out of place here to suggest to those who are in the vicinity of ponds and streams, that there are many forms of living organisms, readily obtained, which they could mount and send off as exchanges, such as cannot be obtained from dealers at all. Desmids and other algæ, mounted fresh in suitable media, will keep green for a long time, and would be valued very highly by some, and the beautiful volvox, it is said, can be preserved in salicylic acid (sat. aq. sol.) Many of us, living in the city, have not the time to collect such objects, while, if properly mounted, they would be valuable additions to the cabinet.

Finally, the great object of this paper is to indicate what it seems that all microscopists should consider the proper way of preparing objects, viz., so as to exhibit as much of their minute structure as possible, giving less attention to the appearance of the object as a whole. What we need is more real study, and practical application of that study. It is far from the author's intention to deprecate the value of the microscope as a mere source of enjoyment apart from instruction. One can hardly look at any microscopic object, from a butterfly's wing to the monad, which looks like a mere point, without feeling that it reveals to us a wonderful world of beauty, and some of the most beautiful instances to be found of unity of plan and perfection of design in nature. We may see this by mere casual glances, but how much more clearly when we apply ourselves to this study.

R. Hitchcock.

8 *Beekman Place, New York.*

Notes upon "P. T. Cleve and J. D. Moller's Diatoms, I., 1-48." Upsala, 1877.

BY PROF. H. L. SMITH.

THE following notes upon the above named series of forty-eight specimens, which are handsomely mounted, and in a very neat case, are not intended as criticisms, but rather as an attempt to clear up the confused nomenclature, which has arisen in part, from the students of these little organisms, in places widely remote, giving different names to the same species. The present specimens, as authentic representatives of forms named by Prof. Cleve, A. Grunow, and others, and partly described by them, are valuable to the student, and will assist very much in any attempt at correction of nomenclature.

No. 1. *Hyalodiscus stelliger*, Bail. This is not Bailey's diatom, which is what is now known as *Podosira maculata*, as I have remarked in the notes on my own "Species Typicæ," under No. 12. Möller has heretofore issued on his slides *Actinocyclus interpunctatus* of Brightwell, labeled as *Hyalodiscus stelliger*. Prof. Cleve's diatom, which I had noticed long ago in material from Spitzbergen, which he kindly sent to me, is so much smaller and more hyaline than the ordinary *A. interpunctatus*, that I failed to identify them. Prof. Cleve states* that he has seen specimens from California. I certainly have never found *A. interpunctatus*, which is abundant enough all along the California coast, either as small or as finely marked as this specimen; nor have I seen any of Möller's so-called *H. Stelliger* that were as hyaline and small as the specimens on the present slides issued by Cleve and Möller. On No. 15, the same form occurs as a dry mount, and its similarity to *A. interpunctatus* is more easily seen. Yet I do not understand Prof. Cleve's remark that its cellules are not so dense as on the California specimens. Whatever it may be, it is not the form called *Hyalodiscus Stelliger* by Bailey.

*"On Diatoms from the Arctic Sea." Stockholm, 1873.

No. 2. *Hyalodiscus Franklini*, E., = *Craspedodiscus Franklini*, E., 1853. This diatom was described by Bailey, and figured by him in 1853 as *Hyalodiscus subtilis*, it has also been called *H. Californicus*. As Bailey's generic name is the proper one, it would seem better to admit also his specific one, especially as he figured it first.

No. 4. *Eupodiscus Jonesianus*, Grev. There can be very little doubt that this diatom is, as Prof. Cleve supposes, the *Coscinodiscus concinnus* of W. Smith. It is much finer lined than the specimens from Hong Kong figured by Dr. Greville, and the spines less conspicuous, or absent. The processes, when present, are generally two and on one side.

No. 14. *Synedra Thalassiothrix*, Cleve. A very remarkable form, long, somewhat curved and swollen in the middle. While it has many characteristics of Synedra, it is in others very distinct, and the figure given by Prof. Cleve* is very imperfect. Its chief peculiarity is a row of minute teeth or spines along both margins of the valves, in some respects reminding of Greville's genus *Clavularia*, and never hitherto observed on any of the *Synedras*. It is, altogether, a remarkable form, which I shall be enabled to place in the "Species Typicæ," through the courtesy of Prof. Cleve.

No. 15. *Synedra Kamtschatica*, Grunow. This is closely allied to S. tabulata, but having a very marked appearance in f. V., which at once distinguishes it from that species, viz.: a long blank space in the middle, free from the marginal striæ which are on the edges of the other portion of the valves, giving a quite characteristic appearance, somewhat like an inflation. I am indebted to Prof. Cleve for specimens of this diatom for the "Species Typicæ."

No. 18. *Staurosira aequalis*, (Heib.,) Grun. Heiberg described this diatom as *Fragilaria*, and really one is at a loss to see why Grunow restores Ehrenberg's genus, which is entirely ignored by many good authorities. Indeed, Ehrenberg only gave this name on

*"Diatoms from the Arctic Sea." T. 4, f. 24.

account of the cruciform appearance of the valves of the species which he placed here. It is quite true that now-a-days, in Geology for instance, the "green-sand," may be of any color, and the "old red sandstone," anything but red. Yet it is hardly desirable in the present case, which is plainly only a specimen of *Fragilaria capucina*, mixed with *F. mesolepta* (the latter the slightly constricted form) that it should be relegated to *Staurosira*. Rabenhorst has given *Fragilaria virescens* as synonym of *F. æqualis* of Heib., which is a mistake, if the present is Heiberg's form.

No. 19. *Grammonema striatulum*, Lyng. I can really see no reason for retaining Agardh's generic name. This diatom was described by Lyngbye as *Fragilaria striatula*, and was recognized as a *Fragilaria* by W. Smith. Kutzing changed Agardh's name into *Grammatonema*. The form on this slide is much less siliceous than the one figured by W. Smith. There is reason, however, to believe that in this respect it varies much. Specimens that I obtained at Alderney in nearly fresh water, were scarcely siliceous. Others that I have, from the Pacific, at San Francisco, are more robust, and as nearly as possible like Smith's figure when the filament is burned; and they are also considerably larger than the present specimens.

No. 20. *Berkeleya Dillwynii*, (Ag.,) Grun. This is not the ordinary *Schizonema Dillwynii*, but it is *B. fragilis* of Greville and Kutzing. There is much similarity in the structure of the frustules of these two species, but *B. fragilis* is much longer and more slender; both are allied to *Amphipleura*. The median line is strongly marked, and constricted at the middle into a very narrow line, more evident when the dry frustule has just absorbed enough moisture to barely wet it. *B. Dillwynii*, the normal form, is very blunt and small, and the expanded ends of the median line are (as in *Amphipleura*) quite evident. The frond varies greatly with the habitat. The color of the frond of the typical form, dried, is a dull yellowish green; it has been named according to appearance of the frond, *Schizonema lubricans*, a dark glistening green, *S. araneosa*, a reddish yellow; the most common form on our Atlantic coast, is of a very bright light green. A somewhat dirty dark green mass has been called *S. viride;* other varieties are *S. Arachnoidea*, *S. Ehrenbergii*, *S. parvulum* and *S. luteovirens*. *Schizonema rutilans* appears to be an intermediate form, between the true *S. Dillwynii* and *Berkeleya fragilis*. The different generic names were given to these forms, whose frustules are so similar, from their different modes of growth; the latter genus has a tuberculate gelatinous frond, the former a filiform and much divided one, resembling the fine-threaded algæ. The figure of *B. fragilis* in the British Diatomaceæ shows the frustule with a small central nodule, which is a mistake. With the exception of its blunt ends, there is a close resemblance to Amphipleura, the median line is narrowed at the middle, so that the fine contracted portion is about one-fifth of the whole length. *Berkeleya Dillwynii*, the normal form, under high powers, shows a minute point or nodule at each end of the contracted central portion of the median line, as figured by Grunow in his representation of *B. Harveyana*. I am not quite prepared myself to admit the identity of Cleve and Möller's *Berkeleya Dillwynii*, with the normal *Schizonema Dillwynii*.

No. 21. *Brebissonia Boeckii*, (Kutz.,) Grun. This is the *Doryphora Boeckii* of W. Smith. It is, most assuredly, not a *Doryphora;* nor do I see the need of constituting the new genus *Brebissonia*. The median blank space on the valve of this diatom is contracted at the middle, and the raphe, or fine line on this blank space, stops short of the centre on either side, so that, instead of a central nodule, we have an elongated blank space; there is a minute puncture at the end of the raphe, as already mentioned above, under (*Schizonema*), *Berkeleya Dillwynii*. In its normal form, this diatom is attached to a stipes, which disappears after a while in quiet waters. It is closely allied to *Colletonema vulgaris*

Navicula Rhomboides, and the so-called *Frustulia Saxonica*, and others of this group leading up to *Amphipleura*, in the structure of the median blank space and raphe; and there is just the same reason for separating it from *Navicula* and making a new genus, as there is for separating *Cocconema* from *Cymbella*. Indeed there is no reason why one of these last named genera should not be abolished. In the present series, as also in my own "Species Typicæ," the names are retained, because, as specimens, authentic for study, the forms are those that have been thus named by well known authorities.

No. 25. *Navicula Rheinhardtii*, Grunow = *N. Vernalis*, Donkin, and one of the group figured as *N. Varians* by Gregory, M. T. S., Vol. III, Pl. IV., f. 14. It is a quite distinct form, and I have found it at Geneva, N. Y., precisely like those on this slide from Sweden. Although there is much truth in what Dr. Gregory says about his *N. Varians*, yet this form appears to be sufficiently strongly marked, and permanent, in widely different localities, to warrant Grunow's name.

No. 25. *Stauroneis amphoroides*, Grun. This is W. Smith's *Amphiprora constricta*, as figured in the British Diatomaceæ, but not Ehrenberg's species. It is the small form of what De Brébisson called *Amphora membranacea*, No. 36 of the "Species Typicæ." It is neither an *Amphiprora* nor an *Amphora*, and so long as we admit *Stauroneis* as a genus, distinct from *Navicula*, we may as well consider it properly placed and named by Grunow. If the characteristic of the *Amphoræ*, viz., development of the dorsal portion of the connecting membrane or zone, so that its breadth exceeds that of the ventical portion, (and thus allies it to the Cymbellæ,) is retained, this form cannot be an *Amphora*, and we must set aside Brébisson's name *Amphora membranacea*. W. Smith's *A. membranacea* is really Brébisson's *A. Ostrearia*.

No. 30. *Cocconema Kamtschatica*. Grun Scarcely distinct enough from *C. cistula* to warrant new species.

Nos. 34 and 35. *Cocconema parvum* and *Cymbella parvum*. So named on the labels; both are called *Cocconema* in the descriptive list. It would be better to abolish *Cocconema* and retain *Cymbella*.

No. 36. *Cocconema stomatophora*, Grun. This is a well-marked variety of the so-called Cymbella gastroides, which is found quite as marked and distinct as this, along with a very peculiar hump-backed variety, at Mackinaw, and at various other places on the upper lakes. A much smaller form, found in Ohio, but very closely resembling this, I have placed in the "Species Typicæ" as *Cocconema gibbum*. The present form is robust and well marked, perhaps sufficiently so, with our present views as to what should constitute a species, to warrant a new specific name.

No. 37. *Encyonema hebridicum*. Of course there is nothing outside the general build of the frustule, which would enable one to say that this is an *Encyonema*, inasmuch as it is from a fossil deposit. It belongs to the same group as W. Smith's *Cymbella maculata*, and Gregory's *C. turgida*.

No. 40. *Gomphonema robustum*, Grun. The locality is given as New York. It is a fresh water form, somewhat stouter but no way different from Ehrenberg's *G. herculaneum*, as figured in the Microgeologie T., XXXV., A., vii., f. 12, 13; and this is only a variety of *Gomphonema capitatum*, E. It is very common in the upper lakes, and especially in Lake Erie.

No. 41. *Gomphonema Balticum*, Cleve. This is a well marked form, allied to *G. tenellum*.

No. 42. *Gomphonema calcareum*. There is scarcely more difference from No. 41 than would be due to a different habitat, it is, however, narrower, and the capitate ends are more strongly pronounced.

No. 48. *Tryblionella circumsuta*, Bailey. This is Ehrenberg's *S. Peruviana*. W. Smith altered the name to *Tryblionella Scutellum*. Ehrenberg figured it in 1843. Bailey gave an outline figure in 1850. It would seem proper, therefore, to retain Ehrenberg's specific name.

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IN two-thirds of the letters that we have received this year from subscribers, we have been urged to double the size of the JOURNAL, and double the price. Hitherto we have been very much opposed to such a course, for we know that we have on our list many amateurs to whom the increased price would be an objection. During the past six months, however, we have felt the absolute necessity for an enlargement, and we *have* enlarged the journal, though the price has remained the same. Our original promise, as embodied in our first three issues, was twelve pages of reading matter; last month we gave twenty.

We have, therefore, decided that in obedience to the requests of the majority of our subscribers, and the increased amount of valuable matter which continues to press itself upon us, we will double the size of the journal, which will then consist of not less than twenty-four pages of reading matter. This, of course, involves a subscription price of one dollar.

In addition to the desire for a larger journal, another circumstance has urged us to this course. When the first number was issued, silver coin had not become common, and pieces of fifty-cent currency were easily obtained. It is now difficult to get currency, while a dollar bill can be had anywhere.

The increased space at our disposal in future numbers will enable us to restore several departments which have of late been crowded out. The notices of new books, the work table notes, current notes, etc., etc., will now be in little danger of being omitted for want of room. We hope, therefore, to give in 1878 a volume which will not only be doubled in size, but greatly improved in the variety of its contents, and the thoroughness with which the different subjects shall be treated.

Although containing a few more elaborate articles, the JOURNAL will still retain its elementary character, and if any of our young friends, or old ones either, feel that the new rate is too much for the amount of benefit which they can derive from it, we will cheerfully accept from them the old subscription, fifty cents. We do not wish to part company with any of our old friends. But we feel that to all, except a very small minority, the change will be acceptable.

From the very first we have had subscribers who have expressed the warmest interest in the journal, and signified their faith in it by paying for two or three years in advance. It is, of course, understood that all such subscriptions will be filled, without further charge, for the full time for which they were originally made.

During the past year we have made several distributions of material for interesting and beautiful slides. We have made arrangements to do the same next year, so that amateur microscopists will not only be told how to work, but will receive material to work on.

Death of Dr. Beatty.

EVERY reader of this journal will grieve to hear of the death of Dr. Beatty, of Baltimore, well-known in connection with the staining of vegetable tissues. Dr. Beatty was only in his fortieth year, but had achieved a high reputation as a successful physician and a scientific microscopist.

His process for staining vegetable tissues has made his name familiar to microscopists and vegetable physiologists everywhere, and although his claims as the originator of the process may have been disputed, we believe there is no doubt as to the fact that he was the first to publish a trustworthy and simple formula—in this respect acting very differently from some who claim to have practiced the art before he did, but who, instead of giving their process to the world, imparted it, *under a pledge of secrecy*, to a few chosen pupils. Up to within a short time previous to his death, he was engaged in important scientific investigations, and it is to be hoped that some of his scientific friends will see that any results at which he may have arrived are not lost to the world.

Diatoms.

PROFESSOR P. T. CLEVE announced some time ago that if sufficient encouragement were offered he would publish several series of mounted diatoms, 48 in each series. The first series has been issued, but the encouragement which has been offered does not warrant a continuance. We feel certain that this arises wholly from the fact that the enterprise is not sufficiently well known. The forms announced are from materials which are not accessible to the general public, and the price is quite moderate, 40 shillings sterling for 48 slides. It is possible that a sufficient number of subscribers may be found in this country to make up the required number. Those who desire to subscribe may send their names to us, or to Mr. Fred. Habirshaw, 113 Maiden Lane, N. Y., who will gladly forward them to Prof. Cleve. It is hoped that arrangements may be made whereby the cost of getting them over will be very slight. Prof. Cleve's address is Upsala, Sweden.

Coorongite.

THE following letter, addressed to Prof. C. L. Anderson, of Santa Cruz, Cal., appears in the report of the San Francisco Microscopical Society, and will prove of interest to many:

Dear Sir—I hope the second slide of coorongite arrived safely. I have several times seen notices of parties in California who had brought coorongite to the notice of the San Francisco Microscopical Society, and lately saw a slide of a section of it from some one in California. I think whoever has it has gotten a little mixed, and would like to enter into correspondence with him about it, in order that I may either be set right myself or show him his error. My attention was first attracted to it during the Centennial; not as a diatomaceous material, but as an oil of parafine shale, and I made the acquaintance of the Commissioner for the purpose of examining it, and have since had a correspondence with the exhibitor, Mr. Stewart. There were two substances exhibited by this gentleman, both hydro carbons; one he exhibited as mineral caoutchouc; this material was gathered in sheets from one-fourth to one-half inch in thickness; has the appearance of brown India-rubber, but contains 90 per cent. hydro carbons, and also has imbedded in it some few diatoms. What was exhibited here as coorongite, and also what was sent to me by Mr. Stewart under the same name, is a grey sort of shale of very recent formation, a very minute piece of which I send you, as I have very little of it. This only contains about 20 per cent hydro carbons. The two materials, Mr. Stewart tells me, are found in the same district—a sink-hole of some extent, from which there is no outlet until the water rises to some height. During the rainy season this hole fills up, and during the dry season they gather some

tons of each material, which they find on the elevations in the sink hole; but the two are never found together—*i. e.* mingled together—the caoutchouc being found on a higher level than the coorongite. I think there is less than one per cent. of diatomaceous matter in the caoutchouc, while in the coorongite there is, I think, about 75 per cent. I think the material called coorongite by this gentleman in California is the caoutchouc of Mr. Stewart. Can you get me a slide of this material, or forward this letter to the parties there who have it, as I should like to enter into correspondence with them about it, in order to set the matter right amongst us? I have had the best success in preparing this coorongite, by boiling it in chromic acid, or putting it in a test-tube with a saturated solution of bichromate of potassa, heating to 130°, and then carefully adding five times the bulk of sulphuric acid. It has to be repeated several times. Yours, very respectfully,

GALLOWAY C. MORRIS.

Philadelphia, Sept. 21, 1877.

Our Book Table.

Practical Hints on the Selection and Use of the Microscope. Intended for Beginners. By John Phin. Second Edition. Fully illustrated and greatly enlarged. Price 75 cents. New York: The Industrial Publication Company.

It would be out of place for us to do much more than merely announce the issue of this book. We may remark, however, that much of it has been re-written, and the additions both to matter and illustrations render this edition substantially a new book. The want that has existed for such a little manual has been well marked, and has probably secured for this one a degree of favor which is beyond its merits. That it has been very generally welcomed is shown by the fact that already the second edition is passing rapidly off, and the work has been adopted in several of our colleges.

Light: A Series of Simple, Entertaining and Inexpensive Experiments in the Phenomena of Light, for the Use of Students of Every Age. By Alfred M. Mayer and Charles Barnard. Price $1. New York: D. Appleton & Co.

The experiments detailed in this book are of the simplest kind, and although they are old and familiar, they have received a pleasant air of freshness and novelty from the manner in which they are presented. The principles which are illustrated are within the comprehension of every intelligent boy and girl, and we can imagine no more pleasant holiday work than for young folks to make the apparatus here described, and demonstrate the laws and facts which they are intended to illustrate.

Practical Directions for Collecting, Transporting, Preserving and Mounting Diatoms. By Prof. A. Mead Edwards, M. D.; Prof. Christopher Johnston, M. D.; and Prof. Hamilton L. Smith, LL. D. Price 75 cents. New York: The Industrial Publication Company.

This is a reprint of a series of papers which are now out of print, but which contain the most complete, thorough and judicious directions that have ever been published. Every one of these authors is a well known authority in his department, and the result is a volume which must find its way into the library of every worker amongst diatoms.

St. Nicholas begins a new volume with the November number, and this first number is a charming one. In addition to the usual pleasant reading matter, there are several articles which will specially interest readers of this journal. One of these is "Stickle-back Bell Ringers," in which a very fine engraving is given, illustrating the way that some minnows were taught to ring a bell. Another capital article is called "A Budget of Home-Made Christmas Gifts," and describes very fully the best methods of making a large number of somewhat unusual, but very neat and useful articles, such as any boy or girl might construct. This article is quite extensive, and is well worth the price of the entire number. Altogether it is a capital number, and the editor, Mrs. Dodge, is evidently unrivaled as a caterer for the young.

Books and Pamphlets Received.

"The Doctrine of the Immortality of the Soul Sustained by Modern Scientific Discoveries." By Charles Skelton, M. D. Trenton: Naar, Day & Naar.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Mounting Algæ.

Ed. Am. Jour. Microscopy—The article by Mr. Charles Stodder in your last number, on "Mounting Diatoms in situ," was not without considerable interest to me, and no doubt to others who have tried their hands at mounting marine algæ in a way to show its best points. I believe that workers in microscopy should do as good camp meeting attendants do—every one should get up and relate his or her experience. Now as I have done considerable lately in the way of mounting marine algæ, I think it my duty to advocate the use of the material

that has given me the most satisfactory results, *i. e.* salicylic acid. My process is as follows: by using "sea salt," (which can be bought for a trifle at any first-class druggist's) and distilled or rain water, a good substitute for sea water is obtained; into this I immerse the rough-dried specimens of algæ, and in an hour or two they have resumed their natural shape. Now, picking out and clipping off such pieces as are best adapted for mounting, I transfer them to a bowl of distilled water and wash them clean, and from thence transfer them to a small saucer containing a saturated solution of salicylic acid. The shallow cell into which they now go is built up of shellac cement made by dissolving bleached shellac in cologne spirits. Cells made of this substance are ready for use twelve hours after being laid on to the slide. I pick up the specimen with forceps, put it on the slide, and fill up the cell with the salicylic acid. I now breathe on the covering glass and put it in its place, and by the use of blotting paper absorb the superfluous fluid. A thin coating of gold size completes the work for the time being; in a day or two I lay on more gold size, and afterwards white zinc cement or brunswick black—the finish, of course, being a mere matter of fancy.

In mounting a piece of algæ having *Isthmia* parasitic on it, it is almost impossible to fill these diatoms if balsam is used, whereas by the use of salicylic acid every valve will be filled. In some cases the medium I have used has robbed the algæ of its color, but this occurs but rarely.

I have now before me a slide of *Ptilota hypnoides* in full fruit, the beauty of which could never be brought out except by first immersing the specimen in the sea water I have referred to. For the study of algæ, direct light should be used, but using dark field illumination is the best way of making it a genuine "Oh my!" slide. H. F. ATWOOD.

Chicago, Oct. 22, 1877.

A Few Words concerning the Performance of Objectives.

Ed. Am. Jour. Microscopy—Referring to the letters of Mr. E. Gundlach, printed in the August issue of the Cincinnati *Medical News*, it will be noticed that Mr. Gundlach bases his optical laws on the performance of his own objectives, or at least he appeals confidently to his objectives to sustain his positions, as to working distance, resolution and angular aperture.

Mr. Gundlach certainly has the right to state the principles which govern him in the construction of object-glasses, and it would be well if other makers would follow his example. But his readers must keep constantly in mind that while the general principles he sets forth may not, as a rule, differ materially from those actuating other opticians, each and every one has a *handling* characteristically his *own*, and that a necessary result of this will be recognized in the *characteristic* performance of various so-called first-class objectives; and further, that between the extremes comprised in the "handling" aboye named, a large margin obtains, sufficient to warrant the acceptance of one objective to the exclusion of another.

The potency of these considerations is enhanced when we remember that the *slightest* superiority in an objective is of the highest importance. Beale says ("How to Work with the Microscope," p. 285) "It is certain that the slightest advantage in defining power ought not to be underrated. * * * Improvement in the means of observation is of the utmost importance, and however slight, always leads to the discovery of new facts."

Again, Dr. Beale writes (p. 283) "The best object-glasses will define clearly and accurately bodies which, from their transparency, are quite invisible under objectives only slightly inferior to the first."

It therefore becomes apparent that these little differences, perhaps due to "handling" on the part of the optician, while they are invaluable to the working microscopist, may also be referable to the genius of the optician—to a particular method of "handling" known optical laws.

By way of illustrating these "little differences," it may be mentioned that among first-class objectives of the same magnification, aperture and resolving power, greater and lesser working distance will be found, and right here is the solution of the dogma of (so-called) penetration, for, of the glasses above mentioned, that one having the greater working distance will be endowed with the greater penetration. This is the whole thing in a nutshell, as set forth by the writer years ago.

If, in the comparison of two objectives, alike

in magnification, aperture and resolving power, one shall be found to have the longer working distance, then is its superiority demonstrated, and, be it remembered, that comparisons of objectives ought always to be made in this kind of a way, otherwise any attempt at comparison would be as futile as if we were to compare a turnip with an orange.

Again, *if it can* be shown that a medium power glass, say a 1-6th or a 1-10th, *having the widest aperture known*, and also comparatively large working distance, say 1-50th of an inch, will more than do any work that can be done with objectives of exceedingly high power, and correspondingly *short* working distance (excess of aperture being barred by the above named conditions), it will be obvious that the former will be eminently the superiór glass.

Now the *facts* warrant the assertion that just such 1-6ths and 1-10ths are made, and by American opticians. The writer has had, and still has in his possession, just such glasses. His first contribution to the columns of the *News*, four years since, set forth their claims, and he has never had occasion to make either modification or retraction of his original statement. When such occasion shall occur, the readers of this journal will be promptly advised; until then I claim (especially for the 1-6th) unequaled intensity of definition, widest known aperture, combined with large working distance—in other words, without that sacrifice of "working distance" alluded to by Mr. Gundlach.

I embrace this, my first opportunity, to say that I have lately examined at length a new duplex 1-10th, the work of a young American optician. This new 1-10th is similar in aperture and has greater working distance than my own 1-10th; its work over such tests as the Nobert and Möller (balsam) plates was quite equal to that of its formidable competitor, while the views it gave by central light were simply glorious, excelling the old 1-10th. This, as a first attempt on the part of a young optician, is truly encouraging. These new duplex glasses will receive my earnest attention, and I may have, in the future, something more to say about them.

Allow me to further state, that, being desirous of acquainting myself with the work of our own opticians, I wrote to the Rochester firm, asking the loan of objectives for examination and study. They responded promptly, sending me by return mail a full line of Mr. Gundlach's lowest priced "Student's" work. They certainly had no time to select exceptional glasses. My time has been so thoroughly occupied, I have not yet given them the attention they deserve, but as far as they have been examined I am much pleased with them—a 3-4th inch at $6, a 1-2 inch at $8, and a 3-10ths at $11, are very fine indeed for their cost.

J. Edwards Smith.

Homeopathic Hospital College, Cleveland, O., Sept., 1877.

Angular Aperture and Central Illumination.

Ed. Am. Jour. Microscopy—The last article of Prof. Smith in this journal seems to demand a few more remarks on my part, but, as already intimated, my reply must be very short. I do not see that anything would be gained by a controversy carried on in this way.

Prof. Smith declines to "reply directly to" my last article, and most of his paper is taken up with an account of his manner of making examinations with a 1 inch and a 1-6th.

However entertaining this may be, it does not seem to affect the points at issue. I would remark that I fail to see the advantage of working a glass up to its fullest capacity with deep eye-pieces. It is trying to any glass, and it is questionable if it is an advantage to use an inch to see 30,000 lines to an inch, with a deep eye-piece, when a 1-2 or 4-10ths would do the same work without being pressed so hard. But this does not touch the question at issue, and I dare say few workers will be induced to follow this plan—in fact, few 1 inch objectives would stand it at all.

In regard to the 1-6th with the "widest aperture known," Prof. Smith merely states that "I get better work than I can with any other style of glass." The 1-10th of Spencer is still better, and with central light. Well, I have already freely admitted to Prof. Smith that Tolles and Spencer are making wonderful glasses, and have no desire to contradict these assertions.

Now, as to some of my "remarkable statements." I claim that the best work of a lens in resolutions requires that the illuminating pencil must have an angle equal to that of the objective. This, Prof. Smith says, is a "most remarkable statement," but, fortunately, saying

so does not prove it. It is an easy way of dismissing the matter, but before I retract it I must know why. To be sure Prof. Smith says that his own experience is opposed to this statement, but until his experiments are published and subjected to public examination, they are not to be accepted as evidence against such a well-founded belief as this.

In regard to the exhibition of the 19th band as an opaque object, Dr. H. A. Johnson, of Chicago, writes me that he is confident of having done this same thing with his method of illumination through the secondary body of the binocular, using a Powell & Lealand 1-10th and a Wales 1-25th. Although no date was given, I suspect it was about 1872.

As regards central light, I wish to state that the charge implied by Prof. Smith by the word "tactics," is quite unfounded. I stated plainly that I was unprepared for the statement, but I did not know at the time that it was considered a vital point in the controversy. It seems to me that the best "tactics" for me would have been to avoid it entirely. But it was not in my plan to question results (see page 110.) Now that I am confronted with the question, I must meet it by saying that while it may be true, for reasons which I cannot occupy the space to give now, I must ask for further confirmation of it before considering it as proved.

It is easy to throw aside the results of mathematical calculations, as Prof. Smith does, for the sake of argument. Still the results are there, and they agree pretty well with practice. *Helmholtz's formulæ never proved that the 19th band could not be resolved.*

I have felt obliged to write this hastily and concisely, and have not explained some points as I would wish. I have nothing more to say on the general question; the field is too wide, and all the points cannot be replied to in one article of moderate length. If, however, Prof. Smith feels disposed to discuss any one point with me, so that we may be confined strictly within the limits of the question, I shall try to hold my ground already taken, or accept defeat in a becoming manner.

I want to reach the truth; I am not prejudiced against any glass of any angle.

ROMYN HITCHCOCK.

8 *Beekman Place, New York.*

Bermuda Diatoms.

Ed. Am. Jour. Microscopy—Please inform Mr. Hamlin that the whole history of the "Bermuda earth," so far as is known has been published in the proceedings of the Boston Society of Natural History. In brief, it is this, the original specimen, now in the Bailey Collection of the B. S. N. H., was sent to Prof. Bailey by Prof. Toumy about 1842 (see *Silliman's Journal*), labeled "Bermuda;" Bailey added, with a ?, "Is." Ehrenberg, probably overlooking the "?," published as "Bermuda Island." Search in the island proved that there was no such deposit to be found there. Then attention was turned to Bermuda Hundreds in Virginia; search there by Prof. William B. Rogers and others failed to find anything. Prof. Johnston received a specimen of "infusorial earth" from Nottingham, Md. This earth yielded to the writer, and to Prof. Johnston, the peculiar forms of the "Bermuda" *Heliopeltas* and *Craspedodiscus elegans*. This was considered sufficient evidence that the long sought for deposit was discovered—probably. Since then my friend, Dr. Josiah Curtis, made an excursion in the valley of the Patuxent River, and found an immense tract of country, many miles in extent, of the diatomaceous earth, same as the Nottingham, containing the same forms. The conclusion is that the original Bermuda of Toumy and Bailey may have been found in *any* of the localities named by Prof. Johnston, or visited by Dr. Curtis; and, so far as present knowledge goes, in no other part of the world. CHARLES STODDER.

Boston, Mass., Oct. 19, 1877.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—A regular meeting of the San Francisco Microscopical Society was held on Thursday evening, October 4th, with Vice-President H. C. Hyde in the chair. After reading the minutes, Mr. X. Y. Clark was elected a resident member of the Society.

In consequence of the absence from the city of many members of the society, no meeting was held at the stated time, on September 20th, and the Secretary had to announce the acquisitions of both dates, which were as follows, viz.: *American Naturalist*, *Monthly Microscopical Journal*, Cincinnati *Medical News*, and AMERICAN JOURNAL OF MICROSCOPY for August and September; the *Popular Sci-*

ence Monthly, with supplement, for September and October; *Nature* for July and August; *Journal Quekett Microscopical Club* for July; Part 2, Vol. II, "Bulletin Bussey Institution," and *Journal de Micrographie*, Pelletan—all by subscription.

By purchase there was added "Manual Botanic Terms," Cooke; "Elements of Embryology," Foster and Balfour; and "Walker's Statistical Atlas of the United States," while Mr. Kinne donated No. X of "Proceedings of the Belgian Microscopical Society."

Dr. S. M. Mouser donated to the Cabinet a slide mounted by him with a stained section of frog's stomach, showing the *villi* and cell structure, and Mr. J. R. Scupham handed in samples of siliceous and micaceous earths from Gold Hill, Nevada. Quite an extensive series of diatomaceous earths were presented by the California State Geological Society, obtained by that young but energetic scientific organization from Monterey, Santa Barbara, Ventura, near Virginia City, ten miles north of Petaluma, and Nottingham, Maryland. Most of these fossil deposits have never been unearthed before, and consequently the members were desirous to know of the characteristic diatoms to be found in them, to which end the Corresponding Secretary was instructed to request Dr. A. M. Edwards, one of their members, to examine the samples and report as soon as practicable, trusting some of them might prove as fruitful as the Santa Monica deposit.

From Mr. J. W. Deems, a corresponding member, residing in New York city, was received three specimens of supposed coral, found by oystermen at Long Island Sound.

The second instalment, being Century II of Prof. H. L. Smith's reliable series of typical diatoms, had come to hand, and were warmly welcomed by all present, particularly those who love to study and become familiar with the correct nomenclature of the siliceous shelled little beauties. The mode of arranging them in book-like rack boxes is a great improvement over the former method adopted by Prof. Smith, and yet a late letter to Mr. Kinne contains the information of something better still in this direction, as well as the discovery of a new method of mounting dry preparations so they will not spoil, (as unfortunately all those with asphalte rings are liable to do), nor the covers become dislodged by any blows or falling.

A very interesting letter was received through the hands of Dr. C. L. Anderson, a corresponding member, residing at Santa Cruz (given in another column), in consequence of the interest the mineral he mentions seems to be attracting in scientific and other quarters. A slide, received from Mr. Allen Y. Moore, of Coldwater, Mich., of the coorongite, was handed to Mr. Hanks at a former meeting, but no report has been received from him as yet. Mr. Kinne stated that he understood the mineral to be named from the District of Coorong, where it is found. With a small quantity of the mineral, Dr. Anderson also sent a small piece of what he regarded as a parafine shale, also from Australia. He stated it to be rich in carburetted hydrogen, and presumed it to be abundant, from the fact that it can be obtained at about $25 per ton in San Francisco. The origin and extent of the deposit must be a subject of interest not only to science but to commerce. The slide sent in by Dr. Anderson, with the samples, was one mounted by Mr. Morris, from the coorongite, and was found to contain varieties of fresh water diatoms.

Mr. H. F. Attwood, of Chicago, sent the members of the society, through Mr. Kinne, several slides of diatoms obtained from the water supply of his city, and which he stated have recently been receiving considerable attention from a Prof. Piper there, who, like many others, seems to mistake notoriety for fame, and proceeds to fright the soul of the average Chicagoan who takes his water straight, by badly executed drawings of diatoms and other fresh water microscopic plants. Some of the Professor's terrible monsters of the deep were at once recognized as Diatoma vulgare, Stephanodiscus Niagara, Cyclotella operculata, Asterionella formosa, Fragilaria, etc., species which are as particular about their water supply as any one need be.

. Indicative of the interest that the microscope is attracting, a letter was read to the members from a lady resident of the city who was desirous of learning of some one proficient in microscopical studies, who would form a class or give private instructions.

The Secretary of the American Postal Micro-Cabinet Club notified the members that the boxes of two of their circuits had come to grief in the riots East or been stolen; at least the use of the highest powers he could obtain was unable to resolve them into anything tangible. As Mr. Hervey in his letter suggested that "lightning hardly ever strikes twice in the same place," the members decided to send on some more slides.

Dunkirk Microscopical Society.—The regular meeting was held on Friday evening, Oct. 12, 1877. The President, Dr. Geo. E. Blackham, in the chair. There was a large attendance of members and visitors. This being the first regular meeting since the summer vacation, a good deal of routine business was transacted in the business session.

At the scientific session, Lieut. W. L. Carpenter, U. S. A., late of the Hayden and Wheeler Surveys of the Territories, gave a brief but interesting lecture "On the use of Curare in the study of Biology." His remarks were illustrated by the injection of a few drops of the dilute solution of this

poison beneath the skin of a male frog, producing complete paralysis of the voluntary muscles. By a careful dissection, the intestine was drawn out, and the circulation of the blood in the small vessels of the mesentery was well shown on the president's large Tolles' stand, with his Tolles' 1 inch objective, and the B (1 inch) Huyghenian and the 1-2 inch and 1-4 inch solid eye-pieces, the powers being respectively 100, 200 and 400 diameters. Under the latter power the individual corpuscles were beautifully defined.

Lieut. Carpenter exhibited one of Zentmayer's new Histological Microscope stands. This is a most compact, convenient and beautifully finished little stand, having several new points of excellence. The mirror bar is pivoted in plane of the object, and carries a sub-stage or accessory carrier, the distance of which from the object can be varied to focus a condenser. The mirror and sub-stage can be swung above the stage, and used for the illumination of opaque objects.

The president, exhibited a Tolles' large microscope stand, "B," with 1 inch Huyghenian, and 1-2 and 1-4 inch solid eye-pieces, and Wenham reflex illuminator. The firmness, solidity, convenience and perfect workmanship of this splendid stand were much admired. The president also exhibited a cheap 1-5 dry objective, by Tolles, price $15, which resolves clearly *P. angulatum* by central light.

The additions to the library and cabinet were, *Science Observer* for August and September; ten pamphlets relative to the display made by the U. S. A. Medical Department at the Centennial Exhibition; *Journal de Micrographie*, Paris, France; Report on the Rocky Mountain locust and other insects injurious to vegetation, by Dr. Packard; the Cincinnati *Medical News* for July, August and September; a series of drawings of typical forms of diatoms, from Rev. J. W. Armstrong, D. D.; foraminiferous earth, from Rev. M. Adams; a number of specimens of the imago and the empty larva cases of the so-called seventeen-year locust (*Cicada Septemdecem*), from Mr. and Mrs. H. L. Hinman.

After a time spent in the examination of objects, and discussion of Lieut. Carpenter's remarks the society adjourned.

Tyndall Association of Science.—At a stated meeting of the Section of Microscopy of this association, held at Columbus, Ohio, Oct. 13, 1877, Prof. T. C. Mendenhall in the chair, papers were read by Rev. I. F. Stidham on the "Oscillaria;" by Mr. C. C. Howard on "Blood," and exhibiting the amœboid movements of the white corpuscles; and by Prof. Albert H. Tuttle on "Sub-Stage Illuminators for Immersion Objectives." There were on exhibition and tested, Wales' Students' 2-3, 1-5 and 1-10 immersion, and Spencer's 1-4 Students' dry and corrected. Considering the cheapness of the above, they did most remarkable work. The following officers were elected for the year 1877-8: President, Rev. I. F. Stidham; Secretary and Treasurer, Curtis C. Howard; Curator, Prof. Thos. C. Mendenhall. P. O. address of officers, "Columbus, Ohio."

Personal.—Our readers have doubtless observed that Prof. J. Edwards Smith, well-known as a Microscopist, has removed from Ashtabula, Ohio, to Cleveland, where he has been appointed to the chair of Microscopy and Physiology in the Homœopathic Hospital College. The college is to be congratulated upon the accession which it has acquired.

EXCHANGES.

Specimens of lead ore, heavy spar, and black tourmaline, in exchange for microscopic slides or scientific books. Address James N. Bishop, Plainville, Hartford County, Conn.

Utricularia, bladders containing entomostracam and confervæ, exchanged for well-mounted specimens, histological preferred. Dr. Chas. L. Swasey, New Bedford, Mass.

Want to exchange a monocular microscope for a Woodward's Student's monocular microscope, or one like it; will pay cash difference. J. Siler, 1,242 Broadway, St. Louis, Mo.

Books wanted: Johnston's "Spongidæ and Lithophytes," Edinburgh, 1842. "British Spongidæ," J. Bowerbank, London, 1864. "Sponges as a distinct sub-kingdom of Animals," by A. Hyatt. R. Allen, 62 North Third street, Troy, N. Y.

Slides of rare chemicals for the polariscope. Send for list. Send list of exchanges to G. E. Bailey, Lincoln, Neb.

Plumule scales of small cabbage butterfly (Pieris Rapæ), mounted, for good slides. Edw. Pennock, 805 Franklin street, Philadelphia.

For exchange, transparent injections, equal to finest English slides of Thymus and Thyroid glands, stomach, bladder, kidney, mesentary, intestine and tongue of cat. J. T. Joslin, Newburgh, N. Y.

Slides of various kinds of fertile fern fronds, Indian corn, deutzia, citra odora and other leaves, decolorized and stained, exchanged for other good microscopic objects. C. Blasdale, M. D., Jericho, Queens County, N. Y.

Polyzoa with "bird's heads," foraminifera, polycystina, holothurian plates, synapta anchors, chirodota wheels and young; spicules of sponges and gorgonia, etc., in exchange for foraminifera, pathological, anatomical and vegetable preparations. F. M. Hamlin, M. D., Auburn, N. Y.

Diatomaceous earth from various deposits on the Pacific coast (Santa Monica, Lower California, San Pedro, San Gregorio, Monterey, Petaluma, Santa Rosa, Ione Valley, Ventura County, Virginia City,) and other localities, in exchange for well-mounted slides of the same, or for fossils and minerals, or for mounted objects having a bearing on Geology. Address California State Geological Society, San Francisco, Cal.

Microscope wanted in exchange for a very excellent gold watch which cost $150. Address E. W., Box 4,875, New York P. O.

Scales and skin of Anguilla vulgaris in exchange for other objects. Address H. B. Hargreaves, Garnerville, Rockland County, N. Y.

Publisher's Department.

A Dogberry Come to Judgment.—A Rhode Island justice has decided that pigeons are not "animals," and that the statute relating to cruelty to animals does not apply to them.

New Standard Light for Gas Testing.—In his Cantor lecture on the "Chemistry of Gas Manufacture," Mr. A. Vernon Harcourt, M. A., F. R. S., stated that the standard sperm candle is uncertain, variable in composition and construction of wick, and that the mode of burning and light of the same candle fluctuates greatly from time to time. He proposes as a substitute for the standard candle an air-gas, obtained by saturating air with light petroleum vapor. The gas he obtains by passing air through water with a measure of light petroleum on its surface contained in a Woulfe's bottle. The gas is to be burned in a burner of definite size and construction, the gas issuing without pressure.

From the best descriptions, or even from plain engravings of fowls, it is difficult to gain a correct idea of their general appearance. Correctly colored plates, however, give almost as accurate an idea of them as looking at the fowls themselves. The *Poultry World* has introduced the new feature of issuing a chromo-lithographic plate of a choice breed with each month's paper.

Fresh Water and Marine Aquaria.—There is no better source of material for microscopic work than a good aquarium. After they are once started they are easily kept up, and afford an endless supply of interesting objects, both vegetable and animal. Mr. Greenwood, whose advertisement appears elsewhere, has given great attention to this subject, and can supply almost any material that may be required.

The Blue Cell Anticipated.—We have recently been glancing over some old works on microscopy, which we have been so fortunate as to pick up at different times. Amongst others "Hooke's Micrographia," 1665; "Zahn's Oculus Artificialis," 1684, in which is described a binocular microscope with two eye-pieces and one objective; "Grew's Anatomy of Plants," and others. It is astonishing to find how many ideas, supposed to be modern, are to be found in these old books. For instance, dipping in Baker's "Microscope Made Easy," we found the following passage: "We should always have ready for this Purpose [the examination of transparent objects] little Slips of Glass, about the Bigness of a Slider, [the old ivory sliders are here referred to] to place Objects on, occasionally; some of which slips should be made of green, blue and other different colored Glass; many Objects being much more distinguishable when placed on one Color than another."

A Strong Cement.—The so-called crystal Porcelain cement consists, according to Prof. Böttger, of gelatine dissolved in acetic acid. It is prepared by placing a small piece of clear gelatine in a porcelain cup, and after adding a small quantity of acetic acid, slowly heating it until a viscid, perfectly homogenous jelly is formed, which on cooling forms a transparent mass. In order to cement two broken parts together, the gelatine-like mass is returned to a fluid condition by gently warming, and applied by means of a brush to the fractured faces; the latter are then gently pressed together, and permitted to lay quietly for twelve or fourteen hours.

Memorandum Books.—The neatest and most convenient thing in this line that we have seen is the new pocket memorandum book brought out by the Silicate Slate Company, of this city. These pocket tablets are made of a new and very fine silicate board called "ivorine," which is very easy to write on, and from which the writing is easily and completely removed by means of damp cloth or paper, leaving a perfectly clean surface. For temporary memoranda these books are invaluable, and we suppose they may be had from any bookseller.

Catalogue of Microscopes.—Mr. Schrauer, of 50 Chatham street, has placed on our desk a very handsomely illustrated catalogue of the microscopes of his make. Mr. Schrauer deals largely in the Hartnack objectives and generally has a full stock on hand.

More Red Tape.—The benevolent work of John G. Chapman, of New Haven, who for five years has been in the habit of supplying the Postoffice with stamps with which to forward letters dropped into the office untamped, is brought to an end by an order from the Postoffice Department that such a course must cease, and all letters held for postage must be forwarded to the dead-letter office. This seems to be a very foolish order.

Amateur Mechanics.—Those of our readers that wish to inform themselves in regard to the best tools for performing various kinds of work would do well to address Mr. George Parr, of Buffalo, and get a copy of his catalogue. Mr. Parr has for many years made a specialty of small tools and amateur tool chests, and his catalogue contains an immense amount of practical information.

Pleasant and Efficient.—The comfort to be derived from any heating apparatus depends not only on the ease with which it warms a room, but the condition in which it leaves the atmosphere. In this respect the stove known as the "Fire on the Hearth" is pre-eminent. It makes very little dust, and while it diffuses a genial glow, it ventilates the room, so as to leave the atmosphere pleasant and wholesome. The address of the manufacturers is 115 Fulton street, New York.

THE AMERICAN

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AND

POPULAR SCIENCE.

VOL. II. NEW YORK, DECEMBER, 1877. No. 12.

A Fossil Peronospora.

AT a recent meeting of the Woolhope Club, Hereford, Mr. Worthington G. Smith, F. L. S., read a paper on a fossil fungus, which he has named *Peronosporites antiquarius*, and which he explained came under his notice as follows: Mr. W. Carruthers, F. R. S., keeper of the botanical department of the British Museum, observed this or a similar parasite some years ago in a slide belonging to the Museum collection. Another slide lent to Mr. Carruthers a few months ago by Mr. J. T. Young, F. G. S., presented a fossil fungus (*Peronosporites antiquarius*), found in the scalariform axis of the stem of a Lepidodendron from the coal-measures, and therefore indicating a remote antiquity. Mr. Smith said that no description, except that of a Mucor, also from the coal-measures, had hitherto been published of any well-defined fungus belonging to the Palæozoic series of rocks. The specimen of the fungus now under consideration shows one of the most interesting groups of threads and fruit, or, more properly speaking, mycelia and zoosporangia (or oogonia) as seen with the vascular axis of the Lepidodendron. A close examination of the mycelium shows that it is supplied with numerous joints or septa. This seems to favor the conclusion that this fossil parasite belongs to Peronospora. One of the most perfect groups of these Palæozoic bladders containing the once mobile spores, having been enlarged to four hundred diameters, revealed the remarkable circumstance that the bladder is exactly the same in size and character with average oogonia of the present day, especially with the same organisms belonging to *Peronospora infestans*, or the potato fungus. The contained zoospores are likewise similar in form and dimensions with the zoospores of *Peronospora infestans* when measured to the ten-thousandth of an inch, so that when enlarged and engraved, and placed side by side, they appear to be identical. Mr. Smith adds that in this fungus we probably have one of the simple primordial plants of the great family of Fungi, and that if Peronospora is an Alga, we have in *Peronosporites antiquarius* a plant which, from its extreme antiquity, lends some favor to the views of Sachs and other evolutionists who place the lower Algæ amongst the primeval plants from which fungi and all other cellular Cryptograms have branched.—*Iron.*

Elementary Papers on Objectives and some Accessories.

BY ROMYN HITCHCOCK.

I.—ABERRATIONS AND THEIR CORRECTION.

THE writer has nothing original to communicate in this article, but he is induced to write it for the benefit of those who have not time or opportunity to look for the information elsewhere.

It is well known that a prism of glass or any transparent material decomposes a ray of light which passes through it into several colors, the violet being at one end of the spectrum, the red at the other. Now, place two prisms of equal angles with their bases in contact, as in Fig. 1, and we find that the light is brought approximately to a focus at A, but on more careful examination it appears that the different colors are focussed at different points along the line B C, so that we have the violet at *v*, and the red at *r*, with yellow, green, blue, etc., between them.

Imagine the surfaces of the prisms to be curved, and we have a double convex lens with positive chromatic aberration; in fact, in calculating the course of rays of light through a lens, we consider it to be made up of a series of prisms, the faces of which touch the surface at the points of incidence and emergence of the rays, and the formulæ are the same as for prisms.

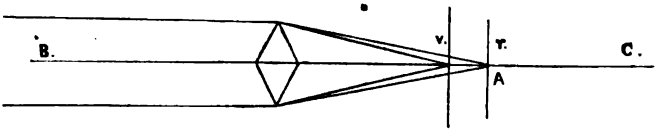

Fig. 1.

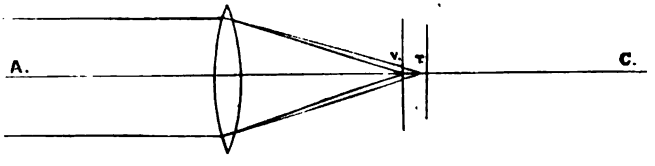

Fig. 2.

Fig. 2 shows the course of the rays through a double convex lens, the light emanating from the direction A, and the decomposition of the light is shown at C.

This aberration is corrected by a lens with concave instead of convex surfaces, usually a plano-concave lens, but frequently a convexo-concave lens, is employed. The action of a concave lens of any form is shown in Fig. 3, which represents a plano-concave lens. Suppose diverging rays to be incident upon the plane surface from A, they are caused to diverge, as may be readily understood; but, as the lens acts like a series of prisms, we find that the light is decomposed, and the violet end of the spectrum is at *v*, the red end at *r*.

Now, combine Figs. 2 and 3, and we have Fig. 4, in which the lens is compound, made up of a double convex and a plano-concave lens. It will be easy to follow the light through such a lens. Granting that the curves are made to correspond, the rays starting from A, strike the surface of the first lens and are there refracted in their course as in Fig. 3. But as soon as they leave this lens they are taken up by the next one having opposite curvatures, and this exactly neutralizes the effect of the first lens. A more careful examination shows us that the first lens throws the violet rays further from the principal axis than it does the red. The tendency of the second lens is

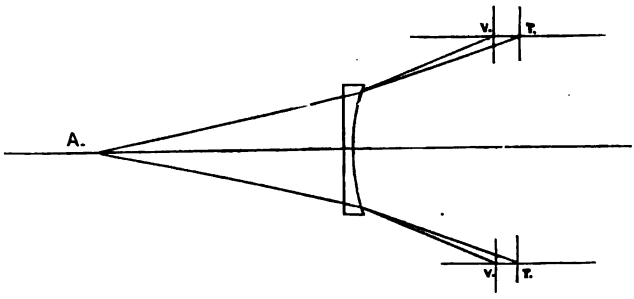

Fig. 3.

to throw the violet in the opposite direction more than it does the red. Consequently the two lenses, if properly made, will neutralize each other, and we obtain from them colorless light.

But it would be impossible to apply these principles to the construction of lenses, were we not provided with different kinds of glass, for, if we make the two lenses of the same glass, we do not obtain achromatism until we destroy their action as lenses entirely. Fortunately we are able to apply these principles to the construction of lenses by employing two kinds of glass, making the convex lens of crown glass and the concave of flint. The reason for this lies in the fact that if we take two prisms of equal angles, one of crown and the other of flint glass, and compare the spectra produced by them, we will find that the spectrum of the flint glass is nearly twice as long from red to violet as that of the crown glass prism. If we select a prism of crown glass and apply to it a prism of flint of such form as will just neutralize the chromatic dispersion of the crown, the emergent rays from such a combination will be colorless, while the refractive action of the crown is only diminished by about one-half.

The form of the achromatic combination used in the microscope is well known, the double convex lens being of crown glass, the plano-concave of flint. Admirable as this correction is, it is not perfect, and cannot be made so, owing to the characters of the spectra produced by the two kinds of glass. Their dispersive powers are not only unequal, but the distances between the colors in the two spectra are not proportionate.

By using three lenses, more perfect achromatism can be obtained than with two.

As to the value of perfect achromatism in

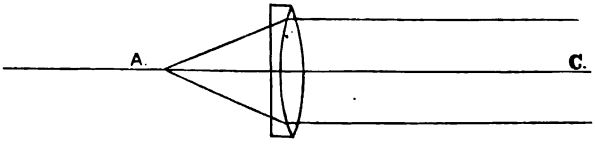

Fig. 4.

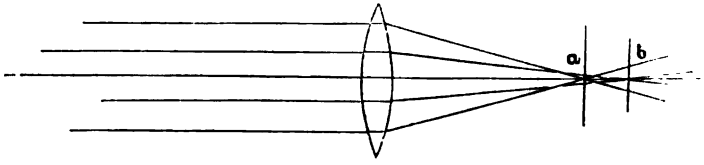

Fig. 5.

an objective, there is some difference of opinion. Dr. Woodward, among others, rather favors a glass slightly under corrected for color, *i. e.*, one in which the flint lens does not quite correct the aberration of the crown. Some insist upon the utmost freedom from color, and seem to think this one of the best indications of the value of an objective. It is certain, however, that an objective may be very excellent, and still have a very appreciable chromatic aberration. Makers are in the habit of varying their corrections to suit special requirements, as *e. g.* for use in photography.

What we call spherical aberration is generally considered quite distinct from chromatic aberration, one referring to the form of the image, the other to its color.

Dr. Pigott, however, considers them to be identical, and he has studied them mathematically with considerable care. In this view he is upheld by others. However we must treat them here as is the usual custom.

Owing to this defect in simple lenses, rays are not brought to an accurate focus, whether we employ white light or monochromatic light, but some rays meet nearer the lens than others. This is caused by the form of the lens being such that the marginal rays are refracted more than those near the centre, and hence reach their focus at a different point. In the figure (Fig. 5) the marginal rays have their focus at *a*, while those from nearer the axis meet at *b*. The distance *a b* is called the longitudinal spherical aberration, and is usually expressed with reference to a lens which has the least spherical aberration possible. Such a lens has its radii of curvature as 1 to 6, the side of greater curvature facing the parallel rays. Calling such a lens 1, we have for the spherical aberration of a plano-convex lens with its plane surface towards a distant object, 4.2; with curved surface towards a distant object, 1.081.

On account of this the front plano-convex lens of a microscope objective is always mounted with the plane side exposed or towards the object. Between the points *a b*, Fig. 5, a series of images is formed which tend to obscure each other. Obviously the correction for this defect is found in the use of the concave, as mentioned above, for chromatic aberration. When the chromatic aberration is corrected, the spherical is nearly so, but generally there is some residual spherical aberration which must be got rid of in some other way. In telescopes it is corrected by the addition of a third lens.

It may be that some apology is necessary for this long discussion of very elementary knowledge. Still, among the many amateurs and beginners who may read this there are comparatively few who are familiar with the subject, and it is for these alone the article is written.

To be continued.

The Siliceous Shelled Bacillariæ or Diatomaceæ.

(*Continued from page* 129.)

VIII.—GENERAL ANATOMY AND PHYSIOLOGY OF THE DIATOMACEÆ.

(*a*). *Structure.*

IN all diatoms, there are generally two preëminent parts to be distinguished, viz., the outer siliceous shell, and the inner soft part.

The siliceous shell (lorica silicea) consists most probably of pure siliceous earth. I say most probably, because later, strict analyses of the fossil diatom-meals of Luneburg and San Fiori, have shown minute quantities of clay. Whether this clay is chemically united with the siliceous shell, or whether it is only contained in the internal substance, and possibly united with the iron also found therein, can only hereafter be decided.

In the siliceous frustule, there must be distinguished especially two things, (1) the peculiar, clear, colorless siliceous shell, and (2), the later, more or less colored layers appearing within the same.

With living individuals, as also with dead, that are observed in water, one may see the shell always clear, transparent and colorless; but as soon as one lets the moist

little body get dry, more or less distinct opaque places show themselves, mostly of a brown color, and which, not seldom, picture peculiar marks upon the shell. These opaque spots, or spaces, stand out yet clearer when the frustule is heated. I distinguish this layer with the name *Cement* (Cementum), because it occurs always on the sides of the individual siliceous plates, and invariably covers the joints of the same. I suspect that this is a siliceous iron-oxide, and, perhaps, also contains the clay, which in the analysis one finds in the shell. The iron, I suspect, from the brown color which the crust shows, and which makes its appearance after the shell is heated.

In many species, *e. g.* Navicula depressa (T. 3., Fig. xlii), this cement stratum is so remarkable that by it the little, fine, cross-striæ, found therein are fully covered, when, however, with single individuals of the same species, the cement has developed itself less strongly, then, by close observation, one perceives the fine transverse lines clearly, (*e. g.* Tab. 3, Fig. xli). In Ehrenberg's opinion, both these forms, which always appear together, are not only different species, but belong to two distinct genera. The apparently unstriped he considers as belonging to Navicula, and the striped to Pinnularia. Here, as in most other cases, the cement stratum clothes the occupied space uniformly, without especial marks upon the inner plate; but with another group it forms neat, delicate points, which are pretty regular, (*e. g.* Nav. rostrata, Tab. 3, Fig. lv), or, is in more or less regular rows (*e. g.* Nav. costata, Tab. 3, Fig. lvi, and Stauroneis lineolata, Tab. 29, Fig. v), or in transverse striæ (*e. g.* Stauroneis aspera, Tab. 29, Fig. xii), or is so arranged that it forms lines, which are oblique, and crossing through each other (*e. g.* Surirella ornata, Tab. 3, Fig. liv).*

The real frustule consists, in most cases, of four plates, or pieces, which are so united that it appears like a four-sided little body. Once for all, I will here remark that I will call those sides which never possess an opening in the middle, but are subject to a division, *main sides* (*Hauptseiten*) (latera primaria); the others, *side sides* (*Nebenseiten*) (latera secundaria); the latter are again distinguished into a *left* (latus secundarium sinistrum), and *right* (l. s. dextrum). I consider those as left, by which the frustules attach themselves when they lie upon the flat side (*e. g.* Cocconeis, Tab. 5, vi, ix). The left side is often concave or genuflexed, (*e. g.* in Achnanthes, Tab. 20), and the opposite, right, convex,* but in most cases both sides are exactly alike, and the distinction is often superfluous. If the main sides in their formation are different, I distinguish them as under and upper (*e. g.* the under concave, the upper convex, as in Epithemia, Tab. 5, Fig. xxii–xxx) or as inner and outer (latus primarium inferius et exterius), as in Cocconema, Tab. 6, where the inner is often concave, the outer always convex.†

The sides are always of the same length, but not always of the same breadth; sometimes the main sides, sometimes the side sides, are most conspicuously developed; and on this development depends the position in which the little body will show itself to the observer, since by floating, or falling

*These dots, lines and other markings mentioned by Kutzing as due to the "cement stratum," must not be confounded with the true striæ, etc., mentioned further on.—*Trans.*

*Ehrenberg calls the concave "*belly* side," and the opposite convex *back* side. These names are, however, only to be taken relatively, because the diatoms are in no ways so distinct animals as Ehrenberg thinks, and therefore there can be no talk of belly and back. Moreover, sometimes the main, and sometimes the side, sides appear curved, yet the distinctions, ventral and dorsal, are convenient in diagnosis, and on this ground have been retained by me.

†The *main side* of Kutzing corresponds to what is called "front view" (F. V.) in the British Diatomaceæ; in this position, the sutural line (line of self-division) is in view. The *side side* corresponds to the "side view," (S. V.) of the Brit. Diat., and exhibits the sculptured valve, and the raphe, and central nodule, when these are present. It is scarcely necessary to add that Kutzing's four plates are really but two, inasmuch as the main sides are but continuations (mostly smooth and frequently easily detached) of the side sides; when detached, these appear, in the circular forms, as so many *hoops;* indeed, whatever the shape (that of the valve generally) they have been termed hoops, sometimes "connecting membrane."—*Trans.*

in the water, it follows the physical law, according to which the flattest side lies underneath. In the main sides the following peculiarities show themselves: (1) It is common when these sides have developed themselves sufficiently in their breadth dimensions, that a longitudinal separate line is formed in the middle, one individual divides itself so that two are formed out of it, and one may notice in this division, that even now a hard, thin upper skin exists, which embraces the whole body, and is especially observable where the corners, at the ends of the newly formed individual, round themselves off. The separation occurs under the over-skin, which also consists of siliceous earth, and in the beginning embraces the new individuals in pairs, but seldom in triplets (Tab. 4, xx b, but especially most of the figures, Tab. 20.) Afterwards it disappears, and is no longer to be observed. (2) The main flats are to be recognized always by the more or less distinct longitudinal lines, which often on their ends push out little openings in the shell (Tab. 15, Fig. iii, 6, 7, 8, 9).

(3) In many forms, especially marine, the main sides are distinguished further through the presence of little length fillets or ridges (vittæ), which stand on the inner wall of the shell, have varied forms, and sometimes separate the contents into several folds. These vittæ are especially remarkable in Grammatophora (Tab. 17, Fig. xxxiii–xxv) Striatella and others.

In the side sides, on the other hand, appear the following peculiarities: (1) There is often found in the middle of the same, an aperture (which Ehrenberg considers sometimes as a mouth opening, and sometimes as a sexual orifice,) *e. g.* in Navicula, T. 4, x, ix, xiv, xv, xvii, xviii, and others. From this opening, there extends towards both ends a more or less distinct cleft (*Spalte*) (especially distinct in Navicula nobilis, Tab. 4, xxiv), which either disappears in the ends (as in Ceratoneis), or, on either side, opens into an aperture (*e. g.* Nav., T. 4, xxiv, xvii, xiv, etc.,) but there are also whole groups which show neither opening, or long clefts, in their side flats.*

(2) Upon the side sides, transverse striæ, lines, points, cells, or other formations show themselves, which belong not to the above mentioned "cement," but are peculiar formations which bear the most intimate connection with the shell, and also, in isolated cases, allow themselves to be loosened from the shell (*e. g.* in Navicula viridis and N. nobilis).

The so-called transverse stripes show either as very delicate *lines* (lineolæ) as in Eunotia and Himantidium (Tab. 5, Fig. xxii–xxx), or as stronger and more solid *ribs* (costæ), as in Epithemia (Tab. 5, xii–xviii). The commonly appearing ones are generally termed *striæ* (striæ). Ehrenberg calls them pinnæ, in several cases where they distinguish themselves by their breadth, *e. g.* in Navicula nobilis. The stripes, lines, or ribs, are either pervious transverse (lineolæ, l. costæ, l. striæ, transversalis perviæ), as in Denticula, Tab. 3, lx a, lxii b, or interrupted, as in Navicula, Tab. 4, xviii a, xix a, xx a, xxi a. When the stripes are elevated much above the plate, they can be seen on the sides of the main flats, since they come into contact with the ends of these, Tab. 4, xviii b.

(3) The side sides never undergo division, but several individuals are sometimes united by them, to become compound forms. In addition to this structure of the two sides, we observe in several other higher developed species, *e. g.* Biddulphia, Climacosphenia, Terpsinoë, that the inner space is divided into apartments through peculiar partition walls, which coincide neither with the stripes or ribs of the side sides, or the vittæ of the main sides.

The *organic contents* of the siliceous shell are of a yellow brown colored substance, which

*These "apertures" of Kutzing and Ehrenberg, are now recognized as a thickening of the siliceous wall, at extremities of the raphe, and as constituting also what is called "central nodule." There is no doubt that the raphe, or median line, is a true cleft, and the little dots, sometimes quite distinct (near the central nodule) at the ends of the raphe, are true openings.—*Trans.*

often appears under the microscope golden. It is, in the beginning, almost everywhere homogeneous, but becomes afterwards granular, and separates itself into several layers, or draws itself together sometimes, into larger or smaller balls. The development and division of this substance is not alike in all groups, but all forms belonging to the same group, show in their development of this inner substance a great harmony.*

To be continued.

A Modification of Wenham's Reflex Illuminator.

THE very ingenious and interesting reflex illuminator of Mr. Wenham was designed to avoid direct illumination by passing light into the slide at such an angle that it would be totally reflected instead of passing into air above the slide. With dry objectives, of any angle, this illumination would necessarily be exclusively reflex, since no light could pass directly to the objective; and with immersion objectives of angular aperture not greater than that corresponding to one hundred and eighty degrees dry, the result would be practically the same, as the light, after passing through a balsam-mounted object, would reach the lens at an obliquity greater than that of its extreme capacity for image-forming rays. But for lenses of greater angle than this, the illumination would be direct, the image being formed exclusively by that portion of the available aperture of the lens which was in excess of the equivalent of one hundred and eighty degrees dry angle. The existence, and even the possibility, of such lenses was not at that time undisputed, some eminent microscopists still maintaining the contrary opinion. But the new reflex illuminator had scarcely arrived in this country before Mr. Samuel Wells, of Boston, succeeded in making it act as a direct illuminator, with several lenses of at least two makers, an efficient and excellent image being formed by these extralimital rays. It immediately occurred to Mr. Tolles that a similarly good illumination might be obtained in the case of dry lenses, and immersion lenses of moderate angle, by changing the angle of the reflecting face so that the illuminating pencil should fall just without instead of just within the angle of total reflection. He at once made several such prisms, of various angles, but, hoping to improve still further upon the plan, refused to offer them for sale. One of these was presented by Dr. R. H. Ward at the Nashville meeting of the American Association this summer. Its reflecting face was inclined twenty-one degrees to the axis, giving an obliquity of forty-two degrees to the central reflected ray. This utilizes the extreme angle of an objective close up to one hundred and eighty degrees dry, or its equivalent in balsam, and in addition gives a slight illumination, though by itself insufficient for useful work, of extralimital rays available exclusively to immersion lenses of excessive aperture. With suitable lenses it gives prompt resolution of numbers eighteen, nineteen and twenty of Möller's test plate in balsam, by lamp-light. The modified prisms are inferior to the original for use with lenses capable of taking up half the pencil transmitted into balsam by the original "reflex." The prism of twenty-one degrees gives the maximum efficiency with dry mounts, as the extreme capacity of the lens is utilized by the half pencil from the illuminator, which can be transmitted to it—a condition very favorable for difficult resolution. Prisms of still smaller angles were made, and are now used for lenses of lower angle. The length of prism, and the condensing arrangement, are modified to suit the changed angle. As in the original reflex, the chromatic aberration is excessive; and it is a question how far the very decided results in resolution attained are due to the nearly perfect monochromatic illumination thus secured. The new illuminators do not seem to have given results not otherwise attainable, and they are subject to the inconvenience that each one is limited to a fixed and comparatively narrow range of angles; but they furnish a ready and easy means of oblique illumination, suitable for extremely difficult resolution, and entirely independent of thinness of stage and concentric rotation of object-carrier.—*American Naturalist.*

*Lately Pfitzer and Petit have attempted a classification based on the arrangement of the Endochrome.—*Trans.*

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W. H. WALMSLEY, 921 Chestnut Street, Philadelphia.

Death of Dr. Lawson.

IT is with great regret that we announce the death of Dr. Lawson, editor of the *Monthly Microscopical Journal*. In a future issue we will give further particulars.

Enlargement of the Journal.

IN two-thirds of the letters that we have received this year from subscribers, we have been urged to double the size of the JOURNAL, and double the price. Hitherto we have been very much opposed to such a course, for we know that we have on our list many amateurs to whom the increased price would be an objection. During the past six months, however, we have felt the absolute necessity for an enlargement, and we *have* enlarged the journal, though the price has remained the same. Our original promise, as embodied in our first three issues, was twelve pages of reading matter; last month we gave twenty.

We have, therefore, decided that in obedience to the requests of the majority of our subscribers, and the increased amount of valuable matter which continues to press itself upon us, we will double the size of the journal, which will then consist of not less than twenty-four pages of reading matter. This, of course, involves a subscription price of one dollar.

In addition to the desire for a larger journal, another circumstance has urged us to this course. When the first number was issued, silver coin had not become common, and pieces of fifty-cent currency were easily obtained. It is now difficult to get currency, while a dollar bill can be had anywhere.

The increased space at our disposal in future numbers will enable us to restore several departments which have of late been crowded out. The notices of new books, the work table notes, current notes, etc., etc., will now be in little danger of being omitted for want of room. We hope, therefore, to give in 1878 a volume which will not only be doubled in size, but greatly improved in the variety of its contents, and the thoroughness with which the different subjects shall be treated.

Although containing a few more elaborate articles, the JOURNAL will still retain its elementary character, and if any of our young friends, or old ones either, feel that the new rate is too much for the amount of benefit which they can derive from it, we will cheerfully accept from them the old subscription, fifty cents. We do not wish to part company with any of our old friends. But we feel that to all, except a very small minority, the change will be acceptable.

From the very first we have had subscribers who have expressed the warmest interest in the journal, and signified their faith in it by paying for two or three years in advance. It is, of course, understood that all such subscriptions will be filled, without further charge, for the full time for which they were originally made.

During the past year we have made several distributions of material for interesting and beautiful slides. We have made arrangements to do the same next year, so that amateur microscopists will not only be told how to work, but will receive material to work on.

Our Book Table.

Pollen. By M. Pakenham Edgeworth, F. L. S., F. A. S. Illustrated with 438 figures. London: Hardwicke & Bogue.

This work possesses special interest at this time from the fact that quite a large number of observers throughout the country are devoting themselves to a microscopical examination of the pollen of different plants, in the hope that they may be able to determine the cause of hay fever. The numerous and excellent figures given in the work before us must prove of great aid in such researches.

To botanists the work will prove of interest, the field being somewhat new, at least so far as general treatises are concerned, and to the mere microscopist it will prove of value from the fact that it will give hints towards the procuring of many very beautiful objects. Mr. Edgeworth has therefore rendered a good service to several large classes of readers.

Captain Waters, and Bill, his Bo'son. A Tale of the Ocean and the Farm. By R. O. Sault (Chas. F. Swim.) New York: John P. Jewett.

The publisher of this work, well known as the man who brought out Mrs. Stowe's "Uncle Tom's Cabin," in the face of the strongest opposition from his friends, has, on former occasions shown that his judgment is to be depended upon in the matter of readable books. If our readers want fun without vulgarity, and sound sense without cant, they cannot do better than read this book.

Price-List of Microscopes manufactured by the Bausch & Lomb Optical Company, 37 Maiden Lane, New York.

This catalogue is specially valuable, in that it contains two able articles from the pen of Mr. Gundlach, one on his new periscopic eye-piece, and the other on his new condenser. These articles are worthy the attention of all who are interested in the microscope.

Fret Sawing for Pleasure and Profit. Williams' Handbook, How to Use the Fret Saw. By an old Amateur. New York: H. Y. Williams.

This convenient and thorough little treatise will be welcomed by thousands. Probably no employment ever took a firmer hold upon amateurs than fret and scroll-sawing, and this for the simple reason that it is adapted to every grade of skill. Even those who have very little mechanical talent find themselves capable of turning out really good work with tools of very moderate price, while not even the most expert and skilful can say that they have learned the whole art. This little book will enable those who have a taste for this employment to acquire a very fair knowledge of the art. We are glad to gee that the price is quite moderate—only fifty cents.

Correspondence.

The Editor of the AMERICAN JOURNAL OF MICROSCOPY does not hold himself responsible for opinions or facts stated by correspondents. In this department we accord the widest liberty consistent with proper courtesy.

Important Improvement in Stands.

Ed. Am. Jour. Microscopy—Mr. George E. Fell, of Buffalo, who has for years been a hard student of things microscopic, and is withal a very modest gentleman, has recently suggested a new and useful addition to the microscope stand.

Mr. Fell proposes to engrave a fine scale on that part of the "body" of the stand which slides on the "limb." This latter can be furnished with a vernier giving readings as close as may be desirable.

I simply state Mr. Fell's plan in brief. It is perfectly practicable, and in one form or another, can be applied to almost any style of stand, and, I apprehend, involving no great expense.

The advantages to be obtained by this little contrivance are self-suggesting, hence I will not trespass on your space. I learn from a correspondent that the president of the Dunkirk society, adopting Mr. Fell's plan, has had the same engraved on his stand. The writer will follow suit at an early day.

J. EDWARDS SMITH.

Homeopathic Hospital College, Cleveland, O., Nov. 15, 1877.

Coorongite.

Ed. Am. Jour. Microscopy—Some time ago I received from Dr. H. T. Whittell, of Adelaide, South Australia, some unmounted microscopical objects, among which was one labeled "Coorongite." The piece sent was apout one-fourth of an inch in thickness, hard and dark on one side, but somewhat soft and lighter on

the other, to which grains of sand were attached.

The following is what Dr. Whittell wrote about it: "A piece of coorongite, named after the place where it is found. The nature of it has puzzled the savans at home. If you cut a *very* thin section you will see that it has imbedded in it a number of diatoms."

I cut a few sections and mounted them, one of which I sent to a gentleman in Philadelphia, who, I believe, showed it to Mr. G. C. Morris.

If the real Coorongite contains seventy-five per cent of diatoms, this certainly must be something else, as it does not contain, I should think, more than one per cent. If Mr. Morris will be kind enough to send me his address, I will be happy to send him a slide of the material I possess. ALLEN Y. MOORE.

San Diego, Cal., Nov. 16, 1877.

TRANSACTIONS OF SOCIETIES.

NOTE.—It will afford us great pleasure to publish notes of the transactions of any of our microscopical societies. The limited space at our command precludes the insertion of lengthened accounts of mere business details.

San Francisco Microscopical Society.—The regular meeting of the San Francisco Microscopical Society was held on Thursday evening, October 18th, with President Wm. Ashburner in the chair, and, in addition to a good attendance of the members, Mr. S. Heydenfeldt, Jr., Secretary of the California State Geographical Society, was present as a visitor.

After reading the minutes, Prof. F. L. Bardeen, of Ann Arbor, Mich., was proposed for Corresponding Membership.

The "American Naturalist" for October, Nos. 1 to 4 of "Science Observer," Bulletins 1 and 2 of the "U. S. Entomological Commission," and No. 12 of "Proceedings of the Belgian Microscopical Society" were added to the library, while the cabinet was increased by a donation of diatomaceous earth with larger fossils, obtained at Santa Barbara, and presented by the California State Geological Society.

A valuable series of coal-tar derivations, in the shape of twelve exceedingly beautiful slides, prepared by Prof. F. L. Bardeen, of their characteristic crystals, was received and examined during the evening. The chemical name and formula was attached to each slide, which were only a few of the colors of the vast range of shades that can be produced by a slight variation of the chemical treatment. Professor Bardeen furnished the following memoranda with the slides, which will be found of interest:

Anthracene is the base of all the others.

Alizarine is a natural dyestuff obtainable from madder; but not until late years was it known to be in coal-tar. It is considered one of the most fast and reliable red dyes. As the mordant is changed it gives all shades, from deep black to light violet. This with iron mordants. With alumina mordant all shades of red, from light pink to deep crimson; and by a mixture of these mordants can be obtained all shades of brown and chocolate. This ranks with madder and indigo as one of the three great dyes.

Anthrachinone is the first step in the manufacturing of alizarine.

Bibrom-anthrachinone, Amido-anthrachinone and Binitro-anthrachinone are all varieties of the second step in preparing this series of coal-tar dyes. Properly they are not dyestuffs at all, as they do not act with mordants.

Bibrom-anthracene and Bichlor-anthracene are highly fluorescent in solution, giving a kind of lavender color.

Purpurine is very similar to alizarine, but less stable and more liable to fade.

Xantho-purpurine is an isomer of alizarine, and only has very feeble dyeing properties. When it is remembered that such beautiful colors (many of them being more striking to the eye when used as dyes than in their crystalline state—the effect of the mordant) can be obtained from the black, dirty, waste products of a gas manufacturing establishment, and that some of them are found in the human economy, and others in the vegetable kingdom, we are at least forcibly struck by the achievements of a science that can teach such facts. For example, purpurine is found frequently in the urates of urinary deposits, giving such deposits a pink or red color, which physicians denominate red gravel. Again, anthracene has been obtained by the deoxidation of barbaloin. This latter substance instead of coming, as purpurine did, first from coal (mineral kingdom), or second from the human organization (animal kingdom), comes from Barbadoes or Socotrine aloes (vegetable kingdom). Other striking examples might be noted. All these various colors are generalized under the head of aniline colors. In the distillation of coal for gas purposes, coal-tar, or gas-tar, is formed, which contains a liquid known as benzol, and this by being treated with nascent hydrogen, by oxidation, etc., and various chemical reagents, aniline dyes, lakes, pigments and every hue of the rainbow are now imitated, and are common articles of commerce. Their application has completely revolutionized the arts of the dyer and color-printer.

State Microscopical Society of Illinois.—The first regular meeting of the season of this society was held at the Academy of Sciences, No. 263 Wabash Avenue, Chicago, Friday evening, Oct. 26, 1877, President Fuller in the chair. Notwith-

standing the unpropitious state of the weather, at least one hundred and fifty people were present, among them many ladies.

After the usual routine of business, Mr. R. F. Nourse read the first of a series of papers on adulterations. His paper was short but spicy, the subject being "Coffee." He had samples of the pure, impure and mixed, peas roasted ready for grinding, and chicory in all shapes. Altogether the platform had very much the appearance of the back office of a wholesale grocery house. After the reading of the paper, Mr. Nourse explained to the many people congregated around him how they could learn to judge the article for themselves, and it would really appear that even the most obtuse boarding-house keeper could learn to buy the pure article—if she wanted to.

Mr. Bulloch exhibited a new style of turn-table, which attracted universal admiration; it is a sort of a cross between the Cox turn-table, and the American scroll-chuck, with a little of the Kinne principle mixed in. In the opinion of many present, it is destined to be *the* table above all others.

Mr. Atwood had a pet in the shape of an "Aulacodiscus Kittonii," with five processes instead of the usual number of four; it was the subject of some discussion among the members that have an interest in diatoms. Dr. Curtis entertained many with their first sight of blood corpuscles as opaque objects.

Mr. Thomas, of course, had some hideous creatures from Lake Michigan under his glass; he has been doing some really good work of late in investigating some of the impurities of our water supply.

Mr. Summers showed some of his beautifully cut and stained sections, while Messrs. Langguth and Bulloch seemed to be busy at their end of the long table answering many questions, such as, "Oh my! what's this?"

It was quite late when the audience reluctantly began to leave. Everyone seemed to be pleased with their entertainment, and the active members of the society have cause to congratulate themselves on the success of this their first meeting.

H. F. Atwood, Secretary.

Microscopic Exhibition.—At a Fair held at Garnerville, on the evenings of Oct. 16th and 17th, for the benefit of the new parsonage of Trinity Parish, an interesting feature was introduced in the shape of a display of microscopical specimens, in charge of Messrs. Readio and Stevens. For the first evening a number of choice pathological objects were arranged for inspection, besides many of a miscellaneous character. The beautiful effects of polarized light were also illustrated. At the second session, the circulation of blood in the foot of a frog was shown; also some of the animated inhabitants of pond water in their native element.

The two microscopes (Queen's Student's) used on the occasion were placed on a revolving table, which enabled a number of persons to examine the objects in a short time. This, like almost all such exhibitions, has awakened a deep interest in the microscope and its revelations.

EXCHANGES.

Subscribers who have a surplus of interesting microscopic material, or objects in any department of natural science, which they wish to exchange, may announce it, without charge, in this column. The following rules must be observed: 1. The privilege of announcing an exchange is confined to subscribers. 2. Exchanges only will be admitted. Sales must be relegated to the advertising department. 3. Each exchange will be limited to three lines, and must be legibly written on a separate slip of paper (not embodied in a letter). Be careful about the address.

Slides of spores of botrychium, and fossil diatoms from Bow, N. H., for other mounted objects. Lists exchanged. Wm. W. Griffin, Lynn, Mass.

Slides of cuticle of larva of Macrosila Carolina, showing crystals, in exchange for other objects. E. A. Burdick, Pension Office, Washington, D. C.

Diatoms from Coldwater, Mich., in exchange for other well-mounted objects. Address F. H. Root, Coldwater, Mich.

Palates of mollusca, a great variety, mounted or unmounted, in exchange for mounted slides of interesting objects or good material. C. M. Vorce, 164 Lake street, Cleveland, Ohio.

Case of algæ, and live fresh water animalculæ, for any well-mounted specimen. Send slides to A. Hobart, Box 581, Penn Yan, Yates County, N. Y.

Slides of Arachnoidiscus Ehrenbergii, *in situ*, on seaweed from Santa Cruz, Cal., and Aulacodiscus Kittoni (transparent), for other mounted objects. C. Mason Kinne, No. 422 California street, San Francisco, Cal.

Wanted, in exchange for diatoms from northern Wisconsin and Michigan, any well-mounted objects; marine diatoms preferred. W. H. Titus, M. D., Shawano, Wis.

Wanted, a small piece of "Monterey stone," or a small quantity of the Diatomaceous fossil deposit from any part of the Pacific coast. State what is wanted in return. F. F. Stanley, 40 Pearl street, Boston.

Specimens of the marbles, granites and minerals of Vermont, in exchange for Western minerals, or good fossils; minerals and fossil woods from the far West specially desired. Dr. Hiram A. Cutting, State Geologist, Lunenburgh, Essex county, Vt.

Stained petal of Anemone patens and other vegetable stainings, for other mounted objects. Address F. H., Drawer 35, Cherokee, Iowa.

Wanted, foraminifera, polycystina and zoophites in exchange for histological preparations, crystals of herapathite and other crystals, various starches, stained sections of old cypress stump from Centennial, and other slides of interest. R. Hitchcock, 8 Beekman Place, New York.

Polyzoa with "bird's heads," foraminifera, polycystina, holothurian plates, synapta anchors, chirodota wheels and young; spicules of sponges and gorgonia, etc., in exchange for foraminifera, pathological, anatomical and vegetable preparations. F. M. Hamlin, M. D., Auburn, N. Y.

For skin of sole send a stamped directed envelope to John Walker, corner Eighth street and Twelfth Avenue, Minneapolis, Minn.

Diatoms from New Hampshire in exchange for other well-mounted objects. W. R. Comings, Medina, Ohio.

Specimens of lead ore, heavy spar, and black tourmaline, in exchange for microscopic slides or scientific books. Address James N. Bishop, Plainville, Hartford County, Conn.

Utricularia, bladders containing entomostracam and confervæ, exchanged for well-mounted specimens, histological preferred. Dr. Chas. L. Swasey, New Bedford, Mass.

Want to exchange a monocular microscope for a Woodward's Student's monocular microscope, or one like it; will pay cash difference. J. Siler, 1,242 Broadway, St. Louis, Mo.

Books wanted: Johnston's "Spongidæ and Lithophytes," Edinburgh, 1842. "British Spongidæ," J. Bowerbank, London, 1864. "Sponges as a distinct sub-kingdom of Animals," by A. Hyatt. R. Allen, 62 North Third street, Troy, N. Y.

Slides of rare chemicals for the polariscope. Send for list. Send list of exchanges to G. E. Bailey, Lincoln, Neb.

Plumule scales of small cabbage butterfly (Pieris Rapæ), mounted, for good slides. Edw. Pennock, 805 Franklin street, Philadelphia.

For exchange, transparent injections, equal to finest English slides of Thymus and Thyroid glands, stomach, bladder, kidney, mesentary, intestine and tongue of cat. J. T. Joslin, Newburgh, N. Y.

Slides of various kinds of fertile fern fronds, Indian corn, deutzia, citra odora and other leaves, decolorized and stained, exchanged for other good microscopic objects. C. Blasdale, M. D., Jericho, Queens County, N. Y.

Microscope wanted in exchange for a very excellent gold watch which cost $150. Address E. W., Box 4,875, New York P. O.

Scales and skin of Anguilla vulgaris in exchange for other objects. Address H. B. Hargreaves, Garnerville, Rockland County, N. Y.

Bermuda shell sand, composed entirely of foraminiferal and other shells, with coralines and sponge spicules. Very interesting for low powers and opaque specimens. C. C. Merriman, Rochester, N. Y.

Publisher's Department.

Microscopic Examination of Flour.—To ascertain whether there are *acari* in a specimen of flour, M. Troupeau recommends to place some of the flour between two sheets of paper, and thin it out by pressure with the finger. If acari are present, they soon reveal their existence by appearing as small molecules, visible to the naked eye. These may be transferred by means of a moistened point to the stage of a microscope. To study the legs and hairs of acari it is indispensable to use a mixture of glycerine and acetic acid, which increases the transparency. To avoid bruising the insect a hair should be placed between the plate and the cover-glass. Examining in this way a number of specimens of flour, of various source and age, M. Troupeau has found that nearly all have contained acari, and that these animals are more abundant the longer the flour has been exposed to the action of air and moisture.

Improved Field-Glasses.—One of the oldest houses, if not the very oldest, in this city, which makes a specialty of spectacles, opera glasses, telescopes, etc., is that of H. Waldstein, of 545 Broadway, representing here the European house of Waldstein, of Vienna. Mr. Waldstein has been in business here for over thirty-five years, and is pretty well known to our citizens. We recently had the pleasure of examining some improved telescopes and field-glasses which he has introduced into this market, and which possessed very great power, combined with wonderful clearness of definition. The specialty of this house, however, is artificial human eyes, and in this department they have, we believe, almost a monopoly, owing to the great superiority of their goods. This subject is obviously one of great importance to physicians, many of whom we number amongst our readers, and we shall recur to it again at an early day.

Picture Frames.—However much we may ridicule the idea in the abstract, it is an undoubted fact that an appropriate and beautiful frame adds wonderfully to the appearance of any picture, however great the intrinsic value of the latter may be. It is not every fine frame, however, that will suit every picture, even though the size may be right. To produce the best effect, the frame should be made by one who is an artist in his line. Having had occasion to employ Mr. Renner, of 719 Sixth avenue, in this city, we have found that he not only knows what is appropriate, but has all the facilities required for producing what is wanted in the best shape.

Foreign Microscopes.—Amongst the importers who have long been favorably known as extensive dealers in European microscopes is Mr. F. J. Emmerich, whose assortment of French and German instruments is well worthy the attention of those who desire a microscope for young people. Mr. Emmerich makes a specialty of Hartnack objectives and Bourgogne and Möller's slides. His stock of opera glasses, magic lanterns and holiday goods is very large.

Two Chromos Free.—A pair of beautiful 6x8 chromos, worthy to adorn any home, and a three months subscription to *Leisure Hours*, a handsome 16-page literary paper, filled with the choicest stories, sketches, poetry, etc., sent free to all sending fifteen cents (stamps taken) to pay mailing expenses. The publishers, J. L. Patten & Co., 162 William street, New York, guarantee every one double value of money sent. $1,500 in prizes, and big pay, given to agents. Send at once.

Publisher's Department.

Betrayed by the Smell.—In connection with a poisoning case now before the courts, the *Union Medicale du Canada* relates a curious, but little known, episode of another celebrated trial, which took place in Belgium some years since. At one time, the prisoner, B., could hope to escape conviction, when a casual observation caused his ruin. The government had called as an expert M. Stas, Professor of Chemistry at the Polytechnic School of Brussels, who conducted his experiments on the deceased's intestines in a closed room, in presence of a number of persons. "I beg you, gentlemen," said the professor, "not to smoke; the smell of tobacco is unbearable to me!" "Nobody is smoking," answered one of his assistants. The smell, then, emanated from the viscera of the body itself. An idea struck the eminent chemist like lightning; the reagent for nicotia was immediately applied, and the alkaloid which had been first detected by the smell was proved to be present. Six weeks later, B. was executed at Mons. ——. Had M. Stas been a smoker, the prisoner would have been saved.

Safety and Comfort.—The offensive and dangerous character of the old phosphorus match is so obvious and so well known that any allusion to it would be almost superfluous. Poisonous, offensive in odor, and liable to ignite at any time when not wanted, it may be characterized as the greatest poisoner and incendiary ever tolerated in civilized life. The only wonder is that it has been endured so long. Even the so-called parlor match, though it avoids the odor of the common brimstone article, is highly poisonous, and almost as liable to unexpected ignition as the older form. Fortunately for humanity, however, the day of these dangerous articles is passing away, and a new and better means of obtaining fire is now obtainable. We allude to the new safety match, which is perfectly devoid of odor, is not in the slightest degree poisonous, and cannot be ignited except by rubbing it on a specially prepared surface. As a mere source of comfort to invalids, and those with weak lungs, this match would be inestimable, but as a means of safety it becomes so valuable that the only wonder is that any other is ever used. Children cannot ignite them by playing with them, or poison themselves by sucking them; mice and rats cannot set buildings on fire by carrying these matches to their holes and chewing the ends; and it is safe to say that if the use of these matches was universal, half the fires that now occur would be prevented.

American Society of Painters in Water Colors.—The tenth annual exhibition will be opened in the galleries of the National Academy of Design, on the 23d day of January, 1877, and will be continued until the 4th of March. Original works which have never before been publicly exhibited in the city of New York, will be received for the exhibition from the 10th to the 12th of January, inclusive. A competent person will be in attendance, and have the management of the sales in the interest of contributing artists. The society also requests the loan of water color pictures, not before publicly seen in New York. Works in black and white, drawings on paper, wood, or stone, in lead, crayon, chalk, charcoal, india-ink, sepia, etc., are again solicited. We understand that this exhibition has already received promises of such support as cannot fail to render it a decided success.

Surveying Instruments.—Amongst the fine displays of scientific apparatus at the recent Centennial Exhibition, one of the most interesting, if not the most showy, was that of Mr. James Prentice, of this city. His case contained not only a collection of very fine surveying and mathematical instruments, but a complete set of parts in various stages of manufacture. Mr. Prentice has long been known as a maker of first class instruments. Of course he received a medal, as did almost everybody else, but the *reasons* for giving this medal, as stated by the judges in their report, was very flattering to Mr Prentice.

Prize in Industrial Hygiene.—Our English exchanges tell that an offer of a medal in connection with this subject has been made by Mr. Benjamin Shaw, and has been gratefully accepted by the Society of Arts. The medal will be of the value of £20, and will be awarded every fifth year. Mr. Shaw has transferred into the name of the society a sufficient amount of Consols for the purpose. The terms of the offer are as follows: "For any discovery, invention, or newly-devised method for obviating or materially diminishing any risk to life, limb, or health, incidental to any industrial occupation, and previously capable of being so obviated or diminished by any known and practically available means." The first award will be made in May, 1877. Parties desiring to compete for the above prize should communicate with the secretary of the Society of Arts. A full description of the invention or process must be given—illustrated, if necessary, by models, drawings, specimens, etc. When the invention or process is in actual work, it is desirable that this should be stated, so that the committee may, if they think proper, have the opportunity of examining it. The council reserve to themselves the right of withholding the prize, in the event of nothing of sufficient merit being sent in for competition. The latest date for receiving communications will be March 31st, 1877. In case a sufficient number of objects are sent in for competition, the council will make arrangements to exhibit them, or a selection from them, to the public.

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The subscription to this journal, mailed direct by the London publishers, is $6 per annum, at which rate we are prepared to receive and forward subscriptions, thus saving our customers the trouble and risk of remitting small sums.

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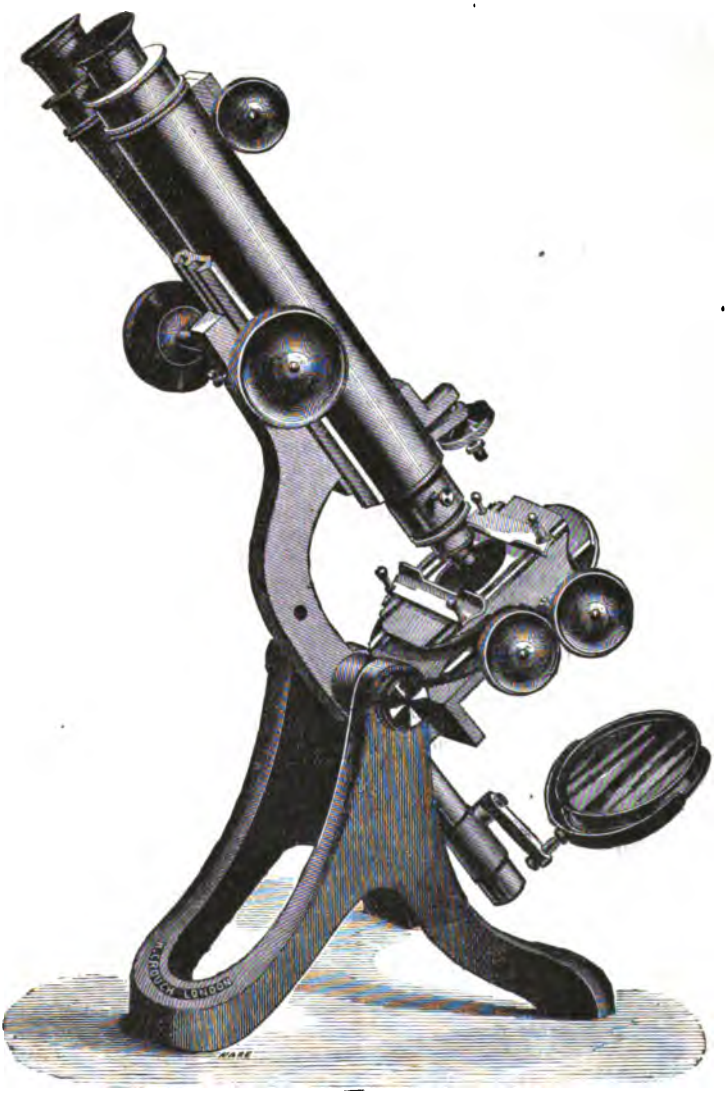

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CONTENTS OF NO. 2.

*Illustrated articles are marked with an *.*

The Richmond Diatomaceous Earth..... 17

*The Turn-Table..... 19

The Microscope in Mineralogy..... 22

Mica in the Laboratory..... 22

In Preparation—Microscopic Bibliography..... 23

Foraminifera and Barbadoes Earth..... 23

To Our Exchangers..... 23

Correspondence.

Tingis Hyalina (H. Sch.)..... 24

Microscopic Objectives—Wide *vs.* Narrow Angular Aperture..... 24

Our Book Table.

The Art of Projecting..... 25

A Manual of the Vertebrates of the Northern United States..... 25

Botanical Hand-Book..... 26

Report Upon the Invertebrate Animals of Vineyard Sound and Adjacent Waters..... 26

Transactions of Societies..... 26

Exchanges..... 28

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State of New York, } ss.
City and County of New York. }

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(Signed) JOHN W. JENKINS,
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CONTENTS OF NO. 3.

*Illustrated articles are marked with an *.*

The Siliceous Shelled Bacillariæ or Diatomaceæ.. 41
The Permanent Exhibition 44
Reproduction of Rotifer Vulgaris..... 44
*Two New Illuminating Glasses for the Microscope 46
Bleaching Ivory..... 47
The Bramhall Illuminator..... 48
List of Microscopical Societies..... 49
Instruction in Microscopy..... 49

Our Book Table.

Life of a Scotch Naturalist..... 49
A Brief Paper on the Use and Educational Value of Simple Microscopes..... 49
Transactions of the Buffalo Microscopical Society. 50
San Francisco Microscopical Society..... 51
Exchanges 52
Books Wanted..... 52

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CONTENTS OF NO. 3.

*Illustrated articles are marked with an *.*

The Siliceous Shelled Bacillariæ or Diatomaceæ.. 29
The World of Matter..... 32
*A Self-Centering Turn-Table..... 34
Eosin—A New Staining Fluid..... 35
Kutzing's Bacillariæ..... 36
Barbadoes Earth..... 36

Correspondence.

An Ingenious Contrivance..... 36

Our Book Table.

How to Choose a Microscope 37
The Microscopist 37
Notes and Queries..... 37
Mr. Merriman's Method of Preparing Crystal for the Polariscope..... 38
Tragacanth Mucilage..... 38
Adhesive Cement..... 38
Lecture and Soiree..... 38
Value of the Microscope..... 38
Transactions of Societies..... 39
Exchanges 40
Books Wanted..... 40

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CONTENTS OF NO 5.

On Microscopy in the Unitted States 53
The Carpet Beetle 56
Fossil Ants 56
Foreign Stamps 57
Polycystina 57
A Question of Priority 57

Correspondence.

High Angles *vs.* Low Angles 58
Classes in Microscopy 59
Amplifiers 59

Our Book Table.

Report on Water Supply of City of Rochester .. 59
A Course of Practical Histology 59
Transactions of the Boston Microscopical Society. 60
San Francisco Microscopical Society 61
Academy of Natural Sciences, Philadelphia. 63
Exchanges 64
Books Wanted 64

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Publisher's Department.

Personal.—Our readers will see, by a notice, in another column, that Mr. W. H. Walmsley, who is well known as an able and skilful microscopist, is about to open an American branch of the house of R. & J. Beck, of London. Mr. Walmsley, being a good microscopist himself, knows what is wanted by others, and our readers may feel confident that their transactions with him will result satisfactorily. We wish him every success.

Blue Glass.—The blue glass mania is not without benefit to a large and very important industry. The supply of Belgian blue glass was quickly exhausted, and stocks could not be replaced in time to satisfy the popular demand. It was accordingly necessary to supply it by a domestic production. A dormant industry was thus quickened into profitable activity. The manufacturers report that they have scarcely time to pack their production in suitable shape for transportation. The efforts of interested dealers to create the impression that the American blue glass is worthless, and that the mysterious "electro-magnetic" virtue lies only in the imported mazarine blue article, is simply a trick of the trade. Pale blue gelatine would answer just as well as glass, and one kind of blue glass as well as another. The virtue is not in the glass nor the color, but in the actinic rays of the sunlight.—*Iron Age.*

The virtue lies in the imagination of the patient, or, in the case of plants at certain periods of their growth, in the mere diminution of the intensity of the sunlight, as we explained in a former issue.

Messrs. Hardwicke & Bogue announce that they have purchased the remaining copies of the new and enlarged edition of Wilson's "American Ornithology," edited by Sir William Jardine, in three volumes 4to, illustrated with 400 figures colored by hand, and offer them at a considerable reduction from the price at which they were originally published.

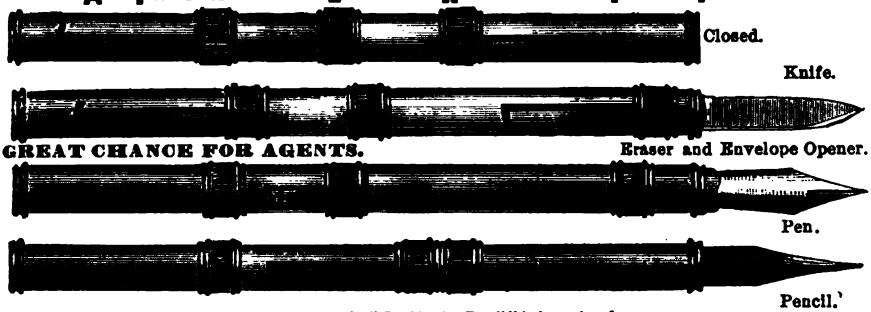
The Paris Exposition.—Two thousand laborers, busy as ants, were employed in giving shape and beauty to the latest marvel of architecture. The general disposition of the new building will more or less resemble that of 1867, the principal difference consisting in altering the elliptic form of it. The galleries will thus present a more striking aspect, and the decorations of each division, which will be either square or oblong, will be more easy to exhibitors. The galleries on the right, forming the foreign section of the building, will be divided by spaces of different breadth, according to the importance of each nation. In walking from the Pont d'Iena to the military school, a visitor will thus be enabled to see the productions of all the peoples of the world, and may compare the relative value and perfection of the same goods in different countries. To compare a French article, however, with a foreign article of the same sort, the visitor will have to cross the fine art galleries, or return to the grand vestibule. In short, the arrangements will be as sensible and practical as in 1867, but the whole affair will be much grander. For instance, the space allotted to the fine arts alone will be four times larger than that granted to them ten years ago.—*London Letter.*

Re-established.—Mr. Cheyney, who suffered so severely in the late Bond street fire, has again established himself near his old quarters. There is probably no man engaged in the business in this country who has a more thorough knowledge of philosophical apparatus than Mr. Cheyney.

Cement Casks as a Substitute For Wooden Ones.—M. Bollert, near Zurich, in 1871, first attempted to substitute casks made of cement for the usual wooden ones for storing wine, his cellar being moist and destructive to wood. The success of the experiment was such that all the wooden vessels have since been thus replaced. Among the advantages ascribed to the cement casks, in addition to diminished cost of construction, are great economy of room, great solidity, without expense for repairs, diminished loss of the contents, and lightening of the work in the cellar. New wine is filled into them without hesitation, as no injurious effect is noticeable. The general plan of construction was first to coat suitably selected portions of the cellar walls roughly with cement-mortar, and then with the best pure Portland cement, and to form the other portions of the vessels by pouring the material into suitably constructed wooden moulds. He succeeded in rendering the finished vessels deceptively similar in external appearance to the wooden ones. After the interior was sufficiently hardened, they were filled with water for ten days to ascertain whether they were tight, and also to extract the caustic ingredients of the cement. The latter object was not fully accomplished in this way, as the wine lost almost all its acidity in a few days; but this defect was ultimately removed by soaking them with a solution of carbonate of ammonia, and subsequent rinsing with water. Others have employed them since then, and their introduction by the wine-growers on the Mosel is contemplated.

A Curious Explosion.—A curious accident that lately occurred shows that even a water-tank must be as carefully approached with an unprotected light as a leaky gas-main or a powder-magazine. A workman on board H. M. torpedo-ship *Vesuvius* approached an iron water-tank with a candle, when the hydrogen gas that had been liberated by the galvanic action which had very likely been established between the zinc coating of the galvanized iron and the edges, where in fitting the sides together the ungalvanized iron was exposed, exploded with such violence as to tear out the side of the tank.

A PRESENT for EVERY READER of THIS PAPER.



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INSTRUCTION IN MICROSCOPY.

Prof. Romyn Hitchcock, late of Chicago, desires to announce that he would be pleased to form a class for instruction in the practical use of the Microscope, as suggested in the March number of this journal. The instruction given will be thoroughly practical, and adapted as far as possible to the wants of beginners, not only showing how the different effects of illumination and definition are secured, but also stating why. The terms for such instruction will be arranged in future, depending entirely upon the size of the class. All who are interested in this matter are requested to communicate with Prof. H. at once, either by letter or in person, at his residence, No. 8 Beekman Place (Fiftieth Street and East River.)

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Publisher's Department.

Protection from Lightning.—The season is now approaching when buildings are specially exposed to destruction by lightning, and those who would secure themselves should carefully study the subject of lightning rods. It may be safely affirmed that of all the lightning rods now in existence, three-fourths are absolutely worthless, having been put up by men whose object it was to make money for themselves rather than to protect their customers. Persons owning houses, or about to build, would do well to procure a little book, "Plain Directions for the Construction of Lightning Rods," issued by the Industrial Publication Company, 176 Broadway, New York. It is the only book now before the public in which this subject is fully treated, and which has not been written for the purpose of puffing some patent lightning rod, and is simple, direct and thorough. The price is only fifty cents.

Glycerine as a Lubricant.—Chemically pure glycerine, free from water, is recommended as a lubricant for small machines and machinery parts, where common oils and fats turn acid or hard, and so clog or smear. Glycerine is of particular suitability for sewing machines, as any accident with it is of less consequence than with oils which soon become dirty.

Rogers's Statuary.—Our friends in the country who wish something unusually attractive for their grounds, ought to send to Mr. Rogers and obtain a description of his "Hide and Seek." Nothing more charming has been brought out in a long time. His latest statuette, "Weighing the Baby," is no doubt by this time familiar to most of our readers, and like all his other works of this class, is a perfect gem for the parlor or study. His illustrated catalogue forms quite an interesting study. It may be obtained for 10 cents by addressing Mr. Rogers, at 1,155 Broadway, New York.

Mineral Oil Fuel.—The neighborhood of the naphtha springs of Bakou has suggested the idea of using mineral oil as fuel for the Russian flotilla stationed in the Caspian. It is more than a year since the first experiments were tried, and a steamer, a schooner and a gun-boat are already heated by this means. The result has proved so satisfactory that the boilers of four other vessels are being altered to adapt them to the new system; and, for the future, naphtha will probably be more extensively used by vessels in the South of Russia.

Field Sports.—Many people think that the time spent in hunting and target shooting is wasted, but it is a well known fact that any nation, to be successful in war, must be fond of the chase, and skilled in the use of weapons, which skill they must acquire in time of peace. To become a good marksman requires great practice, and this can be attained in no easier way than by shooting the Champion Air Pistol, which can be used indoors, as it makes no noise and is perfectly accurate and harmless. May be had of any gun-dealer or of the Pope Mfg. Co., 45 High St., Boston.

Spongy Platinum.—The production of spongy platinum of good quality, says the *Metallarbeiter*, is a task more easy in appearance than reality. The principal requirement of spongy platinum is that it should be spongy, but this obvious requirement is very frequently overlooked, and hard and useless masses of platinum are produced through overheating the sponge and running together the finer particles. Into a concentrated solution of muriate of ammonia drop a similar solution of platinum chloride; a yellow precipitate is formed, which is washed three or four times with hot water to free it from the sal ammoniac. This precipitate, when properly cleaned, and while still moist, is dropped on a very thin platinum wire stretched several times across a small ring of copper, and is then allowed to dry thoroughly. After drying, it is slightly heated over a spirit lamp, contact with the flame of which is to be avoided. As above remarked, only very careful heating over the spirit lamp will give satisfactory results.

No Change.—We are requested to state that the recent change in the firm of Jas. W. Queen & Co. (the retirement of Mr. Walmsley), does not affect the business arrangements of Mr. G. S. Woolman, of New York, who, in addition to his own proper business, continues to act as agent for Messrs. Queen & Co., and also for Messrs. R. & J. Beck, of London.

Artificial Gold.—A new substitute for gold has come into use in France. It consists of 100 parts by weight of pure copper, 14 zinc or tin, 6 magnesia, 3.6 sal ammoniac, 1.8 burnt limestone, 9 cream of tartar. The copper is first melted, then the magnesia, sal ammoniac, limestone and cream of tartar in powder, are gradually added, separately. The whole is kept stirred for half an hour, the tin or zinc being dropped in piece by piece; stirring goes on till they melt. The crucible is, last of all, covered, and the mass kept in fusion for thirty-five minutes. The scum being removed, the metal is poured into the moulds. The alloy is fine-grained and malleable, and takes a high polish. It does not oxidize easily.

Fish Culture in Germany.—Thirty or forty years ago salmon were plentiful in the Moselle, but gradually disappeared. Five years ago the government began to deposit every spring a quantity of young salmon from the piscicultural establishment at Hunningen, and now there is good salmon fishing added to the many charms of the blue Moselle.

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Publisher's Department.

Edwards on Diatoms.—We are requested to say that all the copies of this work have been sold, and it is now entirely out of print.

New Pear.—Lovers of good fruit will be glad to hear of a new variety of great excellence—the Marshall—which is now being propagated by Mr. P. H. Foster, of the Babylon Nurseries, Long Island. The tree is moderately vigorous and very productive; fruit rather large and juicy, and of good flavor. Ripens about ten days after the Bartlett, to which it is preferred by almost all who have tried both.

A New Book on the Microscope.—Just as we are going to press, we have caught a glimpse of the new edition of "Wythes' Microscopist," which has been so long expected. It differs entirely from any work now before the public, and is very complete in almost every department. The author has brought his researches down to the very latest date, and illustrates the various topics with remarkably fine plates, many of them colored. There are 205 illustrations, covering Micro-Mineralogy, Micro-Chemistry, Biology, Histology, Pathological Histology, etc. The price is $4.50, and it may be obtained from the Industrial Publication Company, 176 Broadway, New York.

Premiums for Flowers.—Vick, the well-known seedsman, offers a premium of $40 for the best show of flowers at every State Fair in the United States and Canada. There are also four minor premiums, thus giving a very liberal chance to all who are fond of growing flowers. These premiums are to be offered by the regular State, Territorial or Provincial Societies, and where there are two prominent societies, Mr. Vick authorizes *both* to offer these premiums in his behalf. Our readers who are interested in flowers should see that the attention of the officers of their societies is called to these premiums. Full details may be obtained from Mr. Vick, whose address is Rochester, N. Y.

The New York Aquarium.—The managers of this institution have done a good work for New York by bringing within reach of the people such a large number of unusual forms of animal life. In addition to the usual attractions, they have engaged Prof. Starr, of Westfield, N. J., to deliver a course of lectures on the microscopic forms of animal and vegetable life. These lectures will be illustrated by the oxyhydrogen microscope, and from the well-known skill of Prof. Starr in the use of this instrument, they cannot fail to prove intensely interesting. We recently had the pleasure of hearing Prof. Starr deliver a lecture before a Sabbath School in Paterson, N. J., and we have never seen an audience more interested and delighted.

Richmond Diatoms.—We have received from Mr. Peticolas, of Richmond, a number of slides of the diatoms from several deposits in that region. Mr. Peticolas has given special attention to the preparation of these deposits, and his slides are remarkably clean and beautiful. We have compared them with slides by some of the most famous *preparateurs* in this country and Europe, and they suffer nothing by the comparison. His selected diatoms show great skill, and those who wish to add choice slides to their collection would do well to obtain some of his.

A Daily Companion.—"Webster's Unabridged Dictionary" has been, in common with other great lexicons of the English language, one of my daily companions. My testimonial to its erudition, the accuracy of its definitions, and to the vast etymological research by which it has been enriched through the labors recently bestowed upon it, can hardly be of much value, sustained as the book is in world-wide reputation, by so general an approbation; but I have no hesitation in thus expressing my sense of its merits.—*John L. Motley, the Historian, late Minister at the Court of St. James.*

Lightning Rods.—"Much has been said," remarks the *Independent*, "of the debts of city churches; but country churches are not all well off. We know of a village church in New Jersey which held a Fourth of July festival to pay the interest on the cost of their lightning-rod."

That must have been a very expensive lightning-rod, and the probability is that the trustees were swindled, for since the congregation was so poor, it is presumed that the building was not very large. If they had followed the directions given in Phin's little book on "Lightning Rods," some of the village mechanics might have put up a really good rod at a very small cost. We believe this is the only book on the subject that was not written for the purpose of grinding somebody's axe.

A New Mode of Treating Burns.—The removal of infilteration of the skin is easily accomplished, according to M. Ungerer, by osmose. He had occasion to prove this lately in having to treat an extensive scald on the hand, which resulted in a large and exceedingly painful swelling without wounds. Cold water treatment for 12 hours did not relieve the swelling in the least, and the pain was almost unbearable when the hand was removed from the water only a few seconds. He, therefore, made a diffusion experiment, dipping the hand in a saturated salt solution, and the success was surprising. Though the salt solution had not the temperature of the ice water, the pain diminished almost immediately, and in four hours blister and pain were both entirely gone. The hand next day differed from the other only by a very slight swelling and redness.

not greater than that usually charged for the addition of the Wenham Prism and secondary body alone. With the improvements it has since received, it still remains one of the best instruments of its class; and the author, after considerable use of it, can strongly recommend it to such as desire a binocular at once cheap, good and portable."

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CONTENTS OF NO. 6.

The Siliceous Shelled Bacillariæ or Diatomaceæ.. 65
Country Laboratory Apparatus..... 69
Trichobasis, or Grain Rust..... 70
English Fish Culture..... 71
Milled Heads *vs.* Screw-Drivers..... 72

Correspondence.

Mr. W. H. Bulloch's Improvements in Microscope Stands..... 73
Information Wanted..... 75
Spermatozoa of Earth Worms..... 75

Our Book Table.

Annual Record of Science and Industry for 1876 75

Exchanges..... 76

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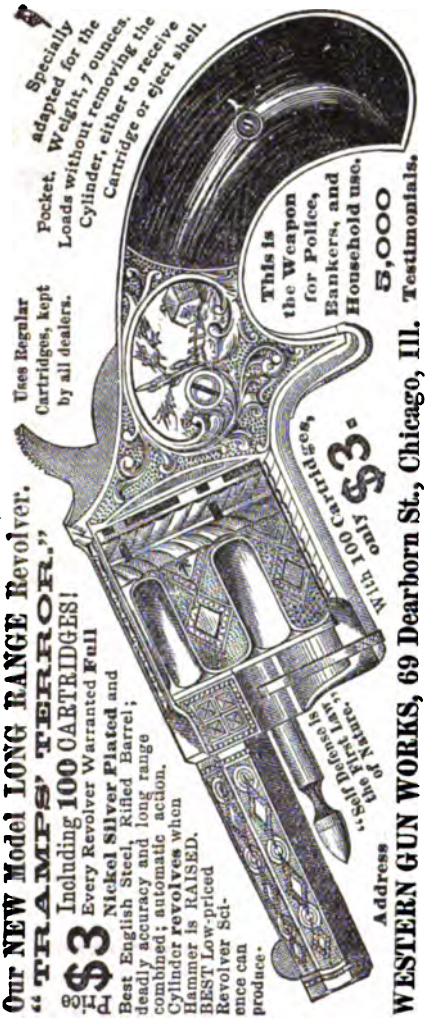

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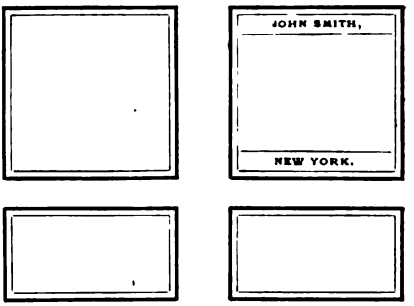

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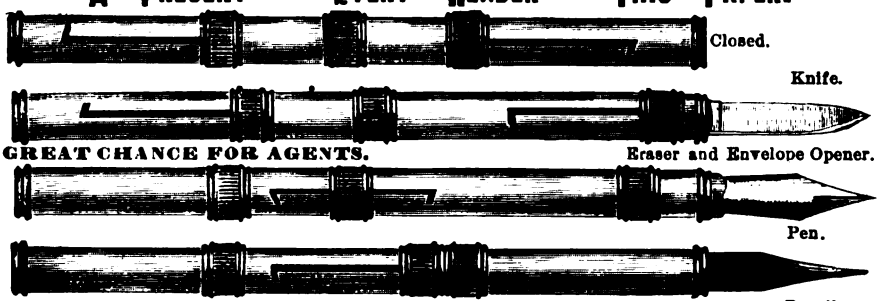

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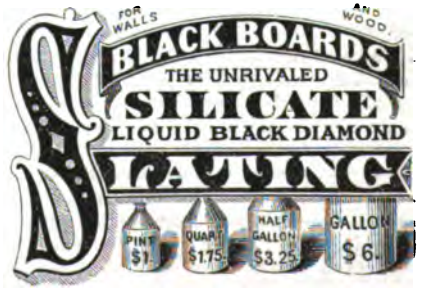
INSTRUCTION IN MICROSCOPY.

Prof. Romyn Hitchcock, late of Chicago, desires to announce that he would be pleased to form a class for instruction in the practical use of the Microscope, as suggested in the March number of this journal. The instruction given will be thoroughly practical, and adapted as far as possible to the wants of beginners, not only showing how the different effects of illumination and definition are secured, but also stating why. The terms for such instruction will be arranged in future, depending entirely upon the size of the class. All who are interested in this matter are requested to communicate with Prof. H. at once, either by letter or in person, at his residence, No. 8 Beekman Place (Fiftieth Street and East River.)



Publisher's Department.

Ruskin's Idea of a Scientific Lecture.—Mr. Ruskin is a chronic growler. He says of a modern hall and a lecture in it: "Your present system of education is to get a rascal of an architect to order a rascal of a clerk of the works to order a parcel of rascally bricklayers to build you a bestially stupid building in the middle of the town, poisoned with gas, and with an iron floor that will drop you all through some frosty evening; wherein you will bring a puppet of a Cockney lecturer, in a dress coat and a white tie, to tell you smugly there's no God, and how many messes he can make of a lump of sugar. Much the better you are for all that when you get home again, aren't you?"

New Edition.—Notwithstanding the fact that an unusually large edition of "Practical Hints on the Selection and Use of the Microscope" was issued, every copy is gone. Although the old plates are still as good as new, the publishers prefer to recast the work and improve it, as the great progress which has recently been made in microscopy demands this. It is expected that the new edition will be ready in a very short time. It will be greatly enlarged, and a considerable number of new illustrations (including four full-page plates) will be added, while the price will remain the same as heretofore—75 cents. It is published by the Industrial Publication Company, 176 Broadway, New York.

American Lenses.—The following letter explains itself:

WASHWOOD HEATH, BIRMINGHAM,
Dec. 20, 1876.

Dear Mr. Tolles—It is one of the characteristics of a real work of art that the more closely examined the more its beauties shine forth. Surely few modern lenses have been as carefully looked at as the 1-25th you sent me, and I should assuredly say that few have come so well out of the ordeal. Four persons living hundred of miles apart have passed independent judgment upon it, and I am very, very glad to be able to tell you that to make a summary of the opinions, all consider that "the lens is superior to any objective of similar high power yet seen in England." The image is "bright" and "robust," instead of having the poorness and flatness usually recognized in most 1-16ths, and I may say in *every* glass beyond that power. There is an absence, too, of colored fringes, which shows how carefully you have made the chromatic corrections. Mr. Mayall has undertaken the examination for power of "resolution" with "reflex illuminator," and special contrivances of his own. He reports at length, but I quote his concluding words: "You may, however, take it from me without reserve, that this 1-25th is quite ahead of any lens I have ever seen." Mr. Mayall, when the lens was in his hands showed it to Powell & Lealand, and it really is magnanimous in them to say of the work of a rival so potent as yourself, after putting the glass through all sorts of trials, "it is first-rate in every way." This is as agreeable to me to record as it will be pleasant to you to hear. My own testing was with "axial illumination," and on a series of different objects (not diatoms). It convinced me that I could see more than with any of my heretofore optical appliances. The glass which runs yours the closest was a *picked* 1-25th by Zeiss, of Jena, made from a formula by Professor Abbé, a glass to which the perfectly easy resolution of *balsamed* gemma and "gram" subtilissima of Möller's "probe platte," gives at once a certain value. I am now speaking of purely "axial illumination." The images have great beauty, but I am not altogether sure that these beautiful images are at the same time *true* images. If I look at the external surface of the pollen grain of the "red salvia," a fine German objective shows me one structure, and your 1-25th shows me another, and yet both images are so beautiful that they would excite admiration in a scientific soirée; they can't both be right. As to diatoms, we have got into a conventional mode of trying to get certain appearances characterized as "dots," which I am very sure is *not* right, but we settle it; we want to develop "dots" and so we do show them. Yours,

JOHN ANTHONY.

Wanted.—The Industrial Society of Rouen has just offered prizes to those who desire a means of producing the following: A substance capable of replacing albumen of eggs in all its applications to printing of tissues, and considerably cheaper; new source of albumen, either in natural products containing it, or by transformation of other proteic matters; a new dark color as intense and solid as aniline-black, but not weakening the cloth, and capable of being printed with any other colors without alteration at the point of contact; a method for volumetric determination of commercial glycerine; a solid blue coloring matter, applicable like indigo but cheaper; new process for fixing indigo blue by steaming; new method of fixing aniline colors; a new thickening matter to replace Senegal gum; production of ozone in the concentrated state; new application of ozone; industrial production of oxygen; rapid and exact means of determining the reducing power of a coal or any carbon; utilization, in metallurgical or ceramic arts, of iron pyrites, desulphurized by roasting; process of concentration or precipitation of nitrogen and phosphoric acid in fecal matters, urines and sewage waters, yielding a manure of at least 5 per cent. nitrogen and 20 per cent. phosphoric acid.—*English Mech.*

CONTENTS OF NO. 7.

*Illustrated articles are marked with an *.*

*The Brush and Comb of the Hymenoptera..... 77
The Siliceous Shelled Bacillariæ or Diatomaceæ.. 80
*A New Form of Megascope..... 83
Erysiphe or Wheat Mildew..... 83
Mechanical Finger..... 85
Microscopy in Nashville..... 86

Correspondence.

The World of Matter..... 86
*Cannabalism of the Amœba..... 87

Our Book Table.

A Practical Treatise on Lightning Protection... 89
A Queer Industry..... 89
Destructiveness of Black Ants..... 89
Detection of Oleomargarine in Butter..... 89
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Exchanges..... 92

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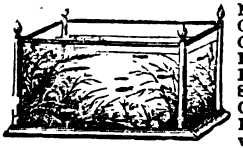

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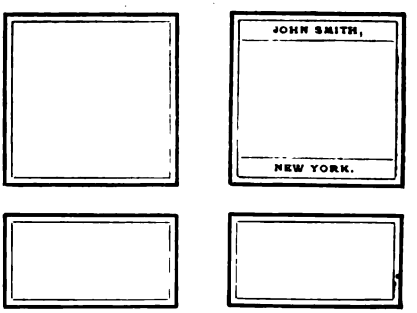

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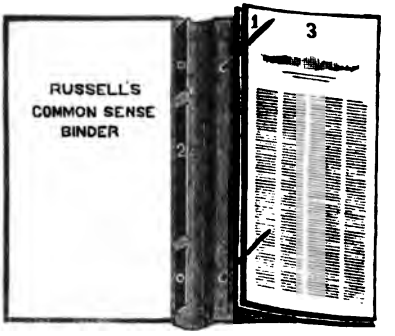

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JONATHAN RICE, merchant, Lowell, Mass., killed at Ashtabula, insured against accidents in THE TRAVELERS for $4,000.

FRANKLIN H. CARTER, New York, drowned, insured against accidents in THE TRAVELERS for $10,000.

JAMES H. PARSONS, lawyer, Providence, killed by falling from a chair, had an accident policy in THE TRAVELERS for $5,000.

JOHN G. SCULLY, a conductor on the Wisconsin Central Railroad, was run over by cars and killed, only two months after taking out an accident policy in THE TRAVELERS for $2,500.

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C. W. WYCKOFF, merchant, Elmira, N. Y., thrown from carriage; laid up 26 weeks, and received from THE TRAVELERS $25 a week—$650.

W. G. FALCONBRIDGE, barrister, Toronto, leg broken by stage accident; insured in THE TRAVELERS, and receiving indemnity for three months' disability—$428.58.

WILLIAM S. HANSCOM, Bath, Me., sawyer, struck by a cake of ice; disabled 26 weeks, and drew on THE TRAVELERS for $15 a week—$390.

LUCIUS PIERCE, farmer, Monticello, Ind., cut off his foot with an axe; took 26 weeks to heal, and THE TRAVELERS paid him $25 a week—$650.

JOHN LINNELL, Woburn, Mass., leather dealer, fell down stairs; 4 1-7 weeks disabled, and received from THE TRAVELERS $50 a week—$207.14.

JOHN WEIST, Freeburg, Penn., secretary mining company; a twig struck his eye, causing 10 weeks' disability, for which THE TRAVELERS paid $50 a week—$500.

NATHAN NEW, merchant, Cleveland, Ohio, fell on icy walk, and for 7 weeks drew on THE TRAVELERS for $25 a week—$175.

L. N. SMITH, merchant, St. Joseph, Mo., thrown from a wagon and hip bone broken. THE TRAVELERS cashed his claim for 26 weeks' disability at $50 a week—$1,300.

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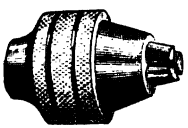

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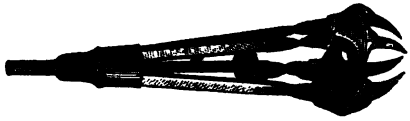

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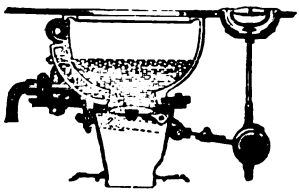

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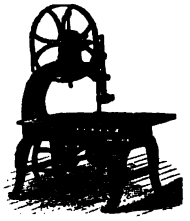

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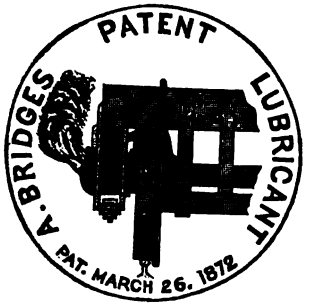

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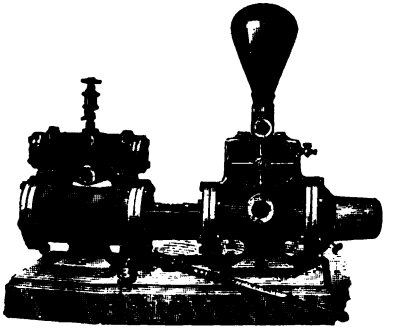

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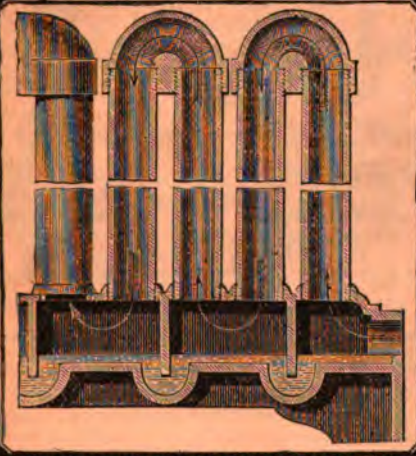

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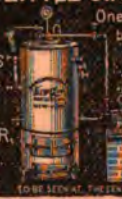

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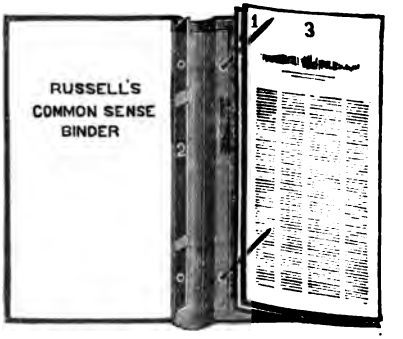

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Discovery of Electro-Magnetism.—A writer in the *Telegraphist* claims for a Professor Romagnosi, a countryman of Volta's and Galvani's, priority over Oersted in the discovery of electro-magnetism. The discovery of Oersted, to whom a statue has just been erected in Copenhagen, bears date 1819; Ampére made his researches public in 1820; but a distinct statement of Romagnosi's discovery is contained in a work published in Paris in 1804, and a tablet in the Collegio Alberoni, Piacenza, records the same discovery, to which it gives its actual date, 1802.

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CONTENTS OF NO 8.

What I Know About Late Improvements of the Microscope 93
Gundlach's Stands 95
The Siliceous Shelled Bacillariæ or Diatomaceæ .. 97
Notes on Cent. I of the "Species Typicæ Diatomacearum" 99
Cements and Varnishes 103
Prof. R. Hitchcock *vs.* High Angles 103
Change of Address 105
Permanent Enlargement 105

Correspondence.

Earth as a Disinfectant 105

Our Book Table.

Magazine of American History 105
The American Naturalist 106
Newspaper Directory for 1877 106
A Successor to Penikese 106
Transactions of Societies 106
Exchanges 108
Books Wanted 108

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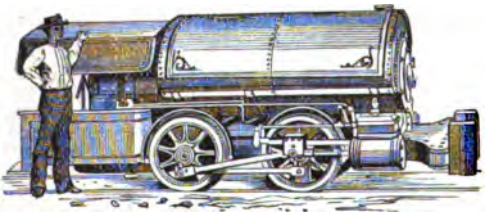

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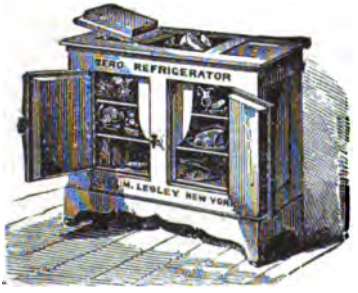

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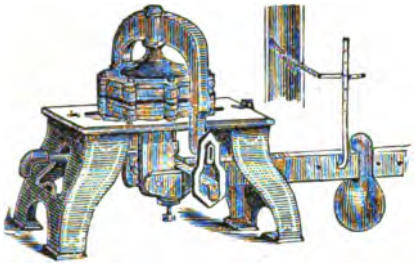

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CONTENTS.

PREFACE. - - - - - - - - - - v

INTRODUCTION. - - - - - - - - - - ix

THE MICROSCOPE. What it Is; What it Does; Different Kinds of Microscopes; Essential Parts of the Microscope; Names of the Different Parts, - - - - - - - - - 13

SIMPLE MICROSCOPES. Hand Magnifiers; Watch-Makers' Eye-Glasses; Engravers' Glasses; Coddington Lens; Stanhope Lens; Stands for Simple Microscopes; Raspail's Microscope; Excelsior Microscope; Twenty-five Cent Microscopes; Penny Microscopes; Craig Microscope; Fused Globule Microscopes—Novelty, Globe, etc., - - - - - - - - - 28

COMPOUND MICROSCOPES. French Vertical Microscopes; the Continental Form; the Jackson Model; the Ross Model; Browning's New Model; the Inverted Microscope; the Binocular Microscope; the Binocular Eye-Piece, - 34

OBJECTIVES. Spherical Aberration; Chromatic Aberration; Corrected Objectives; Defining Power; Achromatism; Aberration of Form; Flatness of Field; Angular Aperture; Penetrating Power; Working Distance; Immersion Lenses; Lens Systems; French Triplets; Focal Length of the Numbers used to Designate Objectives by Nachet, Hartnack and Gundlach, - - - - - - - - - 41

TESTING OBJECTIVES. General Rules; Accepted Standards—Diatoms, Ruled Lines, Artificial Star, Podura; Methods of Testing the Various Qualities; Nobert's Lines; Möller's Probe Platte, - - - - - - - - - 58

SELECTION OF A MICROSCOPE FOR PRACTICAL PURPOSES. Must be Adapted to Requirements and Skill of User; Microscopes for Botany; For Physicians; For Students; Magnifying Power Required; The Stand; The Stage; Mechanical Stage; Revolving Stage; Stages for Special Purposes; Sub-Stage; Mirror; Body; Draw-Tube; Adjustment for Focussing; The Diaphragm; Objectives; High *versus* Low Angles; Eye-Pieces, - - - - - - 69

ACCESSORY APPARATUS. Stage Forceps; Forceps Carrier; Object Holder; Plain Slides; Concave Slides; Watch-Glasses; Watch-Glass Holder; Animalcule Cage; Zoophyte Trough; Compressorium; Gravity Compressorium; Growing Slides; Frog Plate; Table; Double Nose-Piece, - - - - - - - - - 93

ILLUMINATION—SOURCES OF LIGHT. Sun-Light; Artificial Light—Candles, Gas, Lamps, Magnesium, Oxyhydrogen Light; Parallel, Convergent and Divergent Rays, - - - - 107

ILLUMINATION OF OPAQUE OBJECTS. Diffused Light; Bulls-Eye Condenser; Side Reflector; The Lieberkuhn; Smith's Illuminator; The Parabolic Reflector, - - - - - - 111

ILLUMINATION OF TRANSPARENT OBJECTS. Direct and Reflected Light; Axial or Central Light; Oblique Light; The Achromatic Condenser; The Webster Condenser—How to Use; The Spot Lens; The Parabolic Illuminator; Polarized Light, - - - - - - - - - 114

HOW TO USE THE MICROSCOPE. General Hints; Simple Hand Magnifiers; Compound Microscopes; Practical Notes on Illumination; Monochromatic Light; Care of the Microscope, - - - - - - - - - 118

COLLECTING OBJECTS. Where to Find Objects; What to Look for; How to Capture Them; Nets; Bottle-Holders; Spoons; Collecting Walking Cane; Water Strainer; Wright's Collecting Bottle; Aquaria for Microscopic Objects; Dipping Tubes, - - - - - - 129

THE PREPARATION AND EXAMINATION OF OBJECTS. Cutting Thin Sections of Soft Substances; Sections of Wood and Bone; Improved Section Cutter; Sections of Rock; Knives; Scissors; Needles; Dissecting Pans and Dishes; Dissecting Microscopes; Separation of Deposits from Liquids; Preparing whole Insects; Feet, Eyes, Tongues, Wings, etc., of Insects; Use of Chemical Tests; Liquids for Moistening Objects; Refractive Power of Liquids; Iod-Serum; Artificial Iod-Serum; Covers for Keeping out Dust; Errors in Microscopic Observations, - - - - - - 139

PRESERVATIVE PROCESSES. General Principles; Preservative Media—Canada Balsam, Solution of Balsam, Colophony, Damar Medium, Glycerine, Glycerine Jelly, Hantzsch's Fluid, Glycerine and Gum, Deane's Gelatine, Alcohol, Thwaite's Fluid, Beale's Liquid, Goadby's Fluids, Pacini's Fluid, Castor Oil; General Rules for Applying Preservative Fluids, - 152

APPARATUS FOR MOUNTING OBJECTS. Slides; Covers; Cells; Turn-Tables—Plain, Matthews, Kinne's, Cox's; Cards for Making Cells; Hot-Plate; Lamps; Retort Stand; Centering Cards; Mounting Needles; Cover Forceps; Slide Holder; Water Bath; Simple Form of Spring Clip, - - - - - - - - 160

CEMENTS AND VARNISHES. General Rules for Using; Gold Size, Black Japan, Brunswick Black, Shellac, Bell's Cement, Sealing Wax Varnish, Colored Shellac, Damar Cement, Marine Glue, Liquid Glue, Dextrine, - 171

MOUNTING OBJECTS. Mounting Transparent Objects Dry; Mounting in Balsam; Mounting in Liquids; Mounting of Whole Insects; How to Get Rid of Air-Bubbles; Mounting Opaque Objects; Wooden Cells; Pierce's Cell; Prof. Smith's Plan; Deep Cement Cell, - - - 174

FINISHING THE SLIDES. Covering with Paper; Varnishing for Preservation; Labeling; The Maltwood Finder, - - - - - - - 179

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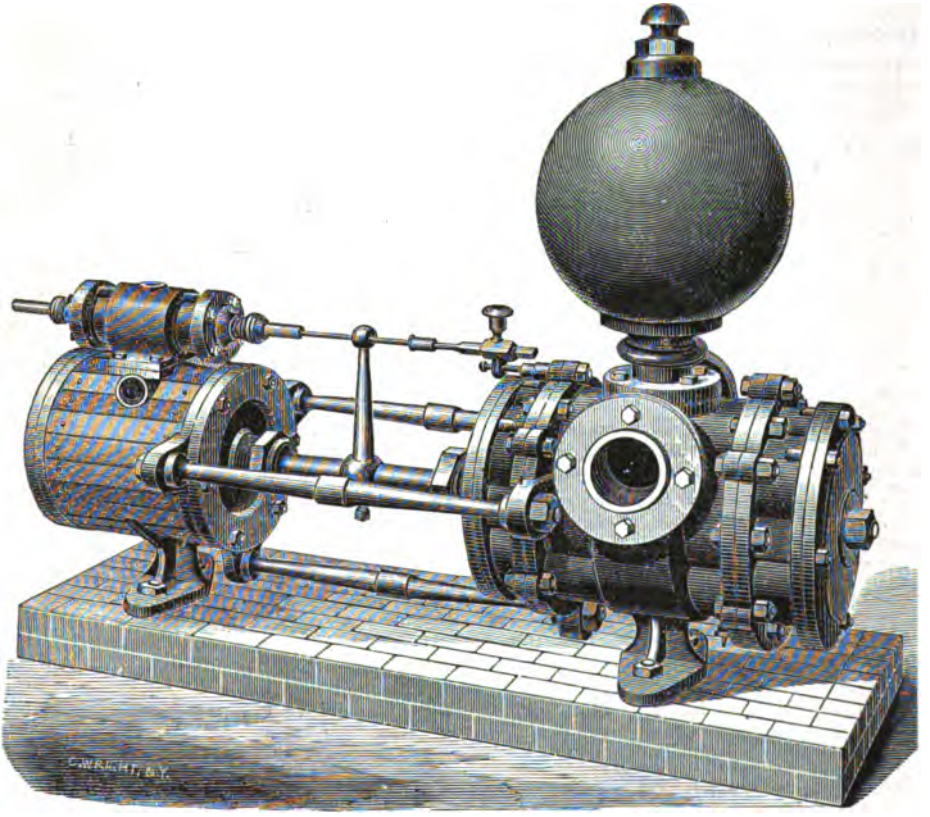

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CONTENTS OF THIS NUMBER.

Entomological Preparations..... 145
Remarks on Mounting..... 146
Notes Upon "P. T. Cleve and J. D. Moller's Diatoms, I.. 1-46." Upsala, 1877..... 149
Enlargement of the Journal..... 152
Death of Dr. Beatty..... 153
Diatoms..... 153
Coorongite..... 153
Our Book Table.
Practical Hints on the Selection and Use of the Microscope..... 154
Light..... 154
Practical Directions for Collecting, Transporting, Preserving and Mounting Diatoms..... 154
St. Nicholas..... 154
Books and Pamphlets Received..... 154
Correspondence.
Mounting Algæ..... 154
A Few Words concerning the Performance of Objectives..... 155
Angular Aperture and Central Illumination..... 156
Bermuda Diatoms..... 157
Transactions of Societies..... 157
Personal..... 159
Exchanges..... 159

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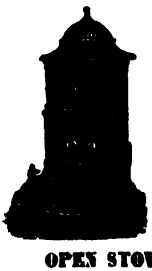

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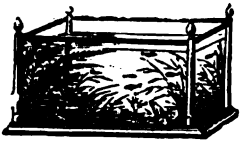

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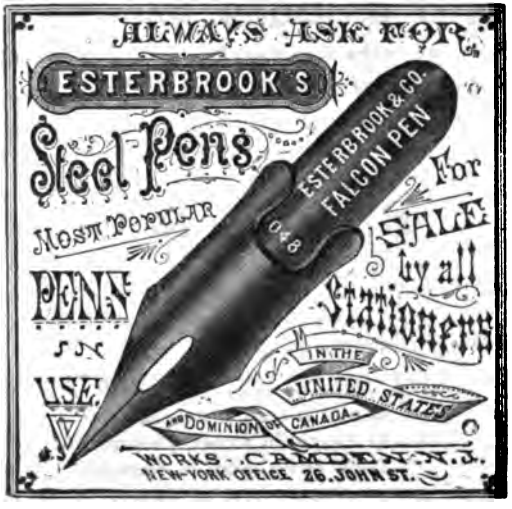

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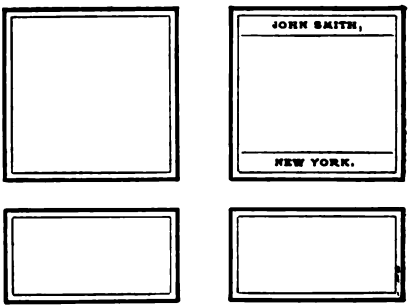

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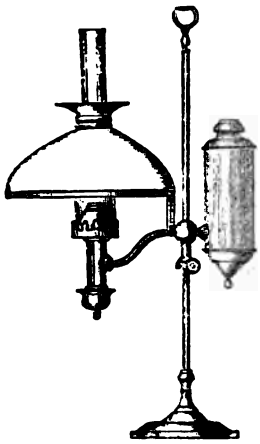

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