D. A. C. Ellicott

Buffalo, N.Y.
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A New Species of Ophrydium.
(*Ophrydium-Adæ.*)

BY HERMANN C. EVARTS, M.D.

During the early part of the past autumn, I found, in Tacony Creek, Frankford, Philadelphia, large numbers of jelly-like masses, in most cases, adhering to the under-sides of smooth stones, sticks and leaves. These masses were homogeneous, transparent, colorless, nearly globular, and attached by a flattened surface, in all instances adhering to the stones or other articles, and averaging from one-half to two lines in diameter. In these apparently lifeless jelly-masses, lived myriads of infusoria.

The masses were detached, without injury, by means of a knife-blade, and dropped into a jar containing water, when they immediately sank to the bottom, and there remained. They have not been observed to attach themselves to any objects placed in the jar, nor to the jar itself.

So far as I can learn, only one species of this genus has been described, viz. : *Ophrydium versatile*, and that by Ehrenberg, who found it in the sea in the form of gelatinous masses, varying from the size of a pea to that of a ball five inches in diameter.

"It has also been found, by Brightwell, in fresh water, and in a small turfy pit, on the tendrils of the roots of marsh plants and stalks of the white water-lily."

O. versatile is described as of a vivid green color. When specimens of the newly-found species are first taken, they contain chlorophyll granules, but not in a sufficient number to give them a vivid green color. When kept for some time in the jar the chlorophyll gradually disappears, unless they have an abundance of food.

When the colony is seen under a low power, the foreign particles floating about in the water are observed to be moving rapidly from all directions of the field toward a common center, *i. e.*, toward the peristomes of the various individuals.

After being transferred to the stage of the microscope, they are all seen to be contracted to a pyriform shape, probably from the disturbance caused by moving them ; but, if allowed to remain quiet for a few moments, especially after the water in which they are contained has become slightly warmed by standing in a warm room, they manifest great activity, extending themselves, everting their peristomes, and causing the cilia to move with considerable rapidity, though not with the same regularity of movement that may be observed in most of the Vorticellinæ.

As irritating particles float against the cilia of the peristomes and discs, the animals quickly contract. It is highly interesting to observe some, among the hundreds, slowly extending, while many others suddenly contract themselves into the gelatinous mass; for when extended they project beyond the circumference of the mass; nevertheless, there is much concert of action in extending and contracting. The individual animal, in its natural condition, is elongated in form, more slender in proportion to its diameter, and not so robust as *O. versatile;* the body attains its greatest diameter a short distance above its point of attachment to the stem. Commencing at that point, it gradually increases until the extreme diameter is attained, it decreases for a short distance and then maintains a uniform size very nearly to the mouth, where it enlarges very slightly to the peristome, thus exhibiting, in a certain degree, the characteristic funnel-shape. The stem is long and non-contractile, and appears to be attached near the center and base of the jelly-mass; in all cases thus far observed, the single stalk divides into two, and to each branch an animal is attached. The two animals thus united usually contract together. These stalks are not readily seen unless the mass is dissected, or broken up by means of needles and slight pressure on the cover-glass. Sometimes the division of the stalk appears near the point where the animals are attached, at other times it is more distant. I have never seen the animals undergoing the process of fission; that they do undergo this longitudinal division is, however, doubtless a fact; but the question naturally arises, does the stalk also undergo fission?

In no case is any axis visible in the stalk with the powers I have employed. I have often noticed the stalks remaining in the jelly-mass, after the animals have been set free; they then exhibit a slight enlargement at the extremity, where the animal was attached. These infusoria have been observed reposing with the peristome everted and cilia extended.

The peristome is annular, and the disc projects some distance above it, one side being a little more elevated than the other, so that most frequently, the peristome and disc give the animal the appearance, when viewed obliquely, of possessing a triangular-shaped head (so-called); with a one-inch objective this appearance is quite characteristic; the cilia act spasmodically, some of the time they are at rest.

Although the cilia of the peristome and disc generally act simultaneously, those of the one part may act or repose independently of those of the other part.

In most cases the upper part of the body bends slightly to one side, thus representing the peristome and disc inclined.

The œsophagus is distinctly seen opening on the disc; it extends to a point about midway between the mouth and the contractile vesicle, diminishing in size as it proceeds downward; it is provided with three or four cilia which may be active when those of the peristome and disc are at rest, during inversion or eversion.

Near the lower extremity of the œsophagus is a fusiform body, the walls of which are resistant or non-dilatable.

The endoplast is a long cord-like differentiation of the cortical substance, extending from above the contractile vesicle down through the body to the lowest part of the dilated portion, almost to its point of attachment with the stalk; it makes several curves, and in some places appears twisted; it is not readily seen except when the animal is either subjected to pressure, or stained with some coloring fluid. During complete contraction, it shortens, thickens, and becomes much folded upon itself.

The contractile vesicle is seen as a clear, circular spot, located near one side, and just below the junction of the upper with the middle third of the body. In most of the individuals observed, its systole and diastole occurred about ten times in a minute. When about to transform to the free state, these animals begin to contract to the pyriform shape more frequently; they extend themselves more and more slowly, until finally the pyriform or oval shape is retained, the animal remaining quiet with the peristome and disc inverted, but the cilia of the œsophagus still active.

A posterior circle of cilia begins to develop, in fact may begin to form before the pyriform shape is permanently assumed; this ring of cilia is located around the dilated portion of the body. After remaining in this condition for perhaps ten, twenty or thirty minutes, the animal seemingly becomes restless, and endeavors, by active movements of the body, produced by the posterior cilia, to twist itself free, and finally, after strenuous efforts, it breaks loose, and rapidly swims off, usually swimming anteriorly by means of the newly-developed cilia, although it has been observed to swim for a short distance with the other extremity foremost.

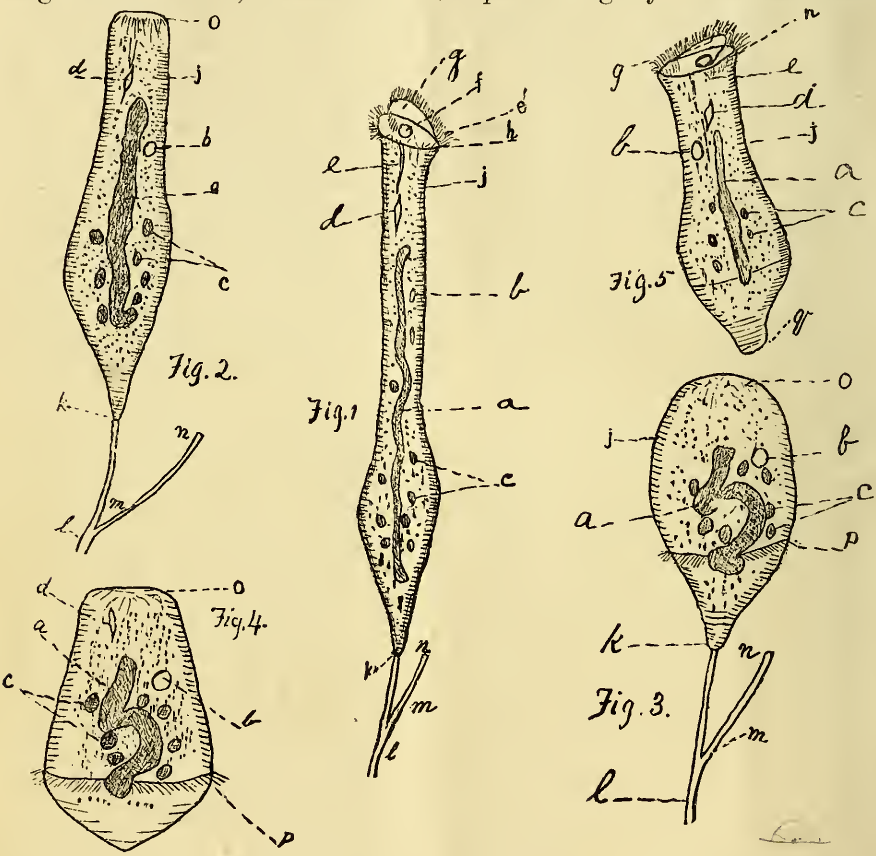
The free condition is assumed without any further division of the stalk, and the animals do not undergo development to the second stage, without the formation of the posterior crown of cilia, yet they sometimes become detached before this condition is attained. In one instance, when the animal was subjected to slight pressure, a sort of fold or invagination of the cuticle appeared to surround the body transversely, near the upper part, and slowly moved downward to the extremity attached to the stem, when the animal became quickly disjointed and moved away.

After assuming the free condition, the animal is cylindrical, the length about twice or nearly three times the average diameter; the anterior cilia are still inverted; the œsophagal cilia may yet be seen in action; the diameter is greatest where the posterior circlet of cilia is attached, and from this circlet the body gradually tapers to the point where it was detached from the stalk. After some time, however, it appears to become more rounded. The upper end of the disjointed stalk may be readily seen.

After swimming about for a short time, these free individuals were observed to attach themselves to the glass slide; in this case the extremity which was formerly free remained so, the other end becoming again attached, losing the circlet of cilia. In this state the body slowly assumes the appearance presented when extended previous to these changes, but it is nearly globular during active contraction, which occurs upon the slightest irritation or disturbance; it gradually lengthens and assumes a condition of activity, the inverted cilia of the peristome and disc slowly everting again, the posterior cilia become less and less active, at last entirely disappear.

To recapitulate, the generic and specific characters of this animal are the following: Lorica gelatinous; animals radiately clustered in numbers varying from one hundred to four or five hundred or even a thousand; each one attached by a long, non-contractile stalk, which penetrates to the interior of the jelly-mass. The expanded body extends beyond this mass, when fully contracted it is drawn down into it. The extended body of the species under consideration is elongated, tapers gradually from its point of greatest diameter, which is in the inferior third of the body, to a small, rounded, inferior extremity.

Above the dilated portion, the diameter, after diminishing for a short distance, becomes uniform almost up to the mouth, where it expands slightly. Peristome an-



EXPLANATION OF THE FIGURES.

Fig. 1. The animal attached and extended. *a*, Endoplast. *b*, Contractile vesicle. *c*, Chlorophyll granules, most apparent in the dilated portion of the body. *d*, "Fusiform body." *e*, Œsophagus. *f*, Anus. *g*, Disc, *h*, Peristome with cilia (*é*), *j*, Transverse striæ. *k*, Point of attachment to stalk (*l*.). *m*, Division of stalk. *n*, Stalk remaining after detachment of animal.

Fig. 2. Animal partially contracted; peristome and disc inverted; the letters refer to the same parts as in Fig. 1 (except *o* which refers to the inverted extremity.)

Fig. 3. Animal more contracted, and attached. Lettered as above, with addition of *p* the posterior circlet of cilia.

Fig. 4. One of the free individuals, very recently detached.

Fig. 5. The stage in which the free individual has become attached by the extremity which was formerly joined to the stalk at *q*. The peristome and disc are again everted; the process of this latter change is carried on very slowly. The condition here represented is attained about forty-eight hours after the free state is assumed.

nular; disc well elevated, and higher on one side than on the other. Endoplast or nucleus very long.

The ciliated œsophagus extends half way to the contractile vesicle. The external surface of the body exhibits very fine, transverse striation.

During contraction, this striation is not more marked, except in that part below the dilated portion—and in this species it is much less conspicuous than in *O. versatile.*

Moreover, during partial or complete contraction, the appearance presented is not the same as in *O. versatile*; the "flask-shape" is never assumed. There are no longitudinal folds like those of *O. versatile*, except when the animal is subjected to pressure, and even then they are not always produced.

I have never seen the animals encysted. I have not seen the acinetiform phase that Stein has observed in *O. versatile.*

The animal is not of a vivid green color; the chlorophyll granules are few, mostly collected in the dilated portion. When fully contracted, the body is pyriform, or nearly oval in shape. The animals are associated in smooth, globular, transparent, homogeneous masses, which are always attached, varying from one-half line to two lines in diameter.

Length of extended individual about $\frac{1}{100}$ of an inch (254μ). Habitat, so far as known, only fresh water. Although the locality where I found this rotifer has been frequently visited during the past spring and summer, and the fauna of the stream studied, these masses were not found until the early part of the past autumn. That they are hardy, is evident from the fact that the water of the jar in which they lived, was frozen, yet they were alive and active after the thawing of the ice. This animal appears to be very closely allied to *O. versatile*, but I believe there are specific differences. Its general form is unlike that of *O. versatile*, the latter is truly fusiform, the greatest diameter, when the animal is extented, is near the middle of the body, and, taking all facts bearing on this point into consideration, I regard it as an hitherto undescribed species, and designate it by the name *Ophrydium Adæ.*

———o———

Memorandum on the Amplifiers of Zeiss.

BY J. J. WOODWARD, SURGEON U. S. ARMY.*

In a paper recently presented to the Royal Microscopical Society (*Journ. of the Royal Mic. Society*, Vol. II, 1879, p. 663), I discussed the theory of the use of the amplifier in projecting images from the microscope upon a screen, for the purposes of photography, and, in the course of my remarks, alluded incidentally to the new amplifiers advertised by Carl Zeiss, of Jena, last March. In so doing, I remarked that I was unable to give an opinion as to their merits, because I had not seen them, but expressed the fear that I had myself been, unintentionally, the means of misleading Zeiss, as to the most con-

* NOTE.—This memorandum is part of a paper sent, a short time since, to the Royal Microscopical Society. I have, however, been informed by the Secretary that the Council of that Society determined "not to publish that part of it which deals with Tolles and Zeiss, as the latter will want to reply, and so on." I regret this decision the more because there appears to have been no hesitation on the part of the Society, to publish, in the paper referred to in the text, a comparison between certain objectives of Zeiss and Tolles, very much to the favor of the former; and I am unwilling to think that an American maker must not be praised in England, even for so small a matter as an amplifier.—J. J. W.

venient focal length to be employed for the purpose. I have now to report briefly the results of my examination of three amplifiers, by Zeiss, sent me by Professor Abbe, with the request that I would test them photographically. Each of these amplifiers had a virtual focus of about 10.5 centimeters, and were achromatic, but differed in construction; one was a meniscus, one a plano-concave, and one a bi-concave combination. Each was mounted with a double screw, so that either side could be turned towards the objective. Professor Abbe explained to me that the first was the form which Zeiss has been making for use at the end of the draw-tube, but added that he has "no reason at all for considering this the best form, as this, of course, could be made out by trial only." He requested me, therefore, to make the trials to ascertain "which of the three would give the best performance, and in which position."

I have now made these trials, and communicated the results to Professor Abbe; but, as the subject is one of general interest, I have thought it worth while to publish this brief memorandum. After having ascertained the best position which each of the new amplifiers should occupy, in order to give an image of *Amphipleura pellucida* of a convenient size, I began by making a photograph of a pair of frustules of this diatom, with the Zeiss one-twelfth inch and an amplifier by Tolles. I then made a series of photographs with the same objective, all the other conditions remaining unchanged, except that I shortened the distance enough to obtain approximately the same magnifying power, and substituted successively the three amplifiers of Zeiss, which I used first with one side, then with the other, turned toward the objective. The result of the trial was, that with no one of the Zeiss amplifiers, in either position, could I obtain as good results as with the Tolles amplifier; the images they gave were somewhat deficient in brilliancy of definition, but they were still more wanting in flatness of field. As between the several Zeiss amplifiers, I am disposed to give some preference to the meniscus, but the difference is not very conspicuous. I see no reason why it should be impossible to construct amplifiers of this focal length which should give flat fields; yet, certainly, the difficulty appears to be greater than with those of longer focus, and I have requested Professor Abbe to ask Zeiss to make for me an achromatic meniscus of the focal length I have been successfully using, and will report on its performance so soon after I receive it, as I can give it adequate photographic trial.

———o———

Notes on Fresh-Water Algæ.

These notes are designed to assist the learner, as he begins the study of the algæ, not by discussing classification, or in any particularly scientific or systematic manner, but by affording brief, general descriptions of the plants found in our ponds and ditches, accompanied by one, or more, illustrations in each number of the Journal. The practical value of such a course will, it is thought, be very great; not only as an aid to the beginner, but in the course of time a good series of illustrations of Algæ will be accessible for reference, which will be more valuable than the best descriptions to the advanced student.

In the preparation of these notes the editor is assisted by Mr. Francis

Wolle, to whose labors we are indebted for a knowledge of many new and interesting plants, belonging to the fresh-water Algæ. With the coöperation of such an able and enthusiastic worker, they cannot fail to be of interest to the general student, and of sterling value to the specialist.

We are indebted to Mr. Wolle for the excellent delineations of *Aptogonium*, and also for the observations upon the reproductive process of that plant, which are the results of original investigation.

I. *Aptogonium Baileyi*, Ralfs. This is one of the filamentous desmids, and one of the most beautiful. So far as known, it is only found in America. The illustrations which we give, are more true to Nature than any we have seen elsewhere. *A*, Fig. 6, represents one side of a filament, *B* the same filament, seen with an angle toward the eye. Previous to conjugation the chlorophyll, which is homogeneous in the young plant, separates into two oval portions (*C*); after some time these unite, their contents flow together, and the spores develope. At first the spores are small, oval bodies 25.4^{μ} 30.48^{μ} in diameter, within the cells or joints of the ordinary filament. As the spores mature they enlarge, press the walls around the aperture together and the sides of the filament apart, until they become nearly three times their original diameter (*F*). When fully matured, the filaments separate in the middle, and release the spores. A filament from which the spores have escaped is represented at *G*. *DD* are end views of cells. This alga was first found by Professor Bailey. It is distinguished from others of the same genus by its margins, which are not crenate. An alga found in Silesia, *Dismidium cœlatum*, Kirchner, has its margins also entire, but it differs

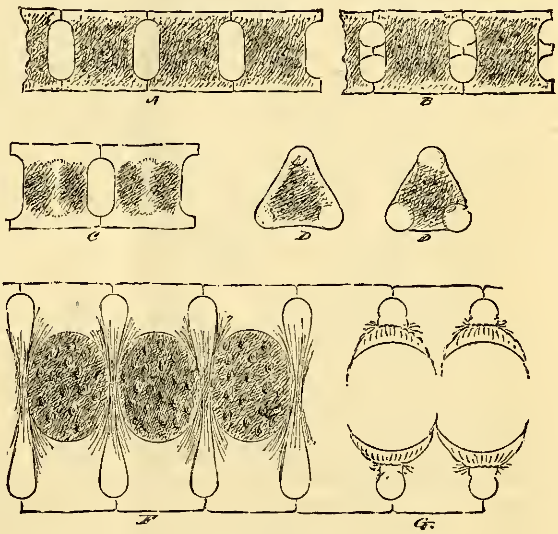


Fig. 6.

from our *Aptogonium* in the form of the cells, which are quadrangular, not triangular in front view.

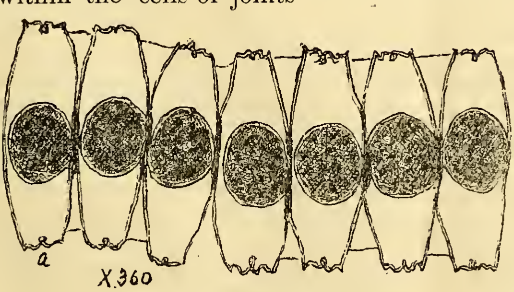


Fig. 7.

II. *Desmidium Swartzii*. This is one of the most common of our desmids. The cells are connected into long filaments, which might not at first be recognized as made up of a series of desmids. A section across the length of the filament would show that the cells have a triangular shape, and if we look at the filament in any position, we will observe that it is twisted. In this condition the plant is doubtless well known to most collectors; but it is not so usual to find it fruiting. During the month of September we obtained some excellent specimens with well-formed zygospores. The appearance of the fruiting plant is shown in our Fig. 7. This beautiful plant can be easily grown in confinement, and its process of growth and conjugation carefully studied without the necessity of visiting its native pond a second time. We have now some perfectly healthy specimens of *D. Swartzii*, which were collected last September. In fact, the same is true of most Algæ, even the most delicate. We will give some hints about growing Algæ in aquaria, in a future number of the JOURNAL.

———o———

A Method of Making Sections of Insects and their Appendages.

BY J. D. HYATT, EX OFFICIO F.R.M.S.*

In studying insect anatomy it is frequently necessary to make a section through a part of the body, or through some organ which consists of several pieces, in such a manner that the section will show all the parts in their normal position. How to make such a section through hard, chitinous organs, such as stings and ovipositors, sufficiently thin to allow of examination by transmitted light, and at the same time retain all the parts in place, was a problem that, for several years, defied all my attempts to solve by any process on record. After many fruitless attempts by other devices of my own, the following very simple method has proved entirely successful.

The insect, or organ, is placed in alcohol until it is thoroughly permeated by that fluid, and then removed to a clear, alcoholic solution of shellac, in which it may remain for a day or two.

Fit a cylinder of soft wood into the well of the section-cutter; split this cylinder through the middle, and cut a groove in one or both of the half-cylinders, sufficiently large to admit the object without pressure; put the two pieces together with plenty of thick shellac, and tie them with a thread. When the shellac is quite hard, which will be the case in a day or two, place the cylinder in the section-cutter, and after soaking the wood with warm water, sections the $\frac{1}{500}$ of an inch in thickness, or less, may readily be made.

Should the shellac prove so opaque as to interfere with a proper examination, a drop of borax solution will immediately remove this difficulty.

*President of the N. Y. Microscopical Society.

———o———

New Microscopes and Accessories.

I.

The latest design for a stand is the one which we illustrate on the opposite page. The stand here shown is made by Messrs. Sidle & Poalk, of Philadelphia, who have recently gone into the business of manufacturing microscopes and objectives.

The cut is so clear that but few words of explanation are necessary. The aim of the makers seems to have been to produce a good, cheap stand, which would be adapted to all kinds of work. For ordinary purposes the stage is made of two thin circular brass plates, the upper one, shown in the lower left-hand corner of the engraving, fitted to turn upon the lower, so that the object can be rotated in the field of view. The stage can be centered. The upper plate can be removed, and two spring clips attached to the lower one, either above or below, thus making an excellent stage for use with oblique light.

The aperture in the stage has a standard screw-thread, which is intended to receive various accessories for illumination, when it is desired to have the mirror move independently of them; and also to afford a means of mounting the selenite, so that it can be revolved without turning the Nichol prism.

The mirror and sub-stage are both attached, by sliding fittings, to the same bar, which carries them around the object as a center. The circular piece at a right angle to the stage, gives perfect steadiness to the bar, and the movement is very smooth; this piece is graduated to show the angular direction of the illuminating pencil.

The sub-stage is adapted to carry the larger accessories — polariscope, paraboloid, etc., and is also provided with a cap having the society-screw, so that objectives may be used as condensers. It has a centering adjustment.

The piece of apparatus figured in the cut, lying immediately behind the stand, screws into the sub-stage, and in its upper part carries an admirably constructed, adjustable diaphragm, quite as good as the expensive iris-diaphragm, of which it appears to be a modification.

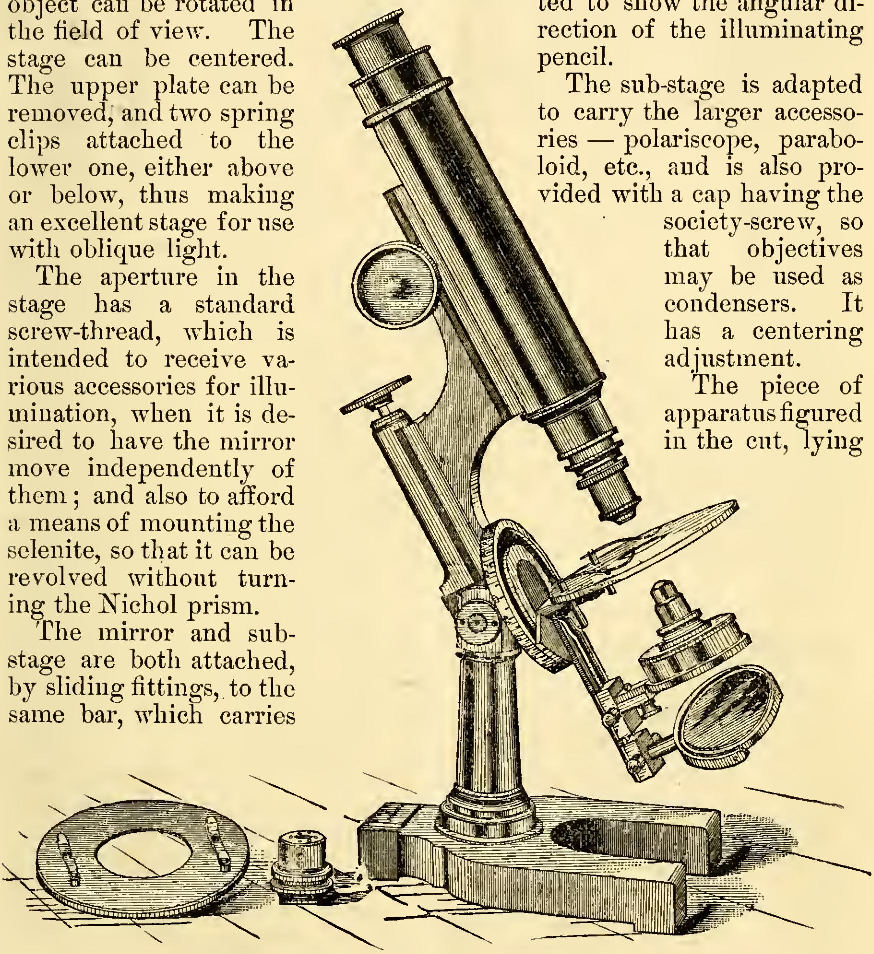


FIG. 3.—THE NEW ACME STAND.

The body-tube measures $1\frac{5}{16}$ inches in diameter, and beside the society-screw, it is provided with the new screw, of $1\frac{1}{4}$ inches thread, for low-power lenses of extreme angular aperture.

The fine-adjustment moves the entire body, and consists of an adjustable slide at the back part of the arm, moved by a fine screw.

The slides of both the quick and

the fine adjustments are of the prismatic or dove-tail form, with broad bearings, to insure rigidity.

The horseshoe base is reversible, so that greater steadiness can be insured when the stand is used in the horizontal position. This base may be removed and a polished walnut foot substituted for it, thus converting the instrument into a convenient class-microscope.

We can speak well of the design and construction of the stand.

Inclined as in the illustration, it measures 35 $^{cm.}$ in height.

It is sold, with the accessories mentioned in this article, for $45.00.

The makers of this stand have worked out the following series of objectives, which we describe in their own words, not having personally examined them. The ⅔-inch of 32° resolves up to No. 5 of Möller's balsam plate; the $\frac{3}{10}$-inch of 115° up to No. 13, and the $\frac{1}{5}$-inch of 120° up to No. 14 of the same plate.

——o——

The Simplest Forms of Life.*

BY B. EYFERTH.

[By republishing this work in English, the Editor believes that the labor will be best appreciated by the amateur collector. To the advanced student this classification will not be satisfactory, in every respect. However, there is no elementary work of equal value to the general student in English, or in any other language. In carrying out this translation, the plan of arrangement in the original will not be closely followed. The work itself opens with the Algæ, after which follow the Rhizopoda. The classification of the chlorophyllaceous Algæ has been given in the *American Quarterly Microscopical Journal*, and, therefore, will not be reprinted in this journal at present. The temporary omission of this part of the work, will be amply compensated for by the "Notes on Fresh-Water Algæ" which will appear from time to time.

Our first installment will be the classification of the Rhizopoda, after which will follow that of the Infusoria.

Dimensions are given in millimeters.—Editor.]

Rhizopods.

The bodies of rhizopods consist of a homogeneous, nucleated plasma. Dujardin called this substance sarcode, Max Schultze and Cohn have shown that it is identical with the plasma of plants. The rhizopod body has no constant form, is soft, and projections (pseudopodia) constantly stretch out from the surface and are retracted. These pseudopodia serve for locomotion, and also for seizing food. In some species the pseudopodia are very fine, branched, sometimes flowing together — anastomosing; in others they are thick, finger or lip-like. Within the body are found many small particles, generally one or more nuclei, often with prominent nucleoli; also one or more vacuoles. Generally there can be seen an endosarc and ectosarc. Many rhizopods surround themselves with a covering, which is either secreted from the body-mass or formed of foreign material. The covering has an opening for the extrusion of the pseudopodia, which also affords an entrance for the particles of food. The naked amœbæ simply envelop their nutriment. In either case, digestion takes place by the direct contact of the food with the body-mass. Little is known of the reproductive process; as yet only simple division has been observed.

* Translated from the German, by the Editor.

Most of the rhizopods live in the sea; these have recently been studied by M. Schultze and E. Häckel. In the following classification only the common fresh-water forms are given, some of which are placed, by many authors, among the Infusoria.

Pseudopodia fine, branching, somewhat changeable,	Actinophryina.
Pseudopodia thick, very changeable	Amœbina.

I. Family, Actinophryina.

The body shows a difference between the outer coat and the inner portion. The pseudopodia placed upon the outer coat are thin, pointed, simple or branched, sometimes anastomosing. Movement very slow.

Body without an outer test,	
pseudopodia radiating from the entire surface,	Actinophrys.
pseudopodia not covering the entire surface,	
in a belt encircling the body,	Trichodiscus.
lateral, in a bunch,	Plagiophrys.
Body with an outer test,	
test free, not fixed,	
not incrusted with hard particles,	
finely sculptured,	
elongated, with terminal aperture,	Euglypha.
retort-shaped, with lateral aperture,	Cyphoderia.
not sculptured, structureless, membraneous,	
elongated, with lateral opening,	Trinema.
spherical,	Gromia.
incrusted with foreign particles,	Pleurophrys.
test provided with a long pedicle,	Clathrulina.

1. Genus, *Actinophrys*. Ehr. The spherical body of the animal appears almost frothy, owing to numerous vacuoles; near the surface a large contractile vesicle appears, which projects outwards. The radiating pseudopodia have an axis of somewhat firmer consistence.

A. Sol. Ehr. Parenchyma alveolate, excepting a small, central, thick portion. Passing outwards the alveolæ increase in size. A circular nucleus, with a nucleolus in the centre. Size as large as 0.06 d. Common.

A. Eichornii, Ehr. (*A. Sol.* Kölliker, *Actinosphærium Eichornii*, Häckel, Hertw., and Lesser.) Body spherical, vacuolated throughout, inner part distinctly separated from the outer coat. The latter with large, radial, vacuoles, and several contractile vesicles: the former with small, polygonal, thick-walled vacuoles, and numerous nuclei, size 0.04—0.4. Not uncommon in stagnant water.

2. Gen. *Trichodiscus*, Ehr. Body spherical, with an equatorial zone of pseudopodia.

T. Sol. Ehr. 0.055—0.111 d. Among water-plants, not common.

3. Gen. *Plagiophrys*, Cl. and L. Body spherical; pseudopodia streaming out from one part in a bunch, branched, rarely anastomosing. Nucleus simple, contractile vesicle not noticeable. According to Hertweg and Lesser, the body is enveloped by a thin, close, membraneous lorica; in such case these forms properly belong to the succeeding group.

P. Sphærica, Cl. 0.03—0.04 d. According to Claparède, vesicle present. In river-water, not common.

P. Cylindrica, Cl. Length 0.13, breadth ⅓ the length.

Pseudopodia terminal. Among algæ, rare.

4. Gen. *Euglypha*, Duj. Shell ovoid or flask-shaped, formed of hexagonal, spirally-arranged, plates.

Pseudopodal opening terminal. The plasma consists of two different parts—a posterior homogeneous portion with a simple nucleus, and an anterior, granulous portion ; contractile vacuoles in both. Pseudopodia homogeneous, branched, not anastomosing.

E. Ampullacea, H. Carapace flask-shaped, plates in 24 rows ; aperture with 12 notched teeth, 0-07 l., 0.04—0.05 d.

E. Alveolata, Duj. Carapace ovoid ; plates in 8 rows ; aperture with 8 fine teeth, 0.08—0.11, half as broad. Not rare.

E. Globosa, Carter. Shell spherical, with small, neck-like carved appendage. Plates often separated by bands.

5. Gen. *Cyphoderia*, Schlum. Carapace elongated, retort-shaped, the neck-like extension obliquely cut off by the oval, pseudopodal aperture ; very finely marked with regular six-cornered projections.

The plasma consists of two similar parts, the anterior contains numerous contractile vesicles, the posterior a nucleus. Pseudopodia numerous, homogeneous, branched, not anastomosing, *C. Margaritacea*. Sch. (*Lagynis baltica*, Schultze, *Euglypha margaritacea*, Wallich.) L. 0.125—0.2. In ditches, especially in peaty soil.

6. Gen. *Trinema*, Duj. (*Difflugia*, Ehr.) Carapace elongated, egg-shaped, turgid behind, structureless, hard. Aperture lateral, oblique to the axis, with borders bent inwards. The plasma consists of two unlike parts ; the posterior is homogeneous and contains the nucleus with a nucleolus, the anterior is granulated. There are three contractile vacuoles,about one-third the length from the anterior end. Pseudopodia pointed, filamentous, not anastomosing.

T. acinus, Duj. (*Difflugia enchiles*, Ehr.) 0.031, half as broad. In fresh and old turfy water, not rare.

7. Gen. *Gromia*, Duj. Carapace spherical, soft, membraneous, yellowish-brown, with a small, round opening. Pseudopodia long, filamentous, branched, anastomosing.

G. fluviatilis, Duj. *Gr.* up to 0.25 d. In stagnant water, with plants, sometimes abundant.

8. Gen. *Pleurophrys*, Cl. and L. Carapace irregularly oval, formed by the union of siliceous particles, brownish. Pseudopodia very fine, branched, anastomosing, carrying granules.

P. sphærica, Cl. and L. l. 0.02-0.1.

9. Gen. *Clathrulina*, Cien. Carapace spherical, fenestrated, on a stalk ; colorless, later brown. Plasma with numerous contractile vesicles, and central nucleus with nucleolus. Pseudopodia numerous, branched and anastomosing,carrying granules.

C. elegans, Cien. Test, 0.06 d, Stalk, 1—2 l. In ditches, among algæ, not common.

II. FAMILY AMŒBINA.

Pseudopodia large, blunt, lip or finger-like ; plasma with nucleus and contractile vesicle.

Body without carapace,	
pseudopodia not spread out or leaf-like,	
circular, blunt,	Amœba.
part broad, part whip-like,	Podostoma.
pseudopodia spread out leaf-like at the end,	Petalopus.
Body with carapace,	
carapace a product of secretion,	
flexible,	Pseudochlamys.
not flexible,	Arcella.
carapace incrusted with foreign bodies,	
without tubular prolongations,	Difflugia.
with tubular prolongations (thorns),	Echinopyxsis.

Cont. page 84.

EDITORIAL.

Special Notice.

Subscribers will please remember that their subscriptions are due in advance. By remitting on receipt of this number they will greatly oblige the publisher, and save him the time and labor required in making out a large number of bills. The receipt of the journal, hereafter, will be an acknowledgement of payment received. Those who are willing to assist in extending the circulation of the MONTHLY, can readily do so by referring to it in their correspondence, stating that they have received this number.

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Aims and Prospects.

Entering once more upon a field which is already strewn with the wrecks of so many enterprises in the line of scientific journalism, it seems proper that we should say a few words about the character of our publication, and its prospects.

There has long been a recognized demand for a good, authoritative periodical, devoted to the microscope and its practical applications. Popular in its form and aims, yet sufficiently technical to be valuable to the serious student. It is such a journal that we propose to issue. How well we shall succeed in meeting the wants of our readers, remains to be seen. A number of susbcribers have already requested articles on certain subjects, and we intend to furnish them as soon as practicable. We are always ready to receive requests and suggestions of this nature from correspondents, and will give them early attention; if readers will express their desires, they will greatly assist us in selecting articles to meet their wants.

We wish to impress the fact, upon the minds of our subscribers, that the columns of this journal are freely open to them for the discussion of subjects of general interest. Only well-tempered and courteous criticism will be allowed, but any side of any subject will be fairly presented. The correspondence column, and the "Questions and Answers" will offer every facility for discussion, criticism, and giving and imparting information. We cordially invite subscribers to make free use of the facilities thus offered.

Concerning original articles for the body of the journal, they need not be long or exceedingly scientific. In truth, our paper is not large enough to admit lengthy articles, such as were published in the *Quarterly*. It is far better adapted to popular articles, embodying the results of observations by amateur workers, descriptions of minute forms of life, hints designed to assist young students, accounts of the habits and peculiarities of the microscopic animals and plants found in various places, and to contributions that possess a general interest, or are valuable as records of discoveries. With these suggestions in mind, no one need hesitate to contribute whatever seems to be of value; and no isolated fact concerning the minute inhabitants of the world revealed by the microscope, can fail to interest the student of natural science. In carrying out this scheme, the journal does not lose its value as a scientific periodical. Apart from its influence in fostering the study of microscopy among amateurs, the student of special branches will find much to interest him in the articles on classification, on fresh-water Algæ, and in the translated articles which will appear from time to time; and also in the editorial "Review." To the physician and medical student who would use the microscope intelligently, it will be an invaluable aid.

In this connection we may refer to the very valuable articles which were announced in our prospectus, as forthcoming. Some of them will not appear immediately, but the promises we have made will be fulfilled to the letter, and as early as practicable.

This editorial is already so long that we can merely touch upon our prospects. We will only add, that the outlook is exceedingly encouraging. The encouragement we have received, before the issue of our first number, has exceeded our expectations. If a corresponding readiness to support the JOURNAL is shown by those who receive this number, the first year of its existence will prove successful beyond all anticipation. We have reason to congratulate ourselves for the hearty reception which the Prospectus has received ; and for the very substantial evidence of confidence in our representations and management.

It is our intention to increase the size of the JOURNAL, and to render it more valuable and attractive in every way, so soon as the subscription-list is large enough to justify the additional expense that would be thus incurred. In this way, we hope to establish a periodical that will more fully represent the status and progress of microscopical investigation in America.

In conclusion ; the JOURNAL is designed to further the interests of microscopy in all branches of science ; it favors every advance in knowledge, every improvement in objectives and the methods of using them ; supports everything within its sphere that is good, condemns what is not good, opposes humbug and pseudo-science, and strongly advocates the adoption of a micrometric unit, based on the French metric system.

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Review.

The August number of the *Journal of the Royal Microscopical Society* contains several important articles ; two are by H. J. Carter, F. R. S., the first describing a "New Species of Excavating Sponge, *Alectona Millari ;* and a New Species of *Rhaphidotheca, R. affinis ;*" the second is "On a New Genus of Foraminifera, *Aphrosina informis*, and Spiculation of an Unknown Sponge." A very able paper by Professor Balbiani, entitled "Observations on *Notommata Werneckii*, and its Parasitism in the Tubes of *Vaucheria*" is translated from the *Annales des Sciences Naturelles.* The paper opens with an historical summary, from which we learn, that as early as 1803 Vaucher observed peculiar swellings upon *Vaucheria*, caused, as he supposed, by the insect named by Müller *Cyclops lupula*, which he considered were similar to the galls of the higher plants. Several writers of later date observed the same excrescences, but Ehrenberg was the first to determine the nature of the animal which had its origin within them. He named it *Notommata Werneckii;* beyond this specific determination of the animal, we have heretofore known very little about it. As this curious rotifer may be looked for by some readers of the JOURNAL, we quote from the article as follows : "On examining the tubes of the *Vaucheria* (*V. terrestris*), I distinguished on the greater number two kinds of laterally placed excrescences :—the one easily recognizable as the organs of reproduction, from their characteristic form; the other much larger, generally club-shaped, representing a kind of pocket, or elongated capsule, nearly at right angles to the principal filament, and having the same green color.

I opened one of these, and saw the parasite gradually disengage itself from the green matter. It was a blackish and extremely soft body, continually contracting and modifying its shape."

The parasitic cysts, in which the animal developes, are only the persistent branches which bore the reproductive organs, greatly increased in size. The animal lays its eggs within the capsule and then dies; the eggs hatch in ten or fifteen days, when the young rotifers make their exit into the surrounding water, through openings in the walls of the plant. They soon return to the plant through openings, just as they left it, deposit their eggs, and die. *N. parasitica* and *N. Petromyzon* are two other species of this genus, which are said to inhabit the spheres of *Volvòx globator*.

A recent contribution of Professor Karl Möbius, bids fair to keep alive the discussion about the animal origin of *Eozoön Canadense*, for a considerable time to come. The paper is abstracted and extensively illustrated, in two numbers of *Nature*. We cannot do justice to the views of Professor Möbius by any abstract in the short space at our disposal; but we may say, that he has evidently devoted much time and labor to the study of the structure known as *Eozoön*, and he has reached the conclusion that the Eozoön structure is not of animal origin. Both Dr. W. B. Carpenter and Principal Dawson have criticised the work of Professor Möbius, and none of his statements seem to have altered the opinions of those able investigators. The subject cannot be properly studied without very careful preparation, and intimate acquaintance with foraminiferal structure. For this reason, we consider that the most competent authorities on this subject are Dr. Carpenter and Principal Dawson, and we still hold to the belief in the animal origin of *Eozoön*.

We must add, however, that we have long wished for a good view of the structure that Dr. Carpenter has described, but have not seen it on any slide we have examined.

A full and complete memoir on the subject of *Eozoön*, is in course of preparation by Dr. Carpenter and Prof. Dawson.

We are obliged to leave untouched many interesting subjects in the "Review" this month, owing to the space required for other matter.

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Catalogue of the Diatomaceæ.

The very valuable "Catalogue of the Diatomaceæ," by Frederick Habirshaw, of New York, has been revised, enlarged and brought up to date by the author, in the expectation that it would be published by Dr. J. Pelletan, editor of the late *Journal de Micrographie*, Paris, France. After extensively advertising the book in his journal, and soliciting subscriptions for it, both Dr. Pelletan and his journal have mysteriously disappeared. In concluding his "Review" in the June number of the *Journal de Micrographie*, the learned Doctor says farewell in a few graceful sentences, telling his readers that he intends to take a "vacation" during the months of July and August, and that he would not issue his journal again until September or October; at which time, we doubt not, he expected to recuperate his mental and physical vigor.

We have undertaken to publish the "Catalogue of the Diatomaceæ" as a subscription book, to be issued in four parts, at one dollar and a quarter each, and an advertisement of the work will be found elsewhere in this JOURNAL.

We call attention to the publication in this place, because we believe it is of sufficient scientific value to justify an extended editorial notice; and also because we wish to say that it is our intention to make it, in every respect, a work which shall be worthy of a place in the finest library.

As the book will not be commenced until a sufficient number of subscriptions is secured to insure the completion of the work, those who intend to secure copies will do well to subscribe immediately.

Each part must be paid for as it is issued, but no payments in advance are desired.

CORRESPONDENCE.

On Central Light.

TO THE EDITOR:—The following little "wrinkle" has, no doubt, occurred to many of your readers, but as I have never seen it mentioned in any article on the microscope, I thought it might be new and useful to some.

As I continually have occasion to carefully test the performance of various objectives, I find it of importance, in securing the best definition, to have the light as nearly central, or coincident with the optic axis of the microscope, as possible. To effect this, having placed the object on the stage, and focussed, I remove the eye-piece, and placing the eye centrically at the end of the tube, observe the image of the diaphragm and mirror, projected at the back of the objective. This should appear as a disc of light in the centre of the latter. If the spot of light is not circular in outline, or does not appear central with the lenses of the objective, adjust the mirror or diaphragm, or both, until it is so. The aperture of the diaphragm may be perfectly central, and yet the light which strikes the object be received through only a part of the opening, from one side of the mirror, thus giving oblique illumination, and more or less imperfect definition, although often a better resolution of close lines.

This adjustment of the light is so easily and so quickly effected and, with good lenses, gives such uniformly good results, that I find it of great advantage.

EDWARD PENNOCK.

Philadelphia, Dec. 6th, 1879.

[The full benefits of strictly central light are seldom reaped by microscopists, and this note of Mr. Pennock has certain practical bearings which many of our readers would do well to observe. Our correspondent has found, by experience in testing objectives, that strictly central light is better for definition, than the light which comes from the mirror carelessly adjusted. Such evidence commends itself to the reader's attention. In a future number we shall discuss the subject of illumination quite thoroughly, and explain why certain results are obtained by particular methods. What we wish to urge now, is the value of a good diaphragm. By far the greater part of microscopical observation is carried on by what is called central light, but what in truth, is not central. In the course of our own observations we almost never work without the smallest diaphragm-hole in use, and it is a source of wonder to us that so many really excellent observers seem to be absolutely ignorant of the advantages of a diaphragm. Hardly one man in a dozen appreciates its value, and yet, we might almost say that we could tell at a glance, whether a familiar object is shown with or without a diaphragm. A suitably-arranged diaphragm will be of more value to the student, than a dozen of the more elaborate traps sold to aid microscopists in their work.—ED.]

A Note From Mr. Tolles.

[We have received the following note from Mr. Tolles, which we publish at his request.—ED.]

BOSTON, Dec. 23, 1879.

R. HITCHCOCK, ESQ.;

Dear Sir—I have your letter of 22d instant.

All I wish at your hands is the statement that I disavow the use of the expression "+180°" (as likewise "180°+") as applied to objective angle of aperture, and deny ever having written or printed the same in either form, otherwise than to point out the error of its use.

Yours respectfully,
ROB'T B. TOLLES.

NOTES.

—No account of the meeting of the American Society of Microscopists, at Buffalo, has yet appeared, and the synopsis which we intend to give is crowded out of this issue. The presidential address, by Dr. Ward, was very interesting; and we will publish abstracts from it in our next number.

—The expert evidence which has been offered during the course of the trial of Mr. Hayden, at New Haven, for murder, possesses some features of interest to microscopists. After the mass of evidence, which has been given by the scientific gentlemen on both sides, it will be strange if any jury of ordinary intelligence can decide what is right or wrong. Really, there is much confusion where there should be none at all; whether the microscopist is or is not able to positively identify human blood, or any other kind of blood, is not a matter of opinion, but of fact and experience; and there should be no dilly-dally about it. In our next issue we will review the evidence, and show how easily a man can make assertions under oath, which, after more thorough study, he would discover to be unfounded.

—In preparing diatoms *in situ.*, Mr. Paul Petit proceeds as follows: In order to destroy the cellulose, the diatoms are placed in strong nitric acid for twelve hours; they are then washed, dried, and slowly burned on the cover-glass. To mount them, oil of lavender is dropped upon the cover-glass, which is then inverted upon a drop of balsam on the slide, and the slide is warmed in the usual manner. Oil of lavender is the only medium which Mr. Petit has found, that will thoroughly displace the air in such valves as those of *Melosira numularia* and certain others. It is a good plan to mount some frustules cleaned in the ordinary way, along with those *in situ.*

—*Endamœba Blatta.* Prof. Leidy describes this organism as follows:

"ENDAMŒBA.

General character and habit of *Amœba;* composed of colorless, homogeneous, granular protoplasm, in the ordinary normal active condition without distinction of ectosarc and endosarc; with a distinct nucleated nucleus, but ordinarily with neither contractile vesicle nor vacuoles.

ENDAMŒBA BLATTÆ.

Eine art Proteus. Seibold: Beitr. z. Naturges. d. wirb. Thiere, 1839. *fide* Stein.

Amöbenform. Stein: Organismus d. Infusionsthiere, 1867, II, 345.

Amœba Blattœ. Bütschli: Zeits. f. wis. Zoologie, 1878, xxx. 273, Taf. xv., Fig. 26.

Initial form globular passing into spheroidal, oval, or variously lobate forms, mostly clavate and moving with the broader pole in advance. Protoplasm finely granular, and when in motion more or less distinctly striate. Nucleus spherical, granular, with a large nucleolus. Distinct food particles commonly few or none. Size of globular forms 0.054^{mm} to 0.075^{mm} in diameter; elongated forms 0.075^{mm} by 0.06^{mm} to 0.15^{mm} by 0.09^{mm} Parasitic in the large intestine of *Blatta orientalis.*

The *Endamœba blattœ* affords a good example of a primitive, active *nucleated organic corpuscle*, or a so-called *organic cell without a cell wall.* In the encysted condition it would be a complete nucleated organic cell. *Endamœba* may be recommended as a convenient illustration of a primitive form of the organic cell on account of its comparatively ready access."

This amœboid has been described by Prof. Bütschli under the name of *Amœba Blatta*, but as it has no contractile vesicle nor any differentiation of endosarc and ectosarc, it is not an *Amœba;* and it is unlike *Protamœba*, for it has nucleus.

—A bunch of *Sphagnum*, which Prof. Leidy recently (June, 1879,) examined, contained no less than forty species of Rhizopods belonging to the genera *Difflugia, Nebela, Arcella, Heleopera, Quadrula, Centropyxis, Hyalosphenia, Euglypha, Assulina, Sphenoderia, Cyphoderia, Trinema, Placocista, Pseudodifflugia, Clathrulina, Hyalolampe, Acanthocystis, Amphizonella and Amœba.* The list is given in full in the *Proceedings of the Academy of Natural Sciences of Philadelphia.* We mention the various genera for the benefit of those readers who may be interested in studying Rhizopods. With the Rhizopods were associated numerous desmids, diatoms and other organisms. *Sphagnum* is the generic name of a kind of moss which grows in bogs—it is often called bog-moss. The moss which Prof. Leidy examined was found in a cedar swamp in New Jersey. We need hardly add that it would be well for collectors to take home bunches of moss which they find in marshy places, as it is quite likely to furnish, not only such organisms as Prof. Leidy describes, but also the most beautiful and delicate rotifers.

—A circular to the members of the American Postal Microscopical Club has been issued by the Managers, requesting immediate renewals of membership, in order that the circuits may be arranged and boxes put in circulation. No new circuits will be established, but applications for membership will be "entertained to the extent of filling vacancies." Such applications should be sent to the managers at Troy, N. Y. The officers for the ensuing year are the following: President, Rev. Samuel Lockwood; Secretary, Rev. A. B. Hervey; Ass't Secretary and Treasurer, Joseph McKay; Managers, R. H. Ward, M. D., and C. M. Vorce, Esq. We would urge the members to reply to the circular immediately, for by doing so they will hasten the time of starting the boxes on their circuits.

—In the Third Annual Report of the Department of Public Works, of Chicago, a few pages are devoted to some remarks of Mr. B. W. Thomas, who has subjected the water of that city to microscopical examination. A full-page lithograph plate accompanies the article, and shows the more common forms of plant and animal life that are found in the Chicago water.

The remarks of Mr. Thomas can hardly possess more than a local interest; therefore, we cannot give space to a lengthy notice of his work. It is unfortunate that the specific names of the inhabitants of the water were not carefully determined, and given in the report, for its intrinsic value would have been thus greatly enhanced.

QUESTIONS AND ANSWERS.

[This column is freely open to all who desire information upon any subject connected with microscopy. It is hoped that the readers will reply promptly to the questions which are asked.]

1. Can any reader inform me, what is the highest magnifying power that has been obtained by a microscope?

This is a question that was asked in the *Quarterly* and I have waited patiently for some one to reply, but have not received any satisfactory answer yet.

W. M.

NEW YORK.

2. I would like to be informed, why objectives made for the resolution of test-objects are more under-corrected than those intended for ordinary Work?

J. W.

NEW YORK, Dec. 15, 1879.

MICROSCOPICAL SOCIETIES

CAMDEN, N. J.

One of the most active of our Societies appears to be the Microscopical Society of Camden, N. J., of which Mr. A. P. Brown is the President. This Society has a room of its own, which the members have fitted up with a neat floor of narrow boards, finished in oil, suitable furniture, a handsome case containing an herbarium, in which almost all the plants of New Jersey are represented, and another case of the minerals of New Jersey and the adjacent States. Among the interesting objects exhibited at a recent meeting may be mentioned, living *Stentors* and a mounted *Melicerta* by A. P. Brown; a handsome preparation of the foot of a garden spider by A. W. Vail, showing the beautiful "combs" by which the insect manages its web, was shown by the Secretary Mr. J. L. De LaCour; the circulation in a salamander by Dr. Geo. P. Fortiner. The Society seems to be in a very prosperous condition.

NEW YORK.

We have a very full report of the proceedings of this Society, furnished by the Recording Secretary, dating from the meeting of September 5th, but it was received too late to be published entire. We extract the more interesting parts as follows:

Sept. 5th. Mr. Hitchcock read a short paper, on the conjugation of the Zygnemaceæ, which was illustrated by blackboard drawings. Mr. Van Brunt then discussed some facts relating to the subject, which he had also observed in these plants; and both gentlemen afterwards showed some of the specimens, as found in different stages of their existence. President Hyatt stated that he and the Recording Secretary, Mr. Shultz, attended the Buffalo meeting of the "American Society of Microscopists" and enjoyed a very pleasant time, both in hearing the interesting papers and discussions, and witnessing a fine exhibition of instruments and objects, in which he and the Secretary participated.

Mr. Hitchcock proposed a scheme which he thought would, if adopted by the Society, add greatly to the interest and value of the meetings. His remarks may be summed up as follows: In order to secure some interesting objects for exhibition at every meeting, he proposed that a number of the most active members should agree to collect specimens of living plants or animals for each meeting. These members should be divided into companies of two for each collection, and he had prepared a short list of members arranged according to the plan proposed. During inclement weather, it is expected that the gentlemen appointed will furnish mounted objects, or material or apparatus of interest in place of living forms. In addition to this, it was proposed that there should be a popular address delivered every two months, upon the evenings of the regular conversational meetings. Invitations should be issued to ladies and gentlemen who are known to be interested in scientific studies. A scheme for table-work was also brought forward, which was intended to afford practical instruction in methods of preparing, mounting and studying specimens.

October 3rd, 1879. M. Hyatt exhibited a section of the silicious coat of *Equisetum hymnale*, or common scouring rush, by polarized light—a gorgeous object. He announced that he prepared it by first scraping off the matter which adheres to the inner surface of the cuticle, then bleached it by steeping it in Labarraque solution, afterwards washing in alcohol and mounting in balsam. Mr. Wall showed his method of mounting opaque objects in wax, by cutting thin sheets of black wax into circles, placing a disc upon the slide, fixing a brass curtain-ring in the wax by the application of heat, and covering the cell thus made by thin glass, after which he finished it in the usual manner.

Public conversazione held Oct. 17th, 1879. This was the first of the meetings provided for by a recent resolution.

A popular address was delivered by Mr. J. D. Hyatt, the President. He was introduced by Mr. Braman, who made a few very happy remarks upon the history and condition of the Society. The subject of Mr. Hyatt's address was "The Mechanism of Insect-Stings" which he illustrated by blackboard sketches, and greatly magnified, colored drawings on paper. He fully explained to the audience the elaborate compound levers and muscles, by which great rapidity and much power was displayed by the Bee in thrusting its stings into the flesh.

This address was attentively listened to by a very intelligent audience of about 200 ladies and gentlemen, who, at the conclusion were shown into the smaller meeting-room, where twenty-nine microscopes with attractive objects, were exhibited.

ILLINOIS STATE.

The Illinois State Microscopical Society recently held its semi-annual meeting, at which Mr. Colgrove delivered an address on "Recent Microscopical Work." He stated that while no discoveries of special interest had been made in microscopy, during the past six months, the microscope had contributed materially to the sum of human knowledge, during this period. He reviewed the subject briefly, stating that the discussion of the question of aperture had ceased; the advocates of low angles, with the exception of Mr. Wenham, have apparently abandoned the field while makers are now producing objectives of high angular aperture; and we find that those best qualified to judge, generally recommend the immersion objective, used with a fluid whose refractive index is the same, or nearly the same, as that of crown glass.

In this matter we do not fully agree with Mr. Colgrove. The discussion is not dead, but sleepeth.

Continuing his remarks, the speaker said that Prof. W. Fleming has recently published a detailed account of his extensive researches on the structure of nuclei, and their behavior during the process of cell division, according to which the nucleus consists of:

1. An investing membrane.
2. An intra-nuclear net-work, consisting of an extensive system of ramified filaments, exhibiting at intervals, thickenings or pseudo-nucleoli.
3. The true nucleoli.
4. A pale ground-substance filling up the remaining space, and devoid of visible structure in the living state, but assuming a granular, fibrillar appearance by the action of reagents.

The subject was afterward taken up by the medical gentlemen present, and discussed at considerable length. Dr. Curtis stated that since the appearance of Klein's Atlas, he had devoted some time to the investigation of these statements; that, with high powers, and the object just out of focus, he had seen an appearance something like that illustrated by Klein, and described by Fleming as an "intranuclear net-work." When the corpuscle is in true focus its surface presents a granular appearance, of a somewhat regular pattern, like the surface of a raspberry.

The meeting closed with an exhibition of interesting objects.

GRIFFITH CLUB, MICH.

The Griffith Club of Microscopy, of Detroit, Mich., is a new organization which we are glad to hear from. We have a report of a paper read at its second monthly meeting by Mr. J. C. Holmes. The paper was on "The Progress and Uses of the Microscope", and is not readily summed up.

Mr. Holmes' paper was listened to with the closest attention and was highly commended by his associates. At its close Prof. E. W. Wetmore, President of the Club, presented the following formula for determining the magnifying power of a microscope:

1. Divide ten inches by the nominal focal length of the objective; this will give the magnifying power of the glass.

2. Divide ten inches by the linear distance between the centers of the field-glass and the eye-glass of the eye-piece.

3. Multiply these quotients together and you will get a close approximation to the working power of the combination, when used with the standard length (ten inches) of tube.

To put the above in mathematical form, let F O equal the nominal power of the object-glass: let F I equal the distance between the lenses of the eye-piece; then 100 divided by F O multiplied by F I, equals the magnifying power of the instrument. For an instrument with a longer tube, substitute the length of the tube for the first ten inches in the formula.

After the announcement that Dr. Main, of Jackson, Mich., would, at the next meeting of the Club, read a paper on his specialty, "Section Cutting," the formal session ended.

SAN FRANCISCO.

We are obliged to omit from this issue a report of the San Francisco Society.

Reviews of Books.

The Microscopist.—A Manual of Microscopy and Compendium of the Microscopic Sciences, Micro-Mineralogy, Micro-Chemistry, Biology, Histology, and Pathological Histology. By J. H. Wythe, A. M., M. D. Third edition, with 205 illustrations. Philadelphia: Lindsay and Blakiston. (8vo. Price, $4.50.)

This is a book of 250 pages, printed on good paper with clear type, and replete with excellent illustrations. It is so well known to microscopists, however, that we need not enter into a detailed review of its contents. There are some portions that should be rewritten to bring them up to date, particularly those which relate to the capabilities of modern objectives; but in speaking of this we may also add that there is not one single published work, treating of the microscope, which embodies the results of recent investigations upon the theory of the microscope, the proper methods of illumination, and various other subjects of theoretical and practical importance. Most of the illustrations are printed in one or more colors, on full-page plates, thus greatly adding to the good appearance of the book.

The field covered is a large one, embracing all the subjects mentioned in the title, and many others. The work contains much that is not usually found in books of a similar character *e. g.*, the micro-chemical tests, and some tables giving the classification of certain animals and plants.

We believe it is a valuable work for the general student.

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Exchanges.

THE AMERICAN
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Fallacious appearances among the Fresh-water Algæ.

III. Fresh-water Algæ are often the subjects of peculiar transformations in their life-history, both before and after they have attained maturity. A knowledge of a few of these may help the novice to bridge over some of the difficulties he meets with in his studies. There are several very common plants found about the outlets of springs, in trenches and small ponds, belonging to the genus *Conferva*, Link., including also forms which Thuret needlessly separated as *Microspora*, in consideration of the greater abundance of microspores found in the cells of the filaments. There is a number of species belonging to this genus; they differ in the

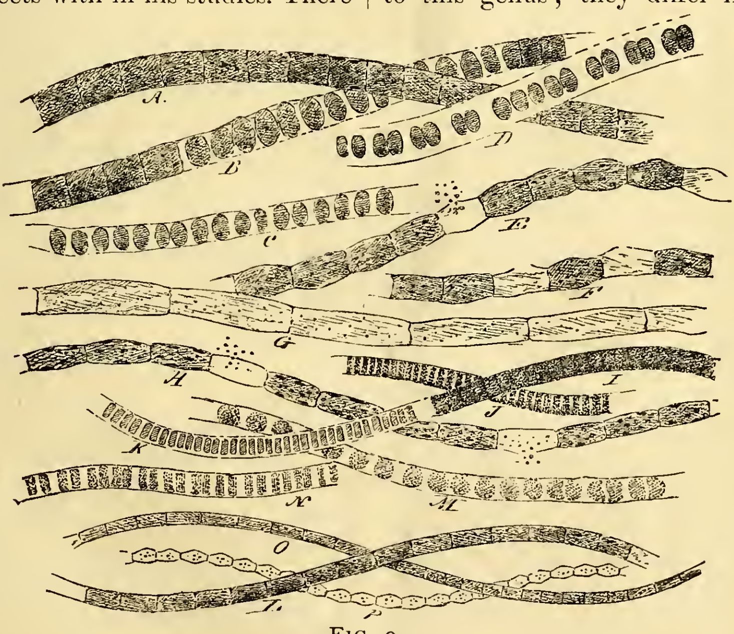

FIG. 9.

thickness of the filaments and the proportionate length of the cells. I shall notice the fallacies incident to four of them.

In *Fig. 9*, *A* represents the normal condition of *Conferva floccosa*, Ag. Diameter of filaments measures .0005″–.0006″(12.7μ–15.2μ); length of articulations 1—2 diameters. Fruiting cells (*F*) are often swollen in the middle. The microspores may be occasionally seen escaping through an aperture in the side of a cell. The more singular transformation occurs in sterile plants; the granular chlorophyll becomes homogeneous, separates from adjoining cells, and forms sub-spherical masses, as *B C;* at the same time the firm outer structure of the cells, or filaments, changes to a soft, colorless, gelatinous sheath, and then gradually widens to an appearance resembling *D;* the sub-spherical, green cells divide; thus we have, instead of the representation of *Conferva*, a typical *Hormospora*. Mr. Cienkowski, of St. Petersburg, observed a similar transformation in species of *Ulothrix*, and infers that all plants hitherto classified under *Hormospora*, are doubtful species. We have a number of plants which possess or assume the generic character of this genus. They are filamentous, and composed of a series of cells surrounded by a wide, gelatinous sheath, similar to the sheath which encloses the filaments of *Hyalotheca*, of *Didymoprium*, and of young forms of *Bambusina*. These are certainly distinct forms. *Hormiscia moniliformis*, Ktz., has a similar, though closer sheath, but may be looked upon with doubt. During the past summer I found a plant of like structure, purplish color, but much thinner; it suggested the name *Hormospora purpurea;* another one received from Prof. Hobby, of Iowa, I have temporarily named *Hormospora Hobbyi*. These three have a uniform character throughout, and yet are so like the forms of *Conferva* and *Ulothrix* approaching decay that their specific identity may be questioned.

The study of living specimens of these forms is recommended as profitable work.

To return to the figures, *G* represents *Conferva fugacissima*, Roth., and is put in merely for an illustration of variety; *H* is a fertile filament of *Microspora vulgaris*, Thuret; *I* is the same in a transition state; *J* is more advanced, and *K* still older and so absolutely distinct it could not be recognized. If taken away from less developed forms, it might pass for a good form of *Ulothrix; L* is *Conferva abreviata*, Rabh., in its usual condition; *M* the same in a distinct and new form; the cytioderm has become more gelatinous and wider, the cell contents globose, finely granular, and covered with a very thin, scarely perceptible envelope. At one end of the filament, these cells are represented divided; *N* shows them divided a second time. The plant in this stage of its life also resembles *Hormospora* and would make a good species. Passing through a stage of dissolution, the cells continue to divide and redivide—early habits cling to them even unto the end. *O* represents *Conferva punctalis*, Rabh., and *P* a form derived from it, which would make a good species of *Glœotila*, Ktz.

To identify fresh-water Algæ, repeated examinations should not be considered needless.

F. Wolle.

Preparation of Ranvier's Picro-carmine.

BY S. H. GAGE.

The preparation of this excellent staining agent is somewhat difficult, owing to the fact that the right proportions of its ingredients and the precise operations for its manufacture have not been definitely determined.

Ranvier's directions are, to add an ammoniacal solution of carmine to a saturated solution of picric acid, until saturation. Four-fifths of this mixture is then evaporated in an oven, allowed to cool, then well filtered and the filtrate evaporated to dryness. When wanted for use the dry powder is dissolved in water, in the proportion of one part by weight of picro-carmine, to one hundred parts by weight of water.

It is very difficult to decide when the mixture of carmine and picric acid solutions becomes saturated, and the simple watery solution soon becomes mouldy.

Some experiments were made in the anatomical laboratory of the Cornell University to determine definitely, if possible, the process of making a solution that would keep for any length of time.

1. It was found that equal parts by weight of picric acid and carmine gave the best results. *

2. The picric acid should be dissolved in one-hundred times its weight of water, using heat if necessary.

3. The carmine should be dissolved in fifty times its weight of strong ammonia.

4. Mix the two solutions. It seems to make no difference in the result which solution is poured into the other.

5. Use porcelain evaporators and glass funnels.

The best results were obtained when the solutions were made at the ordinary temperature of the laboratory, 17° C., and then evaporated three-fourths at a temperature of 40°–45° C. The solution should be allowed to cool, and filtered through two thicknesses of filter paper. The filtered liquid is then evaporated to dryness at 40° C. or at the ordinary temperature.

*One gramme each of picric acid and carmine will make enough picro-carmine to last an individual or a small laboratory a long time. The best carmine, that known as No. 40, should be used.

If the preparation has been successful the residue dissolved in one-hundred times its weight of water should give a clear solution, after filtering. Make 50c.c. of such a solution and filter it through two thicknesses of filter paper and a fine cotton filter moistened well and crowded into the neck of the funnel. Filter the solution four or five times through the same filter, and a clear solution will probably be obtained. In case a clear solution cannot be obtained by repeated filtering, the whole of the powder may be dissolved in the proportion given above and allowed to stand a few days in a tall, narrow vessel. If the finely suspended particles settle, the top will be clear and may be decanted; but if the fluid remains cloudy, a quantity of ammonia equal to that originally used should be added to it, and the evaporation of three-fourths should be repeated with the subsequent filtration and evaporation to dryness. Usually, however, if the method given above be followed, one will succeed the first time. In case the third evaporation should not give a clear solution, it is advisable to begin again with new materials.

When a clear solution is obtained there should be added to every 100c.c. of the picro-carmine 25c.c. of strong glycerine and 10c.c. of 95 per cent. alcohol; there will thus be formed a permanent solution, that may be kept perfectly clear by filtering once in five or six months.

The characteristics of this staining fluid are very clearly set forth by Ranvier as follows:

1. The staining is double,—some parts staining red and others yellow.

2. The carmine is entirely neutral.

3. If desirable, the yellow color may be removed by soaking in water.

If the preparations stained in picro-carmine are mounted in glycerine the latter should be acidified, as for Frey's carmine—glycerine 100 parts, acetic or formic acid 1 part. If the sections are to be mounted in balsam or damar, they should be carried directly from the staining solution into 95 per cent. to 100 per cent. alcohol, and soon afterward cleared in oil of cloves. In this way but very little of the yellow color will be taken out by the alcohol.

NOTE.—There have been three ways of preparing the picro-carmine described.

1. That by Ranvier in his *Traité Technique de Histologie*, p. 100.

2. That given by Creswell Baber in the *Quarterly Journal of Microscopical Science*, 1874, p. 251. In Mr. Baber's method the evaporation is at the ordinary temperature, and there is no filtration after partial evaporation. He gives the following test for the solution: "Place a drop of the solution on a piece of white filter paper, and allow it to dry, when, if the picro-carmine be good, a yellow spot is formed, surrounded by a distinct, red ring.

3. That given by Rutherford his *Practical Histology*, p. 173. Equal parts of picric acid and carmine are mixed at a boiling temperature, and evaporated to dryness without intermediate filtration.

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Cleaning Foraminifera.

In regard to cleaning Foraminifera when mixed with sand, all the authorities say that if the dry sand and shells be thrown or sifted into water, the sand will sink and the shells, because they contain air, will float. The very reverse of this is nearer the truth. If dry sponge sand rich in Foraminifera be sifted into water, nearly all the shells will sink, and whatever floats will be sand, spicules, and an occasional foraminifer. Trial will prove this to be so.

To separate the shells from the sand, sift all the material into water, stir the floating film of sand until all that will sink has done so; a slide dipped under what still floats will show it to be all sand, often a group of sand grains surrounding and enclosing an air bubble.

Take about a teaspoonful of the wet sand, and put it in a shallow, nearly flat-bottomed dish or saucer, and put on water enough to cover it to a depth of about a quarter of an inch. Now by rotating the dish with a circling movement the Foraminifera will work out of the sand and gather on its surface, mostly at the center, but by carefully inclining the dish and regulating the speed of the circling movement the mass of shells can be worked to one side of the heap of sand, and thence dipped up with a ball-pipette almost entirely clean and free from sand, but usually mixed with sponge spicules, which it is almost impossible wholly to get rid of. A boiling in weak soda solution will often improve the shells.

As little water as possible must be used in washing, as too much will stir the sand as well as the shells, and but little sand must be washed at one time. C. M. VORCE.

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—Since our last issue we have received the July number of Dr. Pelletan's *Journal de Micrographie*, which we supposed had ceased to exist. This fact will not interfere with the publication of the *Catalogue of the Diatomaceæ* which we have announced. The American edition is the only one which has the sanction of the author.

New Microscopes and Accessories.

This month we illustrate Crouch's "Histological Microscope" the cut of which is furnished by Messrs. J. W. Queen and Co., of Philadelphia, who are the agents for Mr. Crouch.

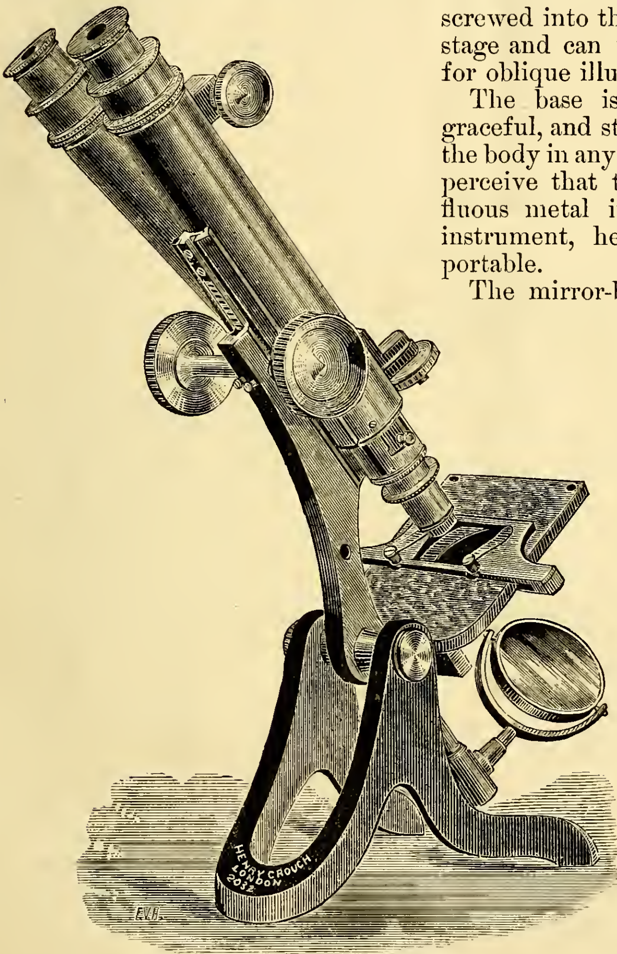

Fig. 10.

The stand is advertised as "the cheapest binocular made," and in respect of price it has few rivals.

The illustration renders a careful description unnecessary; there are so few parts to the stand that nothing we can say would be of special service to the reader.

The stage is quite thin, and the object-carrier does not add much to its thickness. The tube which receives the sub-stage accessories is screwed into the under part of the stage and can readily be removed for oblique illumination.

The base is sufficiently heavy, graceful, and stands very firm with the body in any position; we cannot perceive that there is any superfluous metal in any part of the instrument, hence it is light and portable.

The mirror-bar swings laterally, thus affording every facility for illuminating objects with extremely oblique light.

With the exception of the base, the stand is of well finished brass, and is, on the whole, a useful and attractive instrument.

When inclined as in the cut the stand measures about 35$^{c.m.}$ in height.

This microscope with one pair of eye-pieces in the case, is sold for $50.00, with the addition of a one-inch and a quarter-inch objective for $75.00.

The monocular stand, somewhat different in construction, with one eye-piece and case sells for $32.00.

The Buffalo Meeting of the American Society of Microscopists.*

The Second Annual Meeting of the "American Society of Microscopists took place at Buffalo, N.Y., during the month of August, 1879.

Opening Session.—The proceedings opened at the Central School Building (High School of Buffalo), on Tuesday, August 19th. Dr. R. H. Ward, the President of the Society, called the meeting to order and introduced Dr. H. R. Hopkins, the President of the local committee, who delivered the following address of welcome:

"Mr. President and Gentlemen: Let us exchange congratulations upon this occasion of the meeting of the American Society of Microscopists.

"I most heartily congratulate each and all of you who have the pleasure of remembering that you assisted in the work of founding this Society, and I also congratulate all of you who have the opportunity of attending this meeting and of enrolling your names on the list of its members. I also ask you to congratulate the citizens of Buffalo upon the fact that this meeting is held in our city.

"I congratulate you upon the hearty cordiality with which you are made welcome by every member of your local committee, and the various societies and associations which that committee represents, and I ask you to congratulate us upon the cheering prospect that our expectations of the pleasure of listening to your deliberations are so near fruition.

"Again I congratulate you upon the fact that there is an American Society of Microscopists, and I believe that the work of recording what Americans have done and are doing for the advancement of this department of science, can safely be trusted to the future of this Society. With this thought in my mind I must congratulate you upon the prospect of having with you one who has had the rare good fortune to teach the world how to make objectives, whose angles straddle far outside the limits which authorities had fixed as the boundaries of the possible. Let us give all honor to the modest yet noble American, Mr. Charles A. Spencer, at once the father and the genius of modern microscopy.

"Bright and pleasing to me as are these thoughts with which I would welcome you on this occasion, there are others which call for still more hearty congratulations. I sincerely congratulate you upon the nature of the study which this Society is intended to facilitate and encourage. The labor of the microscopist is a hopeful labor, and although discouragement and despondency will come to all, although many must fail and but few succeed, yet in the light of the glorious triumphs of the various makers and workers of the microscope—triumphs which within the period spanned by the memory of many now present, have produced the high degree of perfection of our optical and mechanical appliances; triumphs which have given birth to whole departments of scientific knowledge — neither discouragement nor despondency can long prevail. But beyond and above the glorious inspiration which history gives us, are we not made hopeful by the feeling that the indomitable perseverance and faith which impel the student to strive and seek

* This Report was written for this Journal by Mr. George E. Fell, to whom our thanks are due.—Ed.

after new truths, are of themselves a sign and a promise, that to some patient seeker nature is still waiting to reveal herself.

"Therefore I congratulate you upon the nature and character of the work you have in hand, upon the sublime patience, courage and glorious achievements of the fathers —upon the character, the zeal, and the inspiration of your co-workers, and upon the organization which gathers all these elements and from them weaves the web of progress.

"In behalf of your local committee and the different learned and professional societies which that committee represents, it welcomes you to Buffalo. May your meetings and deliberations be as profitable to you as they will be entertaining to us."

At the conclusion of his address Dr. Hopkins introduced the Hon. Geo. W. Clinton, of Buffalo, N.Y., who spoke in behalf of the Society of Natural Sciences of Buffalo. He was followed by a short but interesting address by Professor Thos. F. Rochester, of the University of Buffalo, in behalf of the medical fraternity of the city. A portion of this address we quote as follows:

"A physician must either be himself a microscopist or must have almost daily recourse to one, for the necessary information to practice his profession correctly and conscientiously, not to say successfully. Nothing is hazarded in taking for granted that a large proportion of this audience consists of medical men. The microscope, at first a necessity for professional instruction and information, becomes a delight and attraction which captivates its employer and leads him on and on in the boundless fields of science which it unfolds to him and illuminates with a beauty of design and structure of which no description can give an adequate idea, and of which the most abstruse thought and the most vivid imagination could never have conceived.

"What the microscope has done and is doing for medicine can only be alluded to. By it alone we observe the minute homogeneous and wonderful processes by which the human body is evolved from a simple cell to the complete structure we call man. By its information we recognize diseases as local and parasitic which for ages had been considered constitutional. By it the various secretions and excretions of the body are examined, and it alone often determines whether important organs are functionally or structurally disordered. In chemistry, by determining form, it often enables the examiner to predict probable properties. These things and many others the microscope has done for medical science. How much more it will do it is difficult to surmise. Your chief reason for gathering here from all points, many of them far distant, is to extend the knowledge and to promote the use of microscopy. Such meetings, apart from their delightful social elements, must afford you great pleasure and information, and by every advance you make is medicine correspondingly aided and elevated."

To these cordial addresses of welcome, the President of the Society responded in the following words.

"It is no common pleasure to be able to receive and accept the welcome to this Society extended by you, and through you by the citizens of Buffalo, and to give voice to the reciprocation by our members to your words of courtesy and appreciation. We meet you under peculiarly pleasant circumstances. Those of us who had the pleasure, some years ago, of attending the Buffalo meeting of the American Association for the Advancement of Science, will never forget that meeting as distinguished not only by its high scientific standard, but also by the cordial, thoughtful and delicate hospitality which made the week memorable; and from the prompt acclamation with which the invitation to meet in your city at this time was accepted last year, I fear you really have acquired a reputation which will some time be troublesome. But for all this, we have been pleasantly disappointed this summer. We expected the careful and convenient arrangements which your committee have made for our comfort and our work; but we never dreamed of their supplying us with the coolest, not to say the coldest, weather that was ever seen in the midst of dog-days.

"In one other respect our position is peculiar. Our Society is in its infancy, only one year old, and just learning to walk, but though small in years, its size is considerable, its membership large, and those who are interested in it represent not only the various centers of scientific culture, but also the most quiet and secluded nooks in the country. We are brought together by an enthusiasm almost unknown in any other branch of science. We are stimulated by the study of those little things which lead a philosopher to call God great in great things, greatest in the smallest.

"We meet with the expectation of a most profitable session; and we thank you heartily for your interest and encouragement."

The business of the meeting then proceeded. Dr. Carl Seiler, of Philadelphia, was elected Secretary *pro tem.*, and Mr. Geo. E. Fell, of Buffalo, Treasurer *pro tem.* The registration and election of new members occupied the remainder of the first session.

Afternoon Session. After the election of new members, Prof. D. S. Kellicott, of the State Normal School of Buffalo, read a paper entitled "Observations on *Lerneocera cruciata.*" Attention was first called to the fact that very little work had been done upon the external parasites of the fish. Dr. Baird's "*History of the British Entomostraca*" being the only work treating of them in 1864, and although some fifteen years had elapsed since then and many papers had appeared concerning the higher forms of Crustaceæ those treating of the lower forms are very few. "Few species have been described, especially among such as are parasitic in our fresh-water fishes, while the habits and history of still fewer have been published."

After making some remarks about this group of parasites, Professor Kellicott gave the results of his studies of the *Lerneocera cruciata.* The paper was very interesting and valuable, and it was illustrated by carefully prepared drawings.

It was discussed by Prof. Albert H. Tuttle of Columbus, Ohio, and by the author.

Prof. Tuttle then addressed the Society "On the Structure of the Spinal Chord in a Branch of Marsipobranch Fishes." The paper was illustrated by black-board sketches, and sections of the human spinal chord and of the spinal chord of the lamprey were shown. Professor Tuttle considered that the best way to study the human brain was to begin with observations on the lowest classes of the vertebrata, and work up.

The subject was discussed by Dr. Carl Seiler, of Philadelphia, and Prof. J. Edwards Smith, of Cleveland, Ohio.

Mr. Chas. Fasoldt presented the Society with a slide of his remarkably fine rulings. A letter from the Mayor of the city of Buffalo was received inviting the Society to visit the new city buildings.

The meeting then adjourned to meet in the evening at St. James Hall to listen to the President's address.

The address of President Ward was delivered before a large audience. Although from necessity somewhat popular in form, it considered many subjects of great importance.

The address is lenghty and instructive. We have not sufficient space to publish it in full, but the following copious abstracts will undoubtedly be read with interest:

ADDRESS BY PRESIDENT R. H. WARD.

"MEMBERS OF THE AMERICAN SOCIETY OF MICROSCOPISTS: Since this is a new Society, as yet without a history, a policy, or a thoroughly organized membership, it is believed that an informal address, in a popular form, in regard to the position and objects of our Society will be more timely and useful than such a technical report of original work as would usually be expected in a president's annual address.

"The formation of this Society, and the presence of the audience here to-night to welcome its first public meeting, brings us to the contemplation of a branch of science, insignificant in years, trivial in respect to its means and objects of study, but great in its accumulated results, and in its record of influence exerted upon the recent progress of human thought and the development of modern science; a department of learning almost every step in whose progress has been a revolution. It is scarcely more than a hundred years since an enthusiastic friend of the microscope announced certain improvements in the instrument as rendering it "agreeable to the curious." It is within the memory of persons now only in middle age, that a majority of people still considered the instrument merely an elegant toy, that an author who brought one to this country at a cost of $1,000, was derided for his foolish expenditure, and that the high price of superior English instruments was repeatedly and formally stated as the reason of their limited sale in this country, where they are now commended by their cheapness, compared with those manufactured here. It is only thirty or forty years since the English opticians, both theoretical and practical, began the development of the really modern microscope, a work in which they were soon aided and sometimes surpassed by their friends in France, Germany and this country. It is about the same length of time since the brilliant discoveries of Ehrenberg spread abroad from Germany, fascinated the naturalists of England and this country, and taught the whole world the possibilities of the new means of research; yet in those few years an amount of work has been done which it is the labor of a lifetime to review. A dozen years ago the microscope was so complete and satisfactory that some admirers considered it to have reached its limit of practicable improvement. One author called it the only perfect instrument, by which it was meant that it was the only instrument of human construction whose performance equalled its theory, whose adaptations to its objects left nothing further to be desired, in whose contrivance or execution human science had nothing further to ask from human art. Yet every succeeding year must have been a surprise to such an author; the perfect instrument has become more perfect, though it is manifestly faulty still; the stand has been made less clumsy and more steady, less complicated and more convenient, less showy and more durable, less costly and more useful. The objectives have been improved in definition, greatly increased in available aperture, and supplied with far better appliances for cover-adjustment; the immersion system has become universally introduced, its use extended to the means of illumination, and the advantages of a literally homogeneous fluid recognized; the binocular arrangement has grown from an experiment of disputed value to a priceless luxury if not a literal necessity; means of illuminating at definite and known angles have become available; the spectroscope, and the sensitized plate of the photographer, have become powerful accessories; and the instrument of which that proud remark was so lately made, has already become obsolete and grotesque, one of the curiosities of history rather than an instrument of precision well fitted for delicate scientific work.

* * * * * * *

"It is as easy to found a general as a local society, but not so easy to secure its permanence. Our infant Society, the first anniversary of whose birthday we celebrate to-night, begins its life at a time most fortunate. Never before could it have been born with half the present chance of life. The favoring circumstances seem strong, and the hindrances those only that are inherent in the circumstances amid which it must live, if live it can. We enter the field with courage and enthusiasm. Success seems to be simultaneous with effort. The first meeting was equal to our hopes; the second surpasses the first. But we must realize that the magnitude of the project involves the most serious responsibilities. To justify its name, an American society must be American; it must be neither meagre nor local; it must have a large, active, and permanent membership, well distributed among the various sections of the country; it must include names of recognized ability and influence, and must be really representative of American microscopy; it must be a power as well as a name. To make it feeble would be a failure, to make it local would be a farce. Yet the obstacles in the way of success are such as might well check any faith but the enthusiasm of youth. Distances are great in this country, and not all men of science are men of wealth or of leisure. Many persons of distinguished qualifications for membership have written that distances are too great, and that the time and expense involved will prevent their participation. * * * Furthermore, it is well known that some who can give the time to attend distant meetings, have other plans which, unless they can be harmonized, will stand more or less in the way of this. The practical questions, then, of how often these meetings should be held, and over what range of territory, and by what means a steady and adequate attendance can be maintained after the attraction of novelty has ceased to act, and the tax upon time, and thought, and money has become felt, should receive the most serious and deliberate consideration, and all the aid that can be derived from the experience of others, in order that our plans may be wise and our success permanent.

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"One of the most important questions, theoretical and practical combined, which is now fairly before the microscopical world and still is in an unsettled state, is that of gaining definiteness and uniformity in micrometry. In this field emergencies have arisen during the past year which have compelled me to take considerable responsibility, as well as to perform a large amount of work, trusting that the generous approval of my colleagues would accept and ratify what seemed at the time and what seems now most consistent with the interests of science and the dignity of this body. It will be remembered that a year ago, just at the close of our Indianapolis meeting, resolutions were offered favoring the adoption of the metric system for micrometry, and the one-hundredth millimeter as the unit to be employed, inviting foreign coöperation, and accepting an offer of standard micrometers from Prof. William A. Rogers of the Astronomical Observatory of Harvard University. None of these points, save the last, were new or unconsidered. They had been studied at leisure for years by many members who were present. The metric system had been adopted by all the civilized world except Russia, England and the United States; and its universal adoption was, as a rule, earnestly desired and favored by the educated and scientific classes. It has been adopted, or recommended after mature deliberation, by the National Academy of Sciences, the American Metrological Society, the American Association for the Advancement of Science, by the American Society of Civil Engineers, the United States Coast Survey, the United States Marine Hospital Service, the American Medical Association, the Congress of Opthalmologists, and by the largest state and local medical societies and by leading medical schools and journals, by numerous boards of education, college faculties and local scientific societies, and by experts in various branches of science and art. On the other hand, the resolutions contained some minor faults, mostly in matters of taste or tact, which could have been easily remedied by reference to a committee. But there was no time for reference or for adequate discussion, and rather than discourage their object by failure or postponement, they were adopted and referred to the local societies for consideration. They were passed unanimously, at a small session, it is true, but by the same vote which established this Society and authorized its meeting here to-day. As too often happens, their incidental faults attracted more attention than their really scientific object. The unit proposed was evidently too long for integers and too short for fractions, and unlikely to receive a single approval either at home or abroad; the proposal of international action, though its object was universally approved, was in a form not likely to accomplish that object, and the liberal offer of Professor Rogers was wholly misunderstood and perverted, until it took the form of the preposterous statement that it was proposed to make Professor Rogers' micrometers standard as distinguished from those of other (!) makers, not the least amusing of all the blunders and absurdities of this precious statement being the association in any manner of trade, rivalry or mercenary considerations with the work of one of our most generous scientists who has freely shared with the public every result of his labors, while spending thousands of dollars upon his investigations without a thought or a possibility of ever seeing the money again. It soon became evident that an organized treatment of the subject was required to secure a proper and unprejudiced discussion of the objects of the resolutions. Feeling much responsibility as the presiding officer of this Society and of one of the oldest of the local societies, but having no authority to appoint an evidently necessary committee that should represent not only this Society but also sections of the country not yet named upon our rolls, I brought the subject before our local association, and we invited all the societies that could be reached to join with us in the selection of a National Committee for the consideration of this subject. The response from the large and active societies, and from distinguished individuals, was a cordial and almost unanimous approval. Many of the societies nominated to the committee members distinguished as specialtists in this branch of microscopy; both societies and eminent scientists contributed valuable opinions upon all the points at issue; and a large committee was organized which will at a proper time tender a report of progress to this Society. And while speaking of this committee, I will take the liberty of saying that it would be a pleasure to me, and I doubt not to all of us on this side of the Lakes, if our friends from Toronto or Montreal, or any other points in the Dominion which may be represented here, would nominate members, and thus make it an American instead of a national body. To prevent confusion or misapplication of the practical suggestions which follow, and which naturally belong to this time and place, it is necessary to anticipate the report of the committee so far as to say that it will recommend to this Society to rescind its approval of the 1-100 millimeter as the unit for micrometry, and to so modify the form of the other resolutions as to leave the important questions of accurate measurements and convenient and scientific nomenclature in a favorable form for the attainment of valuable results.

"Whether this Society, as such, shall continue to be known as actively interested in this reform, it is for you, not me, to say; though I sincerely hope that the members will unanimously agree with me in judging that it ought to do all that its influence, without dictation, can do in this direction. But I, for one, do not deem the decisions of societies or other corporate bodies decisive and final. I am not much elated by their approval, or discouraged by their opposition. I have an average amount of respect for the motives but not for the efficiency of legislation. In State, in church, in science, it is possible and easy to carry out laws about in proportion as they are unnecessary. People who do not need government are easily governed. Persons who appreciate authenticated micrometers will use them if they can with or without the approval of societies; and those who do not desire them will be about as little controlled by official decisions. While the encouragment and support of societies and of officials is welcome and valuable, as far as it extends, I have more faith in the power of individual influence, and to that I look for an example which is able to settle this question beyond appeal.

"In our micrometry we have the anomaly of a system of work capable of a precision almost if not quite unknown elsewhere to human art, for what other wholly artificial proceedure possesses a demonstrated limit of accuracy inside of the

1-300,000th of an inch, and yet, until now, we have made no reasonable effort to free ourselves from avoidable errors known to be many times larger than that amount. While coal at $4.00 a ton and muslin at six cents a yard are, or at least pretend to be, measured with apparatus that has been carefully verified by standards of known quality, we have been measuring spaces almost infinitesimally small by standards of only commercial quality and possessed of manifest and uncorrected errors. This fact is too suggestive of the days when micrometers consisted of grains of sand, and clippings of wire; with the odds against us, that we know how to do better. Arrange your microscope so as to magnify 3,000 or 4,000 times, making the one-thousandth of an inch on the stage seem three or four inches long through the lenses, then arrange an ocular micrometer so that the magnified one-thousandth of an inch shall be covered by, for instance, one hundred divisions of the ocular scale, and finally ascertain exactly how many of the one-thousandths of an inch on that or any other plate will be similarly measured by precisely the same one-hundred divisions above it. Judging from my experience and that of others who have tried the experiment, you will probably find a perfectly measurable discrepancy between the different spaces of the same name; so that even your own measurements, with the same apparatus, will not be comparable with each other unless, as often done, you select some one average space as a basis of comparison, and are careful to use only that. Now we are trying to ascertain which of these various spaces is the correct one; or if not one is right, then to obtain one that shall be; or if that cannot be done, at least to determine a known error from which we can compute definite results. This is not a question of makers, or dealers, or trade interests in any form, but of unmixed and independent science. We are attempting to procure a standard because we need it, and we hope for the cordial assistance of microscopists of really scientific spirit in the difficult work of attaining it, and in the almost equally important task of bringing it into general and respected use. I call this a standard for convenience, and not in a strict or ultimate sense. Strictly it is only an authenticated copy of a standard, or portion of a standard, namely, of the world's standard meter or standard yard; and hence the importance, not fully shared by the original meter itself, of its corresponding perfectly with its theoretical length.

"The adoption of the metric system has a formal sound, and its difficulties have been, to say the least, well represented. But, to the extent of its use in micrometry, it really presents no difficulties and many advantages. The value of the millimeter and its decimals must be made familiar to the mind for other purposes, even for the understanding of exclusively English literature, and to use it for our own measurements and statements will merely assist to keep it fresh in mind. The English system, or rather tradition, presents no pair of units so convenient for the microscopist as the millimeter for large objects and the 1-1000th millimeter for small ones. For the purposes of most people, for use in micrometry alone, it is sufficient to remember that the millimeter is about one-twenty-fifth of an inch, and surely that is no great intellectual task. Nor would it waste a large portion of a life-time to learn the whole series from the meter down, remembering that, in round numbers, the meter is a yard, with three or four inches to spare, the decimeter one-tenth of that 40 inches, or 4 inches, the centimeter one-hundredth of that 40 inches, or 4-10ths of an inch, and the millimeter one-thousandth of that 40 inches, or 4-100ths or 1-25th of an inch. The real difficulty lies, I believe, not in memorizing the value of the few new units required, but in the awkward and useless habit of stopping to translate every item from the new unit to an old one. Any one can add a few new words to his vocabulary, a few new units to his tables, without harm. The telephone and the phonograph have brought no disaster along with their new double Greek names. An educated person can learn in an hour all the new terms, values, and proportions of the whole metric system, with its interesting and suggestive relations; and the time would be well spent though he never used the system again. But I also know by experience that he can also use it again easily. When you once learn by a little practice to think in the new units the same as in the old, the apprehended difficulties vanish unaccountably and can scarcely be brought to mind again.

* * * * * *

"Aside from the selfish though sufficient motive of our convenience, I hope we shall practically adopt the metric system, because we can thus contribute a trifle of influence towards its general introduction. It seems plain enough now that our country made a serious mistake in not adopting it at first; and I am satisfied that it is still best for us to use it, notwithstanding the greatly increased difficulties in our way.

* * * * * *

"The legal uses of the microscope, offer a department so large that it might almost be regarded as a new science under the name of microscopical jurisprudence; and a few suggestions in regard to that subject will occupy the remainder of this address. Some of its details, as for example the discrimination of blood and other important varieties of stains, have been treated, and conveniently, under medical jurisprudence, though they are not medical to any extent, and though they belong properly here. Others are entirely new and are appropriately and I understand in the opinion of the courts, just as properly objects of judicial consideration as are the so-called medical portions.

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(*To be continued.*)

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The Simplest Forms of Life.*

BY B. EYFERTH.

Rhizopods.—(*Continued.*)

1. Gen. *Amœba*, Ehr. Body almost always in flowing movement, hence constantly changing its form. The round, finger-shaped pseudopodia extend only in one direction at a time, broaden at the ends to resemble drops, and then the rest of the flowing plasma follows. Nutriment, especially diatomaceæ, is more or less completely enveloped by the flowing plasma, and the indigestible portions are released by the same movement.

Although the swarm-spores and plasmodia of the Myxomycetes are

* Translated from the German, by the Editor.

very simular to *Amœbæ*, the latter appear to be independent animal forms.

A. princeps, Ehr. Pseudopodia thick, cylindrical, rounded on the ends, common.

Other species are *A. radiosa*, Ehr., with pointed pseudopodia; *A. bilimbosa*, Auerb., *A. diffluens*, Ehr. *A. actinophora*, Auerb.; *A. verrucosa*, Ehr., *A. limax*, Ehr., and others, which, however, run together and can hardly be regarded as distinct species.

2. Gen. *Podostoma*, Cl. and L. Besides the broad, locomotive pseudopodia, these animals are provided with moving flagella which seize the prey.

P. filigerum, Cl. and L. In stagnant water with Algæ and Infusoria.

3. Gen. *Petalopus*, Cl. and L. Pseudopodia radiating from one place, expanded at the ends.

P. diffluens, Cl. and L. Form rather constant, rounded behind, in front abruptly cut off.

4. Gen. *Pseudochlamys*, Cl. and L. Carapace soft, curved, shield-shaped, the concave side up, a central opening closed by a thin membrane. Plasma sheath-shaped, with firm central nucleus, and numerous vacuoles in the outer part. Pseudopodia long, finger-like.

P. Patella, Cl. and L. Carapace almost bivalvular, interior brownish-yellow, without yellowish-gray. 0.04 l.

5. Gen. *Arcella*, Ehr. Carapace shield-shaped, consisting of two plates, according to Hertwig and Lesser with intermediate hexagonal panel-work, at least, the surface appears to be very finely panelled. Plasma with nuclei and contractile vesicles.

A. vulgaris, Ehr. Carapace at first transparent, later brownish or blackish. Form varies much, at one time flat, at another arched, smooth or with large facets, imprints, corners, or projecting points (*A. dentata*, Ehr.). The plasma does not entirely fill the carapace, from a central mass filamentous portions radiate to the borders. Nuclei numerous. Pseudopodia finger-like. 0.05–0.16 d. Common, among water-plants.

A. patens, Cl. and L., Carter. (*Pyxidula operculata*, Ehr., H. and L.) Carapace brownish-yellow, orbicular, arched above, with small knobs, open beneath, and with a narrow border. Plasma orbicular, with a nucleus. 0.02 d.

A. hyalina, Ehr., Fres. (*Gromia hyalina*, Sch., *Difflugia enchelys*, Schn., *Lecytheum hyalinum*, H. and L.) Carapace almost spherical, transparent, thin but not flexible, with short neck-like projection. The plasma entirely fills the carapace. Pseudopodia homogeneous, branched, sometimes anastomosing.

6. Gen. *Difflugia*, Leclerc. Carapace made up of diatomaceous remains and other foreign particles, cemented or bound together by a membrane. Pseudopodia finger-shaped.

D. oblonga, L. (*D. proteiformis*, Duj.) Carapace ovoid, with terminal opening. 0.1–0.25 l. Common, among water plants.

D. spiralis, H. Carapace retort-shaped, with tangential opening. Surface with undulatory elevations or spiral folds. 0.25 d. or less. Not common.

7. Gen. *Echinopyxis*, C. and L. (*Centropyxis*, Stein, *Arcella*, Ehr., Duj.) Carapace spherical, constituted as in *Difflugia*, but with hollow, curved thorns.

E. aculeata, C. and L. 0.25 d. or less. In ditches, with plants.

Gregarina.

Stein places the Gregarina among the Rhizopoda, but others regard them as belonging to another class.

The Gregarina are single-celled, tube-shaped organisms, with a firm cuticula and liquid parenchyma filled with granules, without a mouth ; nourishment is taken in by absorption through the walls of the body. They live as parasites in the intestines of other animals, *e. g.*, the earth-worm, leech, snails, etc. One of the most interesting of these animals, *Monocystis proteus*, Stein, lives in the body of *Cyclops quadricornis.* If a *Cyclops* is subjected to pressure at a time when the ovaries are filled with blue-black eggs, these are forced out. Sometimes there may be also seen to issue some of these parasites, which were difficult to observe at first, owing to their color. The small, cylindrical body, pointed in front, is constantly changing its shape without moving much from its position. It is a periodical forward and backward movement; the entire body from front to back swells and stretches, whereby the most elegant, but continually changing outline is produced. As the little animal sometimes occurs accidentally free in the water, it has been described by several observers as an infusorium, by O. F. Müller as *Proteus tenax*, by Ehrenberg as *Distigma tenax.* Its true nature was first made known by Stein.

EDITORIAL.

This number will be sent to many persons who are not subscribers, but who are known to be interested in scientific studies. We hope that a large number of these will send us their subscriptions, especially the physicians, to whom the Journal will certainly be of great value. It costs but $1.00 per year, and the subscription-list must be a large one to make our enterprise profitable at such a low price. We consider that the success of our undertaking is already assured, and have to thank the microscopists of the country for their very generous and early support.

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Forth-coming Articles.

We are obliged to ask the indulgence of our readers for postponing our review of the expert-evidence in the Hayden trial, which was promised for this number. Dr. J. J. Woodward has favored us with some valuable notes relative to his own testimony, but the report of the Buffalo meeting of the A. S. M. occupies so much space that these, with much other interesting matter, has to be withheld. We might, indeed, have condensed the account of that meeting and brought it out in a single number of the Journal, but we thought that if the proceedings were of sufficient account to demand any special notice, they deserved to be fully reported in a microscopical journal. The address of the President, Dr. R. H. Ward, will be found to embrace much that is interesting, particularly that part which embodies the results of his personal observations. Among the articles for publication which we have on hand, or which are already written, we may mention the following:

The "Preparation and Mounting of Objects," No. 1 of a series; "The Examination of Signatures;" "Häckel's Classification of the Protista," translated from the original work; "The Objectives which Afford the most Accurate Knowledge of Histology;" "The Preparation and Mounting of Objects;" "A Mechanical Finger;" "Observations on a Fœtal Lung;" "How to Make the New Wax Cell;" "How to Cut and Grind Glass

Slides;" "How to Cultivate Fresh-water Algæ in Aquaria;" "Notes on *Actinosphærium eichornii;*" besides others which are promised. Judging from the present outlook, it will be a long time before this Journal becomes a mere reprint of articles selected from other periodicals.

REVIEW.

In *Zoologischer Anzeiger* the following brief notice is published by Dr. W. Haacke, which we translate quite literally: In a work soon to appear "On the Blastology of the Genus Hydra," it will be shown that until now only two not green hydra species have been distinguished with certainty.

In the first, which I call *H. Trembleyi*, the tantacles of the buds appear together at the same time; in the other, which I call *H. Roeselii*, only two opposite tentacles appear on the buds at first, the succeeding ones are produced singly.

The third and last species to be certainly distinguished, hitherto the only such a one of the genus *Hydra* remains *H. viridis*.

In the above-mentioned work I will give particulars of my discoveries concerning the special relations in the development of the tentacles on the buds of *H. Roeselii*, which are of great interest, and also about their great morphological signification.

In *Science Gossip* we find an article on "How to Stain Vegetable Tissues," which seems to embrace so much that is practical, that we condense the directions as follows:

All anilin dyes are more or less fugitive when applied to vegetable tissues, so that in order to make a double-staining two dyes of different colors must be used, one very fugitive while the other is much less so. "If any vegetable section containing hard and soft tissue be dyed in such colors, either together or separately, and afterwards washed to a certain extent, it will be found that the more fugitive dye still lingers in the harder tissue, which gives it up less readily than the softer parts; these latter still retaining the permanent dye, which is usually not so penetrating as the other dye, and is therefore overpowered by the same in the harder tissue." We have never seen a clearer exposition of the principles which govern the selection of color in double-staining vegetable tissues. It may not be strictly accurate, and the well-known fact that the selection of color in the tissues is not always the same, when they are treated by different processes, may not be in its favor; but there is no doubt that by keeping the above explanation in mind the manipulations will be conducted more intelligently and consequently with better success.

The secret of double-staining with anilin colors lies, therefore, in the partial washing out of the first or most fugitive color. To cease washing at the right moment requires judgment and experience. The writer of the article referred to uses carmine, which is a perfectly "fast" dye, instead of an anilin color, and in this way overcomes one difficulty; for the other color he uses the anilin green known as "iodine-green."

The solution of carmine is made by dissolving 10 grains of number 40 carmine in 10–15 grains of strong ammonia aiding the solution by a gentle heat, then adding 200 grains of distilled water and filtering. For ordinary use dilute this solution with four or five times its volume of water. To fix the carmine, a mordant is prepared as follows: *A*. 10 grains of aluminic sulphate are dissolved in 200 grains of water. *B*. 30 grains of sugar of lead are dissolved in 600 grains of water. Add *B* to *A* until precipitation is complete, allow to settle, and draw off the clear liquid. When required for use dilute with 4–5 parts of water.

The anilin solution is made by dissolving 3 grains of iodine-green in 1 ounce of absolute alcohol.

The process of double-staining is as follows:

The bleached sections are placed in the mordant for several hours, from which they are transferred to the carmine, where they remain an hour or so, and are then washed and placed in alcohol.

The sections are then soaked for twelve hours in the anilin, then transferred to absolute alcohol for a few seconds only, then to oil of cloves, in which they must remain only long enough to become translucent, then mounted in balsam dissolved in benzole.

Undoubtedly, a one per cent. solution of alum would answer for a mordant quite as well as the solution prepared as directed above.

CORRESPONDENCE.

To the Editor:—I doubt not that many of your readers who are interested in the preparation of diatoms and spicula, have desired a more handy method than the only one I have ever seen prescribed in the treatises on such subjects, *viz.:* the boiling in muriatic and nitric acids. In your No. 1, just received, Mr. Paul Petit describes a plan for cleaning diatoms *in situ* on sea-weed. I think if he will try my plan he will find it the more easy of the two. To clean diatomaceous earths (not containing a large percentage of lime) sea-weeds, and the ordinary collections from ponds, etc., I dry them in any convenient way and then mix them in a platinum crucible, with rather more than an equal bulk of pure bi-sulphate of potash, and fuse for 5 minutes at a bright red-heat over a Bunsen burner. Such materials as the Jutland cement stein, and guano, which contain a large quantity of lime, I first soak in muriatic acid in a test-tube until all action ceases, wash, and then fuse in the bi-sulphate of potash. In all cases, after fusing in the bi-sulphate of potash allow the mass to cool in the crucible and then place crucible and all in a beaker of water which will dissolve the bi-sulphate and leave the diatoms and other silicious matter free from alumina and organic matter. Wash with clean water, until there is no acid reaction with litmus paper, and then separate the diatoms from the sand, as usually directed. The advantages of this plan I have found to be, freedom from the injurious fumes of boiling nitro-muriatic acid, and also from the liability to spurt the acid out of the test-tubes. The diatoms are clean and white, requiring no bleaching with chlorate of potash, and the work is all done with one operation, except when the materials contain lime. Even from guano the silica will all come out white and clean. Owing to the common use made of bi-sulphate of potash by chemists for similar operations, I can hardly suppose that this process is new and have been surprised that I have not found it in books treating of the preparation of such material. With diatoms *in situ* on sea-weed I have sometimes burned the material before adding the bi-sulphate.

Galloway C. Morris.

Germantown, Pa.

To the Editor:—I notice that in July, 1876, Dr. Wythe had in his possession an amplifier which consisted of a double-concave lens, and which he reported as nearly doubling the power of an objective, while it gave excellent definition. I had one made by Zentmayer, that came with a Zentmayer's "army hospital" stand (price, $8,) and liked it very much; this was in 1877-8. Is this not the same as Dr Wythe's? It screwed into the lower end of the draw-tube and was fitted with the society-screw, so that it could be used with any microscope arranged to receive a low-power objective in the end of the draw-tube, and could readily be fitted to any draw-tube.

S. A. Webb.

Oswego, N. Y., Dec. 22d, 1879.

NOTES.

—"There is nothing new under the sun." Here is an extract from an application made by Mr. Grubb, of Dublin, for a British patent, dated July 5th, 1854; "My third improvement consists in the addition of a graduated sectoral arc to microscopes, concentric to the plane of the object *in situ*, on which either the aforesaid prism or other suitable illuminator is made to slide, thereby producing every kind of illumination required for microscopic examination; and also the means of registering or applying any definite angle of illumination at pleasure." The patent was not taken out. We are indebted to Mr. Sidle for this extract.

—We have received a slide of kinate of quinia from Mr. A. P. Brown, of Camden, N. J., which seems to us to be one of the finest polariscope objects known. The crystals radiate from centers in a very regular manner, and the colors are brilliant.

Kinate of quinia is a combination of kinic acid and quinia, both of which are constituents of Peruvian bark. The name "quinate of quinia" which has been applied to these crystals is, therefore, incorrect.

—At the annual meeting of the New York Microscopical Society, the following officers were elected for the ensuing year: President, Romyn Hitchcock; Vice-President, John L. Wall; Recording Secretary, Walter H. Mead; Corresponding Secretary, Benjamin Braman; Treasurer, Walter C. Hubbard; Librarian and Curator, Dr. Frank M. Deems.

The second annual reception was held on the evening of the 6th of the present month, when Mr. Hyatt, the retiring President, delivered an address, and a fine exhibition of microscopic objects was given.

—Pharmacists are slowly learning the value of the microscope in their business, for the examination of powders, barks, etc. The January number of *The Druggist and Paint and Oil Review*, of Chicago, gives three wood-cuts, representing the appearance, under the microscope, of sections of *Alstonia constricta* and *A. scholaris*.

—There has been considerable discussion in the English *Medical Press and Circular*, regarding the paraboloid. Dr. James Edmunds claims to have invented a new kind of a paraboloid which he has named the "immersion paraboloid." It was described before the Quekett Club about two years ago, and Dr. Edmunds' name has been attached to it by Dr. Beale, in his work on the microscope. So far as we can understand the matter, the so-called Edmunds paraboloid is precisely the same in principle as one which was made by Mr. Wenham over twenty years ago, and it is to be hoped that Dr. Edmunds will not sacrifice his reputation by permitting his name to be attached to the instrument hereafter.

—Mr. W. H. Bulloch, of Chicago, who is well known to our readers as a manufacturer of microscopes, has received the Medal of Superiority from the American Institute, of this city, for his "Congress" stand, exhibited at the Annual Exhibition of 1879.

—New Yorkers, and those who visit the city, will be pleased to learn that Mr. Wm. Wales, the maker of objectives, has opened an office in this city, where he can be seen at any time.

QUESTIONS AND ANSWERS.

[This column is freely open to all who desire information upon any subject connected with microscopy. It is hoped that the readers will reply promptly to the questions which are asked.]

QUESTIONS.

3. What is a "duplex" objective, so-called? A. L. W.

4. What is the advantage, if any, in a wide body-tube on the microscope over a narrow one, each having the standard size opening at the bottom? If the light comes up in a conical pencil from the objective to the eye-piece, must not the base of the cone be of the same diameter in each? A. L. W.

ANSWERS.

(1.) W. M. inquires "what is the highest magnifying power that has been obtained with a microscope?" I do not know, but I have obtained 80.000 × with Tolles' $\frac{1}{50}$-inch and ⅛-inch solid eye-piece, with Tolles' amplifier. If any one has obtained more, let him reply.

Of course, I have nothing to say of the utility of such magnification.

CARL REDDOTT.

(2.) This question is answered by Prof. Abbe in a paper read before the Royal Microscopical Society, June 11th, 1879, and published in the December number of their journal. To this article J. W. and others interested are referred for a more thorough discussion of the subject than is possible in a brief space; suffice it to say here that the defect spoken of is due to a certain amount of residual spherical aberration (Prof. Abbe calls it "chromatic difference of spherical aberration," *i. e.*, a difference of the spherical aberration of the red and blue rays of the spectrum), which cannot be corrected by the forms of construction now in use. Hence it happens that an objective which is well corrected for the marginal rays will be under-corrected for the central; or if colorless by central light, will be over-corrected by oblique. E. P.

Philadelphia, January 19th, 1880.

(2.) J. W. asks "why objectives made for the resolution of test-objects are more under-corrected than those intended for ordinary work?" Are they all so made? Has J. W. seen all the objectives made for resolution? Makers do not usually give their reasons for making their objectives in special ways. Will J. W. define "ordinary work?" His ordinary work may not be mine, or yours.

CARL REDDOTT.

MICROSCOPICAL SOCIETIES

SAN FRANCISCO.

The regular meeting of the San Francisco Microscopical Society was held Thursday evening, December 5th.

Mr. H. G. Hanks referring to a mineral specimen exhibited by him a year ago, stated that it is determined by A. Michel Levy, M. E., of Paris, to be composed of glaucophane, emaragdite and garnet. The specimen was found near the "Wall St. Mine," Lake County, Cal., in serpentine, and is abundant in California, though heretofore it has been known to exist nowhere but at the Island of Syra, Grecian Archipelago, where it occurs in mica schist. A description may be found in Rosenbush's Mineralogy. Mr. Hanks also exhibited a section of andalusite, stating that the impurities forming the regular figures characteristic of that mineral are discovered to be magnetite.

Mr. Wm. Ashburner read, for M. Chas. Stodder, of Boston, a paper entited:

"Note on Diatomaceæ from Santa Monica, Cal.," which is too long for publication here, and it cannot be condensed to advantage.

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Exchanges.

Erratum.

On page 5, line 10 from foot, for "*rotifer*" read "species." *Ophrydium* bears no close relationship to the Rotatoria.

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Notes on Actinosphærium Eichhornii.

BY HERMANN C. EVARTS, M.D.

On looking over a gathering from a stream in the neighborhood of Philadelphia, about two weeks after it had been collected, I observed several beautiful and well developed specimens of the above mentioned Rhizopod. Not one specimen was discovered in the jar

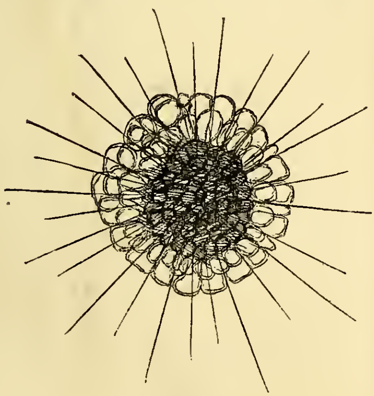

Fig. 11.
Actinosphærium Eichhornii (Pseudopodia extended).

previous to this time. Probably there are no Protozoa, in which the functions of prehension, digestion and assimilation of food are to be more easily studied than in *Actinosphærium* and *Actinophrys Sol.* but more especially the former, owing to its greater size. *Actinosphærium* presents much similarity in structure and habits to *Actinophrys*, and indeed, for a long time they were regarded as identical, Kölliker designating the two animals by the same name (*Actinophrys sol*).

In 1857, Stein proposed the second genus, *Actinosphærium.* The body-substance of this animal is distinctly differentiated into medullary, and cortical regions, or in other words, into endosarc, and ectosarc. The ectosarc is composed of sarcode arranged in the form of large vacuoles, somewhat radiately disposed; it is from these that the sarcode is furnished to form the

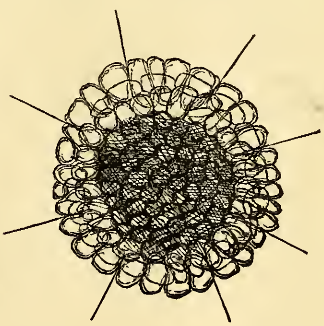

Fig. 12.
Actinosphærium Eichhornii (Pseudopodia withdrawn).

pseudopodia. Several contiguous vesicles may contribute to form a single ray, and ordinarily these rays extend outward on all sides. The endosarc consists of many nuclei, and the alveolar structure is not so apparent as in the outer layer of the body. At various parts of the surface of the body-substance, one or more of these vacuoles may enlarge, and swell out beyond the surface of the sphere. The diastole is very slow (perhaps once in a minute), but the systole is comparatively active. These vacuoles may be compared to the contractile vesicles of the Infusoria. As contraction takes place, the pseudopodia in the immediate neighborhood of the vesicle, gently incline their apices toward a certain point, without in the slightest degree bending their axes; hence, if the vesicle undergoing contraction be on the surface of the animal opposite to the observer, and thus hidden from view, one may readily diagnose the contraction.

Concerning the nature of the pseudopodia, which are complex in their structure, there has been much discussion by various observers. When a pseudopodium is seen under a high-power, two distinct elements may be distinguished entering into its composition. In the centre of the ray there is an axis-filament, a thread-like structure, which is supposed to afford support to the protoplasm which surrounds it. It is about the nature of this axis that learned men have so much differed. Greeff and Eilhard Schulze concur in regarding it as a cylindrical spine, skeletal in nature and import, perhaps consisting of siliceous material, and they maintain that it penetrates the endosarc. On the other hand, Max Schulze, Hertwig and Lesser, and Archer, regard the axis as a peculiar form of contractile plasma, possessing more or less rigidity, and not as a spine. Schulze and Archer aver that it only reaches to and rests upon the endosarc; these are matters that are well worthy of further research.

Two axes have been observed in one pseudopodium—an evidence that two rays have united. The pseudopodia may unite, or anastomose, but they never branch. Several individuals have been seen to unite to form one body; in these instances the nuclei of the various individuals remained distinct; moreover, the animals may be artificially separated.

As to the manner of taking food, these creatures, which are exceedingly slow in locomotion, rest quietly with the pseudopodia extended, and wait for the food to come to them, and an infusorian animalcule or a rotifer by merely swimming against a ray, adheres to it, and this ray will immediately begin to retract, other rays will come to its assistance, and by the time the victim is drawn down to the surface of the body, it is almost entirely encysted in protoplasm. While passing through the ectosarc, it becomes completely encased, and if the creature be a rotifer, or an animal of considerable vitality, it may continue its struggles to free itself until it has fully passed into the medullary portion, where it is digested and assimilated. All the pseudopodia near the point of entrance into the sphere, are partially withdrawn and are much inclined toward this point; the ectosarc at this place becomes much depressed, and considerable time will elapse before the body will assume the spherical form again, and the pseudopodia be extended.

It is quite apparent to my mind, that the axes of these rays, do not consist of a calcareous, silicious, or hard tissue of any kind; it is quite in accordance with what we observe in the movements of the pseudopodia, to regard the axes as being composed solely of a dense, compact protoplasm; so far as I know, no movement of the sarcode-substance has been noticed in the axes, but there is a slow, continuous circulation of the protoplasm in which they are imbedded, and in fact this slow movement takes place in other parts of the animal; in the cortical portion, minute particles may be seen in very slow movement with the sarcode current.

Dr. Joseph Leidy has observed the pseudopodia entirely withdrawn, leaving no axes, and he has also seen them extend again in other localities, where no spines previously existed. Moreover, the axes of the rays have been subjected to the action of various acids, and in all instances they have disappeared.

The nuclei are said to number rather more than one hundred (according to Carter four hundred). Schulze and Schneider have investigated the reproduction. According to their observations, as the period of reproduction approaches, the medulla becomes darker in color, and more distinctly separated from the cortical portion; the axes and pseudopodia are withdrawn, and the animal becomes enveloped by a gelatinous secretion; binary segmentation follows, each segmentation-sphere possessing its own medullary and cortical layers; the cortical region becomes converted into a firm investment, by the deposit of a silicious covering, and this condition attains throughout the winter; in spring this hard, investing layer is lost, and the contents appear as young forms of *Actinosphærium*, afterward the nuclei increase in number.

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Cell-multiplication in Chantransia Violacea, Ktz.

IV. The genus *Chantransia*, among the fresh-water Algæ, is represented in the United States by the following five species which have come under my observation: *C. macrospora*, Wood, found sparsely by Mr. Ravanel in South Carolina, but more recently, in August, 1879, in large quantities, by myself in a pond at Atsion, New Jersey. It is the largest of our forms, and is a beautiful plant. *C. Hermanni*, Roth. was collected by Dr. Beardsley, attached to *Lemanea* in a stream near Painsville, Ohio; another large form, I have named *C. Beardsleyi*, from the same locality. *C. pygmea*, Ktz., from Florida, collected by Capt. D. D. Smith; *C. violecea*, Ktz., and *C. expansa*, wood, a variety of the former are, not unfrequent here. Fig. 13 *A* affords a general idea of the features of the plants of this genus; the color is usually steel-blue or purplish, sometimes yellowish-green while growing, but it changes to purple when mounted and dried and the plants are easily recognized.

The object of this paper is not to describe the plant, but to draw attention to a feature of propagation by cell-multiplication, a process apparently not well understood or even recognized, yet a most important and characteristic feature in the life-history of many of the lower forms of Algæ.

A singular facility for the study of the development of *Chantransia violacea*, Ktz., presented itself in my aquarium. The plant has been growing there for the past three years. The glasses frequently become dimmed by the multiplication of spores, and the profuse growth of the plant. The tetraspores scattered abundantly from the terminal cells (*b b b b*) of the filaments, float about in the water until they find a suitable spot whereon to attach themselves for propagation. The scratches in the glass appear to be the most advantageous places for the reception of the spores. Fig. 13 *C C* represents such a scratch in which a few spores have collected, probably only one at each of the points indicated by the upper ends of the sack-like figures; each spore multiplies, and its product multiplies until tens of thousands, and millions are produced.

The suspended figures *F*, *F*, represent half the natural size of the groupings of cells, as developed in less than two weeks; *G* is a grouping more highly magnified. It may surprise the uninitiated to hear of the number of the so-called plants (cells), in a small space. An ordinary cell measures a ten thousandth part of an inch in diameter —hence in a line one-fourth of an inch long there would be 2.500,

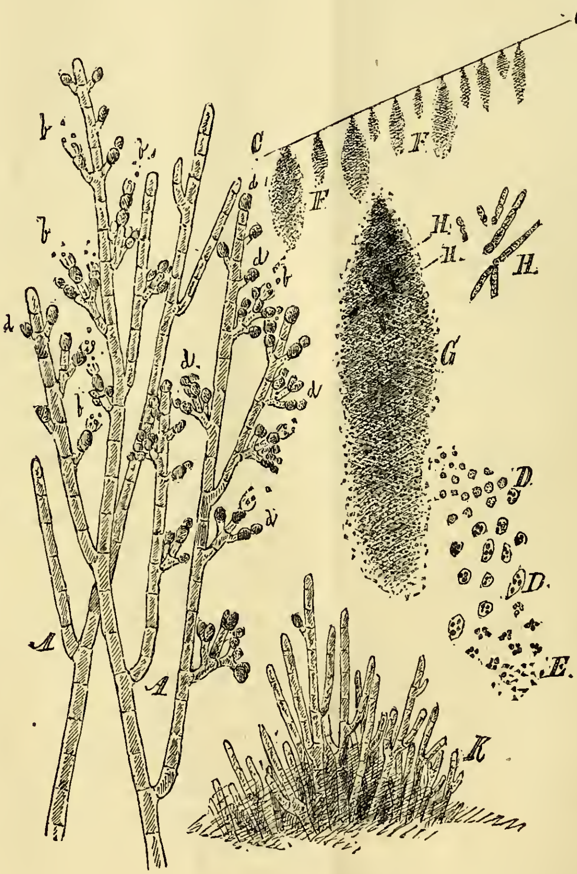

FIG. 13.

and in a square mesuring one-fourth of an inch each way no less than 625.000. These groupings, or families, are often much larger and hence contain millions of the "unicellular plants." They are technically called "tetraspores."

The Floridieæ, the order of Algæ to which the genus *Chantransia* belongs, are accredited with two modes of propagation, the one sexual and the other assexual; the former I have found in but one species, *C. macrospora;* in the other species I have detected neither carpogoniums, trichogyniums, nor spermatozoids. The simple process of multiplication is by tetraspores ("tetra" because of their grouping in fours); these form in sub-spherical cells at the ends of the filaments, or on small branchlets. Referring to the figures *d d d d* are tetrasporangia, and *b b b* tetraspores matured in them; these tetraspores pass out, and float about in the water; here and there one finds a resting place, as represented at *C C* in the figure. Each spore may be considered a mother-cell. The contents of the cells are first semi-transparent and slightly tinted; these characters soon change and the cells become turbid, then finely granular and of a darker purplish color; next the protoplasmic body (cell-contents) breaks up into four parts, which quickly contract, round themselves off, and become enveloped by a membrane; *D*, *D*, represent cells, separated from *G*, under still higher power. They remain a short time encased in the mother cell; the cell-walls are gradually absorbed; they expand, aided, no doubt, by the active movements of the young cells within; finally the walls break and the young are set free (*E*). These young, or sister-cells, with rare exceptions, manifest but little activity. The fact that the groupings (*FF*) increase only in a downward direction, proves that they are influenced by gravity rather than by independent movements. All the cells do not divide and redivide in the same manner for an indefinite period of time; some develope true plants (*H*, *H*, *H*, and *K*). In this process they elongate and add cell to cell until the identical form is reproduced, which primarily gave rise to the spherical cells or tetrapores.

The point which we wish to emphasize here is the cell-division and multiplication. One spore divides into four; these again divide, each one into four, and these multiply in turn in the same manner; this process goes on until millions of cells are produced from a single one, and in less time than the number could be counted singly.

Forms like these are generally termed unicellular plants; there are names for every possible variety, but the time is at hand, when they will be recognized as spores only. The most recent writer, Dr. Kirchner, of Siberia, expresses more doubts as to the reality of these forms as specific plants than preceeding authors, yet hesitatingly adds that he "feels assured that most of them do belong to the developing forms of higher types of Algæ, nevertheless it is impossible to tell from what particular plants they are derived, and whether they are true developing forms, or only similar to them." In *The American Quarterly Microscopical Journal*, April, 1879, I drew attention to some dubious forms of a similar character, and in the *Bulletin of the Torry Botanical Club*, April, 1878, I made some observations on *Nostocs*, showing them to be essentially embryonic forms, and now, here are the forms of "*Pleurococcus*," which belong unmistakably to the life-history of *Chantransia*. The further we advance in the knowledge of how fresh-water Algæ grow, the more positive is the evidence that most of the unicellular forms are of a very dubious character, regarded as perfect plants. Special attention should be given to this part of the study of Algæ.

But why should the spore-multiplication occur? This may be a difficult question to answer. Observation shows, that the spores do multiply very rapidly; they crowd together and upon one another, and most of them finally perish and thus form a crust, upon which the fertile plants develope.—F. W.

How to Make the New Wax-cell.

BY F. M. HAMLIN, M. D.

So far as it has come to my knowledge the wax-cell, which has so suddenly come into favor, has been made by punches which cut a ring of the desired size out of sheet-wax. I have tried a plan of making these cells which works very successfully, and in some respects has advantages over any process of punching them out that I have yet seen. All the apparatus I require is a turn-table and a pen-knife. Having decided upon the size of the cell to be made, I take sheet-wax, such as is used in making artificial flowers, and press together sheets enough to make a cell of the required thickness, and then cut out a square piece a little larger than the desired cell, or, what is much better, take an ordinary gun-wad punch, large enough for the outer diameter of the cell. Placing the slide upon the turn-table, I put the square piece just cut out, or the circular piece cut by the punch, upon the slide and carefully center it. Having made sure that the piece of wax is correctly centered, I press the outer edge down firmly upon the glass with my thumb or fingers. Having determined the exact size of the cell, I turn the slide very slowly and take my knife, with the blade slightly moistened, and hold it so that the point will cut from the upper surface of the wax downward and outward. I make a very slight mark at first, in order to see if I have the size of the cell correct, and then, turning slowly, I gradually press the point of the knife down upon the glass. This manner of holding the knife seems to cause it to serve as a wedge, for the outer shaving of wax is generally thrown up and entirely off from the glass. If a circular piece from a punch is used, its outer edge should be trimmed off to make it perfectly circular, the pressure of the fingers being likely to distort it somewhat. Any superfluous wax that may remain may be removed by means of a bit of cloth held over the end of the finger or on a stick.

The next operation is to cut out the centre, and this is done in the same way, only that the knife is held so as to cut from the top of the wax downward and inward, toward the centre of the cell, so that the bottom of the wax-ring shall be wider than the top, which should be about one-tenth of an inch in width. Again I turn slowly, and as the point of the knife goes down it throws up the different thicknesses of wax till the last is reached, which it removes, leaving the glass inside the ring almost perfectly clean, unless too much pressure has been used in fastening the wax to the slide. If any wax adheres to the glass it is easily removed in the same manner as before.

If it is desired to make up a lot of cells at one time, but not to retain them upon the slides, the cells can be easily removed by drawing a thin-bladed knife under them pressed firmly against the glass. The cells loosen readily unless pressed down too hard in the beginning. The pressure in fastening the wax at first, should be more or less according as they are to be removed or not. If a partly-finished cell gets loose, I put it in place again and apply pressure by placing a flat piece of wood upon it, or a glass slide with a paper cover; for, if two glass surfaces are applied, it is as likely to adhere to one as to the other. This will be the best way to fasten a ready-made cell at any time. The pressure should be made directly over the centre of the cell, so as to press upon all parts evenly, or one side may be crushed lower than the other, and spoil the appearance of the cell.

These wax cells possess certain advantages over others, among which is the slight cost of the necessary apparatus for making them. The punch is not a necessity, but it saves a good deal of trouble, and may be obtained for twenty-five or fifty cents, and one punch cutting a hole eleven-sixteenths of an inch will cut out a piece that will make two cells fit for five-eighth and half-inch covers. The circular pieces that are turned out of the centre may be used again for a smaller cell, or for making cells for opaque objects with the brass curtain-rings. The cells being made and fastened upon the slide at one operation are not liable to that distortion which removal from the punches is liable to cause. They can also be made of any size.

These cells are very pretty in appearance, but I have had no experience in their practical use; my friend, Mr. C. C. Merriman, of Rochester, N. Y., informs me that he has used them much and approves of them highly. He states that the wax must be carefully covered with some cement, whether used for fluid or dry mounts; for it is said that certain volatile portions will ultimately collect upon the glass cover of dry mounts or mingle with the preservative media in liquid mounts, and thus spoil the work in either case. His experience is, that the best cement to cover the wax with is Müller's liquid marine-glue. After coating the ring with this, it is used in the ordinary way.

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The Buffalo Meeting of the American Society of Microscopists.

(*Continued.*)

"The scientist should allow his name and influence to be used only when the full bearing of his statements, in spirit and in probable effect, and without qualification or reserve, is exactly what it purports and seems to be. Nor should he allow his aid to be used to the detriment, in his judgment, of honest individual or social interests. I am aware of the difficulty of his position; he cannot hope to judge correctly every case in advance, which even the members of the legal profession do not claim ability to do, but he should, in my opinion, limit his influence to those cases where the facts within his cognizance seem to fully, not partially, uphold his action, and where they do not seem likely to be used in the accomplishment of wrong. Fortunately, he is under no compulsion of usage or the necessities of society to act in any case against his own convictions. The custom of defending, so far as practicable, almost every cause, however undesirable its success might be, although apparently unavoidable is, in the judgment of those outside of the profession best qualified to decide, the least satisfactory point in the relations of present legal usages to the interests of society; a point at which no doubt all honorable members of the profession take the greatest care to prevent their personal success and that of their clients from becoming a hardship to others; where persons without character, who are liable to creep into any profession without becoming assimilated to it, find it easiest, for selfish purposes and with impunity, to make themselves the enemies instead of the friends and protectors of society. The scientific expert should be, in his limited sphere, as impartial as a judge ; and he should appear in no cause where that policy would be unwelcome. It might be supposed that such a course, if deserving no credit, which it does not claim, would at least protect from detraction or insult ; but it will not. It will be respected, I believe, by courts and by counsellors of respectability and influence, and it is to be hoped that some means may be found by which it can be protected also ; but at present it must expect sometimes to sustain itself against disparagement and insult from some person who may have acquired the place, without the character, of a counsellor, who is none too honest to excite ignorant prejudice against notorious truth by the use of sneers and derision, none too generous to meet simple statements of facts with the merely brutal force of overbearing manners, none too brave to insult a person who is in his power, and none too well bred to bring into the presence of gentlemen, of honorable counsellors, and of dignified judges, the methods, the manners and morals of a coarser civilization. * * * *

"The examination of hand-writing, with a view to determine its authorship, its genuineness, its age, and whether or not it has been altered from its original form and intent, is one of the more recent uses of our microscope, and one the importance, reliability and frequent applicability of which has but recently become known, and is even now not generally realized. Perhaps this is to be accounted for by the fact that large general experience, judgment, and tact in the use of the instrument, and skill in the manipulation, though necessary to this particular work, are not, in themselves an adequate preparation for it. Much special study, and special practice, is required before anything useful can be done, or important should be attempted. But to a person really at home in the study of hand-writing, both with and without the microscope, this instrument furnishes a ready means for its accurate analysis. Those who are governed, not by respect for the rights of others, but only by the expectation of consequences that shall effect themselves, cannot learn too soon, or too well, the fact that writing can scarcely be changed, after its original execution, so adroitly that the microscope cannot detect the falsification. The face of the paper when once marred, by disturbing the position of the fibres, can never be restored; and hence, scratching and erasure can be recognized though performed with consummate skill, and not distinguishable by other means. Inks which are alike to the unaided eye, are marked under the lenses by conspicuous differences of shade, or color, or density, or purity, or chemical composition. Lines which look simple and honest, may show themselves as retouched, or altered, by the same or by a different hand or pen or ink; and lines drawn upon new paper may look different from those after it is old. The microscope does not give any direct information as to the precise age of writing, but if used with sufficient caution, it can determine (not so easy or safe a task as might be supposed) the relative age of superposed, crossing, or touching lines; and it can generally state positively whether lines were written before or after related erasures, or scratchings, or foldings or crumplings of the paper. In one important case, my friend Mr. Wm. E. Hagan, of Troy, who has given extensive and very successful attention to the study of writing, especially imitative writing, and in association with whom many of my own investigations in this field during the last dozen years have been carried on, established the date of a document by recognizing in the paper, fibres which had only recently been used in paper-making, and which, in connection with corroborative proofs to which they led, demonstrated that the paper was manufactured at a later date than that claimed by the writing upon it.

To discuss the subject of imitative writing would require the opportunities of a book, and not of a fraction of a lecture; and many considerations of recognized importance connected with it are still under investigation and not sufficiently mature for publication. A few hints may be given in respect to those points which are well established and most generally applicable. When a word in a fictitious signature, for instance, has been constructed by tracing it with pencil-lines over an original one, and subsequently inking it over with a pen, particles of plumbago can probably be somewhere detected and recognized by their position and their well-known color and lustre. The mechanical effect of the point of a pencil upon and among the fibres of the paper can also be seen, notwithstanding the subsequent staining of the paper by the ink. This clumsy method of copying carries its own means of detection; and still it is not more easily recognized than are methods that are more subtle and seem more dangerous. In writing copied or imitated originally in ink, either by tracing it over a copy or by drawing it free-hand with a copy to inspect or to remember, the distribution of ink is peculiar and suggestive, indicating hesitation, from uncertainty, or pauses to look at a copy, or to recall a style or to decide as to a future course, just at points where a person writing automatically, by his own method, and especially in writing his own name or a scarcely less familiar business formula, would pass over the paper most rapidly and promptly. Again there are certain ear-marks, results of habit, which finally become as natural as it is to breathe, and which characterize the writing of different individuals. Such are peculiar forms and styles of letters and of combinations of letters: methods of beginning or of ending lines, letters, words or sentences; methods and places of shading, or breaking lines, and of dotting, crossing, patching or correcting; habits of correcting or not correcting certain errors or omissions; the use of flourishes, and peculiar ways of connecting words or of dissociating syllables. In imitative writing these ear-marks of another ownership are generally copied with ostentatious prominence, if not with real exaggeration, in the capital letters and other prominent parts, but lost sight of in those less conspicuous places where imitation naturally becomes feeble and the habit of the writer unconsciously asserts itself: and this revelation often becomes more positive by reason of the elaborate efforts that are made to suppress it. Things are overdone from fear, which would have been negligently done from habit; not to speak of gross blunders proceeding from the same source. I once examined a disputed signature from which had been carefully scratched out a line, immaterial and inconspicuous, which conformed to the habit of another person interested in the case, but not to the habit of the ostensible author of the writing. Furthermore the genuineness of a writing may often be disproved by the very success with which it followed its copy; reproducing its mistakes, idiosyncracies of the adaptions of its own special surroundings, in which respects it may correspond too accurately with some one genuine signature (in the hands, for instance, of a suspected person) but differ unquestionably from the ordinary habit of the reputed author. Modifications of style by disease, as paralysis, may present similarly decisive discrepancies or coincidences. All these investigations in respect to writing can be best pursued with the aid of the microscope, and some of them are entirely dependent upon it. For general view of the words, a four or three-inch objective is best adapted; for special study of the letters a 1½-inch, and for minute investigation of the nature of the lines or character of the ink a $\frac{2}{3}$ or $\frac{4}{10}$. The lenses, except the last, should be of the largest angles ordinarily made, and all should be of flat field, and of the best possible definition. The microscope-stand should have a large, flat stage; though it is generally preferable to use a small, portable stand which can be moved freely over the paper and focussed upon it at any point without the use of a stage. For this purpose I sometimes use a tank-microscope, but more frequently a pocket-microscope with its tube prolonged through the stage by adapters, so that it focusses directly upon the table. Even so large an instrument as Zentmayer's histological may be so used to advantage, though a lighter form and smaller size is far more convenient and sufficiently steady for this work. A medium sized bull's-eye is sufficient for the purpose of illumination; and good judgment is more important than, if not incompatible with, the employment of an ostentatious and unnecessarily elaborate apparatus.

To illustrate the application of the microscope to the critical study of writing in cases of practical importance, and its dependence for much of its value on the appreciative comparison of related facts, I will describe a single and very simple case of altered writing occurring many years ago. A certain note, admitted to be genuine and properly signed, and upon which a considerable amount of money and a far greater value of character depended, bore date of the sixteenth of a certain month. The number of the year was printed on the blank except a single figure 1, which was filled in with writing ink; there was also a figure 1 written below in the body of the note. The last named 1 was lightly and smoothly written, of such size and color and style, as might well have been written at the same time and by the same person as the rest of the note. But the figures 16 and 1 of the date, were written clumsily, twice as large as the other, with a pen of different properties and with ink of different color and density. This peculiarity of these three digits was well explained by the claim, supported by the most plausible circumstantial evidence, that the date had been left blank at the time of drawing up the note, and had been filled in at the time at which it was subsequently signed, and with writing materials whose character sufficiently accounted for the nature of the figures. One person who was largely interested in the note having been signed earlier than the date upon its face, and who well knew whether or not it was originally dated upon that day, asserted that its original date was several days earlier than that, though he did not fix it upon any one particular day. Another person who was admitted to have written the date, who had enjoyed unlimited opportunities for changing it if he desired, and was largely interested in its bearing a date not earlier than its ostensible one, asserted that that was its original and only date. At first sight, and still more after much patient study, it seemed hopeless to expect a solution of the case through the microscope or by any other means. The tracks of crime, if present, were never more carefully covered. The disputed figures were bold and strongly characterized. They showed no attempt to make them look like the rest of the writing, and therefore suffered nothing from failure to accomplish it; and their well-marked character was satisfactorily accounted for. The surface of the paper was microscopically perfect, and had not been tampered with for purposes of erasure. Nowhere did a line crop out into view like those of the rest of the writing; and if any such existed beneath the visible figures it was doubtless pale and thin and little likely to be perceptible, even to the microscope, through the heavy coating of thick and muddy ink which covered and concealed it. At last by one peculiar illumination, light being diffused rather faintly over the top of the paper and at the same time condensed strongly upon the lower surface, there came into view an appearance which was lost by the least change of illumination, but could be restored again by careful arrangement of the light. Blended with each of the three disputed figures, though not equally distinct in all, was a very peculiar wedge-shaped or triangular figure, broad and flat at the top and sharp at the bottom, and exactly such in size and position as would accord well with the rest of the writing and with the other figure 1 in the body of the note; but the latter 1 was broad and square at the bottom, and thus strikingly unlike the wedge-shaped figures. Comparison of a large numbers of papers known to have been written by the same author showed that the unusually triangular 1, was his characteristic style, and that the unaltered and not triangular 1 in the note, known to be his writing, was not his usual habit but a rare and, as it proved in this case, a puzzling eccentricity. It was evident that the date had been first written 11, and that the 16 had been subsequently written over it; and that the 1 of the year, though the right figure, had been similarly enlarged to make it look like the rest.

Still newer but scarcely less important than this is the study of powder marks, which call for investigation with the microscope less frequently, it is true, but are likely to be connected with results of the highest interest. Fixing the responsibility for a fatal crime, involving capital consequences, may turn critically upon such questions as the time of firing a certain shot, the position from which it was fired, the kind of powder used or the nature of the weapon employed, all of which questions under certain favorable but not improbable circumstances may be positively answered by our instrument. It is well known that modern gunpowder is not a powder at all, but consists of hard and well-formed grains, often of considerable size, which by burning gradually and comparatively slowly from their surface only, gradually crowd the ball into increasing velocity as it moves through the barrel toward the mouth of the gun, and finally ejects it at a speed and with a power that would not be safely attained or even approached by a fine powder that would burn more rapidly and communicate its impulse more suddenly, and perhaps with destructive force to both ball and barrel. But before the grains are fully burned, the rapidly decreasing advantage gained in this way becomes more than counterbalanced by the resistance to the ball by continued contact with the barrel. Therefore the barrel is never made long enough for the powder to wholly burn before leaving it, and some of the burning grains must in all cases be thrown out as projectiles along with the ball. In using large charges and coarse powder some grains also may be thrown out that have not been ignited at all. The shorter the barrel, other things being equal, the more will this happen; as it will, also, in the case of the pistol, where the charge is generally less than in the rifle, but the flash is greater because the barrel is shortened more than the charge is diminished.

(*To be continued.*)

EDITORIAL.

This number will be sent to many persons who are not subscribers, but who are known to be interested in scientific studies. We hope that a large number of these will send us their subscriptions, especially the physicians, to whom the Journal will certainly be of great value. It costs but $1.00 per year, and the subscription-list must be a large one to make our enterprise profitable at such a low price. We consider that the success of our undertaking is already assured, and have to thank the microscopists of the country for their very generous and early support.

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We take pleasure in announcing that we have established an Agency for the sale of American and Foreign Scientific Books and Periodicals, and that we are prepared to receive and to promptly fill orders for books and magazines of all kinds.

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Spring Collections.

The warm days of spring are fast approaching, and they afford the microscopist who will visit the ponds and streams, a great variety of living objects. Perhaps this is the best season of the year for general collecting; many forms of plants and animals are just awakening into life, after the cold days of the winter months, and the student can learn much about the early stages of the growth of objects which, in their more mature condition, are familiar to him.

We urge all who can, to begin their collecting now—as soon as they receive this number, for it is already late enough—and to share with others the pleasure which their "finds" will certainly give them, through the Journal.

To the novice in collecting, a few words of advice and a few suggestions about what to look for and where to find it, will be acceptable.

It is advisable to choose a clear day, for the sunlight seems to lure the little animals from their hiding-places, and brings them near the surface of the water; and many plants will also rise into view.

It is difficult to give directions for collecting, since there are so many different tastes to be gratified; but if Algæ are desired, they may be looked for along the shores of ponds, either floating free on the surface of the water, or attached to the submerged grasses, stems, or debris along the shore. If they are found upon the surface, it is advisable to take home a good supply and immediately shake it out in some clear water, so as to wash out the diatoms or desmids that it may contain. This water should then be placed in a shallow dish, a saucer or a soup-plate, and exposed to sunlight. The dirt will soon settle, and in the course of a few hours the desmids or diatoms will rise to the surface, quite free from other matter. In this way very clean gatherings can be obtained. Last spring we collected such a quantity of desmids (*Closterium*) one afternoon, that the next morning we skimmed off from the saucer enough to cover the bottom of a two-dram homœopathic vial, to the depth of over a quarter of an inch, after the cells had settled in the water. Many persons fail to succeed in this experiment; they find their diatoms will not rise as they anticipated, but the fault is not with the diatoms—a bottle is not a suitable dish for them to live in, and the experiment is usually tried with a bottle. Put the plants in a shallow dish, so that a large surface will be exposed to the air, and success will follow if the diatoms are alive.

Continuing the search for Algæ, look at any places where water trickles down over the face of rock-ledges. Very likely there will be found an abundance of diatoms in the brownish-colored, jelly-like coating on the rocks, or mingled with the filamentous Algæ (*Conferva*, *Ulothrix*, *Oscillaria*, *etc.*), which are frequently found there. In swiftly-running streams very beautiful Algæ are often found.

In searching for forms of animal-life, rather more apparatus is desirable than is needed for Algæ, but in no case should it be considered essential. It is advisable to possess a cane with a telescopic joint, having a screw for attaching a bottle, a net and a hook; of all these we consider the hook the most generally serviceable attachment, for an abundance of microscopic animals can be pulled up with water-weeds and Algæ, and freed by shaking the latter in a bottle of water. A collecting-bottle is very useful for securing such forms as *Daphnia*, *Cyclops*, *Cypris*, *etc.*, and this can be made as follows:

Choose a common tumbler—those that jellies are sold in are very good —and select a good cork large enough to fit it well (druggists usually have such large corks on hand). Take a 2-in. (or smaller) glass funnel and pass the neck through the centre of the cork, from the lower side, and pass the neck of a similar funnel through the cork from the opposite side. Tie a bit of fine Swiss muslin or lawn over the mouth of the first funnel, put the cork into the tumbler and the apparatus is complete. By pouring water into the upright funnel, the tumbler will soon be filled and the excess will flow out, after being filtered by the fabric through the inverted funnel. The upper surface of the cork can be covered with sealing-wax varnish, which will greatly add to its appearance and also make the bottle air-tight. Another way of making a collecting-bottle will be given next month.

To use such a bottle, dip up the water containing the animalcules and pour it into the bottle until enough has been strained to make a good collection, pour out most of the water, then remove the cork and put the specimens in another bottle, after which the collecting-bottle is again ready for use. We have used one precisely like that described above with great satisfaction.

The finest rotifers will be found among or attached to submerged plants in sheltered localities.

At this season there may be found many kinds of rotifers and vorticellas, water-fleas, water-beetles, hydras, and many other beautiful and interesting creatures.

——o——

Some "Expert" Evidence.

In the course of the recent trial of the Rev. Mr. Hayden, in Connecticut, a large number of scientific gentlemen were called upon for their testimony. Some of the evidence that was thus brought to bear is of an interesting character, not only as an indication of the value of the microscope in such cases, but also as showing to what extent we can rely upon the results of the experiments of individuals.

We will briefly review the testimony that was based upon microscopical examinations.

The microscope was employed for two purposes on this trial; for the examination of specimens of white arsenic, and for the detection of blood-corpuscles.

In the study of arsenic-crystals and the various kinds of arsenic in the market, Professor E. S. Dana had spent several months, and his testimony was of a satisfactory nature throughout. Samples of arsenic from different manufactories vary in character more or less, and this is also true of the products from the same factory at different times. The peculiarities are to be found in the proportionate number of crystals, amorphous particles, and dust, in the size of the crystals and masses, and in the general appearance of the specimens, particularly when examined by reflected light, which shows the crystal-faces either dull or polished, or, when they have been subjected to the slow action of solvents, striated and marked.

Among the causes which prevent uniformity in the products of the same factory at different times, may be mentioned the rapidity of the crystallization—which varies with the temperature—the larger crystals forming most slowly; the density of the vapor in the condensing chambers; and the presence or absence of foreign matters.

Although it is admitted that the product of a factory varies from time to time, it appears that it is possible to distinguish the arsenic of different makers with some degree of certainty, and Professor Dana believes that he could certainly identify the brands in his possession known as "Dayton," "Garland," "Welsh," and "Dragon," by microscopical examination.

Many specimens of arsenic were examined by Professor Dana, but we will only refer to a few of them in illustration of the character of his observations. The arsenic from the Tavestock works which he visited, contains never less than one-half his bulk of minute, but perfect, octohedral crystals. The "Garland" or glass-arsenic contains no crystals, hence, when ground it appears as an amorphous powder. By examining fourteen slides of a certain sample, one-third of it was found to consist of distinct crystals, most of them varying in size from $\frac{1}{1000}$ to $\frac{1}{1500}$ of an inch, taking the maximum and minimum diameters. By reflected light the crystals showed an imperfect lustre.

Another sample was made up almost exclusively of regular octohedra, which formed nine-tenths, never less than three-fourths, of the entire mass, in size about $\frac{1}{1000}'' - \frac{1}{2000}''$, some as large as $\frac{1}{800}'' - \frac{1}{500}''$, with smooth, and brilliant surfaces.

The arsenic that was found in the stomach of the poisoned girl had a yellowish tinge, probably caused by the action of some sulphur compound, which partly changed the oxide into a sulphide. There were no dust-like fragments, or very few, the faces of the crystals showed the peculiar parallel lines and triangular markings or depressions, which are produced by solvent action.

The other gentlemen who touched upon this subject in their testimony did not differ from Professor Dana to any noticeable extent. Professor Brewer's evidence was almost identical.

In closing these remarks about arsenic, we must refer to some photographs of crystals of this substance, kindly sent to us by Dr. T. D. Williams, of Chicago. The photographs show certain characteristics of the samples quite clearly, and any person could readily distinguish the different kinds.

The testimony regarding blood-corpuscles, is of a less satisfactory character than that which relates to the arsenic.

Professor Wormley, of the University of Pennsylvania, Professor White, of Yale, Dr. Treadwell of Boston, Dr. Sanford and Dr. J. J. Woodward were the principal experts on the blood examinations.

A most embarrassing error, and one which we would hardly deem possible for a microscopist to fall into, who was familiar with the appearance of blood-corpuscles, was made by Professor White. He found an alga upon a stone and mistook it for blood. Further examination enabled him to correct the error; but the fact that the mistake was made, shows the necessity of extreme caution in such examinations. One of the most striking statements of all was made by Dr. Treadwell. In one instance he testified, after measuring only four corpuscles (having accidentally lost the others) that ranged from $\frac{1}{2357}''$ to $\frac{1}{3368}''$ in diameter, as follows: "I am quite positive that these were human blood-corpuscles, and that they did not belong to blood of the pig, sheep, goat, horse or cat." In another place, referring to some other examinations, he stated that he had "obtained certain proof of human blood in one instance only" (this was from stains on a knife). Dr. Treadwell was asked this question: "Now, Doctor, if you have five specimens of different bloods given you, will you be able to say which are human?" He replied "Yes, if an honest and competent man prepares the slides for the microscope and with fresh blood. Then I could give you an answer in a couple of hours." We have not space to give the admirable testimony of Dr. Sanford on this subject, which we regard as perfectly reliable and correct.

This review is based upon the reports of the trial given by the daily New York papers, which seem to be quite reliable.

Dr. Woodward speaks for himself in the following extracts from a communication with which he has favored us.

Referring to the range and variation in the size of the corpuscles, Dr. Woodward says:

"What I actually testified as to these points, was substantially as follows: That the largest human corpuscle I had ever measured in any human individual, including all ages, was 400-millionths ($\frac{1}{2500}$) of an inch in diameter, the smallest 222-millionths ($\frac{1}{4500}$). I said, however, that I did not for a moment believe that these dimensions represented the extreme limits, for G. Hayem (*Rech. sur l'anat. normale* *et path. du Sang*, Paris, 1878, p. 44) has recently affirmed that in chronic anæmic conditions he has measured them as large as 12 or even 14 micromillimeters (the latter=551-millionths of an inch) and as small as 2.5, or even 2.2 micromillimeters (the latter=86-millionths of an inch). But even taking the limits I had myself measured as the extremes for healthy individuals, the difference in size between the largest and the smallest human blood-corpuscle was about as great, relatively, as the difference between the shortest and the tallest adult man, and as in both cases all possible transition forms occur, I held that by measuring ten, fifty, or a hundred, or even a much larger number of corpuscles, we are no more likely to obtain an average size that will agree with the next set of similar measurements, than we are by measuring the height of as many men, likely to obtain an average which will agree with the average height of as many more individuals measured elsewhere. It was to this cause, chiefly, that I attributed the considerable differences between the statements as to the average size of human red corpuscles, published by the highest microscopical authorities during the last few years. I said that while many English and American microscopists continued to assume the infallibility of the alleged average size of 312-millionths ($\frac{1}{3200}$) of an inch, propounded by Gulliver in 1848, such able French microscopists as Cornil and Ranvier (*Manuel d'Histologie Pathologique*, Part II, Paris, 1873, p. 498), placed it as low as 7 micromillimeters (*i. e.* 275-millionths or $\frac{1}{3636}$ of an inch). The commission of the French Société de Médecine Légale (*Annales d'Hygiène Publique*, T. 40, 1873, p. 194) composed of Messrs. Miahle, Mayet, Lefort and Cornil, which reported June 9th, 1873, placed it at 7.5 micromillimeters (*i. e.* 295·millionths, or $\frac{1}{3389}$ of an inch), with which Hayem (p. 43 *op. cit. supra*) and other recent French authorities agree. On the other hand, J. Pelouze and E. Frémy (*Traité de Chimie, etc., 3me éd. entièrement refondue*, t. VI, Paris, 1865, p. 492) place the average as high as $\frac{1}{102}$ of a millimeter (*i. e*, 328-millionths or $\frac{1}{3048}$ of an inch), while the average usually accepted in Germany, that of Welker (*Zeitscher. für Rat. Med.*, Bd. XX, 1863, S. 237), is intermediate between the foregoing, viz.: 7.74 micromillimeters (*i. e.*, 304-millionths or $\frac{1}{3289}$ of an inch).

"As for myself, I did not pretend to make any general statement as to the true average size of the human red corpuscles, my experience being that the averages obtained by the most careful measurements of any moderate number of corpuscles differ considerably. As to this I cited the figures I have published (*Amer. Jour. of Med. Sci.*, January, 1875, p. 1; and *Trans. of the Amer. Med. Ass.*, Vol. 27, 1876, p. 304), and added that several other averages of measurements of human blood recently made by me with every possible precaution, also differ from each other considerably (as will be seen below).

"As for the red blood-corpuscles of the dog, I testified that I had measured in this animal single corpuscles as large as the largest I have ever myself measured in human blood; others as small as the smallest in human blood, and every possible transition between. Here, too, in taking averages I had arrived at variable results, as Gulliver himself did long ago. I explicitly stated that the general average of all the measurements that I ever recorded for the dog, was somewhat smaller than the average of all I had recorded for man. Yet, some of the averages I had found for fifty or a hundred, or even more canine corpuscles were larger than the smaller averages obtained for human blood; indeed, occasionally rivalled the larger. I mentioned further that I agreed with the view of L'Périer (*Bull. des Travaux de la Soc. de Pharm. de Bordeaux.* 1877; p. 282 *et seq.*), that the blood of quite young dogs (up to a month or two old) more frequently contained very large corpuscles, and gave averages equal to those obtained from human blood, than was the case with older animals. I had, since the trial commenced, mounted several slides of the blood of a pup three weeks old, in which corpuscles measuring 400-millionths ($\frac{1}{2500}$) of an inch in diameter were by no means rare (I may add that I have these slides and will take pleasure in showing such corpuscles to any competent microscopist). Fifty corpuscles on one of these slides gave an average of 326-millionths of an inch; forty corpuscles on a slide from another pup of the same age, gave an average of 320-millionths of an inch; while twenty corpuscles from the blood of a full grown dog gave an average of but 300-millionths of an inch. Measured with the same instruments, fifty corpuscles of my own blood gave an average of 324-millionths; forty from another individual gave an average of 327-millionths; twenty from another gave an average of 316-millionths. I added that all these measurements were made with a new Zeiss homogeneous immersion $\frac{1}{18}$ and a cobweb micrometer, the power being such, that each division of the micrometer-wheel equalled $\frac{1}{750000}$ of an inch. Every corpuscle in the group selected was measured, each being first brought to the centre of the field for the purpose, and those corpuscles which appeared to be other than perfectly spherical, were measured in the long and short diameters, and the mean taken. In short, every known precaution was employed to secure accuracy.

In view of all the foregoing considerations, I did not think the microscopist is warranted in attempting to distinguish on oath, between human and canine blood, even on preparations carefully made from fresh blood. If he makes a supposition based on the average size of fifty or a hundred corpuscles, he will no doubt often come out right, but he will also occasionally come out entirely wrong; and the difficulties in the case of corpuscles soaked out from dried stains, are of course still greater.

CORRESPONDENCE.

A DEVICE FOR MOUNTING.

To the Editor:—I have recently devised and applied to my Cox turn-table, a simple device which I find to be of much use, especially when mounting in glycerine. In brief, it is a slender arm of brass which is attached at one end to the hand-rest of the turn-table by a milled-head screw. The other end extends over the centre of the turn-table at a suitable height above it. A pointed screw comes down through the end of the arm exactly over the central dot. In mounting in glycerine, for example, after the cover is applied to the object, the slide is transferred to the turn-table, the cover is brought to the centre and the pointed screw is turned down upon the cover, compressing the object and expelling the superfluous fluid. After a rough cleaning a ring of gelatine-solution may be applied, as directed in Marsh's *Treatise on Section-Cutting*, p. 41. After a couple of applications of the gelatine and time allowed for it to set, the screw may be loosened and the slide removed from the turn-table.

This little piece of apparatus may not

be new, but I have never seen it figured or described. Its advantages are obvious, and I am sure every reader of the JOURNAL who will have this simple auxiliary fitted to his turn-table will be pleased with it.

A. L. WOODWARD.

Syracuse, N. Y.

THE ACME STAND.

TO THE EDITOR:—Referring to the description of the "Acme" stand, which appeared in the first issue of your JOURNAL, I desire to add a few words in order to place the matter fairly before your readers.

The "Acme" stand owes its appearance to an agreement, entered into between Prof. J. Edward Smith and myself, over a year ago, while we were present at the Microscopical Congress at Indianapolis.

Without going into details, it was then and there mutually agreed to attempt the production of a new stand, which should, at a low cost, comprise all the late improvements, be equal to any and all work —in short, the idea was to produce, if possible, an *Acme* stand, Prof. Smith agreeing to give the benefit of his long experience as a manipulator, and I mine as a working optician.

Our agreement has been carried out to the letter, and from the date mentioned, Prof. Smith and myself have been in close correspondence, the result of which is the "Acme" stand.

Will you, as an act of justice, publish this explanation, and with the hope that the "Acme" will be found practically what Prof. Smith and myself claim for it, I remain, dear sir,

Respectfully yours,

JOHN W. SIDLE.

Philadelphia, January 25th 1880.

NOTES.

—The Iowa State Medical Society convened at Des Moines, on January 27th, 1880.

A few medical men interested in microscopy, brought their microscopes, and exhibited histological objects, which were changed every session. Most of the members were interested in the matter.

At the close of the morning session of the second day, a microscopical section was formed by electing Prof. J. J. M. Angear, M. D., as President, and Prof. W. D. Middleton, M. D., as Secretary.

—The wax-cell which Dr. Hamlin describes in his article is really a good cell. It may be thought that wax alone is too soft for durable mounts, but this is not the case. Experience has shown that it is an excellent material for the purpose. Dr. Hamlin has kindly send us a cell prepared according to the instructions he has given, and it is very neat and clean. We advise our readers to give the process a fair trial.

—The prices of microscopes and accessories seem to be going up. We notice several changes in Beck's catalogue.

QUESTIONS AND ANSWERS.

[This column is freely open to all who desire information upon any subject connected with microscopy. It is hoped that the readers will reply promptly to the questions which are asked.]

ANSWERS.

(1.) In the *M. M. J.*, vol. 4, p. 18 (July 1870), Mr. Wenham refers to a photograph of *Angulatum* "magnified fifteen thousand diameters," exhibited previously to 1854: One of the photographs is still in the possession of Mr. Jabez Hogg. On p. 124, Mr. Wenham refers to "eleven thousand diameters," and on p. 125 gives au outline-sketch with camera-lucida of *Podura* with "six thousand diameters."

The Rev. W. H. Dallinger has repeatedly mentioned "ten thousand diameters" in his papers, and implies even higher magnifications as being at his command.

Messrs. Powell and Lealand have publicly exhibited *Angulatum* with "four thousand diameters."

Dr. Woodward's photographs go to about four thousand diameters with great success on certain boldly-marked objects, but with Nobert's higher bands he appears to have obtained the best *direct* results with hardly more than one thousand diameters.

J. M., jr.

London, Feb. 11, 1880.

(3) If A. L. W. understands all the different methods of constructing objectives, his question can be intelligently answered.

One method of constructing the front-lens of high-power objectives—the one in most common use by first-class makers —is to make the front achromatic by combining two or three lenses; such fronts are known as compound-fronts. Some years ago Mr. Wenham, of London, introduced fronts of a single lens. About 1872 Mr. Tolles added another single lens in front of the former one, giving better and sharper definition, and he termed the objectives thus constructed four-system objectives; but, finding that term cumbersome, changed it to "duplex." Four systems had been made previously by Ross and by Hartnack; but not on the same formula that was used by Tolles.

Curiously enough, Mr. Wenham, after contending for eight years that it was impossible to get through any objective more than an angular aperture of 82° now (*J. R. M. Society*, Dec. 1879) gives up the point so far as his contention applies to the "duplex-fronts" of Tolles, utterly ignoring the fact, or disputing it, after repeated measurements of the aperture of three-systems by Tolles, Woodward, Keith and others. One of Tolles' three-system had been in Wenham's own hands, and was grossly mismeasured. The same objective had just been measured with Zeiss' apertometer, a modification of Tolles' of 1872, and gave a balsam angle of 93°+, just as Tolles made it in 1872. CARL REDDOTS.

Boston, Feb. 18th, 1880.

MICROSCOPICAL SOCIETIES

WELLESLEY COLLEGE, MASS.

The regular monthly meetings have been kept up with the usual interest during the present college year.

Only a few of the papers and exhibits can be mentioned.

Miss Nunn, Prof. of Biology, who spent the Summer with the Zoölogical Expedition fitted out at the Johns Hopkins' University, for investigating the fauna of the waters along the Southern States, gave an interesting account of deep-sea dredging and shore-collecting, and described some of the life thus found. She exhibited from specimens which she obtained, *Synapta squilla*, and several varieties of sponges and hydroids; specimens of deep-sea dredgings, from the North and South Atlantic and the Red Sea, were also under the microscopes. Miss Ida Brown, President of the Society, a student in Biology, gave a paper on white and colored blood-corpuscles, illustrated by slides showing corpuscles and hæmin crystals. A paper on plant-crystals, embodying much individual work, was given by Miss V. Smith, illustrated by the following specimens prepared by herself: crystal-prisms from cactus, washed out; stellate raphides from lily; crystal prisms in onion-sheath; sphæraphides from begonia; raphides in calla; crystals in pear, stained. Miss Whiting gave a *résumé* of the exercises of the American Society in Buffalo, with an abstract of the portion of the address of Dr. Ward pertaining to the use of the microscope in the detection of forgeries and the examination of gunpowder wounds. Papers on the antennæ of insects, and on the best methods of microscopic measurements have been given. A demonstration with Dr. Seiler's section cutter, and an exhibition with a new polari-microscope of the remarkable phenomena exhibited by minute crystals, in converging polarized light, attracted much notice; also the circulation in the branchiæ of the triton.

The Society have formed a plan for studying the fauna and flora of the waters in the neighborhood of the College thoroughly. Drawings with descriptions are handed in to the President, and those pertaining to specimens not on the list already presented to the Society, are preserved by the Secretary. Thus, in time, the history of microscopic life in the region will be complete.

The regular meeting was held on Monday evening, February 9th; the President, Miss Brown, in the chair.

The leading paper was by Miss Freeman, on the method of mapping absorption-spectra with the bright-line micrometer of the Sorby-Browning Microspectroscope.

The instrument was described in detail, and the method of constructing a scale of reference by obtaining the positions of the principal Fraunhofer lines. The bands in the spectra of different substances are mapped out on the same scale, and thus compared.

The paper gave details of the work of the writer, especially on the spectra of chlorophyll.

Miss Whitney called attention to the contents of the late journals, and read interesting extracts.

Some thirty varieties of ferns, mounted for the Society's collection by Miss Painter, were exhibited and greatly admired. The following mounted objects were exhibited, accompanied by drawings in detail: *Aspidium spinulosum*, *Dicksonia punctilobula*, *Davallia pyxidata*, and *Cibrotium Schiedii*.

The absorption-spectra of two preparations of chlorophyll were exhibited under the microspectroscope.

ADA I. AYER, Cor. Sec.

LIVERPOOL (ENG.).

The second ordinary meeting of the twelfth session of this Society was held at the Royal Institution, on February 6th, 1880, Dr. J. Sibly Hicks, the President, in the chair.

Robert Dempsted was elected an ordinary member of the Society.

Rev. W. H. Dallinger exhibited and explained Col. Woodward's Illuminator, manufactured by Messrs. Powell and Lealand, by means of which any angle of the illuminating ray is secured and registered.

Dr. Drysdale exhibited and explained the oil-immersion condenser of Messrs. Powell and Lealand, showing with it the dotted markings on the diatom *Navicula lyra* through a ½-inch objective.

Rev. W. H. Dallinger read the paper of the evening entitled "Microscopical Notes on the Order of Minute Insects known as Thysanura (Spring-tails) with a special study of these scales," illustrated with transparencies and the lime-light.

GRIFFITH CLUB, MICH.

Mr. E. H. Griffith of Fairport, N. Y., read a very interesting paper on diatoms before this club, but we cannot reproduce it or condense it in our overcrowded issue. The paper was printed in one of the Detroit newspapers and we doubt not that any reader who is sufficiently interested in the subject can obtain a copy by writing to Mr. Griffith. There are several valuable suggestions contained in the paper, particularly those relating to the cleaning of diatoms.

CAMDEN, N. J.

At a recent meeting Dr. Walter M. James delivered a lecture on dust, from which we make the following extracts:

The Doctor opened his lecture by a description of the various kinds of dust, the sources whence they originate, and the important part it plays in the diffusion of light, citing the well-known fact that a ray of sun-light entering a darkened room through a chink or crevice, would be invisible from a side view were it is not for the infinitesimal particles of dust floating in the atmosphere, for light travels only in straight lines, and unless the eyes directly opposed its rays, its presence would be unperceived. Much of the dust we see in the air is composed of the pollen of plants wafted abroad to fulfill its mission in the propagation of its species, and frequently gives rise to diseases of the human system which prevail in the Autumn, especially those called coryza or hay asthma, hay fever, *etc.*

The experiments of Tyndall, showing how fermentation in various liquids may be prevented, if excluded from contact with the atmosphere, were fully explained, and the formation of those fungoid growths called mould, which occur so frequently on articles of food and clothing, in moist places, were traced to the multiplication of the plants from spores carried by the atmosphere.

Various moulds were exhibited under the instruments and the curious branching of the *Penicillium glaucum*, the cells of the yeast-plant, vibriones and various pollens were well shown by Messrs. Brown, De LaCour, Kain and Derousse, with high powers.

Exchanges.

[Exchanges are inserted in this column without charge.]

Polyzoa, Palates of Mollusca, Foraminifera, Sponge and Holothurian-Spicules, Synapta-Anchors, Chirodota-Wheels, Echinus-Spines, Minute Sea Shells, in exchange for Polyzoa, Foraminifera, Histological and Pathological preparations, *etc.* Also, a quantity of Sea Shells in exchange for Land and Fresh-Water Shells.
F. M. HAMLIN, M. D., Auburn, N. Y.

J. J. B. Hatfield, Arsenal Avenue, Indianapolis, Indiana, will exchange Bleached Plant-Sections for good Diatomaceous material. List furnished on application.

For fine specimens of *Tingis hyalina*, send a stamped envelope to ALLEN Y. MOORE,
186 Dodge St., Cleveland, Ohio.

Pleurosigmas and other unmounted Diatoms, both Fresh Water and Marine; also Marine Algæ, Ferns, and a large quantity of miscellaneous microscopical material in exchange for good mounted objects.
M. A. BOOTH, Longmeadow, Mass.

To exchange, well-mounted Slides of Hair for mounted or unmounted specimens of hair from the rarer animals; lists exchanged. WM. HOSKINS,
208 S. Halsted street, Chicago, Ill.

Nicely mounted Slides (opaque) of the Coal-tar Derivatives, chemically prepared, crystalline in form, showing their beautiful colors, in exchange for other well-mounted material. Chemical name and formula attached to each Slide. About a dozen varieties on hand. F. L. BARDEEN, M.D.,
30½ Meigs street, Rochester, N.Y.

Vanadate of Ammonia, $(NH^4)^2VO^4$, Slides for the Polariscope in exchange for other Slides.
H. POOLE, Practical School, Buffalo, N. Y.

Slides mounted from injected Frog's Gall-bladder, Liver, Kidney, Stomach, Intestine and other parts, exchanged for other good and interesting preparations. C. BLASDALE, M. D.,
Jericho, Queens Co., N. Y.

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How to Cut and Grind Glass Slides.

BY F. M. HAMLIN, M. D.

The appearance of many of the slides which I have received in exchange, indicates that many amateur microscopists attempt to do their own grinding; and a few, with a sublime indifference to all that is neat and tidy, send them out with

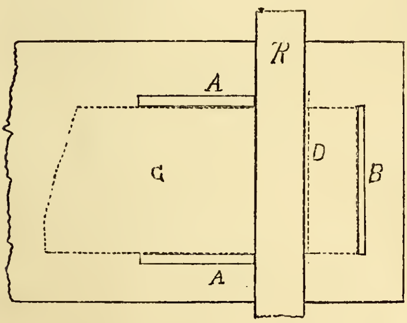

FIG. 14.

the rough edges untouched, just as they were left by the diamond, and varying greatly in width. Such slides, besides being unsightly, are liable to cut the fingers of those who handle them, that is, if any one handles them more than enough to pack them up and return to their owner, with "thanks" which are wholly conventional, who is surprised, and probably disgusted, at the number of "duplicates" there are in the land.

Since many, from motives of economy, or that laudable spirit which desires to know how, and to be able to do various things, attempt to do this work for themselves, I offer some directions which are the fruit of my experience.

First of all, it is important to get the slides cut to a perfectly uniform size. The amateur will, in all probability, have to do the cutting himself, for I have never yet been able to get a glazier to cut any two pieces of glass of the same size, and with his method it is impossible to secure uniformity. I have, therefore,

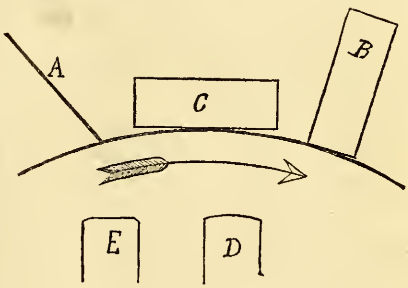

FIG. 15.

devised a simple cutting-board which secures the desired uniformity without trouble. I take a perfectly flat piece of board, of convenient size, and prepare it as is shown in Fig. 14. The cleat *B* is fastened at the end, and at right angles to it are fastened two other cleats (*A*, *A*) exactly three inches apart and with their ends just so far from cleat *B* that when the rule *R* is laid against them, it will permit the diamond to cut just one inch from cleat *B*. When a piece of glass (*G*) three inches wide, is laid between cleats *A*, *A*, and the rule is placed over it and held against the ends, the diamond drawn along cuts off a strip of the glass just one inch wide. Care must be taken that it is the point of the diamond and not the edge of the rule that is just an inch from cleat *A*, or the slide will be too narrow. The track of the diamond is indicated by the dotted line *D*. In this manner strip after strip of glass is cut from the original piece three inches wide until it is cut up into slides of an exact width. Care should be taken that the first end of the three-inch piece is square, and fits up closely to cleat *B*. If it is "out of square," let the end project just beyond the edge of the rule and cut off a narrow strip, which squares the end, and makes the piece right for cutting into slides without loss of material. Proceeding upon the same plan, I make an arrangement for cutting the three-inch strips.

The diamond is undoubtedly the best instrument for cutting glass, but it is expensive, and requires some skill to use it properly; but I have done nearly all of my work with the cheap glass-cutters, which are sold for twenty-five cents, and with entire satisfaction; indeed, I think they make a smoother cut than the diamond and consequently require less grinding. If one of these cutters is used simply for work it will last a long time.

Care should be taken to secure thin, clear glass. Ordinary window-glass is too thick, but in nearly every place where glass is sold there may be found pieces excellent in quality and sufficiently thin. The thickness should not exceed $\frac{1}{12}$ of an inch.

The slides being cut, the grinding follows. This is done upon an ordinary grindstone, and the cardinal principle of the process is to grind with the stone turning from the slides. As the ends of the slide are the most difficult, it is best to begin with them. The corners of the edge are first ground off by holding the slide as at *A*, in Fig. 15. Both sides being treated in the same way, the slide is held as at *B*, and drawn the whole length of the end, so the stone will not grind up into the centre of the slide. The ends being finished, the sides are treated in the same way, the corners first, and then the slide is held as at *C*, drawing the length of the slide from end to end. The slide is to be held firmly, as close down to the stone as possible, and the sides of the slide parallel with those of the stone, except when grinding off the corners. The object in grinding off the corners first is to prevent little pieces from splitting off the sides of the glass. The amount ground off from the corners need be only a very little, just enough to make a straight line from end to end. A little experience will soon teach how much. The edge may be finished in two ways, like *D* and *E* in Fig. 15, the latter being my favorite method. The ends of the slide being most difficult to grind, a good deal of time may be saved by grinding off the sides of the three-inch strips before cutting them into slides.

When grinding, it is best, as soon as a slide is finished, to drop it into a dish of water, for if laid one upon another, or upon any hard substance, the slides are quite likely to get scratched by the particles worn from the stone. If the grinding has been well done and the stone not too coarse, the edges will present a very neat appearance without additional labor, but if their edges are polished they will equal those of the dealers. In glass-factories polishing is done upon wooden wheels with the surfaces charged with emery, or some other polishing substance. I have succeeded very well by the following simple method: I take a soft, pine board and place upon it a quantity of emery and water, and rub the edges upon the wood and emery. A groove soon forms in the soft wood, into which the emery is scraped, and the edge is rubbed until a good polish is obtained. Sheets of fine sand or emery-paper may also be used with success.

In this, as in every thing else, care and observation tend toward perfection. As the fancy paper covers are now nearly abandoned, and very properly too, I think, ground edges are a necessity, if one would have his cabinet present an attractive appearance, and make his work popular with others. A few persons grind off the corners of their slides, making them quite round. If this were a uniform custom it might not be objectionable, but as they are in a hopeless minority, it is advisable to abandon it entirely.

It may be asked whether it "will pay" to do all this. I can say that I think it will, unless one buys his slides in large quantities. Turning the stone with one hand and grinding with the other, I have ground twenty-five slides in an hour, which, at ordinary prices, would make my labor worth 75 cts per hour. But whether it pays or not in dollars and cents, a knowledge of how to do the work with simple means may not only lead to improvement in the appearance of many cabinets, but to the construction of many accessories made of glass, which are very useful about the microscope.

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Mounting in Balsam with Cells.

If a cell is made upon a slide with prepared balsam (by Merriman's method), Algæ and other objects of considerable thickness, may be mounted with great facility. The cell is allowed to dry until clear, and sufficiently hard to bear the touch of the finger. It is then filled with prepared balsam, thinned so as to flow readily. The Algæ may then be taken from the chloroform (if treated according to Stodder's method) and transferred to the cell. The cover being applied, little or no balsam will be found to overflow, and the mount may be set aside to harden. No spring-clip is required. For a short time the inner edge of the cell may be distinguished, but presently the cell and the interior fluid become a homogeneous block of balsam, and the mount is practically finished. A ring of gold-size or other cement, may be added if desired.

W.

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New Microscopes and Accessories.

In the article describing Crouch's "Histological" microscope, we were in error when we stated that the base was not of brass. The stand is made of brass throughout.

This month we take pleasure in presenting an illustration of Beck's "Economic" stand, which has been improved, and adapted to the wants of those who desire a cheap and good stand. When we have said this we have but very little to add, for in its original form this stand was one of the best known in the market.

The illustration shows the present model with rack and pinion. A tube for carrying sub-stage apparatus is shown on the right. This tube is held beneath the stage by a bayonet catch, and serves to hold various accessories, the most important of which are the paraboloid, the dark-well, the polarizing prism and the diaphragms.

This stand is very convenient and useful, and is attractive in appearance.

Including a 1-inch and a ¼-inch objectives, two eye-pieces and several small accessories and case, the stand, as figured, sells for $55.00.

When fitted with a movable glass stage it sells for $60.00, together with the same accessories.

Mr. W. H. Walmsley, of Philadelphia, is the agent for Messrs. R. & J. Beck, of London, and he keeps a full line of their goods, constantly on hand.

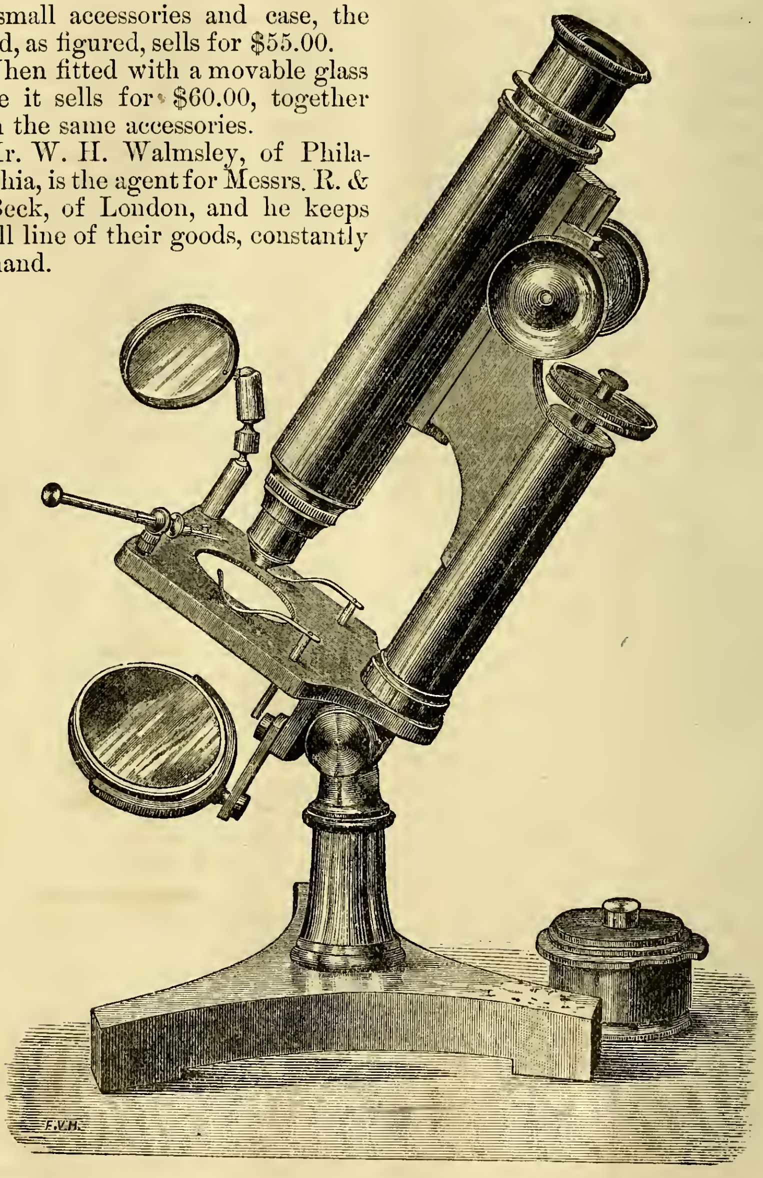

FIG. 16.

The Preparation and Mounting of Microscopic Objects.

I. CEMENTS AND APPARATUS.

Before entering upon a description of the processes of preparing slides for the microscope, a few introductory remarks will be made.

It is always a source of satisfaction to possess a good series of preparations, mounted at home, on slides which are well prepared and attractive in appearance. It is not a difficult task to mount any ordinary object, but to determine beforehand how it should be mounted, that is, whether dry, or in balsam, or in fluid, requires judgement as well as taste.

These articles are intended to be of assistance in deciding this and similar questions which are certain to arise in the mind of the beginner, as well as to instruct in the practical manipulations. By following the directions that will be given, any person of ordinary ability will find it possible to mount objects fully equal, in every respect, to those which are sold for seventy-five cents or a dollar, and in very many instances far superior to these.

As far as the intrinsic value of mounted objects is concerned, there is no doubt that the preparations made at home will be better than those from the shops, for the student is most likely to mount such objects as he finds interesting and with which he is, in some degree, familiar, and he will endeavor to bring the peculiarities of the object into view, even at the sacrifice of its general appearance. It is true that a large proportion of the slides sold by the opticians are only pretty or amusing objects, very attractive on the outside, but of little value to the student. On the other hand, many of the most valuable slides in private collections are dirty, besmeared with balsam, marred by air-bubbles, the cement spread as by a miniature white-wash brush, and labelled on irregular slips of paper of various colors. The preparer of such slides will probably say that they were made for "work" not for "show," and that he has not time to prepare what he calls, with no little contempt, "show-slides"—utterly oblivious to the old saying that what is worth doing at all is worth doing well.

The writer is not speaking from theory in this article, but from practice, and he asserts, in most positive terms, that it is no more difficult to prepare a neat slide without sacrificing its scientific value in the slightest degree, than it is to prepare the same object in a slovenly manner, and it requires no greater expenditure of time. Therefore, whatever is mounted should be mounted in a neat and proper manner, or else, on some future day there will be a great destruction of old slides, because they are unfit for exhibition.

The processes for mounting that will be given in these papers are those which the writer knows to be good for durable preparations.

There are many kinds of cement in the market, but only a few of of them are necessary or desirable, half a dozen at the most will answer all demands. The most desirable cements and mounting media, and the only necessary ones, are the following:—

1. Canada Balsam. It is desirable that this should be rather thick, but the ordinary balsam of the drug-stores is good enough. Balsam thickens by keeping and will eventually become quite hard, even brittle. Old balsam is very valuable for some purposes. The yellow color can be almost completely destroyed, by exposing the balsam to sunlight for a long time.

2. Canada Balsam in benzole, chloroform, ether or other solvent. Perhaps the kind most generally useful is the benzole-balsam. To prepare this, take balsam that is quite hard, either very old balsam or some that has been heated until it is artificially hardened, and dissolve it in benzole. Make a sirupy solution for a mounting medium, and dilute a small portion of this

until it will flow freely from a brush, for use in finishing slides.

3. Asphalt or Brunswick-black. Either of these can be purchased from dealers better than they can be made, without considerable trouble to procure the proper materials.

4. Gold-size. This can be purchased from dealers in artists' materials. It is a good cement, but the writer never uses it alone.

5. Asphalt and Gold-size. Mix one part of good asphalt-cement with one part of gold-size. For fluid-mounts in general, there is no better cement known; but it must be used strictly according to the directions, which will be given in a future article.

6. Shellac. A solution of shellac in alcohol is indispensable. The common shellac is good enough, for the color does not show on the finished slide. The simplest way to make a small quantity, is to dissolve the shellac in alcohol and wait for the insoluble portion to settle, so that the clear solution can be poured off. A little mastic can be dissolved in the alcohol, by heating, and will give greater elasticity to the cement.

7. Glycerin-jelly is a convenient mounting medium. It is advisable to purchase this, or else use in its stead, Deane's "gelatin medium."

All these cements should be kept in wide-mouthed bottles provided with good corks, through which a suitable brush is passed. By keeping the neck of the bottle clean, this method answers very well. A wire or a glass rod passed through the cork of the balsam and glycerin-jelly bottles, is very convenient for taking out portions as required.

In addition to the cements enumerated, a few others may be used for special purposes with advantage, but they are not necessary. They will be referred to in the proper places.

For dry-mounting, some brass curtain-rings, selected to fit the covers, are very useful; but the wax-cells described by Dr. Hamlin* are quite as good, and more readily adapted in size, depth, etc., to the various objects.

There are but few instruments necessary for mounting purposes, and these need not be enumerated. We will only say that a pair of cheap, brass forceps, a few needles mounted in wooden handles, a spirit-lamp, turn-table, slides and covers, are all that are absolutely necessary. The covers should be of three sizes, the most useful measure respectively, ½, ⅝, and ⅞ of an inch in diameter.

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Procuring and Cleaning Diatomaceæ.

It was my good fortune to discover a locality at Citronelle, Alabama, very rich in fresh-water forms, and my plan to utilize my "find" was as follows:—I placed about a gallon of the swamp-muck in a bucketful of water, and thoroughly stirred the mass until it became entirely desintegrated; by this means all of the sand settled at once to the bottom, the water, with the decayed vegetable matter held in suspension, was passed through a coarse sieve to separate the grosser parts, and the water passed again through a sieve with finer meshes; the resulting vegetable matter was then compressed to drive out as much water as possible. After this treatment, it was spread out on an iron ash-pan from a coal-grate, and then submitted to gradual heating over the grate; in about half an hour the entire mass was reduced to a very fine ash, on account of the vegetable matter drying, igniting

* This Journal, page 46.

and burning up. This ash, when examined under a high-power, revealed the valves of the contained diatoms in an almost perfect state of transparency. The water remaining over from the first operation was allowed to stand twenty-four hours, when all of the fine particles in suspension settled down to the bottom, and were easily collected, dried, and burned for the diatoms. Samples of the material secured by the above process will be sent to any one, gratis; my address is in the "Exchange" column.

A quick way of getting marine forms of diatomaceæ is to take a peck of fresh oyster-shells, and brush the back of each one into a basin of water; as this fluid is without body, it would be well to cut up some cotton into tufts and immerse it in the fluid, which will make the product suitable to be dried and ignited, as it will take fire at a red-heat and entirely burn; it will, however, take a stronger heat to destroy the particles of animal matter of the oyster—the young spawn which will naturally be brushed into the water. This oyster-shell process will give Pleurosigmas and Coscinodiscus in abundance. The fresh-water diatomaceæ from the Citronelle deposit contains more than thirty kinds of diatoms, many of which will come in the field of view at one time; and for variety, surpasses any of the fossil deposits of nearly twenty localities that I have examined.

K. M. Cunningham.

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Micrometry and Collar-Adjustment.

In his deservedly popular book *How to Work with the Microscope*, Dr. Beale insists, with good reason, on the importance of making drawings of objects examined, and points out that the value of such sketches is often greatly diminished by the absence of any statement of the magnification used in making them. But he has fallen into an error which should be corrected, because it is made by an acknowledged expert.

He recommends that scales be drawn or printed, showing the size to which hundredths or thousandths of the inch or centimeter are magnified by each of the objectives used; and one of these scales corresponding to the objective employed, he advises, should be pasted on every drawing. He has omitted to mention the fact that in all objectives made with a collar-adjustment, the magnification at the "open" and "closed" points varies so much, that scales made in the manner suggested would be not only worthless, but misleading.

The fact of a difference existing is, of course, well known, and among the methods of nomenclature for objectives, one having strong support is based on the magnification without ocular and at the "closed" point, with a ten-inch tube. The amount of this difference, however, does not seem to have been sufficiently taken into account. This will be best illustrated by a table showing the variations in a few objectives of well-known makers, taken with a tube ten inches in length, measured from the stage-micrometer to the end of the tube proper (not to the end of the eye-piece):

Objective.	*Oculars.* A.	B.	C.
Geo. Wale 1-6 inch, open........	262	433	680
do closed.......	283	466	725
Powell & Lealand 1-8 inch, open..	392	650	1025
do closed	500	833	1300
Spencer & Sons 1-10 inch, open...	462	750	1200
do closed..	533	887	1400
Wm. Wales 1-15 inch, open......	517	850	1350
do closed.....	733	1200	1900

It will be seen that the range in magnification is greater with some lenses than with others, the difference increasing with the increase of power, but with, all it is so great, that such scales as we have referred to, would be worse than useless. Accuracy can only be obtained by using the micrometer with the collar-adjustment at the same point at which the object sketched has been examined, unless, indeed, one were willing to take the trouble of compiling a table for each objective, with the magnification noted for each division of the collar through the whole range from "uncovered" to "covered." J. D. C.

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Cover-glasses.

There seems to be no good reason why the dealers should not furnish cover-glasses accurately assorted as to thickness. This does not appear to be done. Our most reliable opticians have two or three grades, but these are by no means carefully assorted; and one who buys in the expectation of getting the thinnest covers at even a relatively high price, is apt to find himself disappointed.

I have recently measured three lots of covers by means of a good "lever-of-contact", measuring to thousandths of an inch, and give the results below. The covers were obtained from a first-class house, and my experience corresponds with that of friends. The method used was to put the covers in separate piles and measure the height of the several piles or columns.

First lot, 2 oz. marked $\frac{1}{150}$ to $\frac{1}{200}$-inch, making a column 68 mm. high, price $1.75 per once.

Those	.005 in. thick,	measured	1mm.	in height.
"	.006	" "	13	"
"	.007	" "	18	"
"	.008	" "	12	"
"	.009	" "	6	"
"	.010	" "	6	"
"	.011-.013	" "	8	"
'	.014-.016	" "	4	"
			68mm	

From the foregoing it will be seen that less than one-third of the covers came within the limits marked by the label, and two-thirds belonged to the cheaper grades in the catalogues. Only one sixty-eighth were of $\frac{1}{200}$ or .005 of an inch in thickness, and yet that thickness of cover is a very ordinary one for use with moderately high powers. By far the greater part of the whole are only fit for covering opaque objects, or objects for low powers.

To say nothing of the overcharge for an article which is not what it purports to be, there is a more general consideration of interest to all microscopists. We ought to be able to purchase readily, any thickness of cover desired, and to be able to rely on its measurement. The lever-of-contact is a somewhat expensive instrument, and in an hour or two one could measure all the covers he would use in years. The dealer should do this work and give us the assorted covers in thoroughly accurate shape, so that one could order any thickness from .002″ upward.

The second and third lots, measured with the one analyzed above, were labelled respectively $\frac{1}{100}$″ to $\frac{1}{150}$″ and $\frac{1}{50}$″ to $\frac{1}{100}$″. Number two contained none so thick as some that were in number one, and both the second and third lots answered very well to their labels.

R. B., Jr.

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The Simplest Forms of Life.*

BY B. EYFERTH.

Infusoria.—(*Continued.*)

The bodies of Infusoria consist of a soft, colorless, granular parenchyma, which passes into a some

* Translated from the German, by the Editor.

what denser outer layer, and a transparent, structureless membrane, or cuticula. In many species the three layers are readily distinguished, in others they pass imperceptibly from one to another. The parenchyma is capable of contraction and expansion. Many species can only bend and curve themselves to a slight extent, and their shape is, therefore, quite definite; others can stretch out or contract, bend and writhe the entire body, and their forms are constantly changing—metabolic. Externally, the body is furnished either with one or several whip-like appendages—flagella,—or with suctorial tubes, which are expanded at their ends—tentacles,—or with cilia of various lengths and sizes, which may completely cover the body or be found only on certain parts of it. Hence, the class of Infusoria is divided into three orders:

Flagellata (Flagellifera).
Acinetina (Suctoria, Cl. and L.).
Ciliata.

Only the Ciliata are positively known to be provided with a mouth. Whether the Flagellata possess a mouth is not certainly known. All have, however, in the outer parenchyma, near the surface, at least one contractile vesicle. If, as is usually the case, only one vesicle is present, it generally lies near the posterior end of the body. Many species have several vesicles, the number and position of which are generally constant. In the vesicles a watery fluid periodically collects from the body-mass, and from time to time is suddenly emptied, a portion always passing out through an ever-present opening in the parenchyma.

The outer parenchyma of all Infusoria contains at least one nucleus, often more of them, and in many, (not all) near the nucleus, or in a cavity of it, is a smaller nucleolus. Both are sharply defined, with a structureless membrane and homogeneous, finely granular contents. They are not always plainly visible, but become so by the action of dilute acetic or chromic acid, or by staining with carmine or red anilin solutions, which color them more intensely than the parenchyma.

The ordinary process of multiplication is by simple cross-division; longitudinal or oblique division takes place only in a few. What has been considered as longitudinal division is, in most cases, the separation of two conjugating individuals. Other processes of multiplication—by budding, swarmscions or embryos (eggs?)—are often observed in single genera, but we cannot yet regard these as general phenomena. All of them are introduced by the division of the nucleus, or at least accompanied by it. Von Siebold and after him Kölliker, Clauss, Häckel and others, therefore, regard the nucleus in the Infusoria as analogous to the cell-nucleus of plants, indeed, the Infusoria themselves as unicellular animals. On the other side, especially by Stein, these ideas are strongly opposed, for the differentiation of the infusorian body seems to be too much complicated for a simple cell; it might be regarded as a many-celled structure not resolvable by our optical and chemical means, or else as a fusion of different cell-combinations.

Still others reach the conclusion that the ordinary conception of a cell is not applicable to these low organisms.

Many, if not all Infusoria possess the peculiar faculty of contracting into balls under unfavorable conditions of life, *e. g.*, want of water, and by the secretion of a firm, membranous capsule—cyst—thus guard for a long time against complete drying, or starvation. If more water is added the cyst bursts and the animal lives as before. In many species, division into 2, 4, or more individuals takes place within the cysts; some appear to become encysted for this purpose alone.

The minute cysts are lifted up and carried along by the winds from the shores and bottoms of dried up ponds, and widely distributed with the dust which is suspended in the air. The occurrence of Infusoria in all suitable liquids which are exposed can be thus explained without the necessity of assuming their spontaneous origin (*generatio æquivoca*). For this reason also, when the air is dry more numerous forms appear than during wet weather.

The ordinary habitat of the Infusoria is determined by the food upon which they live, which is partly solid and partly liquid. Some kinds live only in fresh-water among Algæ, upon which they feed, or among which they find other animals which afford them nourishment. Others, which live upon foul organic matter, are found only, or at least in greatest abundance, in stinking puddles or infusions. The last are especially important in the household. They remove foul matter in the shortest time, for they consume the organic detritus before its complete decomposition into its elements.

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The Buffalo Meeting of the American Society of Microscopists.

(*Concluded.*)

To observe the course of these burning grains to advantage, cause a pistol charged with coarse powder to be fired in the dark at a distance of a few meters and at right-angles to your line of vision, and the tiny projectiles will be seen to describe graceful curves, each one mimicking, within the range of two or three meters, the trajectory of the leaden bullet in a course five hundred times as long. If the shot be fired through glass at a distance of one or two meters, the ball will pass through leaving a hole that will vary somewhat in appearance according to circumstances, and the burning powder grains will leave, where they strike the glass, pale, grayish stains which look somewhat like grease-spots, or like the fungoid specks where diseased flies have adhered to the glass in autumn. They may be recognized, however, by their grouping around the bullet-hole, by their microscopical appearance, and by chemical analysis, since they do not behave like grease in the presence of suitable tests; and Mr. Hagan has repeatedly obtained from them the sulphurous reaction of blackening a microscopic quantity of a salt of lead. Being caused by the burning powder-grains, they indicate with certainty that the shot was fired near the surface; and a further hint as to the distance may sometimes be obtained from the degree of lateral or vertical displacement of the whole cluster as measured from the position of the ball-hole, the trajectory of the grains being considerably modified, and that of the ball not perceptibly so at such distances, by gravity, or by a strong lateral wind. Still more interesting and suggestive are the appearances when the grains are fired against wood, paint, clothing or the human face; the latter experiment being often tried by small boys who look into the touch-hole of a small cannon on the Fourth of July, to see whether the cannon is going off or not, and with the familiar result of being so well satisfied of the fact that they can prove it any time thereafter. In such a case the burning grains may scorch and smut the surface, and the whole grains may bury themselves entirely below the surface, from beneath which they can readily be dug out, still in a condition capable of exploding. If the grains be small or positive identification be required, by keeping the grain distinctly in view during the manipulation, it should be performed only under the microscope. How small a quantity can be thus treated may become an important question. Every intelligent person at all informed as to microscopical manipulation knows that an object of which it would require thousands to weigh a grain, can with perfect ease and certainty be manipulated, examined, preserved and re-examined by any person of ordinary skill and ample experience in such work. To determine whether minute particles of powder could be not only seen and handled but also burned with characteristic results, and finding it inconvenient to weigh such minute quantities, I procured one decigram (½ grain) of powder carefully weighed, and found it to contain by actual count one-hundred and fifty-three particles. Several of them, of average size, were selected, each of them being by estimate about the 1-100th of a grain in weight. One of these particles, tested by being placed on a strip of platinum-foil covered loosely with a cover-glass, and gradually heated over a spirit-lamp till it burns, will explode with a distinct flash and an audible sound, both flash and sound being perceptible to several persons at once in distant parts of a small room. Similar results, though less in degree, were obtained from smaller quantities, estimated to be one-tenth as large, or 1-1000 grain. The experiment should be tried in a partially darkened room, but still so light that the black particle can be distinctly seen and its identity assured until it explodes. A cloudy, grayish stain is left upon the under surface of the cover-glass, whose appearance is distinctly suggestive of the flash. As there is usually no difficulty in digging out grains as large as those I have mentioned, this test may be said to be applicable to cases where unaltered powder can be found imbedded. In this manner have been identified as powder, black particles taken from spots which had previously been characterized as pencil-marks, and which, if powder, would absolutely prove a shot to have been fired from a position different from that which was understood to be implied in the theory of the prosecution. Examined under the microscope while still, and recently, imbedded in some dry substance, the powder grains appear to be dry and dark, and granular; and their size may often be so fully determined as to indicate positively to which of two different kinds of powder they belong. After being repeatedly or persistently moistened, they become brownish, and spongy in appearance, and may be surrounded by an efflorescence of nitre which is very characteristic. In some cases they become surrounded by a bluish ring on the white paint they have penetrated, believed to be produced by a reaction between the sulphur of the powder and the lead of the paint. Usually some of the grains only indent the film of paint, or the weather-hardened face of the wood, without imbedding themselves; and this may be true of all if the grains be small, the distance great, or the charge light. At a medium distance, the largest globular grains may imbed themselves fully, while the flat, lenticular grains, if they strike upon their flat side, will only indent the wood, but if they strike edgewise will cut partially into the fibres if crossing their direction, but bury themselves deeply between them if they strike with a cutting edge in the direction of their length. In these various ways may suggestions be gained as to the kind of powder and weapon used, the weight of the charge, the distance fired, the time that has elapsed, and the treatment to which the surface may have been subjected by nature, by accident, or by design. Further light may be obtained from the character of the hole made by the ball in passing through the glass; but this is independent of microscopical aid.

These hints concerning some of the fresher fields of microscopical study, show that it is timely as well as fascinating, practical as well as scientific. We pursue it at a favorable time. Never before was the microscope as serviceable an instrument as at present; never before were good microscopes so plenty and so cheap, or cheap microscopes half so good; never, perhaps, were more important fields for work fully open and recognized but yet unoccupied. We shall do poor work, indeed, if we do not make the microscope not only a source of pleasure to ourselves, but of more serious profit to science and to humanity.

Second Day.—The second day of the meeting opened with a large attendance of members.

A communication from Mr. E. H. Griffith, of Fairport, N. Y., offering special inducements to the preparer of the best series of slides, illustrating the adulteration of some common articles of food, was received, for which the thanks of the Society were tendered.

Dr. Lucien Howe, of Buffalo, read a somewhat technical paper on the "Development of the Eustachian Tube and the Middle Ear." He called attention to the apparent contradiction of the authorities on the subject of the development of this tube, and described its appearance in ten embryos, representing as many different stages of development.

"In an embryo, 56$^{mm.}$ in length, the appearance is not unlike that described by Kölliker, in a chicken, at the tenth day of fœtal existence. In another of 78$^{mm.}$ in length, the sides of the first branchial fissure have not only closed, but in doing so have apparently left a spot or opening between them at one point, and the pharyngeal wall in that vicinity is bent outwards, as it were, into a kind of diverticulum towards the otic vesicle.

"In a still older stage this vesicle is increased in length by the formation of new tissue, about the apparent pocket from the pharynx, until finally the middle ear appears at its extremity. It will readily be inferred that the opening which persists on the sight of the otherwise closed branchial fissure, and at which point the middle ear afterward appears, is, in fact, the rudiment of that cavity."

Dr. Carl Seiler, of Philadelphia, followed with a paper on "Photography as an Aid to Microscopical Investigation." It was a practical and interesting paper, and calculated to interest microscopists.

The next paper was read by Prof. J. Edwards Smith, of Cleveland, Ohio, entitled, "Remarks concerning Modern Objectives."

Afternoon Session.—Mr. J. D. Hyatt, of Morrisania, New York, City, President of the New York Microscopical Society, presented the Society with a copy of *The American Quarterly Microscopical Journal*, sent by the publishers.

Dr. Geo. E. Blackham, of Dunkirk, N. Y., gave the results of a series of careful measurements of the objectives of the best known manufacturers.

He had measured the actual amplifying power of the objectives at ten inches from the front surface of the front lenses; the frontal distance; the working distance; the clear aperture of the front lens; the diameter of the field; the flatness of the field; the chromatic correction; also the number of the diatom on Möller's balsam test-plate, that could be clearly resolved by the lenses, with light from a lamp and mirror, and the number of the diatom on the same plate that could be just glimpsed under the same conditions, and lastly, the number of lines per .001 of an inch, which could be clearly resolved.

This actual performance of the lenses was compared with the descriptions given by the different makers, and so tabulated that the comparisons could readily be made.

Mr. C. C. Merriman, of Rochester, N. Y., read the next paper, which was on the "Preparation and Mounting of Double-Stainings." It called forth a lively discussion in which Drs. Seiler, Blackham, Rezner, Prof. Smith, Mr. J. D. Hyatt, and others participated.

Following Mr. Merriman, Prof. J. Edwards Smith gave a short description of a new microscope-stand, which he stated had been devised by himself and the manufacturer, during the last year. The stand exhibited was a compact instrument, combining most of the latest valuable improvements in the microscope.

Third Day.—Dr. Theodore Deecke, of the State Lunatic Asylum, at Utica, N. Y., addressed the society upon "The Microscopical Examination of the Nervous Centers." He exhibited some of his wonderful sections of the entire human brain, which must be seen to be appreciated. With an instrument of his own device, he had succeeded in cutting sections as thin as the $\frac{1}{500}$ of an inch, but thought that those about the $\frac{1}{400}$ of an inch were better adapted to microscopical examination. He cut the sections in a liquid by means of a large knife, which was used with a saw-like motion. In transferring the sections from one liquid to another, he used a sheet of blotting paper.

Prof. D. S. Kellicott read a second paper "On certain Crustaceæ Parasitic on Fishes from the Great Lakes." It was finely illustrated by drawings, on a large scale.

The paper was a detailed description of the peculiarities of these parasites.

At this stage of the proceedings, the Executive Committee handed in their report on the Constitution. The report was received and accepted.

A Nominating Committee, consisting of Dr. Blackham, Prof. Tuttle, Prof. Kellicott, Dr. Ward, Geo. E. Fell, J. D. Hyatt, and C. M. Vorce, was appointed to nominate the officers for the coming session.

Dr. Lester Curtis and Mr. W. H. Bulloch, on behalf of the "Illinois State Microscopical Society," and of the "Chicago Academy of Sciences," invited the Society to hold its next meeting at Chicago. Prof. Albert H. Tuttle invited the Society to hold its next meeting at Columbus, Ohio, and Mr. W. H. Brearley, of Detroit, Michigan, tendered the hospitalities of that city for the next meeting. All of these invitations were referred to the Executive Committee.

Afternoon Session.—Soon after the Society was called to order, President Ward resigned the chair to Mr. J. D. Hyatt, and presented the following report from the "National Committee on Micrometry," of which Dr. Ward is Secretary:

"Buffalo, N. Y., Aug. 21, 1879.

To the American Society of Microscopists:

"During the past year, a Committee upon the subject of Micrometry has been organized, representing a large number of the microscopical societies of the country, and consisting of the following members:

"Prof. Wm. Ashburner, San Francisco, Cal.; President, F. A. P. Barnard, Columbia College, N. Y.; Lester Curtis, M. D., Chicago, Ill.; Geo. E. Fell, C. E., Buffalo, N. Y.; Henry Jameson, M. D., Indianapolis, Ind.; Prof. S. A. Lattimore, Rochester, N. Y.; Rev. Samuel Lockwood, Freehold, N. J.; Prof. Edward W. Morley, Hudson, Ohio; Joseph G. Richardson, M. D., Philadelphia, Pa.; Prof. S. P. Sharples, Boston, Mass.; Prof. Hamilton L. Smith, Geneva, N. Y.; Prof. A. H. Tuttle, Columbus, Ohio; C. M. Vorce, Esq., Cleveland, Ohio; R. H. Ward, M. D., Troy, N. Y.; J. J. Woodward, M. D., Washington, D. C.

"This committee, as a result of individual consideration of the subject and correspondence with microscopical societies and students, would respectfully and unanimously tender a report of progress to the American Society, and respectfully request this Society to rescind its approval of the one-hundredth millimeter as a unit for micrometry and to refer that question, together with those of securing precision and international uniformity, to the committee for further action."

The report was adopted, and the society rescinded the $\frac{1}{100}$ of a millimeter as a unit, and referred the matter back to the "National Committee."

Mr. Thomas Taylor, Microscopist of the Department of Agriculture at Washington, D. C., was next introduced by the President, and he proceeded to explain the work of his department.

Mr. C. M. Vorce, Vice-President of the Society, gave the results of his labors in investigating the comparative destructiveness of certain insects, such as the grasshopper, locust, cockroach, etc. He had made a series of microscopical examinations of the contents of the stomachs of these insects. The grasshoppers appeared to subsist on living plants, while the cockroach and many other insects, sought out decaying matter, either vegetal or animal in its nature.

Prof. S. A. Lattimore followed Mr. Vorce, with a description of different waters, which had come under his observation. He had been requested to discover the cause of the death of fishes in Hemlock Lake, the water supply of Rochester, and on examining some of the fishes which had been sent to him, he found what he thought to be a fungus growth on the surface of the body.

Dr. H. R. Hopkins, in behalf of the Local Committee, invited the members of the society to enjoy an excursion to Niagara Falls, on Friday, at 2 P. M.

The invitation was accepted, and the meeting adjourned.

The Microscopical Soirée.—One of the most interesting features of the convention, was the Microscopical Soirée. It was given under the auspices of the "Buffalo Microscopical Club," at St. James Hall, one of the most commodious halls in the city.

The instruments were arranged on revolving tables, furnished principally by Messrs. Mills & Fell.

Fourth Day.—After the election of members, business matters of importance were taken up. The Executive Committee were empowered to act in the matter of publishing the transactions, and to procure the minutes of the Indianapolis meeting. The publication of the proceedings of the Society is now in progress.

Dr. W. D. Rezner, of Cleveland, made some remarks on the illumination of fine rulings. He explained his method of silvering the ruled plates, and claimed that it made them less difficult to resolve; also, that he was able to easily resolve the 120,000-band on Fasoldt's plate, when so prepared. Remarks on the same subject were also made by Prof. J. Edwards Smith.

Mr. Geo. E. Fell, acting Treasurer, presented his report, showing a balance on hand of $267.90, with dues to be received.

Prof. D. S. Kellicott, Chairman of the Nominating Committee, reported the following nominations for officers of the coming meeting, and on motion, the Secretary cast the ballot in their favor.

The new officers of the Society are the following:

President, Prof. H. L. Smith, Geneva, N. Y.; Vice-Presidents, W. Webster Butterfield, Indianapolis, Ind., and C. C. Merriman, of Rochester, N. Y.; Secretary, Prof. Albert H. Tuttle, Columbus, Ohio; Treasurer, Geo. E. Fell, Buffalo, N. Y.; Executive Committee, Dr. W. D. Rezner, Cleveland, Ohio, Dr. Carl Seiler, Philadelphia, Pa., and Dr. W. C. Barrett, Buffalo, N. Y.

President elect H. L. Smith, thanked the Society for the unexpected honor conferred upon him, and stated that with the aid of the members, he would endeavor to discharge the duties of presiding officer to the best of his ability.

He hoped that the members would not forget that the honor of American Microscopy was in their hands. He also expressed the hope that only valuable scientific papers, and many of them, would be presented at the next meeting, and that material advancement would be reported at that time.

At the conclusion of Prof. Smith's remarks, at twelve o'clock, the Society adjourned *sine die.*

EDITORIAL.

—We take pleasure in announcing that we have established an Agency for the sale of American and Foreign Scientific Books and Periodicals, and that we are prepared to receive and to promptly fill orders for books and magazines of all kinds.

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—Professor Wm. A. Rogers has recently returned from a visit to London and Paris, whither he went for the purpose of verifying the standard-yard and the standard-meter which he has employed in his investigations of standard lengths.

The yard was compared with the Imperial-yard, "Bronze 19," by Mr. Chaney, the Warden of the Standards, and found to be about three ten-thousandths of an inch too short, at 62° F.

Professor Rogers obtained two copies of the meter of the Archives, one a line-meter on a copper bar, with platinum ends of the new form, made and signed by Mr. Tresca, now Director of the Conservatory of Arts and Meters, at two o'clock on the morning of February 6th, 1880; the other an end-measure, made by M. Froment, which was, in 1868, found to be 8.43/ʹ longer than the meter of the Archives, at 0 ° C.

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—The twelfth volume of the U. S. Geological Survey of the Territories in charge of F. V. Hayden, has just been issued. This volume is a large quarto, and it contains Professor Joseph Leidy's report on the Fresh-water Rhizopods of North America, illustrated by forty-eight full-page, lithographic plates, with over 300 pages of letter-press.

The value of this contribution to the knowledge of Rhizopods cannot be over estimated. Professor Leidy has devoted several years to the study of these minute and interesting animals, and we need hardly say that no other man, in this country at least, is capable of making a report like this—so accurate and so good.

We have already examined some parts of the work with care; not only is it well done, from a scientific point of view, but the descriptions are so remarkably clear, and the habits of the various species are given in such an interesting way, that one seems to be familiar with the animal without having seen it. Indeed this is a book that might well be read by those who fail to appreciate the attractions of microscopical study, for it is written by one who is an enthusiast, we think, as well as a careful observer.

Professor Leidy has given more attention to the classification and naming of the forms he has met with, than to the elucidation of structural details, but the latter have not been entirely neglected.

The class Rhizopoda, is divided into five orders, *viz.* I. Protoplasta; II. Heliozoa; III. Radiolaria; IV. Foraminifera; V. Monera.

The first two orders are commonly designated as the "fresh-water Rhizopods," the Radiolaria and Foraminifera are marine. As regards the fresh-water forms, Professor Leidy says:— they "are to be found almost everywhere in positions kept continuously damp or wet, and not too much shaded. They are especially frequent and abundant in comparatively quiet waters; clear, and neither too cold nor too much heated by the sun, such as lakes, ponds, ditches and pools. They are also frequent in wet bogs and savannas, among mosses, in springy places, on dripping rocks, the vicinity of water-falls, springs, and fountains, and in marshes, wherever the ground is sufficiently damp or moist to promote the growth of algæ."

The Protoplasta are divided into two sub-orders, Lobosa and Filosa, distinguished mainly by the pseudopodia, which, in the former are finger-like or lobose, and in the latter filamentous.

The Heliozoa, or "sun-aminalcules" are commonly spherical in shape, with delicate pseudopodia radiating from every part of the surface of the body.

After describing the various genera and species, there are given "Lists of Fresh-water Rhizopods, indicating the many forms which occur together in certain localities," and a valuable bibliography of the fresh-water Rhizopods.

We regret that we cannot give a more extended notice of this book, but in attempting to enlarge upon several points we soon found that it was impossible to do justice to the subject, in the space at our disposal.

While we heartily approve of the system under which such valuable and expensive books can be published by the Government, we cannot but regret that when those books are issued, they are not to be obtained by the persons who most need them. The method of distribution is very defective, and probably always will be, unless the books are put on sale at a price even below the cost of production. We strongly favor the sale of Government publications of this nature; for although students of science are not usually men of wealth, and comparatively few would be able to purchase the more expensive books, nevertheless a larger number of such publications would find their way into the hands of scientists, than is they do under the present system.

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Dr. Treadwell's Evidence.

Dr. Treadwell writes to us that the report of his testimony in the Hayden trial, which we published last month, has placed him in a false position.

We are pleased to learn that he disclaims the assertions regarding the possibility of identifying human blood, that have been attributed to him, and his letter will have all the prominence of the former article.

We quote from it the following portion:

"In the March number of your journal—a copy of which some one has kindly sent me—you quote me as saying in my testimony in the Hayden case, 'In one instance he testified, after measuring only four corpuscules (having accidentally lost the others) that ranged from $\frac{1}{2357}''$ to $\frac{1}{3368}''$ in diameter, as follows: I am quite positive that these were human blood-corpuscles, and that they did not belong to the blood of the pig, sheep, goat, horse or cat. In another place referring to some other examinations, he stated that he had obtained certain proof of human blood in one instance only (this was from stains on a knife). Further on you say 'This review is based upon the reports of the trial given by the daily New York papers, which seem to be quite reliable.'

"I wish to say that the expression 'I am quite positive that these were human blood corpuscles,' and the statement that I had 'obtained certain proof of human blood in one instance only,' or in *any* instance, originated very far outside of my testimony. I gave no opinion whatever as to any blood being human blood except in distinction from the blood of some animal or animals named, and I defy any person to show that I have ever expressed such an opinion as alleged, in any of the comparatively numerous cases in which I have testified. I have always been careful to state that there are animals whose blood cannot be distinguished from human blood and that consequently the latter has nothing in itself by which it can be identified or its origin determined. That I have thus testified in every case in which I have been engaged and in which the question of the possibility of distinguishing the blood of man from that of other mammals has arisen, I can abundantly prove. If you will take the trouble to obtain and consult the official stenographer's report, you will find that I testified to this effect in the Hayden case.

"One of the fractions given in your quotation is incorrect, as is also to a great extent the statement in regard to the identification of the 'five specimens of blood.'"

J. B. Treadwell.

CORRESPONDENCE.

To the Editor—Having frequently noticed the perfect ease with which one can keep both eyes open when using the binocular as a monocular microscope—in fact, a novice will generally think that he is using both,—I thought that the following simple arrangement would be of value to those who use the monocular, but who have not learned to keep both eyes open, as is recommended, while using only one at the tube. Indeed, there are many persons who find it a very difficult matter to do this. I am convinced that the fatigue, and often pain felt after using the microscope is almost entirely due to the closing of the eye not in use. (In some cases it is caused by too intense or too feeble illumination.)

The arrangement is simply a blackened piece of sheet-brass, cut to the required shape and attached to the eye-end of the microscope-tube in the manner best suited to the instrument. A convenient way is to attach it to the cap of the eye-piece. The eye not in use may then be kept open with perfect ease, and will not receive images of external objects to interfere with the image in the other eye.

Edward Pennock.

[Mr. Pennock has kindly sent us one of the shades mentioned in his letter, as made by Messrs. J. W. Queen & Co., and it certainly is the best thing we have ever seen for the purpose.—Ed.]

NOTES.

—The long-expected book of Professor J. Edwards Smith, "How to see with the Microscope," is now in the hands of a publishing house in Chicago, and is expected to be out in March. We look to its publication with much interest, and will give our readers early notice of its contents.

—A sixth edition of Carpenter's excellent book, *The Microscope and its Revelations*, is in preparation, and will be ready next fall. The fifth edition is out of print.

—The *Medical Record* cites an instance of the discovery of Trichinæ in fishes. Near Ostend, on the North Sea, the worms were found in abundance in the flesh of fishes. It is supposed that they had eaten of the offal in the harbor.

—An exceedingly interesting and valuable paper by D. D. Cunningham, entitled "On certain effects of Starvation on Vegetable and Animal Tissues," is published in the January number of *The Quarterly Journal of Microscopical Science*. The experiments on vegetable tissues were conducted by cultivating certain Fungi (*Choanephora, and Pilobolus crystallinus*) in various ways; and for the study of animal structures, larvæ of the toad, *Bufo melanostictus*, and of *Rana tigrina*, were chosen. We regret that we can only direct attention to this article, not having space to notice it more fully.

—Mr. H. F. Atwood, in a private letter to the Editor, writes as follows: "I am using something new in the way of aquaria for Entomostraca, and it works well and makes rather unique ornaments for the window. I use the glass balls such as sportsmen use for trap-shooting. The ones now hanging in my window are of blue glass, and the Entomostraca are doing well, propagating fast, and of course are quite conspicuous, owing to the balls magnifying somewhat. Half a dozen hung in the window present a rather pretty appearance, and I have different families in each." It has suggested itself to us that by using such glasses of different colors, some interesting comparative experiments might be made on the effect of colored light upon the growth and multiplication of various microscopic organisms.

—We have lately received "A Condensed List of a few of the Most Desirable Microscopes, of moderate cost, and accessories, mounting implements and materials," etc., from Messrs. R. & J. Beck, of Philadelphia, and also a "Supplementary Catalogue of new and second-hand Microscopes, Microscopic Apparatus and Telescopes," from Messrs. J. W. Queen & Co. Those who intend to purchase such apparatus would do well to send for both of these pamphlets.

MICROSCOPICAL SOCIETIES.

LANCASTER, PA.

The Microscopical Society of Lancaster, Pa., was organized February 9th, and has already reached the number to which its membership was limited—twenty-five. In addition to the business meetings, a monthly "conference" will be held for scientific lectures and discussions. A large portion of its members are physicians, but other professions as well as trades are represented. The President, Dr. J. W. Crumbaugh, delivered the first lecture, on "The Microscope," on the 16th of March. The new Society promises well and has our good wishes.

WELLESLEY, MASS.

The regular meeting was held Monday evening, March 9th, 1880, Miss Hayes, the newly elected President, in the chair. The first paper by Miss Beattie, on "Cell Walls," was finely illustrated by blackboard drawings, copied from her own work, as was also the next paper by Miss Cook on "Cell Contents." The remainder of the evening was occupied by Miss Whiting, who gave an exhibition upon the screen, of crystallization. The substances used were nitrate of silver, chlorides of ammonium, barium, potassium, sodium, calcium, sulphates of iron and copper, bichromate of potash, alum and camphor. Under the microscopes were shown, with parabola-illumination, several crystallizations, and in illustration of the papers read the following slides, prepared by Miss Painter: Crystalloids from potato-tuber; cystoliths from leaf of *Ficus elasticus;* crystals from onion, calla, and leaf of cactus; starch-granules from potato-tuber, and milk-sap of *Euphorbia;* stomata from leaves of lily and begonia, and cyclosis in stamens of *Tradescantia.*

M. VIRGINIA SMITH,
Cor. Sec.

LIVERPOOL (ENG.)

The third ordinary meeting of the twelfth session of this Society was held at the Royal Institution on Friday evening, March 5th, 1880.

Mr. Stuart, of Messrs. Ross & Co., London, exhibited and explained the principle of their new Patent Microscope, the chief advantage of which consists in a firm, thin stage and swinging substage.

The paper of the evening was by the President, Dr. J. Sibley Hicks, on "The Eyes of the Arthropoda." Dr. Hicks briefly described the condition of the eye in some of the Thysanura, pointing out that in two of the Genera of that Order the eyes consist only of dark pigment. After describing the conglomerate eye as seen in the common Millipeda, he proceeded to give a more detailed account of the eyes of Spiders. He showed that the disposition of the eyes in these harmless and much despised little creatures, although uniformly symmetrical, is extremely varied. Referring to their color and structure, he described the eyes of some spiders as being of the most brilliant hues; each eye a brilliant little shining hemisphere, and the tiny cluster of eyes grouped in front of the head in some of the Salticides, sparkling and glistening like polished gems, vying in color and lustre with the emerald and other precious stones. The structure of these eyes, although in a somewhat rudimentary condition, is the same as that which exists in the higher animals. The most important part of the paper was that which referred to the compound eye which belongs alike to the insect and crustacean. These animals have two compound eyes placed one on each side of the head, and each of these eyes, when examined under a low power, is seen to be divided into numerous facets which, in some instances are square, and in others hexagonal. The eye of the common house-fly has as many as 4,000 of these facets, and in some beetles the number is as large as 25,000. Dr. Hicks proceeded to minutely describe the internal structure of these compound eyes, showing that they are composed of numbers of cones and rods closely packed together, each rod and cone corresponding to a facet. Dr. Hicks combated the statement which is so frequently made in books that each of these facets represented a distinct eye, maintaining that such statements were not in accordance with recent microscopic investigation. After referring to the manner in which the retina of the higher animals is developed, he said no one could fail to be struck with the similarity and agreement in the fundamental plan of structure that exists between the layer of rods and cones of the retina (Jacob's membrane) and the arthropod eye. He showed by a series of diagrams the rods and cones of the fish, the bird, the amphibian, and the mammal, the similarity between these structures and the rods and cones of the compound eye being very striking. To his mind there was no question but that the rods and cones of the vertebrate eye have been originally derived from the crystalline cone and nerve-rod of the arthropod eye.

REVIEWS OF BOOKS.

The Microscope and Microscopical Technology; a text-book for Physicians and Students. By HEINRICH FREY, Professor of Medicine in the University of Zurich. Translated and edited by George R. Cutter, M.D. Illustrated by 383 engravings on wood. Second edition. New York: William Wood & Co. 1880. (Cloth, $6.00.)

We have always regarded this book, in its first edition, as one of the best works on the microscope that medical students or physicians could possess, but the second edition is far better, in many respects; the work has been thoroughly revised, much new matter and many new illustrations have been added, a bolder-face type has been used, and the size of the pages increased.

In the portion which treats of the theory of the microscope, one might reasonably expect to find the recent discoveries of Prof. E. Abbe, of Jena, recounted with some care, but we have only observed two or three brief allusions to his work. The only truly scientific basis for a complete theory of the microscope has been laid by Prof. Abbe.

Much good advice is given relative to the selection and use of objectives, but little or nothing is said about the capabilities of the best lenses that have been produced during the last three or four years.

We are pleased to notice that the objectives of American makers have been spoken of very highly, but we regret that in the American edition, no American stands are illustrated; although many German and French models are shown. This, however, does not detract from the intrinsic value of the work.

The practical part of the book, that part which relates to the work of the physician and histologist, is excellent in every way. The various processes of staining, injecting, preparing and mounting are well described, evidently by one who is practically familiar with them, and in treating of special tissues or organs, the best methods for their examination are given.

The press-work is excellent, far superior to what we usually find in scientific books —or others for that matter,—and the illustrations are all good.

Exchanges.

[Exchanges are inserted in this column without charge. They will be strictly limited to mounted objects, and material for mounting.]

Polyzoa, Palates of Mollusca, Foraminifera, Sponge and Holothurian-Spicules, Synapta-Anchors, Chirodota-Wheels, Echinus-Spines, Minute Sea Shells, in exchange for Polyzoa, Foraminifera, Histological and Pathological preparations, *etc.* Also, a quantity of Sea Shells in exchange for Land and Fresh-Water Shells.

F. M. HAMLIN, M. D., Auburn, N. Y.

J. J. B. Hatfield, Arsenal Avenue, Indianapolis, Indiana, will exchange Bleached Plant-Sections for good Diatomaceous material. List furnished on application.

Pleurosigmas and other unmounted Diatoms, both Fresh Water and Marine; also Marine Algæ, Ferns, and a large quantity of miscellaneous microscopical material in exchange for good mounted objects.

M. A. BOOTH, Longmeadow, Mass.

To exchange, well-mounted Slides of Hair for mounted or unmounted specimens of hair from the rarer animals; lists exchanged. WM. HOSKINS, 208 S. Halsted street, Chicago, Ill.

Nicely mounted Slides (opaque) of the Coal-tar Derivatives, chemically prepared, crystalline in form, showing their beautiful colors, in exchange for other well-mounted material. Chemical name and formula attached to each Slide. About a dozen varieties on hand. F. L. BARDEEN, M.D., 30½ Meigs street, Rochester, N.Y.

Vanadate of Ammonia, $(NH^4)^2VO^4$, Slides for the Polariscope in exchange for other Slides.

H. POOLE, Practical School, Buffalo, N. Y.

Slides mounted from injected Frog's Gall-bladder, Liver, Kidney, Stomach, Intestine and other parts, exchanged for other good and interesting preparations. C. BLASDALE, M. D., Jericho, Queens Co., N. Y.

Well-mounted, selected and arranged Diatoms, for good histological, pathological or anatomical preparation. State what you have, and terms of exchange.

W. W. RINER, Greene, Iowa.

Foraminifera from Sponge-sand, Marl-sand, and Chalk; Transparent Prisms of Carbonate of Lime from fossil Shells; Fresh and Salt Water Diatomaceous material; Carapaces of Rhizopods; polished sections of Fossiliferous Limestones, Corals, etc., to exchange for any microscopical material.

K. M. CUNNINGHAM, Box 874, Mobile, Ala.

The American Monthly Microscopical Journal.

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Double-staining of Vegetable Tissues.

Having used a number of dyes in double-staining vegetable tissues, the conclusion I have arrived at is, that no rules can be given which will ensure success in every case. The process is quite familiar to every working microscopist, but I have been somewhat surprised at the limited number who have fairly succeeded in differentiating the tissues.

In my own experience, I have met with some sections which obstinately refuse to act as they should, under the operation of the two colors, but even these, with patient manipulation, can be induced to show some results, even though they may not exhibit that sharpness and purity which it is the aim and object of the mounter to obtain.

I think that a writer in *Science Gossip* has come nearer to the true laws governing the process, than any one who has written on the subject; he has, at least, indicated the direction in which the practical worker must look to attain success. My own theory differs slightly from his, and consequently my process varies somewhat, but in the main it is the same.

It seems to me that the capacity for staining tissue resides more in the colors than in the tissue itself. A stain may be permanent, unless it is driven out. It may be driven out by some solvent, by some bleaching process, or lastly by some other color. Some tissues hold the stain more tenaciously than others, probably on account of their varying density. Thus the spiral and bass-cells will retain a color longer under the influence of a solvent, than the softer and more open parenchymal cells. I endeavor to take advantage of this property, by giving the whole tissue all of one color that it can be induced to take, and then driving it out of the parenchymal tissue by a stronger color, stopping the process at the moment when the second color has completely replaced the first color in the soft tissues, and before it has begun to act upon the more dense cells. If a section be stained with roseine, and then be left long enough in a solution of Nicholson's blue, the whole section will be blue, with no visible trace of red. If it be taken out before the blue has permeated the entire tissue, the red will show, in some parts, quite clear and well-defined among the surrounding blue tissues. Following out this principle, that exact point must be determined when the blue has gone far enough.

In practice, I carry out my theory as follows. I use a two-grain, neutral solution of eosin, and in this I preserve my prepared sections until I am ready to use them. They keep perfectly well in this solution, and are always ready to undergo the final process, which requires but a very short time before they can be placed, fully finished, under the covering glass. After taking them from the eosin solution, I pass them through 95 % alcohol, merely to wash off the superfluous color, and then place them in a half-grain solution of Nicholson's blue, made neutral. The time required in the blue solution varies with different tissues, and in the nice adjustment of this time, lies the whole success of the operation. I generally spoil three or four sections of each kind in determining the exact time required. I take a section from the eosin, holding it lightly in a pair of forceps, rinse it off rapidly in alcohol, and then immerse it in the blue, still in the forceps, while I count, "with moderate haste," ten. Then quickly place it in clean alcohol, and brush lightly with a camel's-hair brush. This immersion in clean alcohol seems to check the operation of the blue instantly. I then examine it under a one-inch objective, to determine whether the exact point where the blue and the red remain distinct has been reached. If the blue has not occupied all the softer cells, I take another section, and put it through the same process, counting twelve, and so on, until the proper point is reached; or, on the other hand, decreasing the count, if the blue has infringed upon the red in the more dense tissue. Having thus determined the count for the sections of that particular material, I pass the remainder of my sections through the blue into the alcohol, merely counting off the immersion of each section. I then place the sections for a few moments in absolute alcohol, which seems to fix the colors, then through oil of cloves into benzole, and mount in damar and benzole. It is sometimes advisable, with delicate tissues, to merely rinse off the blue in 95 % alcohol and fix the colors at once in absolute alcohol, but every operator will learn the minor details for himself in the manipulation.

Of course, with the "rule of thumb" method of counting off the time, slight variations will occur, which will mar the beauty of the finished product; besides which minute differences in the thickness of the section will affect the result, and even a distance of a quarter of an inch in the same stem will make a difference in the density of the tissue, which will be obvious in the sharpness of the colors under the objective. So that the operator should not be disappointed if, out of a dozen slides, only four should be worth preserving. The others can go into the borax-pot to be cleaned for another operation. However, the beauty of those which do pass inspection, will amply repay for the labor on the spoiled ones. I have perhaps been needlessly minute in the description of the process I have employed, but I have been so often hampered by the lack of minuteness in descriptions of processes by others, which I have been endeavoring to carry out, that I deem it better to err upon the safe side, even at the risk of being considered dry or prosy.

One word as to the use of eosin. I was attracted to it by its exquisite purity of color under transmitted light, and its perfect transparency. I found that sections, preserved in its solution, always retained their transparency, and did not become clogged or thick with color, so that when taken out after months of immersion, the most dense cells were no deeper in color than the solution itself. So far as regards its hold upon the tissues, it is as strong as roseine, or any of the heavier colors I have ever tried. I cannot testify as to its permanence, but I have some slides that were prepared over a year ago, that appear to be as bright and pure, as when they were mounted. Contrary to the experience of some others, I have not found that the benzole has any bleaching effect, and I have used it with damar, in preference to the usual balsam. Slides prepared with damar, however, should have a thick ring of varnish run around them, as the damar is brittle, and should not be trusted alone, to hold the covering glass. W.

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Notes on Fresh-water Algæ.

(*CYLINDROCAPSA*.)

V. *Cylindrocapsa* is the name of a genus of recent creation by Prof. Reinsch, of Silesia. It is represented by a single European species, found in a pond near the city of Breslau. A plant evidently belonging to this genus is frequently met with on my rambles. My first note of it dates 1875. Have found it repeatedly every year since, and have received specimens from Buffalo and Niagara, N. Y., from localities southward as far as Florida, and westward as far as Colorado; but never found it in good fruiting condition until June 20th, 1879, in this vicinity. The plant is always found in company with others. Young plants attach themselves to older filaments of their own, or of another kind, or to blades of grass, etc., upon which they grow; but when matured to some length, they separate and

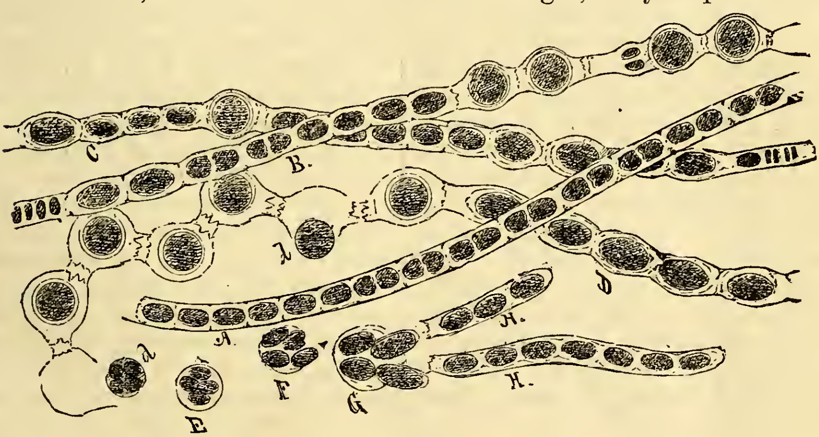

Fig. 17.

form floating masses. They retain the companionship of other characters.

The plants are composed of a simple series of oval, or elliptical, green, granular cells, surrounded by a rather firm, colorless sheath. The oögoniums are developed from the vegetative cells, and each one contains primarily an oval, and then a spherical spore. The antheridia, which I have not seen satisfactorily, are described by Reinsch as being formed in the same sheath by the division of a vegetative cell into two or four parts, which stand side by side, or over one another: each develops two spermatozoids, of yellowish color, spindle-shaped, on the end colorless, with two vacuoles and two celia; when ejected they find their way to the oöspore and fructify it; he add, the oöspore is thus produced and clothed with a double membrane; it changes color to reddish yellow, and then takes a resting period. Its further development is unknown.

The plant shown here has not revealed the whole process of fructification as described by Reinsch. I have not been so fortunate as to detect the spermatozoids; but, on the other hand, I have seen what he did not detect, the development of the young plants from the spores. The American plant I described as "*Hormospora geminella*," in the *Bulletin of the Torrey Botanical Club*, March, 1877; the plant belonged to this genus, rather than to any other of the older order of classification. Now that the mode of fructification and development is known, it is evidently excluded from that genus, and will be called *Cylindrocapsa geminella*.

Referring to the illustration, Fig. 17, *A* is a filament in the normal vegetative condition. Diameter usually .0006″, sometimes no more than .0004″—.0005″. *B* and *C* are filaments with cells enlarging, and developing spores. *D* has cells partly enlarged and others matured into spores (.0008″—.001″), *d, d*, are spores passing out of the oögoniums. *E* represents the granular chlorophyll of the spore, dividing into four parts; *F*, the parts enlarging; *G* shows further increase; and *H, H*, young filaments developed from them.

FRANCIS WOLLE.

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About Diatoms.

A correspondent expresses himself regarding diatoms in the following language, which will doubtless be interesting to many readers:

"My difficulty is this: I see in some gathering or slide, a diatom that is new to me; what is it? I know it to be, say a *Navicula*, but I would like also to know the rest —*Navicula* what? I measure its length and draw its shape, and perhaps the striation. Then I turn to the books and find—— ? Usually I find several species of *Navicula*, either of which *may* be the one in question. I find the size varies considerably, the striation also varies some, and the shape is often very indefinitely described. My specimen comes within the limits of variation as to size and striation of several different species — the shape agrees with some and the size and striations differ; the size agrees with some and the shape and striation differ; and finally the striation comes within the limits of several species, but the shape perhaps differs from all—the result is, complete uncertainty and disgust.

"I believe the only safe plan to escape insanity is to forswear diatoms forever, and stick to the identification of blood and to discriminating one kind from all others, as affording the only field where it is all plain sailing and no chance for doubt or mistakes."

Seriously, there is no doubt that the difficulties which our correspondent alludes to are not imaginary. The study of the diatoms has long been a favorite one, owing to the beauty and symmetry of their forms, the delicacy of their markings, and their curious movements. Still, we believe that it is seldom possible to determine the species of diatoms from descriptions alone. Typical specimens or accurate drawings seem to be necessary for the purpose.

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Soap for Imbedding.

Dr. Heinrich Kadyl has contributed an article to *Zoologischer Anzeiger* entitled, "Soap as an Imbedding Mass for the Preparation of Sections," and from a careful reading of his paper we are inclined to the belief that soap is the best and most manageable medium for imbedding that has yet been suggested. We shall, therefore, describe the method of using it in some detail.

When a certain quantity of hard soap is dissolved in hot alcohol and the solution allowed to cool, the resulting mass will be hard or soft, opaque or pellucid, according to the strength of the alcohol or the proportion of water which the soap contained. If 5–6 parts of rather dry soap are dissolved in 100 parts of 96 per cent. alcohol, there will be obtained a solution which, on cooling, will yield a hard and transparent mass, but the warmth of the finger will cause it to liquify again. A larger proportion of the soap will furnish a white mass, but the addition of a certain quantity of water to the solution will cause it to solidify clear and transparent. An excessive portion of water will cause the liquid to harden more slowly or at a lower temperature. The more soap there is in the alcoholic solution, the more water is required to produce a mass that possesses the requisite degree of hardness combined with transparency. The soap-mass possesses its greatest possible consistence and elasticity when the minimum quantity of water required to clear it is used.

To prepare an imbedding mixture, dissolve about 25 grammes of finely shaved soda-soap in 100$^{c. c.}$ of 96 per cent. alcohol, by heating on a water-bath. To test the mixture, pour a small quantity of the warm solution into a watch glass, and notice the result of cooling. The opaque mass that will probably be obtained, must be rendered transparent by the addition of water in small quantities, testing in the same manner after each addition, until a clear product is obtained. From 5–10$^{c. c.}$ of water will probably suffice.

The consistence of the solidified mass can be altered to suit different objects, by using more or less soap in proportion to the alcohol, thus the author has used solutions containing 10, 20, 30 and 40 per cent. of soap.

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Spring Collections.

A collecting-bottle that is more attractive in appearance, and smaller than the one described in the March number of the Journal, may be made according to the same general plan; but for the jelly-glass a 3-oz. wide-mouthed bottle should be substituted, and, instead of the common funnels, use the glass tubes with funnels blown on the ends that chemists know as "funnel-tubes." Cut off these tubes to a suitable length, put them into the bottle just as the funnels were put in before, and the apparatus is complete.

Perhaps there is nothing more interesting to observe at this season than the development of snails and frogs from their spawn; the specimens for study are readily obtained.

Frog-spawn can be found in any frog-pond, either attached to various articles, such as submerged plants, twigs, etc., or floating near the border of the pond, where the wind has blown it. It looks like a large mass of jelly, filled with dark-colored spots which are the embryos.

The mass must be carefully handled and placed in a large jar, with sufficient water, when the entire process of development, first into tad-poles and then into frogs, can be followed. After the tad-poles are hatched, and show signs of changing to frogs, they should be provided with resting places at the surface of the water.

Snail-spawn can be obtained by

placing a few water-snails in a jar of water. In a short time the clear, transparent, jelly-like spawn will be found attached to the sides of the vessel, from which it may be detached without injury. The simplest way to observe the changes which lead to the development of the snails is to take a two-ounce, wide-mouthed bottle and almost fill it with clean water. In this bottle the spawn may be allowed to remain exposed to the light, but not to direct sunlight, except for a short time during each day. Under such conditions the development will go on rapidly, and the process can be observed under the microscope from time to time, by placing the specimen in a deep cell—a Holman slide is good for the purpose.

We have only mentioned a very few of the interesting objects that are to be found by any person, during an afternoon ramble in the country where ponds or streams abound. If these short articles would serve to arouse a real interest in collecting, if they would induce amateur microscopists to go out and look for themselves, to take notes of what they find, and make careful drawings of the objects they find, we would be very glad to know it.

We are often met with the remark from amateur collectors that they cannot name the forms they meet with.

While it is true that it is a real satisfaction to name an object, or at least to know to what genus of animals or plants it belongs, most collectors must be contented with a very superficial knowledge of the forms of microscopic life. Only those who are willing to devote one or more years to hard study during spare hours can hope to name objects; elementary books are of comparatively little value for this purpose. Such books are pleasing to read, and profitable so far as they give the student a general idea of the nature of the objects to be found; but when they are the sole reliance of the observer for naming his objects, they are more likely to confuse him than to do him good service. By all means, then, we advise every one who desires to name specimens to confine his studies mainly to a certain department of study, to obtain the best works on the subject, and to discard the elementary ones. One authoritative work, even though its cost is considerable, is worth much more, even to the amateur, than a dozen of the little books designed to popularize science.

Therefore, if a person desires to study the Infusoria, we would advise him to buy a copy of Pritchard's "Infusoria," even though a second-hand copy should cost him $25; if he chose the Algæ of fresh water, the best work is Rabenhorst's "Flora Algarum," which costs about $9, and so in every department of study, we advise the student to get the best books, and they will be always valuable. For an elementary work of real utility, we know of nothing that is so good and so reliable as the work of Eyferth, which is being published in this Journal. If used carefully, a little experience will enable any person to determine the genus of almost anything he meets with, and this artificial key to classification will be valuable, even to those who have larger works. Several subscribers have said to us that Eyferth's key does not enable them to name their objects. This is partly because they have not made themselves familiar with the meaning of a few technical words, but more particularly because it is absolutely impossible to make any progress whatever in naming microscopic objects, unless we are willing to work carefully and slowly at first, until we become familiar with the characters of the classes and families, after which we may make out the genera and species.

If the student desires to name diatoms, perhaps the best advice we can give him is to prepare to buy a library of books on the subject, and we doubt if he could name them even then—especially the "common" forms.

New Microscopes and Accessories.

The stand which we illustrate this month is the latest design of Mr. W. H. Bulloch, of Chicago, which he calls the "Biological Stand." We have not seen the stand, and only know of it from the illustration and a written description from the maker.

In this stand Mr. Bulloch has arranged the sub-stage and mirror in such a manner that they can be

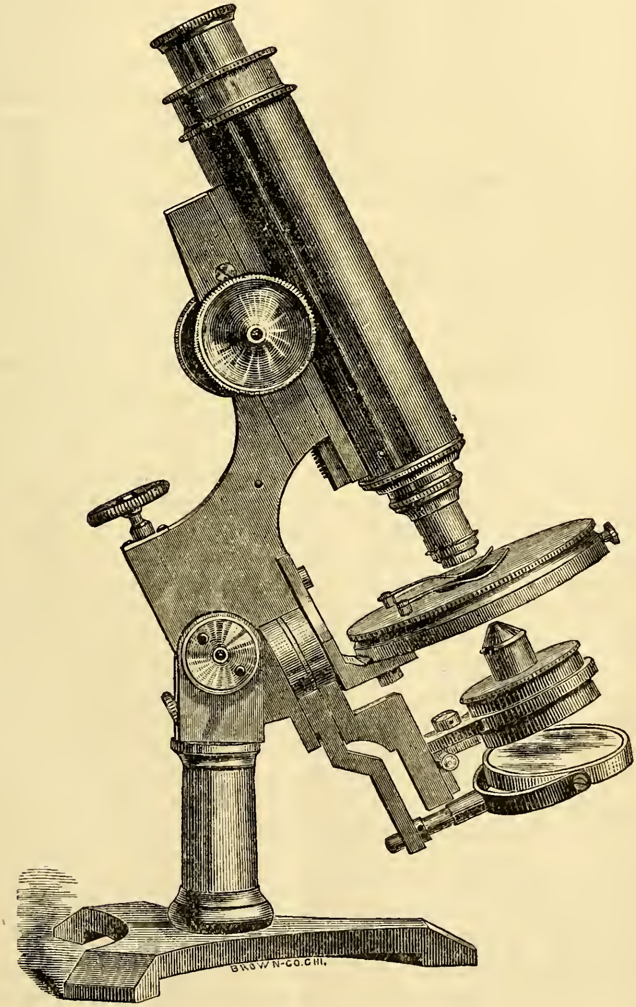

FIG. 18.

moved independently around the focal point as a centre, and can be used above the stage. The sub-stage and mirror can be clamped in any position.

The fine-adjustment moves the entire body. The stand is balanced so as to be perfectly stable, when the tube is horizontal. There is a large screw for wide-angled, low power objectives, which Mr. Bulloch has also applied to his other stands.

The stage, which is adjustable to the axis, measures three and a half inches in diameter, and is three and a half inches above the table. The stand is twelve and a half inches in height, when standing upright.

Other details can be readily observed by studying the illustration which we give.

The stand as shown, made of polished brass, with one eye-piece and case, is sold for $40.00.

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Cleaning Foraminifera.

After having read Mr. Vorce's article on cleaning Foraminifera, it occurred to me to use electrical force to extract the shells in the dry way. For this purpose I used a small tin lid, four inches in diameter, filled with a preparation of rosin and sealing-wax, the resinous surface of which, for convenience, I excited with an artist's brush, known as a "Badger blender." The sand from sponges or foraminiferous marl is spread thinly over as large a surface as convenient; the cake of rosin is then excited by passing the Badger's-hair brush over it several times, and then turning the excited surface of the resinous cake down to within a quarter of an inch of the material, and passing it gently over it. The result will be that innumerable light particles will be attracted to the excited surface, and will remain there, while the sand will be attracted and repelled back, thereby leaving a large percentage of Foraminifera, spicules, etc., adhering to its surface, which may then be brushed off into any suitable receptacle. The above plan may be tested on a small scale by exciting the end of a large stick of sealing-wax. Damp weather is unfavorable for the experiment. I have found it very successful.

K. M. Cunningham.

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A Simple Mechanical Finger.

In mounting objects for the microscope it is often desirable to arrange minute particles on the slide, or to transfer them from one slide to another, or to scrape away dirt. The devices employed for this purpose, so far as I am informed, depend upon the lengthening of the part which supports the sub-stage apparatus, by means of a tube specially fitted for the purpose, or by means of the paraboloid, so that, by a rack movement, the slide may be lifted free from the stage into contact with a hair or fine wire, which is held by the stage-forceps, or by some contrivance designed especially for the purpose. Contact having thus been established, the slide may be lowered, leaving the object adhering to the hair, or, by moving the sliding stage, the object may be pushed in any direction desired. There is, however, another plan which has occurred to me, and which I find to be simpler, and even more effective, in certain respects. With several styles of microscopes a condensing lens is supplied, which is fitted to the limb of the instrument by a ball-and-socket joint and sliding stem-rod. Unscrew this lens, and put in its place a piece of cork, through which a needle passes at a right-angle to the stem. It is well to have two or three pieces of cork fitted with needles having different points; one, for instance, may have a human hair projecting slightly beyond its point, the hair being kept in place by winding with fine thread and coating with gum; another may have a flat point, made by breaking off and grinding the fractured end; other forms will suggest themselves as experience may determine. The ball-and-socket joint should be clamped or wedged, so as to move quite stiffly. Bring the point of the needle into view under the objective, and it may be made to touch the slide, or be lifted away from it by simply turning the stem-rod. Objects which are seen to adhere to the needle are lifted at once and another slide, slightly moistened by breathing on it, may be substituted for the one on the stage, to which the objects may be made to adhere at any desired point, by turning the stem-rod as before. By moving the mechanical stage while the point of the needle is in contact with the slide, objects may be pushed wherever desired on the slide. In this case it is a decided advantage that both needle and object remain within view, however the stage is moved. Thus dirt may be scraped away with the greatest ease.

It is evident that such a contrivance, consisting essentially of a ball-and-socket joint, and a sliding stem with a button attached to the latter, so that it may be readily turned, might be fitted to the stand of an ordinary bull's-eye condenser, and thus become available for use with any microscope-stand whatever.

M. A. Veeder.

The Objectives which Afford the most Accurate Knowledge of Histology.

BY A. A. BRAGDON.

After years of study with the microscope, having commenced with one of the lowest grades of the instrument, and gradually trying to improve my tools, and at the same time to keep informed in regard to modern improvements by carefully perusing what has been written upon the subject; and having, in the course of those years, used various grades of objectives; I trust I may venture to express myself as to what, in my opinion, are the best lenses for histological studies; hoping, that by so doing, I may enable some younger student than myself, who is just commencing the study, to make a short cut to success, and not travel the long road of experience, as I have, to arrive at my present conviction, as regards the best objectives for my study.

In order for the student who truly desires to obtain accurate knowledge of organic tissues, as well as to search out the hidden mysteries of biological science with success, several things are imperatively necessary, among which, for the former study, two are very important:

First.—Some method of making perfect sections.

As an aid in making such sections and mounting them, the student cannot easily find more complete and practical instruction than that given in a series of articles by Dr. J. J. Woodward in *The Lens*, Vol. I, 1872, or, in a series of articles by Dr. Carl Seiler, published in the *Am. Quar. M. Journal* for January and April, 1879.

The knife-carrier described in the latter article can be used with almost any microtome; and is a very simple piece of apparatus to manage, and gives results, such as I have never seen attained by any one using other methods.

Second.—The next requirement of the student, if he really desires to attain the acme of success in the demonstration of histological truths, is some means, after obtaining good preparations to thoroughly examine his work. In order to do this satisfactorily to himself, he must be in possession of means to obtain various degrees of amplification, and often of the very highest. In the very recent past, it has been thought possible, by high authorities, to accomplish this end, only by resorting to high power objectives of $\frac{1}{20}$ or $\frac{1}{25}$-inch focus, and even higher.

The best opticians are ever on the alert, to take advantage of even slight chances for improvement and variation in former methods, to aid the worker with that instrument, which has unraveled so many mysteries. And it seems hazardous to predict, even now, with such perfect instruments as we have, to what degree of perfection such opticians will yet carry moderately high powers, thereby enabling the microscopist of slender purse, who could never for a moment think of buying a $\frac{1}{25}$-inch lens, to get an objective which will do away with all need of, or desire for such necessarily expensive lenses, and at the same time furnish him with a lens which will afford him far more satisfaction, and better results than are possible with ordinary lenses of great power. I say ordinary, for the reason that all objectives of extremely high power, owing to their difficult construction, are ordinary as compared with the moderately high powers of the best makers, which may be said in a very few cases to be extraordinary.

And this brings me to write of what was the object of this article, viz.: to call the attention of young, earnest seekers after histological as well as biological knowledge, to such lenses as I have found to far excell all others I have ever seen, for this class of work.

Much has been said and written about the value of objectives having high interior angles, say 90° and upwards, for histological study.

But most of what has been said, has been inserted in a secluded part of an extended article, calling attention to the results obtained by the use of these lenses on "lined" test-objects; such as *Amphiplura pellucida* and other diatoms.

So that I find the impression is strongly prevalent among microscopists who care but little for this "trivial use of the instrument," that "those high-priced and high-angled objectives are of no use, except to amuse a few Diatomists." But such is, I believe, by no means the true state of the case.

Even a water-immersion objective, having 105° interior-angle, will so far excell another of only 120° or 140° air-angle; that the image of the latter will be unsatisfactory to any careful observer who delights in having the minute details of the object brought out with sharply defined outlines. When we institute a comparison between the glycerin, or more especially the homogeneous-immersion objectives, such for example as the latest production of Mr. R. B. Tolles of Boston, and the water-immersion of 105°, a very decided improvement is noticed in favor of the homogeneous-immersion; owing, as I believe, in part to the great increase of angle that is attainable with the latter. For, when the immersion medium is water, this same high-angled, homogeneous-immersion lens, shows decidedly more force of definition than the one having a lower angle.

In 1878, Dr. J. J. Woodward made a series of micro-photographs of *Amphiplura pellucida*, mounted in balsam, with a Zeiss $\frac{1}{12}$ and $\frac{1}{8}$-inch oil-immersion, together with other notable objectives for comparison of their respective merits. Among these lenses were a $\frac{1}{6}$ and $\frac{1}{10}$-inch by Spencer, glycerin-immersion, and a $\frac{1}{10}$-inch oil-immersion by Tolles. It is only necessary for any unprejudiced person to examine this series of photographs to decide at once as to the superiority of the homogeneous-immersion lenses in defining power, with the exception of the Zeiss $\frac{1}{8}$-inch, over others used in this trial. Since that comparison, Mr. Tolles has brought out a new homogeneous-immersion $\frac{1}{10}$-inch objective of nearly 127° interior-angle, measured in a medium, the same as Prof. Abbe uses, of 1.50 refractive index.

One of these new series, the second that Mr. Tolles had made, I obtained some three months ago, and I have subjected it to a variety of tests and am becoming every day more and more attached to it.

This truly wonderful lens possesses a greater variety of noticeable, excellent qualities, than any that has as yet come under my observation; such as will, I am confident, be fully appreciated by the working microscopist; and more especially such as work on histological preparations, or desire to observe biological phenomena by the aid of high magnifying power and excellent definition. The angle of the lens is the highest yet attained. The corrections are such as yield results surpassing anything I have heretofore been able to get with other objectives of high angle, as well as oil-immersions of very high interior-angle.

The definition of the transverse striæ of *Amphiplura pellucida* by lamplight, with a hemispherical lens as an immersion illuminator, is very sharp and approaches nearer to the resolution obtained by sunlight and blue-cell illumination than anything I have ever seen. The striæ show distinctly with a two-inch eye-piece and no amplifier.

From this point the power can be increased by a $\frac{1}{6}$-inch eye-piece and an amplifier,—the lines still visible and appearing like pickets on a fence. This testing affords an admirable practice for the microscopist, and teaches him how to get the best results with his objective and how to manage the illumination properly, which must be learned by practice; such practice ought not to be sneered at by students of histology.

If, now, we wish to test the brilliant definition of this new $\frac{1}{10}$ on histological preparations, it matters not what specimen we select, the result is always an improvement over results obtained with lower angled objectives. But my favorite object for this purpose is a preparation of the tail of a newt, which I prepared to illustrate the so-called "giant nuclei," but more especially the arrangement of the bioplasm in the nuclei of the epithelial cells, which, when taken at the proper time, exhibit the dividing nuclei.

This object affords a fine opportunity to demonstrate the masterly skill and care that Mr. Tolles has bestowed on this new $\frac{1}{10}$, as well as to show the preëminent manner in which these high-angled lenses exhibit objects by central and slightly oblique illumination. When this object is examined with an ordinary low-angled water-lens, an amateur would be easily misled into the belief that the nuclei are either one homogeneous mass, or a collection of bioplasmic granules.

But neither view is correct.

When we apply the new $\frac{1}{10}$ of over 120° interior angle, taken in a medium of 1.525 index as used by Mr. Tolles for measurement, rather than a medium of 1.50 index, which latter would give several degrees more angle to the objective, our error of observation in the first trial is wonderfully conspicuous; and this performance of the high angle water-lens is noticeably outdone.

We now begin to obtain some accurate idea of the arrangement of the bioplasm in the nuclei of the living, growing epithelial cells of the newt, as well as of rapidly developing nuclei in various parts of other animals.

For want of an engraving the reader is referred, if not already familiar with the subject, to an article by Dr. Klein, in the London *Quar. Jour. of Microscopical Science* for July, 1879, describing and illustrating the nuclei of the newt, as studied by him with the new Zeiss high angle $\frac{1}{12}$ and $\frac{1}{18}$-inch oil-immersion objectives, which article led me to make the preparations I now have. What would be much better for the student, would be to get one of Tolles' new $\frac{1}{10}$-inch objectives, and prepare and study these difficult objects for himself. It is only necessary to immerse the living tissue in a weak solution of picric acid for a few days, then thoroughly wash, transfer to, and harden in, alcohol; cut the sections very thin, stain with carmine, and mount in Canada balsam.

With a $\frac{1}{10}$ like the one above referred to, and a Tolles' one-inch of 30°, the histological or biological student would have the *ne plus ultra* of optical appliances for his study. The one-inch is constructed with eight lenses, has a very flat field, and its defining and resolving power, as well as penetration, are beyond criticism. It easily resolves 40,000 lines to the inch, bears high eye-piecing, and is to my mind the best lens the student of histology can use for a low power for general examinations.

The $\frac{1}{10}$, with its maximum angle, works easily through $\frac{1}{80}$-inch covers and can be used as a water, glycerin, or homogeneous-immersion at pleasure, by means of collar-adjustment, and gives fair results worked dry. Mr. Tolles' idea of retaining the screw-collar is, to my mind, one of the best features of his new production.

The reason for this is, that it affords a means of using water as an immersion medium when one is mounting several preparations, or a number of slides of one kind, and desires to make a cursory examination of them at once with high powers before any change shall have taken place, and without waiting for covers to become fixed by hardening of the balsam.

The medium I have found best for homogeneous-immersion, and one that I believe will come into general favor, is glycerin brought up to the required index, by making a saturated solution with it and sulpho-carbolate of zinc. Chloride of cadmium has also been recommended with glycerin. The former medium is neat; and as yet I have found but one objection, and that not a serious one, to its every-day use, viz.: it is just a little too thick. When the new $\frac{1}{10}$ is used for homogeneous immersion, the systems are closed and no attention is given to the collar-adjustment unless great accuracy is required, and we desire to adjust for the length of the microscope-tube.

Armed with two such lenses as I have called attention to, the student of histology is prepared to battle with difficult questions of structure. I think I have learned by experience in the use of the poor, the medium, and a few of the best lenses that the skilled opticians have produced, what objectives afford me the most accurate knowledge in my studies.

Bangor, Maine.

The Simplest Forms of Life.*

BY E. EYFERTH.

I. Order. Flagellata. (Flagellifera.)

Body not ciliated except at one point in front, in some also behind, provided with one or more very long, moving, filamentous appendages,—flagella, which, however, are only made visible in many forms by reagents; at times they are lost. In most forms contractile vesicles are known; a mouth is only distinguishable in certain cases. All have a resting-stage, during which they multiply by division, and in their development, as also in their outward appearance, they are closely related to the lower Algæ; therefore they have, either in whole or in part, been placed among the latter by many authors. Among recent investigators, v. Siebold, Kölliker, Clauss and Häckel, have asserted their vegetable nature; Stein and Claperède have considered them as animals. Most of the flagellata live as single, free swimming individuals; some are united in families.

The common assumption, that the movement is produced by the active flagella, has been contradicted from many sides, for this cause seems to be inadequate to produce the result; they may serve as rudders. It is still uncertain what the cause of the motion is. It can often be seen that the animals can move the flagella voluntarily, and with considerable energy.

FAMILIES.

Flagella invisible.	
Surface of body rough, uneven, without membrane,	Monadina.
Surface of body hard, forming a membrane,	
living singly, without gelatinous coat (in motile stage),	
membrane thin, body metabolic,	Astasiæa.
membrane thick or hard, body constant in shape,	Cryptomonadina.
living in families or single,	
with a common or special gelatinous covering,	Volvocina.
without a covering, mulberry-shaped,	Hydromorina.
enclosed in a shrub-like, connective coat,	Dinobryina.
Flagella in one of the furrows which surround the hard carapace (often very distinct),	Peridiniæ.

I. FAMILY MONADINA.

Body without an external coat, but only slightly changeable, small, without any recognizable organization. During observation the animal clings to the slide or cover, and then seems to melt away, leaving minute glistening particles which were contained in the body mass. A number of genera have been established by Ehrenberg, Dujardin, Perty and others, which cannot be retained; at least, they are not sufficiently studied. The following deserve a place here, but some of them should belong to the cryptomonadina (*Chilomonas, Heteromita*).

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* Translated from the German, by the Editor.

Individuals living free, with	
one flagellum (or none)	
on anterior end of the body	Monas.
somewhat lateral,	Chilomonas.
two flagella	
one in front, one behind,	Cercomonas.
both in front,	
both alike, swinging,	Amphimona.
dissimilar, one swinging, one trailing,	Heteromita.
four flagella	Tetramitus.
Individuals in spherical families	Uvella.
in shrub-like families	Anthophysa.

1. Genus, *Monas*. Müller. Most of the species heretofore placed in this genus, (and in *Bodo*, Ehr.) cannot now be regarded as perfect organisms. The smallest of all forms (*Monas crepusculum*, Ehr.), is not to be distinguished from the Sphærobacteria (*Micrococcus*, Hallier, Cohn), in part it may be also minute, unorganized particles of plasma. Its minute size (*M. Crepusculum* measures only 0.0005), greatly increases the difficulty of its study. All liquids that contain decomposing organic matter swarm with it. Other common forms are:

M. termo, Ehr. Colorless, spherical, 0.001 d., movement rapid.

M. guttula, Ehr. 0.002.

M. lens, Duj. 0.005 — 0.014, round or disc-like, very common.

M. socialis, Ehr. 0.013. Elongated, conical.

M. flavicans, Ehr. Elongated, oval.

M. spiralis, Perty. Similar to *M. lens*, but screw-like, and turning while swimming.

2. Gen. *Chilomonas*, Ehr. Flagellum, issuing somewhat laterally from a border near the anterior end of the body.

C. paramecium, Ehr. Elongated, oval, slightly three-sided, l. 0.024. Abundant in bread-infusions. (Ehr.; compare *Cryptomonas polymorpha*).

C. destruens, Ehr. L. 0.026, pear-shaped, yellowish. In dead rotifers.

3. Gen. *Cercomonas*, Duj. Only differs from *Monas* by having a second flagellum behind. Dujardin makes 12 species, Perty 11, of doubtful value. The most common seem to be:

C. truncata, Duj. L. 0.01. In water containing bunches of flowers and in other infusions.

4. Gen. *Amphimonas*, Duj. Body with two flagella in front, one or both thrown back laterally somewhat, to small projections.

A. candata, Duj. (*Bodo saltans*, Ehr. ?) 0.01—0.02. In infusions.

5. Gen. *Heteromita*, Duj. Body with two long, fine flagella in front, one of which vibrates, the other trails; several vacuoles, of which usually only one or two are plainly visible; a distinct nucleus in the middle, and numerous granules in the hinder part. Multiplication takes place by oblique division, into four new individuals; after the old form has come to rest, and its outer body-covering, with the old flagella dissolve into a soft gelatin. Movement takes place long before the new individuals separate. The animal is not destitute of a covering, and is, therefore, properly a cryptomonadine. (*Anisonema acinus* is very similar to it, but has much thicker and shorter flagella, one of which always trails).

H. Ovata, Duj. (*Bodo grandis*, Ehr.) Body egg-shaped, attenuated in front, 0.027—0.035 l. Among water plants, also in old water (soap water) sometimes abundant. Swims with a wagging motion. The flagella become readily attached; they are not easily made visible, on account of their great length.

6. Gen. *Tetramitus*, Perty. Body conical, pointed behind, with four moving flagella on the blunt, anterior end.

T. rostratus, P. Colorless, pear-shaped, on one side elongated like a beak, 0.02.

7. Gen. *Uvella*, Ehr. Animal in spherical, moving families 0.06 d.

U. glaucoma, Ehr. Individuals egg-shaped, 0.01 l. without pigment spot, but with many nuclei, color bluish. In foul infusions.

U. virescens, Duj. Greenish, similar to the preceding, and differing from *Hydromorum uvella*.

8. Gen. *Anthophysa*, Bory. Animals in dichotomously-branched stems, fixed, or swimming as flocks.

A. Mülleri, B. Stem brown. Individuals attenuate in front, 0.01 l. Stems 0.1—0.2 l., 0.03 thick.

——o——

The Preparation and Mounting of Microscopic Objects.

II. DRY-MOUNTING. Dry objects are mounted both transparent and opaque. When the objects are quite large it is best to mount them opaque, but when they are small, or when they are to be examined with the lieberkuhn, or with the paraboloid, they must be mounted accordingly. Many of the more delicate diatoms should be mounted dry, as transparent objects, for their delicate markings might be entirely lost in balsam or other media.

The best way of mounting an object, should always be determined by a preliminary examination with the microscope. It will not do to assume that an object will look well dry, unless we examine it in a perfectly dry condition; for many objects will shrink and shrivel during the drying process, and no permanent mounts can be made unless the objects are perfectly dry.

For dry-mounting a cell is always necessary, and these are made in various ways.

1. To mount diatoms, or very minute objects, dry and transparent.

Take a perfectly clean slide, select a suitable cover-glass (a ½-inch is a good size), and make a ring on the slide with the turn-table, just so large that its outer edge will extend beyond the edge of the cover-glass, when the latter is applied. This ring may be made of benzole-balsam, of asphalt, or of various other cements, but the best of all, because it dries so rapidly, is shellac. In all cases the cement must become entirely hardened, before the mounting is carried any further, otherwise the cement is likely to creep under the cover, after the mount is finished and laid away. For this reason, especially if the cell need not be made very thin, it is often advisable to make the ring out of sheet wax, which can be attached to the slide by gentle warmth and pressure, or turned up on the slide by Dr. Hamlin's method (p. 46); very thin sheet caoutchouc may also be used, punching out rings of the right size and attaching them by heat, and this material is excellent for diatoms. It is advisable to keep a number of prepared cells always ready.

The objects should now be placed in the cells, a thin coat of cement —benzole-balsam, asphalt or shellac —should be applied to the cell, the cover-glass immediately pressed down evenly, after which the slide can be set aside until a sufficient number have accumulated to undergo the finishing operations together.

The best cements to apply for securing the cover, as described above, are the balsam or the shellac. After either of these is used, it is advisable to finish the slides with asphalt. We do not advise the employment of other cements for this purpose. Nothing looks so well as a black ring around mounts of this kind. The colored rings are pretty, but they are more suitable for larger and deeper cells. It often happens that the cement does not form a perfectly true, unbroken edge. When this is the case, apply the knife-blade, before the cement sets, and turn the edge smooth and true.

2. To mount objects opaque.

Generally when objects are mounted opaque, they are of such a size as to require deeper cells than those described above, but the cover is cemented on in the same manner, so we will only describe a few of the numerous kinds of cells.

a. The Wax-cell. This can be made of any thickness by punching rings out of several layers of sheet-wax and attaching them to a slide, using a piece of wax to form the floor of the cell. Dr. Hamlin's method (p. 46) is a still better one.

b. The Curtain-ring-cell. Cut out a circular piece of wax, attach it to the slide, place a curtain-ring upon it, soften the wax by heat until the ring is imbedded in it. If the wax should become heated too much, so as to lose its smooth finish, another piece can be cut from a sheet and pressed into the cell to form the bottom. Objects can be made to adhere to the wax by brushing it over with a little turpentine, and attaching them before the latter evaporates.

c. The cement-cell. A good cell can be made of asphalt by applying the cement and turning it up with the knife-blade. A still better one can be made by a cement, which is known as shellac cement, used by Mr. Merriman. The bottom of cement-cells can be made opaque by a coating of asphalt. It is evident that for the paraboloid or the lieberkuhn, any of the cells can be made transparent.

For dry-mounts it is advisable to finish with asphalt varnish. Be careful to cement the cover down with balsam or shellac first, then there will be no danger that the asphalt will run in. The asphalt should be applied so as to come over the edge of the cover, otherwise the cover may come off when the cement becomes hard and brittle.

EDITORIAL.

To Subscribers and Advertisers.

The subscription-list of the JOURNAL is constantly increasing, and so far as we know our readers generally, have been well pleased with the articles we have published. However, we do not hesitate to make use of any criticisms or suggestions that reach us, and, as we stated some time ago, we would be pleased to have our readers express their desires freely, and thus enable us to select such articles as they want.

Experience has taught us that what microscopists most desire is articles having a practical bearing, and we are constantly trying to furnish just such articles. To cite a single example, the articles on mounting, which are now being published, are practical in every sense, and these are only one series, which is to be followed by others on other subjects of equal, if not of greater, value and interest to the amateur.

Although this JOURNAL does not

assume to rank among the most valuable scientific periodicals of the day, we believe that the amount of really, practical information, adapted to the wants of amateur microscopists, or to more advanced students, who wish to keep themselves informed about the latest methods of mounting, preparing and examining objects, will prove to be much larger, at the end of the year, than can be found in any other periodical devoted to microscopy. Students of medicine and practicing physicians will find much that is valuable and useful to them in their profession.

It cannot be denied that much of the success of the Journal is due to those opticians and dealers in microscopes, who have encouraged the undertaking from its inception, and have spoken well of it to their customers.

The promptness and liberality with which they responded to our calls for advertisements, before the Journal had any assured circulation, indicated no little confidence in the representations of the Publisher, which he is pleased to acknowledge in this manner.

In return, he would request subscribers to look over the advertising-pages regularly, and to take note of those who advertise in the Journal. The enterprise and business energy which is shown by the opticians who avail themselves of the columns of a new periodical to advertise their goods, certainly should secure them the patronage of the subscribers to that paper.

Subscribers may be assured that none but responsible and reliable dealers will be permitted to advertise in this Journal.

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—In our notice of the Hayden trial, we referred to an error of Professor White, who, in the course of a preliminary examination, mistook some sposes of an alga for blood-corpuscles. Professor White has written to us that, if the facts had been more fully stated, his evidence would place him in quite a different light. It appears that a very insufficient time was allowed him for the examination. In his letter, he writes: "From one of those spots (on a stone) when moistened, I obtained bi-concave discs, having an average diameter of about $\frac{1}{3300}$ of an inch. These, on the first examination, I believed to be blood-discs, and, having been hurried before the Justice, to testify on the preliminary examination, I gave the opinion that those bi-concave discs were blood, and that they correspond in size with blood-discs," etc. "At the same time, I stated to the court that my examination was not complete, that the examinations were to be repeated, and extended by applying chemical tests, testing by the spectroscope, and by attempting to obtain blood-crystals." As we stated, Professor White corrected his error afterwards.

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—Judging from the letters which frequently reach us, from subscribers who advertise objects in the exchange-column, we are led to believe that our little Journal has given a new impulse to the custom of exchanging slides and material. The benefit of such exchanges is very great, and can be made even greater if exchangers will endeavor to send out only good preparations. Many of our best mounters do not offer their slides for exchange, because experience has taught them that they are not likely to receive an equivalent value in return. A slide may be good, and valuable if the object has been prepared with care, even though it be unattractive in appearance, and such a slide would be acceptable to most persons; but the trouble exchangers meet with is, that they receive slides that show no indications of care in their preparation, full of dirt and bubbles, and only fit to throw away.

We cannot do more than to ask our subscribers not to offer anything that is not really good, in the exchange column.

Sometimes correspondents offer material without asking for anything in return. Many persons are so inconsiderate that they do not think of the labor involved in replying to inquiries for material so generously offered, and they, therefore, send their requests on postal cards. The least they can do, it seems to us, is to send a stamped and addressed envelope to the person who offers the material. One gentleman writes us that he has sent out no less than fifty specimens to applicants "as well as furnishing the three-cent stamp when request was made by postal card," etc.

CORRESPONDENCE.

To the Editor:—Dr. Hamlin's new wax-cell, described in the March number, is an invention which entitles him to the gratitude of all workers with the microscope. My experience, however, moves me to offer two suggestions in regard to the method of its manufacture; 1. Before applying pressure to the outer edge of the disc, a little turpentine should be applied to the lower surface with a brush, extending to the proposed width of the ring; 2. Instead of a slight moistening of the knife-blade, water should be used freely.

Respectfully,

J. G.

Ridgewood, N. J.

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NOTES.

—Mr. M. A. Veeder contributes the following ingenious suggestion, in a late number of *The American Naturalist.*

"In order to reduce the quantity of water containing infusoria, obtained by means of a collecting bottle or otherwise, an easy and effective method is to allow the liquid to stand in a bowl until it has settled, and then take up the water by means of a sponge placed in a pouch made of fine silk. If the water be allowed to soak into the sponge very gradually, and a slight pressure be given before removing it from the bowl, so as to wash away any adherent particles, even the finer forms of animalculæ diffused through a pint of water may be left in great abundance in a quantity of water not larger than a tablespoonful."

—The American Society of Microscopists meets this year at Detroit, and a large attendance is expected. The meeting begins on the 17th of August and continues to the 20th. When the final arrangements for the meeting are announced we will have more to say about the prospects of the Society, which has our best wishes.

—The first two numbers of the seventh volume of the *Bulletin of the Torrey Botanical Club* have reached us, and we are pleased to notice that there is a notable improvement in its appearance, which indicates a renewal of activity in the Club, and an intention to make the *Bulletin* a better paper than it has been of late. Mr. W. H. Leggett is the editor, but he is now assisted by Mr. W. R. Gerard, who is well known as a student of the Fungi.

The subscription price is $1.00 per year. All botanists should take the *Bulletin.*

—We have received from Mr. Geo. O. Mitchell, of Hanover, N. H., an excellent nickel-plated compressorium, such as he manufactures for sale. This instrument is a modification of the well-known compressorium devised by Mr. Wenham. It is much cheaper than the latter, costing only $1.50 of lacquered brass, and $1.75 nickel-plated.

A compressorium is a very useful accessory, and it is of great service in the study of minute Crustaceæ and Infusoria.

—Botanists find the *Botanical Gazette*, a monthly magazine which costs but one dollar a year, to be a valuable periodical, and one which deserves their support. The fifth volume began with the January number. It is published at Crawfordsville, Ind.

—We have to record the death of the Rev. Eugene O'Meara, M. A., of Dublin Co., Ireland; a man who has been well known to microscopists as a careful student of the diatoms. One of the founders of the Dublin Microscopical Club, he was always one of its most diligent members. All of his scientific work was done during such time as he could spare from his business; but he has, nevertheless, written many valuable papers on the diatoms of Ireland. His largest work, the "Report on Irish Diatomaceæ," is left unfinished.

QUESTIONS AND ANSWERS.

[This column is freely open to all who desire information upon any subject connected with microscopy. It is hoped that the readers will reply promptly to the questions which are asked.]

QUESTIONS.

5. Will some of the readers of the Journal who have had experience in the matter please inform me, which is the best device for insect dissection: the compound instrument with an erector, or a simple microscope of some kind? Also, what are the powers ordinarily used?
W.

MICROSCOPICAL SOCIETIES

NEW YORK.

This Society is in a very flourishing condition; the meetings are well attended and interesting. The course of public lectures, which was established last year, has been well attended. The last public lecture was delivered by Mr. Alexis A. Julien, on the evening of the 16th of April. His subject was: "Gems of the Pavement," and the lecture was an interesting one, devoted to the application of the microscope to the study of rocks and minerals. It was illustrated by a new oxy-hydrogen, projecting-microscope, having a polariscope attachment. A large number of slides were shown, and described, both with and without polarized light, and the peculiarities of certain minerals were well exhibited. It was said that the sections were shown upon the screen better than any similar objects had previously been seen in New York.

CENTRAL NEW YORK MICROSCOPICAL CLUB.

A society was formed at Syracuse, N. Y., on the 6th inst., under the name of the Central New York Microscopical Club; membership to embrace the county of Onondaga and the counties adjacent thereto. Officers elected for the ensuing year:

President, Geo. K. Collins; Vice-Presidents, Alfred Mercer, M. D., and Daniel G. Fort, of Oswego; Secretary, A. L. Woodward; Treasurer, Robert Aberdein, M. D.

WELLESLEY.

The regular meeting was held on Monday evening, April 26th, the President, Miss Hayes, in the chair. After reading the Secretary's report, the Society passed a vote of thanks to Dr. C. E. West, of Brooklyn, for the loan of some fine slides. Miss Kitchell read a paper on rock-sections, describing the method of preparing them, the different kinds which are found in the market, the advantages of microscopical investigation of rocks, the varieties of inclusions, and illustrating, by black-board drawings, liquid and other cavities, sections of simple minerals and of crystallized rocks which showed the various peculiarities of structure; with the polarizer she gave brilliant images upon the screen. Under the microscope were exhibited the slides loaned by Dr. West, consisting of several of Dr. Thiersch's injected tissues, one of Dr. Watts' slides of gold crystallized by galvanic action, and crystals of silver and tin; a collection of slides of Lepidoptera prepared by Misses Waterman and Whitney, were very beautiful. Miss Cummings exhibited a Protococcus reproducing itself by division, and several specimens of fresh-water algæ.

M. VIRGINIA SMITH, Cor. Sec.

ILLINOIS.

The annual meeting of the State Microscopical Society of Illinois was held on Friday evening, April 23d, 1880.

The Treasurer's report showed a highly satisfactory financial condition, about $200 having been paid in during the past year, while the expenditures were less than $50.

The following papers have been read before the Society since the semi-annual meeting last October:

Recent Microscopical Work, by James Colgrove.

The Microscopical Examination of Signatures, by Lester Curtis.

The Microscopical Examination of Dust, by A. C. Thomas.

A New Observation on the Histology of the Fœtal Lung, by Lester Curtis.

The Microscopical Examination of Tissues after the administration of Mercury, by S. V. Clevenger.

The Study of the Cell, with reference to the New Theory, by Lester Curtis.

Plant or Animal? A Popular Description of some of the Myxogastric Fungi, by E. B. Stuart.

Notes on Micro-lithology, by A. C. Clark.

The Intra-ovular Life of the Chick, by C. H. Kimball.

The following officers were elected: President, B. W. Thomas; Vice-Presidents, Lester Curtis, M. D., Prof. E. Bastin; Secretary, E. B. Stuart; Corresponding Secretary, Jas. Colgrove; Treasurer, W. H. Summers; Trustees, Prof. E. J. Hill, Dr. S. J. Stone, Dr. F. W. Mercer, H. M. Thompson, and Charles Boring.

REVIEWS OF BOOKS.

Sea-Air and Sea-Bathing By John H. Packard, M. D., Surgeon to the Episcopal Hospital, etc. Philadelphia: Presley Blakiston. 1880. (50 cents.)

This little volume is one of a valuable series of "American Health Primers" which have been written "to diffuse as widely and cheaply as possible, among all classes, a knowledge of the elementary facts of preventive medicine, and the bearings and applications of the latest and best researches in every branch of medical and hygienic science."

We have read the book with much interest, and have been well rewarded for the time thus spent. There is no doubt that, while sea-air and sea-bathing are invigorating and stimulating to almost every person, a little knowledge of how they act and how their most beneficial effects can be obtained, would be valuable to all who visit the sea-shore, and would sometimes prevent accidents which result from neglect or ignorance of a few simple rules. Just the information which visitors to the sea-shore require, is given in this book.

Exchanges.

[Exchanges are inserted in this column without charge. They will be strictly limited to mounted objects, and material for mounting.]

Polyzoa, Palates of Mollusca, Foraminifera, Sponge and Holothurian-Spicules, Synapta-Anchors, Chirodota-Wheels, Echinus-Spines, Minute Sea Shells, in exchange for Polyzoa, Foraminifera, Histological and Pathological preparations, *etc.* Also, a quantity of Sea Shells in exchange for Land and Fresh-Water Shells.

F. M. HAMLIN, M. D., Auburn, N. Y.

J. J. B. Hatfield, Arsenal Avenue, Indianapolis, Indiana, will exchange Bleached Plant-Sections for good Diatomaceous material. List furnished on application.

Pleurosigmas and other unmounted Diatoms, both Fresh Water and Marine; also Marine Algæ, Ferns, and a large quantity of miscellaneous microscopical material in exchange for good mounted objects.

M. A. BOOTH, Longmeadow, Mass.

To exchange, well-mounted Slides of Hair for mounted or unmounted specimens of hair from the rarer animals; lists exchanged. WM. HOSKINS, 208 S. Halsted street, Chicago, Ill.

Nicely mounted Slides (opaque) of the Coal-tar Derivatives, chemically prepared, crystalline in form, showing their beautiful colors, in exchange for other well-mounted material. Chemical name and formula attached to each Slide. About a dozen varieties on hand. F. L. BARDEEN, M.D., 30½ Meigs street, Rochester, N.Y.

Vanadate of Ammonia, $(N H^4)^2 V O^4$, Slides for the Polariscope in exchange for other Slides.

H. POOLE, Practical School, Buffalo, N. Y.

Slides mounted from injected Frog's Gall-bladder, Liver, Kidney, Stomach, Intestine and other parts, exchanged for other good and interesting preparations. C. BLASDALE, M. D., Jericho, Queens Co., N. Y.

Well-mounted, selected and arranged Diatoms, for good histological, pathological or anatomical preparation. State what you have, and terms of exchange.

W. W. RINER, Greene, Iowa.

Foraminifera from Sponge-sand, Marl-sand, and Chalk; Transparent Prisms of Carbonate of Lime from fossil Shells; Fresh and Salt Water Diatomaceous material; Carapaces of Rhizopods; polished sections of Fossiliferous Limestones, Corals, etc., to exchange for any microscopical material.

K. M. CUNNINGHAM, Box 874, Mobile, Ala.

The American Monthly Microscopical Journal.

Issued on or before the fifteenth day of each month.

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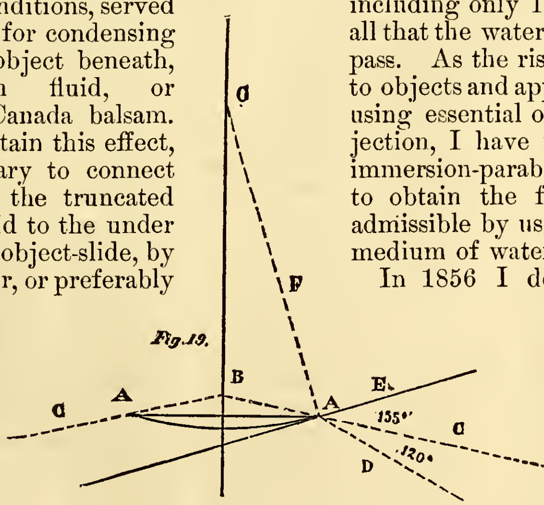
THE AMERICAN MONTHLY MICROSCOPICAL JOURNAL

VOL. I. NEW YORK, JUNE, 1880. No. 6.

On an Improved Immersion-Paraboloid.

BY F. H. WENHAM.

The immersion-paraboloid was first described by myself in the year 1856. It was designed for the purpose of illuminating opaque objects under the highest powers in a black field, by the application of the principle of total reflection from the upper surface of the thin glass covering the object. This surface, under these conditions, served as a speculum for condensing light on the object beneath, contained in fluid, or mounted in Canada balsam. In order to obtain this effect, it was necessary to connect the flat top of the truncated glass paraboloid to the under surface of the object-slide, by means of water, or preferably by some more highly refractive medium, such as oil of cloves, as this allows extra rays to pass beyond the critical angle of total reflection from glass to water. This angle between the glass and water is limited to a convergence of about 120°. The critical angle from glass to air is near 41°, and to prevent the possibility of rays passing through the cover at less than this angle, and producing an imperfectly black field, I cut off the base of my paraboloid a few degrees above this angle, and, therefore, the figure of the curve encloses an angle of 90°, starting from the focal point.



The apex, or flat top, is cut down at a distance from the focal point equal to the thickness of ordinary glass slides, the average of which may be taken as about .06 inch. With the paraboloid in water-contact, the difference between 90° and 120°, is an annulus of light including only 15°, which is all that the water will allow to pass. As the risk of damage to objects and apparatus from using essential oils is an objection, I have modified the immersion-paraboloid, so as to obtain the fullest angle admissible by using an intermedium of water only.

In 1856 I decided from a trial of other foci, that an immersion-paraboloid of $\frac{1}{10}$-inch focus gave the best effect, and as recent experiments have confirmed this, I still adhere to that size for general use. *AA* Fig. 19, (drawn to the natural size), is the diameter of the flat top of the paraboloid. *B*, the focal distance determined by the thickness of the slide. This necessary truncation of the paraboloid limits the angle taken from the focus to the line of the top where it intersects the curve, at the apex of the parabola to 155°, the extent to which the upper section of the figure can reflect rays, as shown by the lines *CC*. The line *D* represents the critical angle from glass to water, limiting the degrees to 120. Now, unless oil is used, rays included between the lines *D* and *C*, are lost; but if the water-angle (*D*) is raised to *C*, the convergent surface of the top of the paraboloid, at the corresponding angle of incidence that will admit *C*, is represented by the line *E*. A perpendicular *F* taken from this at the point *A* will intersect the axis at *G*, representing the radius of the concave required in the top for admitting all rays with a water-contact.

By this illustration it will be seen, that a shallow concave top of $\frac{8}{10}$ of an inch radius, will be sufficient for an immersion paraboloid of $\frac{1}{10}$ of an inch focus. This is shown full size in Fig. 20. *A* is the paraboloid; *B* the focal point; *C* the center of curvature of the hollow top. Of course a deeper concave top will perform equally well, but is not so convenient to use on account of the larger body of water required for filling it. The hollow-topped paraboloid is free from the troublesome adhesion that sometimes takes place between the flat surfaces at the top and slide, which prevents the free use of the stage movements and a concave surface is not liable to be scratched by intervening particles of grit.

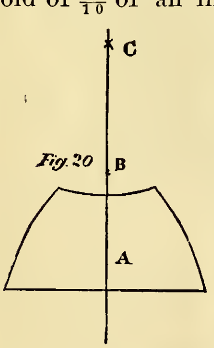


Fig. 20

The immersion paraboloid is most useful in cases where dry or non-immersion object-glasses are employed, as it is only with these that total reflection can be obtained from the top of the *cover* on objects mounted either in balsam or fluid. But if immersion object-glasses are used on objects mounted dry and adherent at the top of the slide, this, under the circumstances, being the total reflecting surface, the contact of the object prevents total reflection at the part where light is admitted and shows the object brilliantly luminous in a black field.

From the above it may be inferred, that if the front of an object-glass, in cases when the aperture is supposed to be limited by water from rays reflected back and increased by an intermedium of oil of cedar or cloves, if the first surface is also made concave, it would be the means of dispensing with the objectionable use of oil. I have tried some experiments this way: Fig. 21 is the front lens of an immersion $\frac{1}{10}$-inch object-glass. At first the concave surface of the front was made much shallower than is shown, without any appreciable difference in effect from that of a flat plane. The concave was then deepened till it reached to near three times that of the hemispherical back radius, with a slightly improved result in the way of increase of light and flatness of field. The experiment was not carried further. The radius of the back convex is .045. That of the concave, .13. Of course if oil of the same optical properties as the glass were to be used, the effect of the concave surface would be simply nil. It would then act like a flat front.


Fig. 21

The Salmon Disease and its Cause.*

Some analogy seems to exist between the spread of the fungoid disease, at present so destructive to salmon life, and the apparently erratic dissemination of ordinary zymootic disorders, which, in their origin, may probably be all referable to violations of natural laws.

Unlike the more subtile character of many epidemics affecting the human family, or even the rinderpest among cattle, the vegetable parasite—*Saprolegnia ferax*, at present developing itself with such unprecedented rapidity, and such mischievous results upon fish in English rivers, is of sufficient size to be studied by the ordinary powers of the microscope, and its growth may be followed from the germination of the infusorial spore, with a $\frac{1}{4}$ or $\frac{1}{6}$-inch objective.

The causes ascribed to account for this hitherto unknown outbreak among salmon are various, but mostly point to river pollution. So far as I am aware, however, they do not indicate any considerable change of condition or circumstance to which the fish have been subjected of late years.

The proximate cause of this disease and the reason why its ravages should extend so rapidly at this time, is a question of sufficient interest and importance to arrest the attention of all interested in the preservation of our most valuable fish—one of the most important sources of food supply. Not that the fungus restricts its attacks to salmon, for many fresh-water fishes are destroyed by it, and even newts, tadpoles and fresh-water mollusca are sometimes attacked; this is well known to those who have aquaria, for despite all ordinary care, it sometimes happens that the finny favorites become fluffy and mouldy, the fungoid pest irritates and destroys the skin, until, seizing upon the gills, the tortured animal can resist the attack no longer, and is soon found dead—the fungus developing rapidly over it in woolly tufts.

Among salmon in rivers this pest first appeared so recently as the spring of 1878 in the Carlisle Eden, the Annan, the Mitt and the Lancaster Lune, where large numbers of spawned fish (Kelts) and also some salmon, smelts and trout were found in pools and floating down the stream, dead or dying. Nearly twenty years ago those engaged in cultivating the ova of trout and salmon found these attacked by a vegetable parasite which effectually destroyed their vitality—they were also to a considerable extent cultivating and disseminating the fungus itself. Mr. F. Buckland thus describes the appearance of salmon killed by this disease "they are all more or less covered with patches of fungus, generally circular in form. The tail is almost always affected, and often to such an extent that the soft parts are eaten away and the bony rays left quite uncovered—a bunch of fungus is generally found growing on the head and nose, and hence the diseased fish in the Eden are called 'salmon with white nightcaps.'"

Many years ago the Rev. M. J. Berkely instanced the genera *Achlya*, *Saprolegnia*, *Pythia* and *Aphanomyces* as "notoriously antagonistic to animals, especially those of aquatic habits in a low stage of vitality;" of these the genus *Saprolegnia* appears to be most inimical to salmon life. On ac-

*A paper read by M. A. Robson, Hon. Secretary, before the members of the North of England Microscopical Society, March the 17th, 1880.

count of their aquatic habits, and also from the fact that they emit active flagellated spores from the clavate tips of their threads, which swim freely like infusoria—they were at one time associated with the Algæ. Mr. Berkely however says: "In these lower plants there is a duality or plurality of modes of fructification. Indeed, though the active spores moving about with one or more lash-like appendages exactly resemble the reproductive bodies which are so common among Algæ. There is now evidence among moulds, as in the genera *Peronospora* (the potato destroyer) and *Cystopus*, and still more amongst the *Myxogastres*, that there are active spores amongst "true fungi;" further, quoting Pringshiem's definition of the genus *Saprolegnia*, he says: "Infusorial spores formed in the interior of the sporangia, and immediately after their formation, isolated and active without any previous membrane. New sporangia formed by the repeated protrusion of the basal membrane into the old sporangium, oögonia containing numerous resting spores."

To make the history more intelligible, Mr. Berkely describes one or more species of each genus, and says of *Saprolegnia monoica* and *ferax*. "The first appearance is that of delicate, white or greyish, nearly equal, simple or slightly branched threads, without any joints, radiating in every direction, and containing a grumus, granulated mass. The tips of these threads gradually swell, and after a time a septum is formed at the base, after which the contents are collected into little pellets, each of which at length, is separated from the rest, and becomes an ovate spore, which escapes by a little aperture at the tip, and is furnished with one or two delicate thread-like appendages, by means of which it is able to move about like an infusorial animal with great rapidity. After a short time motion ceases, and the spore germinates and produces a new plant.

"After the sporangium is exhausted the septum at the base becomes convex, pushes forward into the vacant cavity, which it more or less completely fills, and produces another crop of spores, sometimes projecting through the aperture of that which was first formed. This process is repeated a third or even a fourth time till the powers of vegetation are exhausted. Now, however, a second form of fruit appears, a form that has been called an oögonium, because it produces spores which are quiescent and dormant, for a time, like eggs, and not furnished with motile appendages. Lateral branches are given up for their production which terminate in large globose sacs, which, like the sporangia, are not at first separated by any septum. One, however, is at length formed, and the membrane becomes pierced with numerous apertures." (*Intellectual Observer*, Vol. V.)

The above authorities show that this fungus is possessed of several methods of fructification, and that it also produces resting-spores which may retain their vitality for an indefinite time. Moreover, it is not strictly aquatic in its habits, but can exist and propagate itself out of water—in fact is amphibious—it is extremely common on flies in Autumn, when the insect appears to be gummed to places and covered with a white powdery efflorescence—this is the vegetable parasite in question—known when it attacks the house-fly as *Empusa muscæ* but certainly analagous too, if not identical with *S. ferax.* Mr. Berkely regards it as the latter fungus.

The fly, by the destruction of its

viscera, etc., becomes weakened and unable to move about; but the viscid fluid extending from the tubular hairs surrounding its pulvilli continues to flow, and the insect becomes glued to the point of attachment, by the very secretion which enables it ordinarily to walk on all surfaces and in all positions.

People who make a practice of feeding gold fish, etc., with flies, may thus introduce into their aquariums a supply of germinative spores, sufficient to destroy successive colonies of fishes. Some idea of utilizing this parasite, so antagonistic to certain forms of animal-life, appear to have been mooted in America. The following paragraph, bearing upon our subject, appears in the February number of *Science Gossip:*

"*Parasitic Fungi on Insects.*—Professor Hagen, of Harvard, describes some experiments that had been made by Mr. I. H. Burns and others, and comes to the following conclusions: 1. That the common house-fly is often killed by a fungus, and that in epizootics a large number of insects which live in the same locality are killed by the same fungus. 2. That the fungus of the house-fly works as well as yeast for baking and brewing purposes. 3. That the application of yeast on insects produces in them a fungus which becomes fatal to the insects. 4. That in the experiment made by Mr. I. H. Burns, all potato beetles, sprinkled with diluted yeast, died from the eighth to the twelfth day, and that the fungus was found in the vessels of the wings."

Now that the life-history of *Saprolegnia ferax* has been to some extent examined, we may revert to the causes assigned for its destructive outbreak and extension beyond all previous limits. Mr. A. B. Stirling, curator of the Anatomical Museum, Edinburgh, writes as follows: "I also wish to say that the fungus appears to me to be of a very irritating nature, causing the fish such tortures that they destroy themselves in their efforts to get rid of their tormentor. The sores upon the fish are not caused by the fungus, but by the fish themselves by rubbing the parts of their bodies affected, upon stones or rocks and other projections they find to suit the parts affected. I am quite unable to say what the origin of the fungus may be, but, as I found foreign matter of various kinds, entangled in the mycelium of the fungi, I have pretty good grounds for thinking that it may have arisen from pollution. The foreign matter found in the mycelium or fronds of the plants, were Torulæ or yeast plant, triple phosphates fecula, human hairs, and hairs of cat and mouse; also, desmids and diatoms, shreds of dyed wool and cotton, with other fragments of matter unknown to me."

With all due deference to Mr. Stirling, I feel bound to remark, that although the fish in its efforts to get rid of the parasite does lacerate itself, still the skin is already completely disorganized by the growth of the fungus.

Soft bodied animals, as tad-poles, when attacked are penetrated throughout by the mycelium of *S. ferax*, and the whole substance of the creature is interwoven with its threads. In addition to the *débris* detected by Mr. Stirling, other impurities are detected, as the following extract from a newspaper communication well shows:

"Certain kinds of chemical impurities are known to be favorable to the growth of fungoid life, and the practice of sheep-washing, which is largely carried out in the rivers of the South of Scotland; the use of artificial manures, washed by the heavy rains and melting snows of the past Winter, and the existence in the streams of various polluting matters from factories and towns, are very likely to have combined to produce the conditions favorable to the present outbreak."

Again salmon in rivers are subject to artificial conditions and cannot follow their natural instincts. In evidence of this assertion Mr. F. Buckland writes: "A large number of fish which have done spawning are moved by their instinct to get down as quickly as possible to the sea; but they cannot do so on account of their journey being delayed by the weirs and 'caulds' on the Tweed and her tributaries. The instinct of the invalid salmon teaches them to go to the sea, because it is certain the fungus cannot exist in the sea, and secondly, because they wish to pick up condition and fatten upon their natural food, which consists of sand-eels, sprats, herring, smelts, and the fry of other sea-fish. When these fish are delayed above the weirs the crowding tends to disseminate the disease, for I am sure the fungus is 'catching.'

"Whatever, therefore, may be the cause of the disease, the fact stares us in the face that crowding above the weirs most certainly tends to foster and spread its ravages, just as when pilgrims at Mecca become too crowded, the plague is started and spread."

Mr. Buckland here asserts positively "that it is certain the fungus cannot exist in the sea;" its development may be checked, but it is questionable if the vitality of the resting spores would be impaired by continual immersion in sea water. The salmon's recovery may also be due to improved feeding, and hence tone and increased vitality, which enables the fish to resist the encroachment, and ultimately rid itself of the parasite. I once tried a little experiment with sticklebacks; of these I had a dozen or so, all more or less affected with the fungoid growth. I transferred them from a fresh-water aquarium to sea-water (sticklebacks live well in sea-water after they become accustomed to its density); but although their existence may have been somewhat prolonged, the fungus ultimately reached their gills and killed them all.

The excessive protection afforded to many species of game, and unmitigated destruction of so-called vermin, which naturally clear off the sickly and weak, appears to induce many hitherto unknown maladies among them. Such diseases do not confine their ravages to the point of origin; usually contagious, they extend their limits and include both strong and weak in a common destruction.

So with salmon, it may be that in artificial fish-hatching and rearing a large percentage of weakly fish reach maturity, which, in an ordinary way, would have succumbed to their natural enemies; such would be the first seized by the fungoid parasite in question, and of necessity convey the contagion to others. An outbreak so excessive can only be ascribed to some general cause, as it is scarcely reasonable to suppose that the contaminated rivers became polluted all at once. Where the disease appears, each infected fish becomes an agent of destruction to its kind, and an assiduous emissary in disseminating myriads of motile and resting spores, all seeking or waiting for the conditions essential to development.

The question of chief interest to

microscopists appears to be: How does the parasite establish itself upon the animal, and in what manner is the skin impregnated by its spores? No doubt a scratched or abraded surface would readily meet the requirements of the fungus; but in the absence of such preparation, it is highly probable that the motile spores are introduced by absorption. Something analogous exists in the human family, and the terrible malady known as the fungous foot of India, prevalent among the shoeless portion of the population affords an example. This fungus resembling to a *Mucor*, but scientifically classed as *Chionyphe Carteri*, perforates and honeycombs the bones of the foot; the cavities becoming filled with the mycelium of the plant, when, if speedy amputation is not effected, death soon ensues from exhaustion. Mr. H. I. Carter, F. R. S., is of opinion that this disease is occasioned by the entrance through the sudorific ducts of minute spores in an amœboid state, and which attain a monstrous growth, as the black fungus in the human body.

It is certainly within the microscopist's province to ascertain and accurately describe the character and habits of these destructive pests. When the conditions under which they flourish are once known, such may be removed and the foe ousted from its source. But to deal empirically with an enemy like this, or, when known, to adopt merely vacillating measures, is to trifle with a destructive and insidious antagonist, with the probable result of rendering the mischief chronic.

Although epidemics among preserved animals seem usually to run their course and vanish for a time, as with the civilized portion of humanity, yet a primary cause must exist to account for each outbreak, probably resolving itself in its origin into an interference with the ordinary processes of Nature; inducing a sudden and abnormal development of some putrefactive vegetable ferment which breaks out in a predominant form of disease. Hospital gangrene was supposed by Berkely to be of this nature.

This much is certain, that the salmon, by its environments, is subject to conditions of so artificial a character as to render it improbable that any indigenous wild animal can submit to them without impoverishment, or adapt itself to the rapidly altering circumstances. Hence, unless there is a general reversion to natural conditions, only those will remain which can survive amidst the increasing pollution consequent upon trade extension and the development of mineral resources.

It, therefore, follows that all available means should be adopted in order to conform to natural requirements, and that the fish should be permitted to follow their habits without the interposition of barriers, which interfere with tendencies and instincts that are actually bound up with the creature's existence, and which may be justly regarded as so many inflexible laws laid down by Nature for the preservation of a species.

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Directions for Cleaning Diatoms.

So many microscopists are interested in diatoms but do not succeed well in their attempts to clean them, that a short and thoroughly practical article on the subject will be valuable to many readers of the Journal. There will be nothing in this article that is particularly new; but in most contributions to the subject, the directions are either intended to apply to special cases, or they are given in such an empirical manner, that the beginner is at a loss to know how to proceed in ordinary cases; he can only follow the directions, blindly adding acid after acid because he does not know the effect of the different acids.

In this article it is proposed to not only give such directions as will serve well for such diatomaceous material as the collector is most likely to meet with, but also to briefly explain the action of the chemicals employed, so that a person of ordinary intelligence may know how to vary the processes to suit special cases.

We will not now refer to the methods of collecting diatoms, but will proceed at once to describe the process of cleaning them.

We may have them in the form of fresh gatherings, or as fossil deposits; the method of cleaning will be different in the two cases.

The object of cleaning is: first, to remove all extraneous matter from the frustules, so that they will appear clear, and all their minute markings will be seen to the best advantage; second, to remove particles of sand and dirt which would mar the beauty of the slide. Undoubtedly the first is the more important object of cleaning, but many mounters are too fastidious to be contented with that alone. However, it should be remembered that not every gathering, whether recent or fossil, can be freed from particles of insoluble dirt or sand, and this is often the case with collections which contain rare forms. Consequently a preparation should not be condemned because it is not entirely diatomaceous. It may be valuable, and some of the most remarkable and interesting forms we have seen, forms which we have studied by the half-hour on account of the exquisite beauty of their shape and markings, were isolated specimens, on a slide containing much *débris.*

Moreover, even when the material can be cleaned very well, it may be that the quantity in hand is so small that the best results cannot be attained. Many have tried to clean the celebrated Richmond deposit and have failed, partly because they worked with too little material, and partly, no doubt, because their specimen was not well selected, for not all of that deposit will give very clean slides.

A diatom consists of a siliceous frustule, which for our purpose may be considered as composed of pure silica; and the endochrome. As to the endochrome, we may regard it as organic matter containing a trace of iron; in cleaning the diatoms we have to destroy the organic matter, and to remove the iron by solution.

NITRIC ACID PROCESS FOR FRESH GATHERINGS.

Only the simplest process of cleaning, therefore, is necessary, when we have to work with fresh gatherings that are purely diatomaceous. The iron of the endochrome is in solution, and will give us no trouble to remove, for any dilute acid will take it out at once. Hence, we need only remove the organic matter. This is readily done by boiling the moist or dried gathering in strong nitric acid, and this is all that is necessary to do, if we wish to clean a pure gathering of diatoms that are mixed with a considerable quantity of other vegetable or organic matter. Nitric acid is an oxidizing agent, and it burns up and destroys the organic matter of the diatoms, while it also dissolves the small quantity of mineral matter with which they may be contaminated. In this process it sometimes happens that some traces of the cellulose of the diatoms, or of filamentous algæ which usually accompany them, even in the cleanest gatherings, are not removed by the boiling, but can afterwards be seen, as clean, white filaments. These bits of cellulose are capable of oxidation, but often resist all but the most powerful oxidizers. In case they are numerous, the best way to destroy them is to pour off the nitric acid from the diatoms, wash them with water, and then use strong sulphuric acid and chlorate of potash, in the manner to be described elsewhere in this article. Although nitric acid may not remove the cellulose at once, it is not always necessary to resort to the action of the sulphuric acid process, and usually it is not advisable to do so, for the nitric acid will have converted the cellulose into a substance that is chemically analogous to guncotton, nitro-cellulose, and this nitro-cellulose will instantly dissappear if the frustules are dried and heated upon a cover-glass.

Now that we have explained the action of nitric acid, we will describe, in detail, the process which we would recommend for cleaning rather pure gatherings of living or recent diatoms. The operations can be readily conducted in test-tubes about six inches long.

1. Shake the material in water, if it contains any impurities that can be mechanically separated in that way. If it is a marine or brackish water gathering, wash in fresh-water to remove the salts from the sea-water. Pour off all the water, and if the diatoms are then somewhat dried, it will be all the better.

2. Boil in nitric acid, until oxidation appears to be complete. A few minutes boiling will suffice, and the less time the acid is allowed to act the better it will be for the more delicate or finely marked diatoms. Some persons add a few crystals of chlorate of potash to the boiling acid just before the boiling is finished. This hastens the oxidation somewhat, but very little should be used, enough can be held on the end of a knife-blade.

3. Fill the tube with filtered water, allow all the diatoms to settle, pour off the water, and repeat these operations until the acid is entirely washed out. The residual mass, at the bottom, should be of a pure white color. If it is not, and the operator thinks the nitric acid has acted to its full power, the sulphuric acid process should be resorted to.

4. It is now necessary to separate the *débris* and flocculent matter from the perfect frustules. Among the many methods described in books, we have found the one here described to be applicable to every collection we have cleaned. First add ammonia, the aqua ammonia of the druggist, to cover the diatoms to the depth of about one inch, allow to stand about fifteen minutes, then fill the tube with water, allow to settle, and pour off the water once. Then cover the diatoms with water to the depth of about two inches, shake thoroughly, set the tube upright and allow it to stand, undisturbed, fifteen seconds, then pour the supernatant fluid into a clean test-tube, and repeat the process in the first tube from three to five times, according to the quantity of material that settles through the two inches of water in fifteen seconds, each time pouring off into the second tube, which should be larger than the first one. In the second tube let all the diatoms settle, then transfer them to a tube just like the first one, cover with water to the depth of two inches as before, and allow to settle one min-

ute and a half, and repeat this three to five times. Go on with these operations until the diatoms settle for three, four or five minutes, and the result will be that the frustules will be well separated into large and small forms in the different tubes, and experiment will soon indicate what time should be allowed for settling to get them free from broken frustules and particles of *débris*. The times stated above are purely empirical. They should be determined by experiment, by using the microscope, for each gathering.

5. Filtered water is pure enough for the operations described above, but to preserve or mount the diatoms they should be finally washed with distilled water, then placed in a mixture of distilled water and alcohol in equal parts, and kept in small glass-stoppered bottles.

The ammonia is used to remove flocculent matter, and in some instances the effect is very marked.

It is not advisable to keep cleaned diatoms in bottles with cork stoppers, for after a while the alcohol becomes discolored by the cork, and the diatoms become dirty in appearance.

(*To be continued.*)

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Microscopic Examination of Tissues after the Administration of Mercury.*

BY S. V. CLEVENGER, M. D.

Five years ago it occurred to me that the medicinal workings of mercury could be accounted for by supposing that the finely divided metal underwent no change after it was taken, but passed into the minute, tubular structures of the body, and cleared them of morbid accumulation. I found no justification for this view in the writings of therapeutists, and endeavored to rid myself of the notion, hoping and waiting for the true *modus operandi* to be discovered. I read of theories emanating from authoritative sources quite as puerile as I then conceived my own hypothesis to be. The greatest objection to the mechanical theory, seemed to be the fact that the mercury of the salts must undergo reduction in the body to the metallic form, to account for their physiological effects. For the purpose of defeating my own assumptions and forever ridding myself of speculation in this direction, I began a series of experiments which, though not yet concluded, have confirmed my original views. Calomel is reduced to metal, in the duodenum, by the pancreatic juice and glucose; corrosive sublimate passes into yellow oxide and extremely divided metallic globules in the intestinal fluids, and in alkaline blood; cyanide of mercury is decomposed in the stomach by its hydrochloric acid, and forms the bichloride of mercury, which is then reduced as just mentioned. The iodides, bromides and oxides are similarly broken up, all the mercuric salts acting alike in precipitating a more finely divided metal, and the mercurous salts resemble calomel and blue mass; the effects of all being modified, but not essentially, by the elements combined in the preparation given. The microscope revealed the courses taken by the separate globules through the intestines, lacteals, veins, arteries and lymphatics, and I believe that some valuable results will be obtained in studying histological tissues thus injected before death.

Tubular structures, which would escape the scrutiny of the observers with the best appliances and under the highest powers, would be thus rendered apparent.

* Read before the Illinois State Microscopical Society, Chicago, February 27th, 1880.

The following extracts are from a paper read before the Chicago Biological Society, February 4th, 1880, and published in the *Chicago Medical Gazette:*

* * * When the metal, in an undivided or uncombined state, is administered, it rapidly passes through the intestines, with apparently no effect whatever. The cohesive properties of its component particles resist separation. Considerable trituration with an excipient is necessary to reduce the metal to globules; shaken up in water an uneven but pretty fine division may be made, but eventually the fluid metal runs together again. Honey, fats, oils, confections, etc., when mixed with the fine globules, tend to keep the particles apart. I found that albumen and glycerin would effect a separation better than many substances. Finely divided, mercury presents a grayish appearance, passing into black as the division is made extreme, this condition favoring the reflection of light from particle to particle, until no rays are reflected to the eye. The microscope shows that no change from the metallic state has occurred in reducing the metal to this form. To count the globules in one gramme (15.4 gr.) of blue mass, I spread it, mixed with water, over a square decimeter of surface and found an average of 2,000 visible under a very low magnifying power in an area of a square centimeter, which would make 200,000 of these globules in a gramme. But under an objective magnifying seventy diameters, more than ten times as many became apparent. Dr. Lester Curtis estimated the size of these globules at from $\frac{1}{8000}$ of an inch to sizes almost immeasurably small. In a gramme of pill-mass there is one-third of a gramme of mercury, which would measure $\frac{1}{40}$ of a cubic centimeter. Taking .01 millimeter (Kölliker) as the average diameter of the capillaries, the division of this mass into twenty-five million globules would suffice to reduce all the mercury to capillary sizes. But we have seen that all are not so reduced, though many are divided up very much smaller. Carpenter, on p. 138 of his Physiology, asserts that metallic mercury, finely divided, can be absorbed by the blood-vessels from the alimentary canal.

* * * Under a three-quarter inch objective, magnifying seventy diameters, I placed the web of a frog's foot, and acquainted myself as thoroughly as possible with the peculiarities of its blood-vessels, pigment-granules, appearances by reflected and transmitted light, and then gave the frog five grains of blue mass. Twenty-four hours afterward I examined the frog, and was surprised to find little globules of mercury mingled with the mucus it had excreted from its skin. Brushing these off, I placed its feet again under the same lens, and found blood-vessels choked with metallic mercury: aneurismal and varicose pouches were distended with mercury, and a great number of so-called pigment-granules had changed to a yellow, metallic luster; these spots reflected the light as would mercury when examined by direct rays. As many as twenty of these lacunæ, or star-shaped bodies could be counted between two toes, and altogether there were about a hundred on each foot. The close resemblance between these lacunæ thus injected, and the description in Stricker of the lymphatic sacs in the course of the lymphatics of the frog, led me to believe, at Dr. Lester Curtis' suggestion, that I had observed mercury in the lymphatic channels of the frog. Two little tubules choked with mercury, pre-

sented a singular phenomenon. Under the power used, these tubes appeared blind, but a little globule of mercury lay upon the surface of the web, at the outer end of one of the tubes. Watching this globule intently for ten minutes, it suddenly increased in size and the tube collapsed, having emptied its mercurial contents outward. The globule thus formed was twice as large as the characteristic blue-mass globule, and was easily removed from the web by a canal's-hair pencil. The other tube was more curved, and at its outer end had two such globules, both of which increased slowly in size, and in half an hour had grown very large, at the expense of the tubular contents, the tube disappearing as did the first one. Nowhere could I see anything like foreign particles circulating in the blood. The white and red blood-corpuscles were distinctly visible, but in one capillary I found a small, dark particle gradually accumulating similar particles near it; these I suspected were minute mercury-globules; they accumulated against the current, and the blood passed around them freely; suddenly the down stream end of the mass broke away and apparently washed away in the blood, out of sight. This was repeated several times while the mass, in this way, was proceeding up stream. While exchanging objectives for a higher power, the capillary cleared up. In one vein I observed plainly a large globule of mercury lying motionless, while the blood-corpuscles beat against it with as little effect as water would have against a great stone in a brook; the corpuscles changed positions to pass it in the vessel, but slid by as rapidly as ever. Some of the exuded mercury-globules on the web, enabled me to obtain good comparative measurements. Six of these metallic spheres lay on the surface, just over one of the smallest capillaries. The six together measured the diamether of the capillary, and could easily have passed through this blood vessel abreast.

I repeated the experiment on a smaller frog by anointing the chin, axillæ and thorax with Squibb's oleate of mercury, with the same result, only the large sized globules were not so numerous. To a third (large sized) frog I gave ten grains of blue mass, and about as much blue ointment. I kept him in a glass jar, to be sure he did not eject the pellets, and in this case, twenty-four hours after, found the lymphatic sacs engorged, but blood circulation undisturbed. In all the frogs so treated, where unavoidable lacerations of their feet had occurred in manipulating, there oozed from the torn edges, minute globules of mercury. The last frog shed his skin in three days after the dose, but otherwise none of them underwent any apparent change in health or vigor. The skin I think must have afforded the main means of exit for the metal. There is not a fragment, however small, of this discarded cuticle which does not exhibit plainly the metallic globules attached to it in great numbers; many hundred slides may be mounted with the skin from this frog alone, and every slide will reveal fifty or more globules. In the dissecting room of the Bennett Eclectic College of this city, a cadaver was exhibited to the students, the skin of which was so covered with mercury that an ordinary pocket magnifier revealed the globules in countless numbers. Dissecting the frog last mentioned, I found the stomach coated with the globules, but, ten days having elapsed since the dose, no mercury was found between the intestines and the skin, except in the dermis, but very probably in the liver. This organ was apparently choked with sacculations of an opaque substance, which at first Mr. E. B. Stuart (who rendered indispensable assistance) and I, took to be pigment granules, but after slicing by the microtome some sections $\frac{1}{200}$ of an inch thick, and the opacity of these spots persisting, careful consideration leads us to think these opaque spots are aggregations of metallic mercury, held in the hepatic channels. In reflected light the unmistakable glint from mercury globules may be caught. Hoping to discover the courses taken by the metal through the body of the frog, I administered a gramme (15.4 gr.) of finely divided mercury, in albumen, to a male frog. In five hours, globules appeared on its back. Dissection showed that the intestines, renal-portal circulation, heart, kidneys, and even the testes, contained numerous globules of mercury, and the lymphatic passages were beautifully injected with globules much more finely divided. Apparently the smaller particles had passed into the lymph channels, or the metal had undergone further division in absorption into these passages.

At 10 A. M. I gave five grains of calomel to a chicken weighing four and a-half pounds, eighteen months old. At noon it was sick and very thirsty; at 9 P. M. I blew ten grains more calomel into its pharynx, and at 10 o'clock P. M. killed it.

It ejected four ounces of water from its mouth, mixed with the last dose of calomel, and I recognized black oxide crystals in this liquid, which had apparently formed above the crop. I did not expect conversion to occur at this point, but the fact indicates the general tendency of mercurials toward decomposition everywhere in the body instead of a formation of higher salts.

The fæces contained mercury globules. Mercury was distinguishable by the microscope in three out of five parts of the chicken's blood; traces of calomel and black oxide were discernible in the proventriculus and gizzard; a few crystals of the black oxide with a great many globules of the metal were found in the upper intestine, with only metal lower down; the liver contained the metal, while the mesenteries held unmistakably large quantities of the globules, ranging downward in sizes from those usually found in blue mass. The liver globules were small, while those in the mesenteries were large.

Rationally, then, often repeated, small doses of calomel would impress the general system better by allowing reduction and absorption to occur at intervals, insuring complete reduction and absorption, and wide-spread dissemination through circulatory channels. This is no less true of the mercurials in general.

(*To be continued.*)

About Diatoms.

The trouble encountered by the correspondent (page 84) in finding specific names for diatoms, is one that is encountered by every student in every branch of natural history, in botany and zoölogy. It is one that can be overcome only by persevering study and consultation of the original descriptions of genera and species, and of all that has been written on the same, since it arises from imperfect descriptions, from the various opinions of different authors as to what constitutes specific or even generic characters, and, in the case of microscopic objects, in part from the inferior instruments in use.

The identification of species of the diatoms is peculiarly difficult on account of their vast number, and from the fact that the original descriptions are scattered among more than two hundred publications. Only two attempts have been made to collect these together in one publication. As a result of those efforts we have, first, Pritchard's *Infusoria*, edited by Ralfs, 1860, which contains descriptions of all species and figures of typical species known to him at that time. Large additions have since been made, both to genera and species; second, the *Catalogue of the Diatomaceæ*, by Frederick Habirshaw, privately printed, a work of vast labor and research. This contains all the specific names and synonyms known to him at the time, 1879, and references to the authorities, but no descriptions, so that the work is no help for identification for any individual *Navicula*, except by reference to the authority of each one named in the list. There are over six thousand names, and of these eight hundred and sixty-two are recorded as *Navicula*. Probably one hundred and fifty of these are synonyms, and if every one could be tested by authentic specimens, the number might be reduced to three hundred. The others having no legitimate claim to specific names. A little less numerous than the Naviculas are the forms belonging to the genus *Coscinodiscus*. The magnificent *Atlas* of Schmidt, now in course of publication, has figures of about two hundred species of this genus, and does not include all on Habirshaw's list. Your correspondent may now learn what it is to identify any one diatom.

The difficulties of identification may arise from imperfect description, or from the use of different terms by the authors. One case of this kind may serve as an illustration of the difficulty of describing forms. Harvey and Bailey published in the proceedings of the Philadelphia Academy, 1853, (*Wilkes' Exploring Expedition*), *Hyalosira punctata*, with a careful description; Wm. Smith's *British Diatomaceæ*, 1856, Vol. II, p. 35, contains *Rhabdonema mirificum*, with description —a figure of this was published in the *Quarterly Journal of Microscopical Science*, Vol. VII. H and B's figure was published in 1860 —only one hundred copies were printed by the government. A comparison of the two figures showed at once that they were the same thing. Both descriptions were good and accurate; yet Bailey's must have been known to Smith, and both were known to Ralfs, for he prints one on page 804 and the other on page 805. The terms used by the two authors in describing the same thing were so different that neither Smith, Ralfs, or any one else, could recognize it until the figures were compared. This reminds me of an observation of one of the best diatomists in this country, "Figures are nothing, description is all." He was mistaken. I challenge any observer to so describe *Biddulphia pulchella*, so that any person who has not seen one, or a figure of one, could form any definite idea of its shape, or that any draughtsman could make a drawing that any diatomist could recognize.

Another difficulty in identification is that one may find and name a form new to himself, which had been named by another, perhaps years before; but the first publication was in some inaccessible periodical that the second discoverer never saw, and so both names get into the literature.

Many new names are given in consequence of the ideas of the authors as to what constitutes specific or generic characters. This is well illustrated by the names given to what Prof. H. L. Smith, Rev. Mr. Dallinger and the writer consider *N. rhomboides*, viz.: *Frustulia Saxonica*, *F. torfacea*, *N. crassinervis*, *N. Amici*, all of which were grouped together by De Brebisson in genus *Van Huerkia*—simply because the transverse striæ are parallel. Wm. Smith makes genera of those forms that grow in gelatinous tubes. Prof. H. L. Smith rejects that even as a specific character; Wm. Smith insists on the closeness of striæ as a specific distinction—one generally rejected, and with it many specific names. He also considers the position of certain oily globules in the frustule a specific character (Vol. II, p. 25), but curiously enough, never mentions that in any specific description.

Now, your correspondent need not "forswear diatoms forever," if he is an enthusiastic microscopist, for they are interesting as exhibition objects, even if he knows no more of them than can be learned from the dealer's label on the slide. But if he is a true naturalist wishing to know all about these "gems of the Ocean," as the late Prof. Bailey called them, he must be prepared for long study and large expenditure for books and instruments, with indomitable patience and perseverance. And without these, no branch of microscopy can be successfully pursued. If he "sticks" to blood, he will find it is not "all plain sailing." Who is right in the interpretation of blood and its contents? Salisbury, Cutter, Richardson, Woodward, Schmidt, of New Orleans, or Treadwell? He must test the theories and measurements of all. If he only proposes to use his microscope where it is plan sailing, I recommend the point and eye of a needle and similar objects, such are plain enough, and afford "no chance for doubt or mistakes."

It is to be hoped that there will be sufficient encouragement to insure the publication of the new editions of Habirshaw's Catalogue and Smith's Synopsis of the Diatoms. Also, of Prof. Smith's great work, yet in manuscript, on the Diatoms, with his beautiful drawings of the living plants. If ever published by the Smithsonian Institution, it will be an honor to the nation.

I may be allowed to add, that one of the best means of identifying species of diatoms by the best authority now accessible, is Prof. Smith's series of named slides, beautifully mounted and at a low price. There will be about seven hundred slides when the series is complete.

CHARLES STODDER.

BOSTON, May 20, 1880.

The Simplest Forms of Life.

BY E. EYFERTH.

II. FAMILY ASTASIÆA.

Body contractile, metabolic, smooth or striped, usually colored green or red, with numerous granules within. A contractile spot is visible in most of them, in many there is a red pigment-spot (stigma) near the anterior end.

Individuals moving free, with
one flagellum in front, this with a
large base, from the pear shaped, pointed
end; no stigma, Peranema.
slender base, from the blunt or emarginate end, the latter
without a stigma, Astasia.
with a stigma
body pointed behind, Euglena.
body blunt behind, Amblyophis.
two flagella in front
both alike
on the pointed end of the body, Chlorogonium.
on an emarginate part of the body, Zygoselmis.
dissimilar, one moving one trailing, Dinema.
Individuals with the pointed posterior end fixed, often in families, Colacium.

1. Gen. *Peranema*, Duj. Shaped like a long pear, the small end continued into the moving flagellum; at the base of the latter an oblique mouth opening, below this a vesicle.

P. protracta, Duj. (*Trachelius tricophorus*, Ehr.) Body colorless, very metabolic, constant in shape or changing very gradually, swims generally slowly, and in a straight line. 0.03–0.07. Common in detritus, but single.

P. globosa and *P. verescens*, Duj. Appear not to be generically different.

2. Gen. *Astasia*, Ehr. Body elongated, emarginate in front without stigma.

A. hæmotodes, Ehr., red, and *A. viridis*, Ehr. Green, 0.06 l. Apparently these belong to the following genus.

3. Gen. *Euglena*, Ehr. Body fish-shaped, green, with a hyaline place in the head, at the posterior border of which is the red pigment spot. In place of the mouth there is a slight swelling from which the flagellum arises (which, however, often is not present, or is invisible). In the central part of the body are rounded or oval chlorophyll granules.

E. viridis, Ehr. Body green, metabolic, only constant in shape while swimming; turning in a long spiral as it swims. L. 0.04–0.08. Common in all stagnant water, very abundant in bad-smelling puddles and ditches, the grass-green coatings of which are often made up of Euglenæ. Division follows an encysting process. The cysts which are hardly to be distinguished from *Protococcus*, often are so close together so as to form an ulva-like scum in which they appear as six-sided masses.

E. sanguinia, Ehr. Only differs from the former in color, and seems to be the winter-form of the same.

E. deses, Ehr. Body elongated, 0.07–0.11. Movement crawling, never swimming, but slowly winding. Among algæ, not common.

E. acus, Ehr. Body long, spindle-shaped, form constant, only occasionally slowly contracting. L. 0.1.

E. spirogyra, Ehr. Body spirally marked, with two very large, ring-like nuclei. Color green or brownish. L. 0.2. Singly, among algæ.

4. Gen. *Ambliophis*, Ehr. Body large, similar to the preceding, but blunt behind, with a large vacuole in the middle, in front and behind which are several rod-like nuclei.

E. viridis, Ehr. Green; l. 0.02 in stagnant water not common.

5. Gen. *Chlorogonium*, Ehr. Body spindle-shaped, stiff, not contractile, with two flagella on one of the pointed ends, and a pigment spot near by. The genus differs from the preceding forms not only in the want of contractility, but also in

the method of multiplication. This takes place, usually, by repeated longitudinal division, but sometimes the entire plasma becomes transformed into numerous brood-cells (according to Stein only between 7 and 9 A. M.) which swarm out when mature.

C. euchlorum, Ehr. L. 0.08. Sometimes abundant in stagnant water.

6. Gen. *Zygoselmis*, Duj. Body of variable but slowly changing form, without pigment spot, with two slowly moving flagella.

Z. nebulosa, Duj. Body colorless, with gray or green granules. L. 0.02. In ditch water, not common.

7. Gen. *Dinema*, Pty. Similar to if not identical with the preceding species. The distinction is found in the fact that one flagellum lashes, the other trails.

D. grisiola, P. Among algæ, not abundant.

8. Gen. *Colacium*, Ehr. Individuals with the pointed hinder end fixed, sometimes in shrub-like families. Flagella not apparent.

C. vesiculosum, Ehr. L. 0.03. Usually on *Cyclops quadricornis*.

EDITORIAL.

Although we printed a large edition of the January number of the Journal, we are obliged to announce that we have but few copies remaining; and it is very doubtful if we can fill orders for the first two numbers after three or four months from this time. For this reason, all subscriptions hereafter received, will begin with the March number, unless the subscribers expressly order from January. Single copies of January and February numbers will not be sold hereafter.

———o———

Sub-Section of Microscopy, of the A. A. A. S.

Dr. S. A. Lattimore, Chairman of the Sub-section of Microscopy of the American Association for the Advancement of Science, which is to meet at Boston, August 25th, desires us to announce that the Local Committee has made the most complete and ample arrangements for the accommodation of the Sub-section. The entire Physical and Biological Laboratories in the Institute of Technology will be placed at its service; and in addition, two large rooms may be used, which are well adapted for lantern-exhibitions of any kind, day or evening.

Ample arrangements will be made for the display of microscopes and accessories, as well as for their safe keeping during the session, without trouble or care to the owners.

It is hoped that the efforts of the Local Committee will be rewarded by a large attendance of the microscopists of the Association; and that they will induce many others to seek admission to the Association.

———o———

Catalogue of the Diatomaceæ.

We have recently issued a circular advertising Mr. Habirshaw's "Catalogue of the Diatomaceæ;" and it is our present intention to begin work on the first part sometime this month. The four parts are to be issued in rapid succession, and as only a small number of extra copies will be printed, those who intend to subscribe should do so immediately.

We especially desire to call the attention of librarians to this work. It is one that should be in every library of scientific books, for it will be a work of reference of very great value.

———o———

Poison Detected with the Microscope.

Mr. C. M. Vorce sends the following account of how the microscope afforded important aid in detecting poison in an article of food.

In Cleveland, Ohio, "an entire family were taken violently sick, after eating some stewed prunes that were given to a member of the family by a neighbor and relative.

"The remainder of the prunes was submitted to Dr. W. B. Rezner, the Health Officer of the city, and was examined by him and myself with a microscope; and it was found to contain a large proportion of pulverized cantharides, or Spanish fly, thus confirming the suspicions excited by the nature of the symptoms. Other observers subsequently verified the observation. The fragments of the beetles being identified, not only with the entire insect, as obtained from a druggist, but with the dry powdered article obtained from the same source."

—We wish to call the attention of the editors of the *Cincinnati Medical News* to the fact that the appropriation of articles published in other periodicals, without accrediting them to their source, is a practice that deserves the appellation of stealing. The contents of a periodical are the property of its publisher, his stock in trade. Morally, no other publisher has the right to reprint them. However, we have no objection to seeing any article we may publish in the pages of any other reputable periodical, if the editor will be so courteous as to give us credit for it at the time; but when a journal come out one month with several articles taken bodily from our columns, and credits one to *Microscopic Journal*, and then comes out the next month with one of our editorials, appropriated as an original contribution, entirely ignoring its source, we think it is time to protest against the practice.

NOTES.

—In the *Zeitschrift für Mikroskopie* there is a description and an illustration of Dr. Weber-Liel's "Ear-Microscope," which is designed to assist in examining the interior parts of the ear for medical and scientific purposes.

By means of a flexible tube provided with a mouth-piece, the air can be rarified or compressed within the ear, and the movements of the parts of the ear can be distinctly observed.

The vibrations of the parts can also be studied, while speaking or singing in the mouth-piece mentioned above. It is claimed that the instrument is valuable for detecting important pathological changes in the ear. In the same periodical there is an interesting article on the examination of food, manufactured articles, etc., for technical purposes.

—The *Catalogue of North American Musci*, arranged by Eugene A. Rau and A. B. Hervey, A.M., has been published. It is an elegant, well-printed pamphlet of 52 pages, with the matter well arranged. It is more than twice as large as the authors intended to make it at the time of their first announcement, and they have been obliged, therefore, to raise the price to 50 cents for a single copy, or $1.00 for three copies.

We hope that botanists will not be tardy in showing their appreciation of the great labor which has devolved upon the two gentlemen who have compiled this Catalogue.

We cannot doubt that it is a very useful and valuable book; the names of the authors are a sufficient guarantee that the work has been accurately done.

"The classification is mainly that adopted by Prof. Shimper in his *Synopsis of European Mosses.*

"All the authentic species and varieties reported, from Mexico to the Arctic regions, have been included and their habitats given with as wide a range as the examination of references and several good herbaria would permit."

—Some time ago we received a bottle of a rubber cement from Mr. A. P. Brown, of Camden, N. J. Since that time we observed that Mr. Brown has prepared this cement for sale, and from what use we have made of it, we do not hesitate to recommend it. It is transparent, does not crack, and is not likely to run under the cover.

—We have received a programme of the microscopical soirée which was given at Detroit, under the auspices of the Griffith Club of Microscopy, April 8th. There were sixty microscopes and one hundred and seventeen beautiful objects. The Griffith Club seems to be a very enthusiastic organization, and as an admission fee of twenty-five cents was charged at the soirée, we hope the Club found their exhibition a profitable one.

—Medical Journals, in general, are filled with so much matter that is without any scientific value whatever, that it is a pleasure to know that there are a few exceptions to the rule. One of the best medical journals in this country is *Archives of Medicine*, published bi-monthly, of which Dr. E. C. Seguin is the chief Editor. The articles published in that periodical are of intrinsic value. It is not filled with reports of college clinics, which are of a very doubtful value to the practitioner, and the editorial department is full of interesting and instructive matter.

In appearance, *Archives of Medicine* is the most attractive medical journal among our exchanges. (Putnam's Sons, Publishers.)

—We have received Part 2 of Volume second of the "Proceedings of the Davenport Academy of Sciences," which is one of the very few scientific publications from the West, that are of sterling value. In this part we find a number of important articles, quite fully illustrated by woodcuts, etchings on steel, and by albertype or artotype plates. There are ten full-page plates, and a number of wood-cuts besides. The prosperity of the Academy is largely due to the liberality of Mrs. P.V. Newcomb, who presented the lot on which the Academy building now stands. Mrs. Mary L. D. Putnam was elected President of the Academy in January, 1879.

—Mr. Henry Skaer of St. Louis, announces that he intends to revive *The Valley Naturalist*, of which he was the publisher during the year 1878. The subscription price will be $1.50 per year; the paper "will consist of sixteen pages of valuable reading matter," occasionally illustrated by wood-cuts and lithograph plates. Communications should be addressed, Room 34, N. W. Cor. Third and Pine Streets, St. Louis, Mo.

CORRESPONDENCE.

To the Editor:—Many microscopists labor chiefly at night, at times under a strong, glaring light, and it is to them that I would make the following suggestion; especially to those who use the monocular instrument, as such are more liable to experience an injury, than those using a binocular: The crown of an old silk hat, with an opening made through the center (the diameter of the aperture being a trifle less than the diameter of the draw-tube), fitted to the draw-tube about two inches below the eye-piece, will prove an effective eye-shade.

T. D. Williams, M.D.

MICROSCOPICAL SOCIETIES

CENTRAL NEW YORK.

The regular meeting was held on the evening of Tuesday, May 29th, at the office of Dr. Aberdein, in Syracuse, President Collins in the chair. Dr. B. W. Loomis gave a very interesting demonstration of his method of staining vegetable sections with anilin violet in acetic acid. The process was speedy and the results good. The sections were all made by the "free hand" method, and as regards thinness and regularity were very instructive examples of what may be done by the skilled hand, unassisted by the microtome.

Dr. C. E. Slocum followed with some remarks from memoranda on the use of the microscope in medical jurisprudence, referring to the structural differences in the histology of man and the lower animals. Dr. Slocum's remarks were principally confined at this time to giving a general outline of his subject, with some considerations as to the various shapes of the canaliculi in human and other varieties of bone.

WELLESLEY COLLEGE.

The regular meeting of the Society was held Monday evening, May 24th, the President, Miss Hayes in the chair. Miss Clark read a paper on Starch, giving the theories of growth and the different characteristics of the starch grains in different vegetable substances. This was illustrated by black-board drawings of the starch grains, the potato, bean, corn, buckwheat, rice, oats, and arrow-root. She then gave a very full analysis of the structure of a grain of wheat, illustrated by drawings of the various parts, under the microscope and the polariscope. Slides illustrating the subject were shown.

An interesting exhibition of the performance of a Spencer's "Professional" one-quarter and one-sixth inch and a Gundlach one-quarter inch objective on the Möllers, balsam test plate was then given.

M. VIRGINIA SMITH, Cor. Sec.

REVIEWS OF BOOKS.

Microscopic Examination of Samples of Commercial Arsenic, and the Practical Results to Which it Leads. By Edward S. Dana, Ph. D. Jersey City, N. J.: F. D. Lynn & Co. (Pamphlet, pp. 36. 50 cents.)

Commercial arsenic occurs in two distinct varieties, viz.: as "glass-arsenic," which is transparent and not crystalline; and as a white, crystalline solid. The ground arsenic of the shops is made by passing either of these varieties between millstones. Most of the arsenic used in this country is manufactured in England, where the crystalline variety is the most usual product.

Under the microscope the powdered arsenic from the glassy variety is composed of amorphous particles or dust, with little or no appearance of crystallization. On the other hand, the crystalline variety, when ground, shows a great abundance of perfect octahedral crystals, sometimes mixed with more or less dust, which partly comes from attrition and the crushing of the large crystals.

The pamphlet of Prof. Dana gives an excellent description of the characters of various kinds of arsenic, illustrated with cuts of the four samples which attracted so much attention during the Hayden trial.

We may give a very brief summary of Prof. Dana's conclusions in the following words: The form of the crystals is not likely to be of much assistance in distinguishing different samples. The size, however, is of great importance for this purpose, in some samples the crystals will be quite uniform in size, in others they may vary widely. They may measure from $\frac{1}{5000}$-inch to $\frac{1}{300}$-inch across. The appearance of the surfaces, whether they are bright or dull, when examined by reflected light, often affords a means of distinguishing specimens. The relative amount of dust and crystals should be observed. According to the experience of Prof. Dana, arsenic does not seem to be very much adulterated.

Exchanges.

[Exchanges are inserted in this column without charge. They will be strictly limited to mounted objects, and material for mounting.]

Polyzoa, Palates of Mollusca, Foraminifera, Sponge and Holothurian-Spicules, Synapta-Anchors, Chirodota-Wheels, Echinus-Spines, Minute Sea Shells, in exchange for Polyzoa, Foraminifera, Histological and Pathological preparations, *etc.* Also, a quantity of Sea Shells in exchange for Land and Fresh-Water Shells.

F. M. HAMLIN, M. D., Auburn, N. Y.

J. J. B. Hatfield, Arsenal Avenue, Indianapolis, Indiana, will exchange Bleached Plant-Sections for good Diatomaceous material. List furnished on application.

Pleurosigmas and other unmounted Diatoms, both Fresh Water and Marine; also Marine Algæ, Ferns, and a large quantity of miscellaneous microscopical material in exchange for good mounted objects.

M. A. BOOTH, Longmeadow, Mass.

To exchange, well-mounted Slides of Hair for mounted or unmounted specimens of hair from the rarer animals; lists exchanged. WM. HOSKINS,
208 S. Halsted street, Chicago, Ill.

Nicely mounted Slides (opaque) of the Coal-tar Derivatives, chemically prepared, crystalline in form, showing their beautiful colors, in exchange for other well-mounted material. Chemical name and formula attached to each Slide. About a dozen varieties on hand. F. L. BARDEEN, M.D.,
30½ Meigs street, Rochester, N.Y.

Vanadate of Ammonia, $(NH^4)^2VO^4$, Slides for the Polariscope in exchange for other Slides.
H. POOLE, Practical School, Buffalo, N. Y.

Slides mounted from injected Frog's Gall-bladder, Liver, Kidney, Stomach, Intestine and other parts, exchanged for other good and interesting preparations. C. BLASDALE, M. D.,
Jericho, Queens Co., N. Y.

Well-mounted, selected and arranged Diatoms, for good histological, pathological or anatomical preparation. State what you have, and terms of exchange.
W. W. RINER, Greene, Iowa.

Foraminifera from Sponge-sand, Marl-sand, and Chalk; Transparent Prisms of Carbonate of Lime from fossil Shells; Fresh and Salt Water Diatomaceous material; Carapaces of Rhizopods; polished sections of Fossiliferous Limestones, Corals, etc., to exchange for any microscopical material.
K. M. CUNNINGHAM,
Box 874, Mobile, Ala.

The American Monthly Microscopical Journal.

Issued on or before the fifteenth day of each month.

Correspondence should be addressed to the Editor, Romyn Hitchcock, 53 Maiden Lane, New York.

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Notes on Fresh-water Algæ.

(*BULBOCHÆTE.*)

The Bulbochæte form an interesting family of fresh-water algæ, at once recognized by the bushy growth of the plants, and by the more characteristic feature, the long bulbous-based, attenuated chæte or bristles, with which many of the joints of the filaments are furnished. These bristles are long, jointless and colorless, and are usually attached to the upper end of the joint or cell.

FIG. 22.

The plants are generally found attached to other algæ or to water-plants, sometimes singly, but more frequently in small clusters, and occasionally fringing sticks or rootlets of trees extending into the waters of ponds.

The illustration represents five varieties. The species are separated from each other by the different forms of the vegetative cells, the different modes of fruiting, and the different positions and characters of the oögoniums.

The plants of this genus belong to the higher, sexual grade of plant development. The mother cell (oögonium) contains a single embryo (oöspore). The development of fertilizing germs constitutes a feature not observable in the lower forms. Certain cells of the filaments produce these germs; they are called *Zwerg Mänchen* by the Germans; technically *Nannaners*, signifying dwarf men; they are the antheridia. The cells in which they are developed are the androsporangia or spermatogonia. The dwarfs escape through a slit in the side of a cell, or by the separation of two cells, and find their way to the mother cell when it is partially developed, and lodge on it, or on a cell immediately above or below it. The oögonium (mother cell) contains the embryo of the plant; when in condition for fructification, a small pore opens on the side or upper end of the mother cell, and through it are injected the spermatozoids which are developed in, and ejected by the dwarfs. The oöspore, lodged in the oögonium, is thus fructified. It lies dormant for a season after maturity, but finally leaves the mother cell and reproduces the original form.

There is another process of development denominated the asexual process. This is shown in Fig. IV, representing a specimen found in a pond near Hammonton, N. J. Thousands of these plants were growing on twigs and rootlets. I found no evidence of sexual propagation, but the filaments were well supplied with oval cells, attached at the joints, not unlike the oögonia in other forms. These open at the top by a lid (operculum) which is thrown back by an upward pressure from within; then follows an interesting process, the young (zoöspores) slowly working their way out like little chicks escaping from the eggs; the illustration shows these immature forms in various stages and positions of the process of ejectment.

A similar feature of development is often observed in a sister family, the Œdogoniums, but in these the zoöspores come out from the vegetative cells of the filaments, not from distinct cells.

These young Bulbochæte forms (zoöspores?) do not appear to be provided with celia; they evidence none of the activity common to zoöspores. The two or three prongs, pseudo-rootlets, are formed before the young come out of the matricular cell, a feature which is also distinct from the zoöspores of the Œdogoniums. These young forms find a place where to attach themselves and then grow. The seta appears first on the rounded end of the cells; then the apex to which it is attached separates, and cell walls are formed. This process is repeated many times until the larger plants are developed. The seta which was the end of the first cell, is now the seta on the end of the filament.

Fig. I represents *B. rectangularis* Wittr., from Wayne Co., Pa. Fig. IV is *B. intermedia*, De Bar., frequent in our ponds. Fig. III, species not determinable for lack fruit; from pond in New Jersey. Fig. V, *B. nana*, Wittr., not unfrequent. Fig. II, *B. mirabilis*, Wittr., a variety, pond, New Jersey.

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Finishing Slides.

Having used damar dissolved in benzole as a mounting medium for some time past, I find that when thoroughly dry, the gum becomes brittle, and a slight jar is apt to start the covering glass, and rapid destruction of the slide follows. I have found it necessary, therefore, to run a ring of some tough material around the covering glass to protect it, my efforts being directed to discovering a material that would give the necessary strength, that can be easily handled, so as to make a neat finish. I have found that the best results can be obtained by the use of a thick, copal, furniture varnish, what is known as rubbing varnish. As I have not seen the use of it mentioned in print, it may be new to some readers, and I therefore give the results of my experience.

I use the thickest, finest varnish I can procure, and put enough dragon's blood in the bottle to give it color, without destroying its transparency. It should be so thick that a small drop will not flow from the camel's hair brush. The older it is, the better.

The slide having been cleaned of superfluous gum or balsam, should have a little shellac varnish run around in the angle formed by the covering glass and the slide, to prevent the colored varnish from running under the cover in the subsequent operations. When this is dry, which will be in a few minutes, the slide is mounted on the turn-table, and a sufficiency of the varnish "dobbed" around the edge of the covering glass, extending over the slide. The turn-table is then put in rapid revolution, and with the point of a knife applied to the glass, first outside on the slide, and afterwards inside on the covering glass, a ring is spun, which may be made as narrow as is desired, and with its rounded top extending above the covering glass. I find it very easy to turn a perfectly symmetrical ring.

The slides are laid aside in a dry place for at least a week to harden, when the superfluous varnish can be cleaned off from the glass, with a bit of soft linen rag, and rotten stone and water, rubbing the whole mount gently, with circular strokes. This removes the superfluous varnish from the glass, to the edge of the ring, leaving it with a clean, circular edge, and at the same time rubs down any inequalities which may exist in the ring itself. After this, wash the slide well in fresh water with a soft brush to remove all traces of the rotten stone, and gently dry it with a soft cambric handkerchief. When it is dry, a few circular strokes with dry cambric on the end of the finger, will give the ring a semi-polish, which leaves it with a very neat finish.

I usually clean the whole slide with the rotten stone and water, so that when it is dried, and gently wiped, it is ready to receive the label. The whole process is quite expeditious, and the results are so satisfactory, in the permanence and finish of the slides, that I am confident if any one gives it a fair trial, it will supersede all other cements for a like purpose. W.

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Cover-Glasses.

Your correspondent "R. B. jr." in April number, p. 68, writes: "There seems to be no good reason why dealers should not furnish cover-glasses accurately assorted as to thickness." There is one good reason, neither "R. B. jr." nor other purchasers will be willing (except in special cases) to pay the extra cost of measuring each piece of glass; "R. B. jr." can do that himself, or he must pay some one to do it for him. To obtain 100 covers $\frac{5}{1000}$ of an inch will require, at the best estimate, the measuring of 500. This will take time, and time is money, to dealers as well as to opticians.

One dollar the hundred will probably be a fair extra charge for accurately measured covers.

Purchasers generally do not know how the cover-glass is obtained. It is a very difficult article to make. The glass makers have nothing to do with the cutting up into squares and circles; they simply assort it by roughly estimating the thickness by feeling with the fingers into three grades, Nos. 1, 2 and 3. Of course the division line between 1 and 2 is indefinite—some No. 2 will be thinner than some No. 0. It is sent from the glass house in irregular sheets, from 1 inch to 15 or 20 inches, superficial area. Each sheet may vary in thickness in different parts. It goes into the hands of the cutters, who usually pack the squares or circles labelled with the original numbers of the glass maker, and of course subject to all the variations that "R. B. jr." found in his clumsy method of measurement. Some dealers are more careful about thickness, and take a measurement of each sheet of glass before cutting—and then calling for example all from $\frac{5}{1000}$ to $\frac{8}{1000}$ No. 1—with some similar limit for Nos. 0, 2 and 3. But as will easily be seen this does not secure accuracy. Neither in practice, is there any need of it except for very high power objectives—such as from $\frac{1}{20}$th to $\frac{1}{50}$th. A modern first-class water immersion objectives from $\frac{1}{16}$-inch down, with "adjustment," work satisfactorily through covers of varying thickness from $\frac{12}{1000}$ to $\frac{5}{1000}$. "Homogeneous immersion" objectives without "adjustment" are said to work equally well with any thickness of cover.

Formerly—10 to more years ago—English $\frac{1}{8}$-inch and other foreign objectives had so short working distance, that their owners had to hunt for very thin cover-glass in order to use them. Such objectives are now behind the times, American opticians produce one-tenths that will readily work correctly through $\frac{1}{100}$ of an inch.

CARL REDDOTS.

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The Microscopical Examination of Signatures.*

BY PROF. LESTER CURTIS, A. B., M. D.

We all know that every one who writes acquires certain habits of writing. He is accustomed to form his letters in a certain way and at pretty definite distances apart; he writes on the line, or above it, or possibly below it; he has habits of neatness in writing, or his writing is marred with blots or erasures. He has certain habits of punctuation or want of punctuation. He may, also, have certain characteristic errors in spelling, or his spelling may be correct but formed on some peculiar model. All these, and many other things, make the writing of every one characteristic, and render it practically impossible to imitate any large amount of writing so successfully as to avoid detection by one at all skilled in the examination of such things. Forgers, therefore, are accustomed to confine their operations almost exclusively to the imitation of signatures, and these signatures are usually direct copies. There are several methods of procedure that may be followed by forgers. The oldest and the most common of these is direct imitation with a pen, as one would write after a copy in a copy-book. But however close this imitation may be, it is never so close as to avoid some imperfection which can be detected by care, particularly if the microscope is used in the examination.

* Read before the State Microscopical Society of Illinois.

An instance illustrating this was related to me by Professor Babcock. A note was put into his hands for examination, with an endorsement upon it, which professed to have been written by one William Lill, who was dead. The note was not paid by the party making it, and the owner applied to the estate of Mr. Lill for payment. A large number of the signatures of Mr. Lill were given to Professor Babcock for comparison. He noticed an unsteadiness in the lines of these signatures. In the earlier ones this tremor was slight, hardly perceptible to the naked eye, and confined to the upward strokes, while the down strokes were firm and steady. This tremor increased somewhat in the later signatures. From this appearance he concluded that Mr. Lill was an old man who had been growing feeble for a number of years. The endorsement upon the note resembled, to the naked eye, the undoubted signatures very closely, but on examining it with the microscope it presented some striking points of difference. The up strokes were even and smooth, indicating that the one who wrote it had a steady hand quite different from the hand of the trembling old man who was supposed to have signed it. There was another marked point of difference between the endorsement and the genuine signatures. In the genuine signatures there were three *i*'s, each one carefully dotted. These dots were always made by pressing the pen upon the paper and taking it up again without moving it, leaving a little fulging of the ink below. In the endorsement on the note the dots to the *i*'s were scratches like commas. Professor Babcock was able, therefore, to testify that the endorsement on the note could not have been written by the same person who wrote the other signature.

This case, however, is a somewhat exceptional one. The forger was an unusually bold man. As a rule a young and healthy person writes his own name rapidly, and the lines, whatever may be said as to their beauty, are usually firm, while the forger, who writes slowly and anxiously, strives to imitate his copy, introduces as a consequence a certain tremor into the lines, which, on careful comparison with the genuine signature, at once betray the fraud.

Sometimes, indeed, forgers lay a piece of paper over the signature, and placing it upon a plate of glass opposite a strong light, trace the name. This method, however, while it secures accuracy in the general outlines, makes the tremor much more evident than in the ordinary copy. Besides, the shaded portions of the lines have to be gone over the second time and are filled in. This leaves a scratched appearance to the paper which can always be detected by the microscope.

It often becomes of importance to know which of two lines was made first. This can easily be known if the lines are made with ink. In writing, the ink is left upon the paper in a mass of appreciable thickness, especially when examined with the microscope. Now, if a line is drawn with a pen and ink across another line, it is as easy to see the second line lying above the first, as any other solids lying one above another.

Professor Babcock related an interesting case illustrating this point. A man occupying a respectable position in society lost a building by fire. The building was fired by an incendiary who was caught. The incendiary accused the owner with hiring him to fire the building in order that he might collect the insurance, and gave the time and place where the bargain was made. The party accused claimed that he was in another place at the time alleged, and brought in the register of a hotel with his name signed to it to prove his *alibi*. The signature had every appearance of being genuine and headed a list of names claiming to have been signed at the alleged date, and the claim of the defendant seemed strong. The book was put into the hands of Professor Babcock, who found that the signature was written with an ink which differed from that which had been used on the pages immediately before or afterwards, but did correspond with ink which had been used in the book some months later. The surface also was rougher than the other signatures, which had been worn by the friction of the leaves of the book against one another in opening and shutting it,* and several of the lines of the signature crossed lines in the signature below, and were found to lie above them. It was decided, as the result of this, that a vacant line had been left at the top of the page of the book, and that this name had been interpolated some months later. The man was convicted.

Sometimes, when pale ink is used, there is not body enough to the ink to make a mass such as has been described. In this case, it is found by experiment that the ink in the line last made will shade off into the line first made and never the other way.

As an illustration of this may be mentioned the case of a party who was sued by an estate for a certain sum of money. The party sued claimed that the bill had been paid in instalments at different times, and brought into court a receipt for a certain sum of money in full up to date, as proof. The parties prosecuting the case acknowledged that part of the money had been paid, and that so much of the receipt was genuine, but claimed that the remainder of the money had not been paid, and that the words *in full up to date* had been interpolated and were forgeries. The receipt was put into Professor Babcock's hands to examine. He found that these words were at the end of the receipt, that they had been written in a hand which differed from that of the other parts of the receipt, and with a different and paler ink. Two or three of the lines of the words crossed some of the lines of the signature below. On examination with a microscope there was no appearance of one mass above another, but the ink had run from the lines of these words into the lines of the signature, which they crossed, thus showing that they had been written after the signature, and, consequently, that they were interpolations.

These facts about the crossing of ink marks will not prove true when we come to consider pencil marks. A pencil leaves a film on the sur-

* Mr. Colegrove has related to me an interesting case illustrating the effect of wear on ink marks. A suit was brought against him for part of the value of some goods which were sold to him, as the party claimed, for $15. He asserted that only $5 had been charged for the goods, and brought in a receipt for the payment of the same. The prosecution brought in their books, however, and showed the charge against him of $15. They alleged that the $5 was only part payment for the goods. Mr. Colegrove examined the entry with the microscope and found that the surface of all the writing on the page, as well as that of the figure 5 in 15, had been polished smooth by the friction of the leaves in the book. The surface of the figure 1, however, in the 15, was rough and stood up higher above the surface of the paper than that of the 5 or any other writing on the page. It could not, then, have been subjected to the same amount of friction as the writing, and must have been added later. The prosecution failed to prove their claim.

face of the paper of an imperceptible thickness, and no matter how many marks cross at any one place the surface is not raised; it is impossible, therefore, to tell which of these marks was made first.*

It is often of importance to determine the age of writing. This can often be done with approximation to accuracy by observing the changes in color, which writing undergoes by time and exposure to the air. Every one who has seen old writings knows that by the lapse of time they change from black to brown, and gradually become fainter and fainter until they finally become quite illegible. This is due to the action of the oxygen of the air on the ink. Most inks, as every one knows, are made by adding to a solution of gall-nuts, sulphate of iron, together with a little gum. The iron unites with the gallic and tannic acids, forming a tannate of iron, or gallo-tannate of iron, which is black. In time these substances separate from the iron, which then unites with oxygen, forming an iron rust, which is much paler than the ink. This action takes place with much greater rapidity in the finer lines of the writing than in the coarser ones, on account of the relatively greater extent of surface exposed to the action of the air. From these lines it gradually spreads to the coarser lines. The process does not take place with equal rapidity in all kinds of ink, but if care is used in the examination of two signatures made at different times, it is usually possible to determine with a fair degree of certainty which was made first, by noting the comparative degree in which this change has taken place in the two samples.

The browning of ink is sometimes imitated by the use of coffee and sugar; these means, if used carefully, may possibly produce what seems to the naked eye to be a fair copy of the original, but it will not bear examination with the microscope. The color is too uniform and the surface is glossy: chemical tests will settle the point at once, showing in the one case the presence, and in the other the absence, of iron.

There are a very large number of inks containing iron, but there are some inks which do not contain this substance, the most important of which is called chrome ink. It consists of chromate of potash 1 part, and solution of logwood 1000 parts. This is much more permanent than ordinary iron inks.

Pure vegetable substances are also sometimes used as in the case of the *Cariaria thymofolia*, or ink plant, of New Grenada, the pure juice of which becomes black by exposure to the air. It is said that all the old Spanish documents of Central America are written with this substance, and that they keep their color well. The ink does not corrode the pen.

Other vegetable substances have been used as ink with more or less success. The subject is worth experiment, for our ordinary writing ink is anything but perfect.

Of colored inks red ink is made of carmine dissolved in ammonia and diluted, or of a decoction of

* Professor Babcock has given an instance in which such a thing was determined with the microscope. It became important at one time to ascertain which of two pencil marks which crossed, was made first. Without expecting to learn anything by the examination, he put them under the microscope, when, to his surprise, he saw four or five clean cut grooves in the course of the lines, which showed a clear white in contrast with the dark lines. The grooves in one line ploughed through those of the other line and showed clearly which was made first. These lines were probably made by crystals of carbon in the graphite of the pencil.
(*Proceedings of State Mic. Soc. of Ills.*)

Brazil wood, to which a salt of tin has been added. The carmine is more brilliant, but fades faster than the Brazil wood. These inks, of course, do not undergo the same changes by time as iron inks.

Blue ink is usually made of Prussian blue and iron ink. Of late considerable use is being made of anilin colors of various hues in the manufacture of inks, with a fair promise of permanency. India ink has been used for centuries for writing purposes, and is the most durable of all conceivable substances that can be used in the manufacture of ink, as it consists of pure carbon. It has this disadvantage, however, that it rests upon the surface of the paper and does not penetrate the fibres; therefore it can easily be removed by scraping. It is stated, however, that if it is put in a weak solution of hydro-chloric acid, it will be dissolved, or at least so minutely subdivided, that if it is used as ink, it will penetrate the surface of the paper and become so intimately attached to its fibres that it cannot be removed without removing the fibres also. The same thing will take place if a bit of India ink is placed in a strong solution of caustic potash which can be afterward diluted to a proper consistency. Such an ink is absolutely permanent. It cannot be removed by the application of any chemicals and will endure with all of its original color as long as the paper itself, or even longer.

Professor Silliman says that faded writing, when iron ink has been used, can be restored by brushing over the surface of the paper with a weak solution of gall nuts.

Forgers often erase writing for the purpose of making changes in its sense. Acids are used to oxidize the ink. Strong alkalies are used, and sometimes the ink is bleached by the use of chlorine. Modern paper, however, generally contains a certain amount of coloring matter, particularly ultramarine. Each of these processes will discharge the color of the paper and leave a blotch, so that forgers are often compelled to resort to scraping. This can almost always be detected by examining the surface with a microscope, and the marks of the scratches can be seen. The fibres of the paper will be cut, their direction will be changed and the surface of the paper roughened. If a piece of paper so tampered with be placed in water, it will absorb the moisture much faster than other parts of the paper. If the paper is quite thick, it is recommended to use melted paraffine, turpentine, or benzole for the same purpose.

If an ink mark is drawn across such a scratched place, the edges will look blurred instead of being sharply defined, as they would be upon any other part of the paper. This blurring can be seen with the microscope if it cannot be detected by the naked eye. In order to avoid this blurring, the forger is accustomed to restore the surface with gum water, or varnish, or some other glaze. This, however, can be detected by the microscope as the edges of the glaze look different from the surface of the paper. It can also always be detected chemically. The smoothness of the surface of paper is produced not by any glazing applied to it, but by immense pressure from smooth heavy rollers, and nothing which is not contained in the substance of the paper can be dissolved from this surface by chemicals. Artificial glazing always differs from the natural glazing. Starch will turn blue by the application of iodine; size and gelatine are browned by the same; gum issoluble in water and precipitated by alcohol; the resin which is contained in varnish is soluble in alcohol and precipitated by water. Often when erasures have been made, traces of the ink can be detected by the application of a solution of nut galls. Acids which have been used to remove the ink can, sometimes, be detected by soaking the paper in water and dipping blue litums paper into this water, when it will turn red.

Forgers sometimes resort to bold and ingenious expedients to conceal alterations which they make in writing. An interesting case illustrating this was related by Professor R. H. Ward in his inaugural address as president of the American Society of Microscopists. One party sued another to recover the value of a note. The defendant brought a receipt into court claiming that this receipt covered the face of the note. The note, however, had a date later than that of the receipt. The defendant did not deny that the note was genuine, but claimed that it had been paid and that the date was originally earlier than the date of the receipt and had been changed to its present date for purposes of fraud. Two figures of the date of the note were written in a handwriting which differed from the body of the note. The prosecution claimed, however, that there had been no change, but that the note had been filled out several days before it was signed, and the places of these figures had been left blank until the time of the signatures. The note was put into Professor Ward's hands for examination. The body of the note was written in a small hand with pale ink; the figures in question were written in a bold hand with black ink. There was no evidence of erasure, nor any change in the surface of the paper indicating that it had been tampered with. On examining the figures with the microscope, he could at first find no evidence to prove that any other figure had been written in the location of the present figures, but by changing the illumination and resorting to a number of expedients, he at last discovered the faint outlines of a figure corresponding in size and shape with those of the other figures of the body of the note. This figure indicated a date earlier than the date of the receipt and corresponded with the statements of the defendant, thus proving that the bolder figures were forgeries.

It is often of use to study the paper itself with the microscope, for forgeries are often written upon paper which could not have been used by the original parties. The fibre of which the paper is made whether of linen, cotton, straw, wood or other material can be recognized with the microscope. Much can be learned by studying the water-marks of the paper which differ in different manufactures. Even the arrangement of the fibre itself can sometimes be studied with profit. In ordinary paper the fibres cross irregularly in every direction, but in paper made by some of the modern machines, most of the fibres run in one way, so that the paper tears more easily in one direction than another. Other accidental peculiarities in the paper may be noticed such as spots or grease marks; indeed nothing seems unworthy of attention.

Chicago, December 1879.

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Local Scientific Societies.*

On the 14th of November, a little more than two years ago, the first

* Abstract of an address delivered by the President before the New York Microscopical Society, February 20th, 1880.

meeting of the gentlemen who afterwards organized this Society was held. The meeting was called at the residence of our present treasurer, Mr. Hubbard, and only twelve persons were present. One month from that time our first election of officers was held, which resulted in the election of Mr. J. D. Hyatt as President, who has filled the office for two years with honor and credit, to both himself and the Society.

The two years which have passed have not been without some drawbacks to our prosperity; but on the whole we have no reason, it seems to me, to wish for any better prospects than are now before us. * * * * * * * * *

There are two kinds of associations, both of which may properly be classed as scientific, one composed of advanced students representing the higher departments of science, who meet to consider questions of interest and importance to themselves; the other made up of persons whose interest in scientific work is more general in character, and whose attainments are limited by the little spare time which their business allows them to devote to study.

The former contributes to the advancement of science, the latter assimilate and popularize the result attained by the former.

I am not one of those who believe that there are no benefits to be derived from the associations of dilettanti.

A society of amateurs in science is certain to be composed of members engaged in various pursuits, some scientific, some literary, some commercial, and the influence of these various pursuits will make itself felt by the entire body.

Such a society cannot take rank among the assemblies of professional men, and may not receive even the recognition from these that it deserves. Still, I believe that it contains the very elements that are necessary to advance and encourage the study of science among the people—elements which are too often wanting in associations of the other kind. * * *

It is a fault of our educational systems that men of science are not men of literary culture. A successful teacher must not only be a master of his subject, but more than that, he must be able to present it in an attractive form. It is a mistake to suppose that people will be attracted by the announcement of a scientific lecture. Experience has taught them that the so-called "popular" lecture on a scientific subject is pretty sure to be a miserable failure, at least so far as its popularity is concerned. I have heard some of our most able scientists lecture in this city, men for whose attainments I have the greatest respect, but their "popular" lectures were about as unpopular as anything that can be conceived—faulty and inaccurate in expression, unattractive in delivery, and the lecturers showed no consideration either for themselves or for their hearers. Is it strange, then, that science does not advance faster in its progress among the people? These "popular" scientific lectures would be better characterized as unpopular pseudo-scientific lectures, and the less we hear of them the better it will be for science.

In a society of amateurs it usually happens that there are one or more members of literary attainments who are also careful students of science. It is such a combination of literary ability with scientific knowledge that will enable a speaker to deliver a popular lecture, a lecture that will be sure to interest and instruct a general audience; a man who possesses these qualities has it in his power to accomplish much more for his fellow-man, than has the most profound scientist who lacks the literary training.

I believe, therefore, that a society like ours should have for its aim not only the instruction of its members, but also that it should endeavor, by every means in its power, to make the department of study which it represents popular and attractive to the people at large.

If we should throw our doors open to the general public for every meeting, I am not sure but we would benefit many persons who now know nothing of our studies, and I see no reason why we should sit with doors closed against any who chose to enter. Our scheme of giving a public lecture every two months certainly seems to be a good one, and I would like to see it carried out with spirit. The man who lives only for himself is not a high type of manhood. The society which strives to benefit only its members, it seems to me, leaves unfilled a wide field of greater usefulness. Success, however, will not come without some efforts on our part, and even then it will not be immediate.

I do not forget that a little learning misapplied may prove dangerous, but I believe that the people now need more instruction in natural sciences. We should urge the introduction of science-teaching into the public schools, and frown upon the farce which represents it there now; we should afford every opportunity to those who desire knowledge to attend our meetings and see for themselves the objects of which we speak; for the methods of thought engendered by scientific study, when once they gain a controlling influence upon the people, will exert a strong moral influence upon them.

The remains of superstitions that have come down from the forgotten past, changing their forms with every advance of civilization, still linger with us, and exert a powerful influence upon the thought and feelings of the people; but as our knowledge of Nature and Nature's processes increases, they will disappear; a fierce battle must yet be fought between science and theology, and the purest Christianity of the present day must give way to a more rational, not to say a more human and a better religion.

But I do not ask you to become teachers of ethics or expounders of a new religion, perhaps I have been led away from my subject by the course which my thoughts have taken. The idea which I have desired to convey is simply this, that as a society we can, if we will make the effort, do very much, with the means and talent which we possess, toward making the study of science popular with the people, and that in doing this we will not only benefit ourselves, but also exert an influence for good upon those who avail themselves of the instructions which we offer.

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Microscopic Examination of Tissues after the Administration of Mercury.

Continued from page 113.

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Oleate of Mercury.—With a vague idea that all mercurials depended for their efficacy upon their conversion into an oxide in the body, though no valid reason for, or demonstration of, the theory can be found, in 1872, Dr. Marshall suggested the incorporation of mercuric oxide with oleic acid as an eligible substitute for the common ointment.

Any chemist, by inspection of Marshall's process, or even later improvements in modes of manufacturing this preparation, can see that the oxide must be destroyed. In fact a precipitation of visible metal occurs, the weight of which is subtracted, plus its oxygen weight, from the original weight of the mercuric oxide used, and the invisible remainder is assumed to be mercuric oxide in oleic acid. Squibb's label on the bottles containing the oleate reads: "This bottle contains 6 per cent." (or some other percentage, as the case may be) "of mercuric oxide in oleic acid." By decanting off the liquid, further precipitation of the metal, as metal, can be found, and under the microscope beautifully uniform, minute globules of metallic mercury in countless numbers may be seen suspended in the oleic acid. A mechanical mixture of oleic acid and minutely divided mercury, I found, presented very nearly the same appearance, the globules wanting in uniformity, which I think can be remedied by permitting the mixture to stand some days, allowing the larger globules to precipitate. The settling may prove to be the cause of the minuteness and uniformity of size in Squibb's oleate. So, instead of a mercuric oxide being introduced into the system by inunctions with this preparation, a simple mercurial, reduced to such beforehand, is thus administered and as such it acts. A physician of this city had several applications of the oleate to his axillæ, and soon after, while being dry-cupped, called the attention of Dr. J. S. Jewell (who was treating him for ataxia) to the presence of mercury globules visible in the cupping glass.

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In its action as a parasiticide there can be no doubt that the small globules, in some cases, when sucked by parasites into their tubules, cause fatal occlusion; and in other cases, by external contact, effectually asphyxiate them by choking up their stigmata and tracheæ. Mercury absorbed by plants doubtless kills them by filling up the cellular spaces necessary for the passage of nutrient liquids. Hales found that "during the bleeding season a vine can push up its sap in a glass tube to a height of twenty-one feet above the stump of an amputated branch." Obviously an interference with this process would be fatal to the life of the plant, and no one can doubt that such a force is capable of pushing the suspended globules well up into the branches. The anthelmintic effects of mercury may be the same in its effects upon other invertebrates and some of the lesser vertebrates.

The Secretary of our Society, Mr. E. B. Stuart, the chemist and microscopist, kindly aided me in preparing specimens for exhibition, and our conjoint observations led me to the following conclusions:

1st. Mercury globules under various modes of illumination, can be advantageously used as test objects, comparing them with air-bubbles of glycerin, fat, oil, and pus-corpuscles. It cannot be assumed that this subject has been exhaustively written up; the resemblance in many cases are provokingly identical, particulary as to multiple reflection from globular surfaces. Reflection from the face of the objective, or cover glass will often cause an opaque object to simulate an appearance of translucency.

2d. The microscope has been too much neglected by chemists, physicians and pharmacists. It will in many cases render unneccessary, tedious and expensive chemical and physiological researches usually performed without its aid, and in most cases supplement such labors.

3. Particularly in medico-legal investigations has the microscope been too little used. Elaborate chemical manipulations have been relied upon almost exclusively. It is of greater use in this connection than merely in the blood-globules and spermatic fluid examinations, to which it has been principally applied.

III. Family Cryptomonadina (with Thecomonadina, Duj., P'ty).

Body clothed with a stiff membrane or a hard carapace, therefore of constant form, green, containing chlorophyll, or colorless.

Body flat, carapace soft, membranous
- leaf-shaped, with pigment-spot and
  - tail-like appendage, — Phacus.
- oval, more or less emarginate in front,
  - two similar, moving flagella, — Cryptomonas.
  - one moving and one trailing flagellum, — Anisonema.
  - four flagella, — Tetraselmis.

Body ovoid or spherical, carapace at first soft, later hard, brittle (Thecomonadina),
- without a neck-like appendage, — Trypomonas.
- with a neck-like appendage, — Lagenella.

1. Genus *Phacus*, Nitsch. (*Euglena*, Ehr.) Body plano-convex, spirally striped, with a longitudinal furrow above, a red pigment spot in front, with a short unsymmetrical tail behind.

P. pleuronectes, N. Body much resembling a sole-fish. Turns about the longitudinal axis while swimming, but is generally still. L. 0.05. Common, particularly in turf-water.

According to Claperède's observations, brood-cells are formed, as in *Chlorogonium*.

P. triquetra, N. Body with an elevated keel. L. 0.04. Among algæ, not common.

P. pyrum, N. (*Lepocinclis*, P'ty). Body pear-shaped, with strong, spiral furrows. L. 0.03. Among algæ, characeæ, etc. Not abundant.

2. Gen. *Cryptomonas*, Ehr. Body oval, smooth or angular, in front somewhat emarginate laterally. Usually without pigment spot, (with pigment-spot, *Cryptoglena*, Ehr.) and with two longer or shorter flagella, rounded behind, conical or tapering behind.

C. Polymorpha, P'ty (*C. curvata*, *ovata*, *erosa cylindrica*, *glauca*, *furca*, Ehr.). Form various, color grass-green, yellowish, brown or colorless (var. *hyalina*, P'ty), then generally filled with bluish grains. (Possibly this is identical with *Chilomonas paramecium*, Ehr.) The larger, grass-green forms usually have a large and a small nucleus (nucleus and nucleolus ?) L. 0.01–0.02. Movement usually slow, bending and turning. Very common in fresh and old water, the colorless particularly so in infusions, also in Winter.

With perfect right, Perty has united all these forms in spite of their differences, for all possible gradations between them are found. I have only found the variety *hyalina* quite constant, possibly this is a distinct species.

3. Gen. *Anisonema*, Duj. Body oval, flat, colorless, with two flagella in front, one lashing, the other trailing. The latter often becomes attached, the animal then jerks upon it and often suddenly parts.

A. acinus, Duj. Body shaped like an apple seed, flagella on the end, movement forward in a straight line. L. 0.02–0.03. In stagnant water (comp. *Heteromita ovata.*)

A. sulcata, Ehr. Body with a

somewhat lateral opening in front, from which the flagella project, above this a somewhat prominent keel. L. 0.022. Movement wagging and trembling. In stagnant water, with *chara*, sometimes abundant.

4. Gen. *Tetraselmis.* Under this name I place, in spite of my objections to the making of species, a form which I have only once seen, but the several specimens were of quite constant shape. The body is slender, conical, with an anterior depression from which four flagella project. It is not identical with *Oxyrrhis*, Duj., and I cannot regard it as an alga-spore.

T. cordata, n. g. et sp. Body green on the sides, colorless, in the middle. L. 0.02. In fresh water, among algæ.

5. Gen. *Trypomonas*, Pty. (*Trachelomonas*, Ehr.) Carapace spherical or ovoid, rough or spinous; in old forms brown, opaque, brittle, in younger condition clearer. The soft, metabolic body is furnished with a flagellum and generally with a red pigment spot. Usually it fills the carapace, but at a certain time it separates from the walls, shrinks somewhat and rotates within the carapace. Finally, the latter breaks, the animal escapes and then resembles an *Euglena viridis* with its flagellum lost. Division often takes place within the carapace.

T. volvocina, Ehr. Very changeable in form, size and roughness of the surface. In the middle d.-0.025. Movement rolling. Common at all times of the year among algæ, especially in green-colored water.

Chætotypla armata, Ehr., with long tail behind, cannot well be regarded as a species distinct from the preceding.

6. Gen. *Lagenella*, Ehr. (*Cryptomonas*, Duj., *Chonemonas*, P'ty, with stigma *Chætoglena*, Ehr.) Differs from the preceding genus by a short, cylindrical neck on the anterior end of the carapace.

L. euchlora, Ehr. Carapace rounded behind. L. 0.02. Among algæ, not abundant.

L. acuminatum, Pty. Carapace terminating in a tail.

EDITORIAL.

Adulterations.

For nearly two years the editor of this JOURNAL has been studying the subject of adulterations, with particular reference to the detection of adulterations in articles of food, by means of the microscope. During this time he has accumulated a large number of notes and memoranda relating to the subject; and some time ago these were carefully written up, with the intention of publishing them in book form.

Various circumstances have conspired to prevent the completing of the manuscript, and the difficulty and uncertainty of finding a publisher who would undertake to issue such a book, at one time led the author to abandon the idea of finishing the work. However, the interest which has lately been aroused in the subject of adulteration by articles in the daily papers, and elsewhere, has induced him to revise and complete the manuscript; many parts will be re-written so as to make the work more popular in character, and he now proproposes to publish the book himself. This plan will be carried out only on condition that a sufficient number of orders can be secured in advance, to make the work remunerative. All who desire to take a copy, are therefore requested to send their orders to the editor at an early day. The book will be published next Fall, if the responses to this announcement are encouraging.

Most adulterations are readily detected by simple means, and by any person of ordinary intelligence; and this work is intended to be a reliable guide for those who desire to test the purity of the articles they use. It will treat of the examination of foods of all kinds—starches, flours, meals, tea, coffee, cocoa, sugar, milk, butter, lard, spices, etc.; the characters of the various fibres used in manufacturing, and the methods of distinguishing them when they are mingled in textile fabrics; the examination of water and air for sanitary purposes, and much useful information will be given about foods and fabrics, from a sanitary or hygienic point of view.

For further particulars the reader is referred to the announcement among the advertisements.

———o———

Synopsis of the Diatoms.

Dr. Henri Van Heurck has just issued a prospectus of his "Synopsis des Diatomées de Belgique," a publication which we believe will prove of great value to all students of the diatoms. Owing to the great abundance of diatoms in Belgium—the numerous genera and specie—salmost all the marine forms which have been found in England are there represented; the Ardennes furnish a large number of the European Alpine species, and the region of Central Belgium produces fresh-water species in abundance. The Synopsis will, therefore, be of great use to diatomists in all countries.

Prof. H. L. Smith recently alluded to the book in a note to the editor in these words: "I think one can safely promise that it will meet the wants of hundreds who cannot get 'British Diatomaceæ' or Pritchard."

In his prospectus the author states, "There is no book to-day in any language, which enables the beginner to determine diatoms with certainty, if we except the classic work of William Smith, which, published in 1854, is now behind the times," and he expresses a hope that by this publication he will render great service to micrographers.

The work will present figures of all the forms described in the text; and great care has been given to the execution of the drawings. They are completed or designed by the author, or under his supervision, and retouched by him or by Mr. Grunow. The drawings are reproduced by heliography, and the plates are therefore very perfect.

The synopsis will be published in six fascicules, appearing at intervals of three to four months, each of which will contain ten plates (about two hundred and fifty figures), after which the volume of descriptive text will be published.

The price of each fascicule, to subscribers, will be $1.50; the volume of text will also cost $1.50. The complete work, comprising six fascicules of plates and one volume of text, will cost $10.00 to subscribers.

Subscriptions may be sent to the editor of this Journal. The first fascicule will be ready very soon.

———o———

Studies of Atmospheric Dust.

We have received a pamphlet from Dr. George M. Sternberg, Surgeon U. S. A., which gives an account of the microscopical investigations of the Yellow Fever Commission.

Dr. Sternberg is now in New Orleans, where he is conducting experiments in connection with the other work of the Havana Commission, to determine, if possible, the nature of the yellow fever poison.

The work of the Commission has been divided among the members, and Dr. Sternberg is working in accordance with the suggestions in the following paragraph, taken from the instruction to the Commission:

"But in addition to these, the National Board desires that the Commission shall consider certain problems relating to this disease; problems which may be entirely insoluble, but which nevertheless are of such importance that an effort should be made to decide whether the National Board of Health will be justified in undertaking the labor and expense which will probably be required to obtain anything like a complete solution of them, if such solution is at all possible. *These problems relate to the nature and natural history of the cause of yellow fever.*"

The wording of the instructions indicates that the National Board of Health, is very doubtful about the possibility of discovering the germs of yellow fever. Microscopical investigations like those which Dr. Sternberg has undertaken are of the most delicate, and withal unsatisfactory, nature. Delicate, because the utmost excellence in objectives must be supplemented by special and long-continued training of the observer; unsatisfactory because the organized germs which produce disease if such there be, cannot be isolated from hundreds of others which are collected with them. We may go further than this, and say that even if Dr. Sternberg fails to discover any connection between the organisms which he finds in the air of infected districts, the question of the germinal origin of the disease will be still an open one. This is true, because we know that there are organized, living particles of matter so minute as to be invisible with the best microscope, and we can hardly hope to be able to cultivate and identify the organisms which develope from such spores.

There can be no question about the existence of such minute, invisible spores, for they have been observed as an unresolvable cloud by Mr. Dallinger, during his admirable work on septic organisms. It will be difficult, therefore, if not impossible, to prove or to disprove the germ theory of disease by examinations of the atmospheric spores. Nevertheless, we are much pleased to know that our National Board deems it worth while to assign an able investigator to study systematically, the microscopic particles in the air from day to day, during seasons of health and also when desease prevails. Certainly such researches will prove to be of great value to science, if not to medical science.

Although Dr. Sternberg's researches have not been continued long enough to lead to many definite results, he already feels justified in announcing that "*there is no gross and conspicuous germ or organism, either in the blood of yellow fever patients or in the air of infected localities*, which by its peculiar appearance or abundant presence might arrest the attention of a microscopist and cause suspicion that it is the veritable germ of yellow fever."

Klebs and Tomason have lately announced that they have discovered what they believe to be the germ of malarial fever, in the vicinity of Rome. We fully concur with the opinion of Dr. Sternberg that the observations of those gentlemen "require verification," and it is a satisfaction to know that he has been instructed to repeat their experiments, and search for their *Bacillus malariæ.*

Some of the information about the microscopic constituents of the air may prove interesting. Dr. Sternberg quotes from Dr. Cunningham, whose work was conducted near Calcutta in 1872, as follows:

"Distinct infusorial animalculæ and their germs or ova, are almost entirely absent from atmospheric dust.

"Distinct bacteria can hardly ever be detected among the constituents of atmospheric dust, but fine molecules of uncertain nature are almost always present in abundance. They frequently appear in specimens of rain water collected with all precautions to secure purity, and appear in many cases to arise from mycelium developed from atmospheric spores.

"Distinct bacteria are frequently found amongst the particles deposited from the moist air of sewers.

"The addition of dry dust, which has been exposed to tropical heat, to putrescible fluids, is followed by a rapid development of fungi and bacteria, although recognizable specimens of the latter are very rarely to be found in it while dry.

"Spores and other vegetable cells are constantly present in atmospheric dust and usually occur in considerable numbers.

"No connection can be traced between the numbers of bacteria, spores, etc., present in the atmosphere, and the occurrence of diarrhœa, dysentery, cholera, ague or dengue; nor between the presence or abundance of any special form or forms of cells and the prevalence of these diseases."

We have never regarded the idea that certain diseases had their origin in specific living germs, as deserving of the prominence which physicians generally have given to it. It is merely an hypothesis, which has become popular because it seems to afford an easy explanation of certain phenomena.

It may surprise many readers to learn that only three or four diseases are known, which are accompanied with Bacteria in the blood under circumstances which indicate that those organisms may have produced the diseases; but it is not improbable that either of these diseases may occur, unaccompanied with the organisms—we know that some of them do occur under such circumstances.

With these few possible exceptions, whenever the germ theory has been subjected to a critical microscopical examination by competent observers, it has failed of support. Nevertheless, there are those who seem able to discover a specific living organism for almost every disease; but we cannot be surprised at this, when a physician who has considerable local reputation as a microscopist, expresses the opinion that a blood-corpuscle is affected by a fungus, when any careful observer could see at a glance that the "fungus" was nothing more than the corrugated or shrunken appearance of the dried corpuscle.

It should not be forgotten that very few physicians or microscopists are capable of conducting observations of this character. Medical and microscopical literature is replete with contributions upon this subject from utterly incompetent observers; and some of their hastily formed conclusions are so absolutely unfounded, that it is surprising that any man would publish them over his signature.

We do not wish to appear unduly skeptical about the existence of living germs of disease. It is a very difficult subject to investigate, and it is not strange that so little is known about it. Our opinion is, that all the evidence in support of the germ theory, is purely of a negative kind.

——o——

—Dr. J. Pelletan, the editor of the *Journal de Micrographie*, has favored us with a notice in his number for January, 1880, which we feel bound to correct. He is in error when he writes that we announced *sur le ton de la plus grande jubilation* that the *Journal de Micrographie* was dead. We certainly had reason to think that Dr. Pelletan's journal was dead, for the numbers which he promised to issue in September, did not reach us until some time in February or March of the present year. This fact, in connection with certain rumors from European sources and our personal experience with Dr. Pelletan in a little matter of business, led us to infer not only that the journal had closed its carrier, but also that the editor had taken French leave of his creditors.

We would be much pleased to learn that our information about Dr. Pelletan is incorrect, and we will then gladly make amends for any injustice we may have done him in thought or by words, so far as it lies within our power to do so; but as the matter stands now we have nothing to withdraw. As to the *Journal de Micrographie*, we have always mentioned it in high terms of praise, and we were far from feeling pleased when it disappeared from our exchanges.

——o——

—We hope that all microscopists who can will attend the meeting of the American Society of Microscopists, which convenes in Detroit on the 17th of August, and adjourns on the 20th instant, and also the meeting of the sub-section of microscopy of the A. A. A. S., which occurs in Boston on August 25th, as mentioned on page 117. Both of the meetings will be interesting, we have no doubt, but as yet we have not been informed what papers are to be read or what business of general interest is to be transacted at either of them. In our next number we hope to give our readers some information about those matters.

NOTES.

—We notice a new edition (the fourth) of *The Microscopist*, by Prof. J. H. Wythe. It is a larger book than the former editions, and the price has been increased to $5.00. Several chapters on the use of the microscope in pathology, diagnosis, and etiology have been added, with many wood-cuts.

—The New York Microscopical Society desires to have a complete list of all the Microscopical Societies in the country, with their post-office addresses. Secretaries of Societies would confer a favor by sending the desired information to Mr. Benjamin Braman, 117 E. 30th St., New York, who is the Corresponding Secretary. The Society has adjourned for the Summer; the Fall meetings begin on the third Friday in September.

—An instrument has been made by Mr. Young, of Philadelphia, designed to describe arcs of a few inches to infinity. It is said that the machine will draw a line "straighter than a straight-edge."

CORRESPONDENCE.

GLASS FOR SLIDES.

To the Editor:—The article in the April number of the *American Monthly Microscopical Journal*, on the subject of cutting and grinding glass slides, was read by me with interest. Will you be so good as to place an inquiry in your journal addressed to microscopists in general, and to the writer of the article named in particular, as to where one must go to procure suitable glass for the purpose of making slides, what kind of glass must be inquired for, etc.?. I find great difficulty in procuring glass sufficiently thin, and perfect enough to be used to mount objects upon, and I think that any information in regard to these points will be acceptable to many readers of your journal besides myself. Of course, it is desirable to use nothing else but the "best, polished, French glass slides," but when one is putting up hundreds of slides in the course of a month, the great expense of these first-quality slides is an important item, and we are forced, sometimes, to use very inferior grades of glass in working in haste, especially when a quantity of valuable material must be put up *immediately*.

HENRY V. HULL.

MOUNTING BOTTLE.

TO THE EDTOR:—My drop-bottle for balsam, damar, etc., is made as follows: Take a morphia bottle, and with a rat-tail file, bore a hole through the centre of its cork, through which pass a piece of glass tubing, drawn to a point at the lower end and somewhat expanded at the upper. Cover the upper end with a rubber bulb; a nipple with the opening closed by means of a heated rod will answer. Put the medium into the bottle, insert the cork, and it will be air-tight. Do not squeeze the bulb while the cork is in the bottle, for the tube and bulb would then fill with the medium when the pressure is withdrawn, thus rendering the apparatus useless. When cement is desired, remove the cork, squeeze the bulb till as many drops as may be required are obtained, and return the stopper. By care, the cork and neck of the bottle will be kept clean and the bottle always ready for use.

CHAS. H. COCKEY, M. D.

MICROSCOPICAL SOCIETIES

NEW YORK.

The last meeting of this Society, until Fall, was held in the Mott Memorial Hall, No. 64 Madison Avenue. The Society has rented that hall for the ensuing year, and is now more pleasantly located than it has been at any previous time since its organization. Regular attendance at the meetings enables us to speak confidently about the condition and prospects of this Society, and we do not hesitate to assert that the members have reason to feel well satisfied with the present outlook. Although the amount of original scientific work done by the members thus far has been very small, it should be observed that the Society is still young, and in a city like New York, where science receives very little public appreciation, perhaps the first efforts of such a society should be directed in such a way as to make scientific study more attractive to the people, if possible. Elsewhere in this journal will be found a few abstracts from an address by the President, which was delivered at the beginning of his term of office; we commend them to those who are interested in the work of societies.

At the last meeting, which was rather informal, some very interesting objects were shown. Among them were the circulation of blood in the foot of a frog while under the influence of curare, and beside this the circulation in the gills of a young tad-pole, both by Mr. Wall; *P. angulatum*, by Mr. Wales, under one of his very excellent, cheap objectives, which made the frustule a very attractive object, and the beautiful *volvox globator*, by Mr. C. S. Shultz.

During the past season several attempts were made to add to the interest of the meetings. The most successful plan was suggested by Mr. C. F. Cox. He proposed that at each meeting some particular subject should be chosen for general discussion. The plan has been tried at two meetings, and has succeeded admirably. The subjects chosen were "Parasites," and "Moulds and their Fructification," both of which proved very interesting and instructive.

GRIFFITH CLUB, MICH.

The fascination of microscopical study was well illustrated recently by the demonstrations of Prof. Chas. H. Stowell, of Michigan University, before the Griffith Club of Microscopy. He first showed epithelial cells, which he obtained from the side and roof of his mouth by a movement of the tongue, and deposited upon a glass slide. Skimming the air bubbles from the top with a pin, and removing the surplus saliva with a piece of blotting paper, he added a drop of staining fluid to better define the cells, and placing the preparation under a microscope, exhibited a multitude of thin, transparent scales, each about one-five-hundredth of an inch in diameter, and containing a nucleus in the center. He then showed glandular epithelial cells from the scrapings of the liver of an ox, much smaller, but similar in some respects to those previously shown. The third demonstration was of cells from the mucous membrane of the roof of a frog's mouth, which exhibited the extraordinary action of the cilia. These cells were fringed with hair-like protuberances, known as cilia, that moved with great activity and regularity, and seemed endowed with independent life.

The professor asserted that these cells were very common in the human body, noticeably in the bronchial tubes, where the cilia, moving always in one direction, were active in throwing off foreign substances injurious to health. The circulation of blood in the feet of several frogs rendered insensible by an injection of woorara, was then shown.

One of the most noticeable features of the evening was the exhibition and use of twenty Ann Arbor frogs, which the professor brought with him as scientific curiosities, stating that they were a distinct variety peculiar to Ann Arbor, and of great rarity, possessing a most curious and interesting resemblance to the human body in one or two respects. Apologizing to the ladies present for so doing, the professor gathered the thirty gentlemen present at one side of the room and exhibited the distinguishing characteristics to them.

An exceedingly interesting demonstration on the subject of crystalization was given on the evening of June 2d before the Griffith Club of Microscopy, by its President, Prof. E. W. Wetmore, who illustrated the subject by allowing various solutions to crystalize under the microscope. Prof. Wetmore, Fred. H. Seymour and Prof. Charles H. Stowell were appointed a committee to arrange for a public entertainment, at which, by the use of a stereopticon with a microscope attachment, a great variety of microscopical objects will be enlarged and thrown upon a screen, so as to be seen by a large audience. They propose in this way to show chrystals forming, polariscope objects, circulation of the blood, the pulsations of a frog's heart, and many forms of living animalcules.

We are pleased to observe the activity shown by the members of the Griffith Club, and although we cannot always publish the records of the meetings, which we receive regularly, we will do so as frequently as circumstances will permit.

Exchanges.

[Exchanges are inserted in this column without charge. They will be strictly limited to mounted objects, and material for mounting.]

Polyzoa, Palates of Mollusca, Foraminifera, Sponge and Holothurian-Spicules, Synapta-Anchors, Chirodota-Wheels, Echinus-Spines, Minute Sea Shells, in exchange for Polyzoa, Foraminifera, Histological and Pathological preparations, *etc.* Also, a quantity of Sea Shells in exchange for Land and Fresh-Water Shells.

F. M. HAMLIN, M. D., Auburn, N. Y.

J. J. B. Hatfield, Arsenal Avenue, Indianapolis, Indiana, will exchange Bleached Plant-Sections for good Diatomaceous material. List furnished on application.

Pleurosigmas and other unmounted Diatoms, both Fresh Water and Marine; also Marine Algæ, Ferns, and a large quantity of miscellaneous microscopical material in exchange for good mounted objects.

M. A. BOOTH, Longmeadow, Mass.

To exchange, well-mounted Slides of Hair for mounted or unmounted specimens of hair from the rarer animals; lists exchanged. WM. HOSKINS,
208 S. Halsted street, Chicago, Ill.

Nicely mounted Slides (opaque) of the Coal-tar Derivatives, chemically prepared, crystalline in form, showing their beautiful colors, in exchange for other well-mounted material. Chemical name and formula attached to each Slide. About a dozen varieties on hand. F. L. BARDEEN, M.D.,
30½ Meigs street, Rochester, N.Y.

Vanadate of Ammonia, $(N H^4)^2 V O^4$, Slides for the Polariscope in exchange for other Slides.

H. POOLE, Practical School, Buffalo, N. Y.

Slides mounted from injected Frog's Gall-bladder, Liver, Kidney, Stomach, Intestine and other parts, exchanged for other good and interesting preparations. C. BLASDALE, M. D.,
Jericho, Queens Co., N. Y.

Well-mounted, selected and arranged Diatoms, for good histological, pathological or anatomical preparation. State what you have, and terms of exchange.

W. W. RINER, Greene, Iowa.

Foraminifera from Sponge-sand, Marl-sand, and Chalk; Transparent Prisms of Carbonate of Lime from fossil Shells; Fresh and Salt Water Diatomaceous material; Carapaces of Rhizopods; polished sections of Fossiliferous Limestones, Corals, etc., to exchange for any microscopical material.

K. M. CUNNINGHAM,
Box 874, Mobile, Ala.

The American Monthly Microscopical Journal.

Issued on or before the fifteenth day of each month.

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THE AMERICAN MONTHLY MICROSCOPICAL JOURNAL

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A new Injecting Apparatus.

I send you herewith a diagram of an injecting apparatus designed and arranged by Mr. Justin Spaulding, of this town, which will be found to be very simple in construction, easy of manipulation, and I think the most perfect in operation of any yet contrived. The amount of pressure is under perfect control, and can be maintained at a given point, or diminished or increased at pleasure.

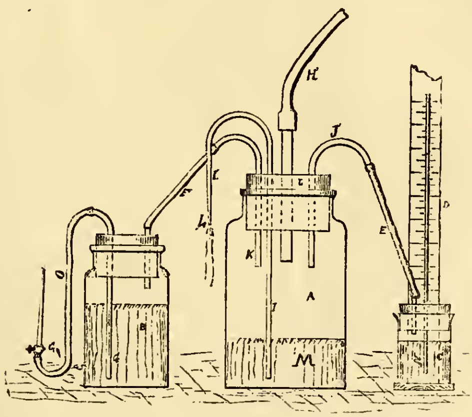

FIG. 23.

A is an ordinary wide-mouth bottle (of any convenient size or shape) connecting by a glass tube and rubber pipe (*H*) with an aqueduct faucet, or with the tap of a vessel of water at an elevation. *J E* is a glass tube with an elastic pipe leading to a small vial containing mercury (*C*), and a tube (*N*) through which the mercury rises and indicates the pressure employed, upon an index (*D*). *F K* is a similar pipe and tube connecting with the bottle *B*, containing the injecting fluid, which is forced into the specimen through the pipe and tube *G O*. The most important improvement over other similar arrangements is the addition of the bent glass tube *I*, terminating in a small aperture (*L*), which permits the constant escape of a small quantity of the water (*M*), and thus acts as a governor to maintain a constantly even pressure.

The connecting rubber pipes *E*, *F*, *H*, *O*, may be of any convenient length, and the cost of the entire apparatus need not exceed one dollar, with the exception of the pipe and stop-cock *G*, and by using a spring-clip to constrict the rubber pipe this may be dispensed with.

The pressure is, of course, regulated at the faucet which supplies the pipe *H*.

JOHN D. WHITE.

SPRINGFIELD, Mass., May, 1880.

——o——

A Useful Culture-cell.

BY GEORGE M. STERNBERG, SURGEON U. S. A.

While in Havana, last Summer, as a member of the Havana Commission for the investigation of yellow fever, I made a large number of culture experiments, for the purpose of ascertaining whether any particular organism would develope in the blood of a yellow fever patient, enclosed in a culture-cell, when proper precautions were taken to prevent infection by atmospheric germs. I may say here that my results were negative, and that while "in certain specimens, kept under observation in culture-cells, hyphomycetous fungi and spherical bacteria made their appearance, after an interval of from one to seven days. The appearance of these organisms was, however, exceptional, and in several specimens, taken from the same individual at the same time, it occurred that in one or two a certain fungus made its appearance, and in others it did not." (*Prelim. Rep. of Havana Com. to Nat. Board of Health*). The inference being that, in those specimens in which organisms were found, infection by atmospheric germs occurred during the brief time occupied in collecting and enclosing the drop of blood in the culture-cell.

In these and like experiments a culture-cell is required which will preserve the blood in a fluid condition, free from atmospheric contamination, and yet surrounded by a sufficient amount of air to furnish the necessary oxygen to any organisms that may develope from any germs that may be present in the blood. In addition to this it is necessary that a very thin stratum of blood should be within reach for examination by the highest power immersion objectives.

The Boldeman cell (made by Mr. Otto Boldeman, 150 W. 16th Street, New York), fulfils the first requirement, and is a very useful cell for many purposes. In this cell a central eminence is surrounded by a circular channel, ground in the glass, which serves the purpose of an air-chamber. The summit of the central eminence is slightly concave and the drop of fluid to be observed is placed upon this and protected with a thin glass cover, which is attached to the slide by a circle of cement, or simply by a little oil.

The main objection to this cell, for my purpose, was that the stratum of blood held in the shallow cup of the central eminence, was too thick for satisfactory examination with high powers; that portion of the fluid next the cover, which could be brought into focus, being shut off from the light by floating corpuscles in the back-ground.

This difficulty led me to invent the culture-slide here described, which, so far as I know, is new.

A circular hole, about ¼-inch in diameter, is drilled through the centre of a glass-slide. A very thin circle of cement, ½-inch in diameter, is then turned about this central hole on one side of the slide, and a thin glass cover is attached to it by gentle pressure.

When the cement is thoroughly dry, the cell is ready to receive the drop of blood or other fluid which is to be observed. This is placed in

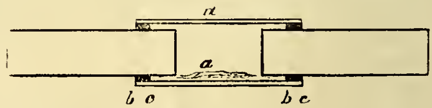

FIG. 24.

the bottom of the cell (*a*, *Fig. 24*) and flows, by capillary attraction, into the space below between the thin cover and the slide until it extends to the circle of cement by which the cover is attached. We have thus a thin stratum of the fluid, between the points *b* and *c*, which may readily be examined by inverting the slide and bringing an immersion lens down upon any point between the central air-chamber and the circle of cement by which the cover is attached. Finally, the cell is closed by turning a still larger circle of cement upon the upper surface of the slide and attaching a larger thin glass circle (*d*).

I have found this a cheap and useful culture-cell; and do not see why it should not also serve a good purpose as a cell in which to mount objects either dry or in fluid. If the manufacturers will furnish us glass slips of different thicknesses, having central perforations of ¼ to ½-inch in diameter, we can easily attach a thin glass cover to make the bottom to the cell, and I see no reason why these should not, for many purposes, replace the various cells in common use.

———o———

A Simple and Speedy Method of Staining Animal and Vegetable Sections.*

BY B. W. LOOMIS, M.D.

After cutting the sections, wash them in water, and allow them to soak for a while.

Transfer them to a solution of anilin violet in commercial acetic acid; the solution to be of the following composition:—

Anilin violet . . 1 part.
Acetic acid . . . 300 parts.

The sections are to be left in the solution until sufficiently stained, which may be determined by removing them from the solution to clean water. If sufficiently blue, they are then ready to be mounted. If not sufficiently colored, return to the solution.

The sections are mounted, after the staining, by transferring them to a clear glass slide, draining off any excess of fluid and adding a drop of solution of acetate of potash of the following strength:

Acetate of potash . . 1 oz.
Water . . . . ½ oz.

Cover, and fasten the cover with varnish, permanently if you wish.

The advantages of this method are its simplicity and the beauty of the results attained. The disadvantages are that the specimens may fade within a year or two.

This method is taken from Orth's recent work on histology, and is one strongly recommended for demonstrating the structure of cartilage.

SYRACUSE, N. Y.

* Report of a paper read before the Central New York Microscopical Society.

———o———

On the Double and Treble Staining of Animal Tissues, with a Note on Cleaning Thin Cover-Glasses.*

By HENEAGE GIBBES, M. B., F. R. S. M.

While engaged last year in an examination into the structure of the Vertebrate spermatozoon, I tried the effect of a large number of staining agents, and succeeded at last in staining the head and body of the spermatozoon of *Triton cristatus* different colors, showing thereby a different chemical reaction. This led me to try these stains on sections of animal tissues, and the specimens under the microscopes will show with what results. It may be interesting to give a few details of the different processes I have used, in the hope that some one who have more leisure than myself may work out the subject thoroughly.

The first double-stain to be mentioned is the well-known picrocarmine and logwood, which gives very good results in sections of skin and other parts. I have also found it answer better than any other stain in an investigation into the development of spermatozoa, in

* From *Journal Royal Microscopical Society*.

which I am at present engaged with Dr. Klein.

There is one point which greatly facilitates a good result with this process—that is, after staining the sections in picrocarmine to place them in plain water acidulated with a few drops of acetic or picric acid for an hour before staining with logwood; they take the second stain better and do not fade afterwards.

The next process consists of—

1. A solution of carmine and borax.

2. A mixture of hydrochloric acid and absolute alcohol.

3. A solution of indigo-carmine.

The carmine solution is prepared by mixing

Carmine, . . .	half drachm
Borax, . . .	two drachms
Aqua, ...	two ounces

and pouring off the clear fluid. It must not be filtered. Three or four drops of this solution are placed in a watch-glass, and the sections immersed for a few minutes; they are then removed to a mixture of hydrochloric acid and absolute alcohol, one part of the acid to twenty parts of alcohol, and allowed to remain there until they take on a bright rose color; this happens in a few seconds. They must then be washed in methylated spirit several times to remove the acid, when they will be ready for staining with the indigo-carmine, which is prepared in the following manner:

A saturated solution of indigo-carmine is made in distilled water and filtered; a portion of this solution is then added to some methylated spirit until it has attained a moderately deep-blue color; this must then be filtered to remove the coloring matter, a good deal of which is precipitated; it will then be fit for use.

A small quantity is placed in a watch-glass, and the sections allowed to remain until they have a distinctly blue color.

I have found this process very useful in pathological investigation, especially in the Carcinomata; and in specimens hardened in chromic acid it does away with the tedious process of passing them through a solution of bicarbonate of soda.

This method is modified from one mentioned in the *American Quarterly Microscopical Journal* by Dr. Seiler.

I next come to the anilines; and of these, after a large number of experiments, I have found roseine, aniline violet, aniline blue, and iodine green, give the most satisfactory results. The principle I worked on was to make a spirituous solution of one color and a watery solution of another, and in this way I could depend on the result.

I made solutions of roseine and aniline violet in spirit, and of aniline blue and iodine green in distilled water. A few drops of one of the spirit solutions being placed in a watch-glass and diluted with spirit, the sections were immersed for a short time (this will depend on the strength of the solution and the tissue itself, as some stain more quickly than others); they ought to be taken out of the stain and examined in clean spirit, and a little practice will soon show when they are stained enough. They are then washed in methylated spirit until no more color comes away from them. A little of the aqueous solution is now placed in a watch-glass and diluted, the section is removed from the spirit to it; the spirit causes the section to spread itself out and float on the watery solution, and it may be seen taking on the new color. For a light stain this is sufficient, and it need not be wholly immersed. It is then well washed in plain water and placed in spirit, when more of the first color generally comes out. When it is quite clean, it is ready for mounting in the usual way. This is a very good process for double staining, and if the section is of the same thickness throughout, the staining will be perfectly even, and each color will have picked out those tissues for which it has a special affinity.

To stain with more than two colors is much more difficult, as they so often combine and produce an entirely different color uniform throughout. I have obtained the best results from chloride of gold or picrocarmine with the anilines just mentioned.

The specimen of a rat's tail was first stained with chloride of gold in the usual manner, and then submitted to the aniline process I have already described.

To stain with picrocarmine I make a dilute solution about ten drops to a watch-glass of distilled water, and leave the sections in it for about half an hour; the time will vary with the tissue and the manner in which it has been prepared. They are then removed to plain water acidulated with a few drops of acetic or picric acid, and left in it for an hour, after which they are ready for the aniline process.

This method succeeds very well in the tongue of different animals, as will be seen from the specimens under the microscope; and I can also say that it does equally well in every other tissue as far as I have tried it. But its great utility consists of, I think, in its power to differentiate glandular structures according to their secretions. For instance, in the section of dog's tongue the ordinary mucous gland will be found to have taken on a purple color, while serous glands which supply the secretions to the taste-organs stain a totally different color. Again, in an examination I made lately in a case of Dysidrosis I was able to stain the duct of the sweat-gland an entirely different color from the surrounding tissues, and so demonstrate its relation to the vesicles. For minute structures, such as the dividing nuclei of germinating epithelium or developing spermatozoa, I think logwood is far above every other stain, and when used with picrocarmine I find its effect is intensified. The carmine and indigo-carmine process is of great use in demonstrating the blood-vessels in the web of the frog's foot, the tail of the tadpole, and similar structures, as it entirely does away with the necessity of injecting them, and shows the vessels in their natural state, without the bulges in them depicted by some writers, which are caused by the injection mass unduly distending them. It also shows the amyloid substance in amyloid degeneration of the liver to perfection, as the blue stains it alone.

I should like to call attention to the great importance of preparing all tissues properly in the first instance, as unless this is done no good result can be obtained from any staining process. Every specimen properly prepared will bear the highest magnifying power that can be applied to it, and will show plainly the structure of each epithelial cell, muscular fibre, or other element of which it may be composed, and it is utterly impossible to make a good specimen unless it has been first properly hardened.

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An Undescribed Point in the Histology of the Fœtal Lung.*

BY PROF. LESTER CURTIS, A.B., M.D.

During the whole of one's life

* Read before the State Microscopical Society of Illinois.

the lungs are among the most active and important of his organs. All the blood in the body passes through them in the course of a very few minutes to be aerated. The vessel which carries the blood to these organs is called the pulmonary artery. Before birth, however, the blood is aerated by another organ, and the lungs have scarcely any function. They, of course, can receive no air and lie as collapsed, solid bodies in the cavity of the chest. The blood which after birth is carried to them in such volumes is, at this time, in great part taken to other parts of the body by a branch which is, after birth, closed. The lungs receive abundant nutrition from another set of vessels, the bronchial arteries, which are derived from the aorta. At this period of life very little blood is conveyed to the lungs by the pulmonary artery, which is afterwards called upon so suddenly to convey such volumes of blood. As to the condition of this vessel before birth, I have never seen anything printed.

I have happened upon some observations which throw light upon this subject.

Some years ago, I made an injection of the blood-vessels of the lung through the pulmonary artery of a new-born child, that had never breathed. I cut the injected lung into sections, and examined great numbers of them in connection with Professor H. A. Johnson, of this city.

While making these examinations we came upon appearances which, at first, puzzled us. The structures in question were sometimes round and sometimes in longer or shorter ovals. The outer portion consisted of several concentric layers interspersed with bright, oblong nuclei. Within was an irregular star-shaped apperance, of a blue color from the prussian-blue injecting material. Very soon the interpretation dawned upon us. What we saw was the undistended pulmonary artery. The vessel during fœtal life receives a large quantity of nutriment from the bronchial arteries. Its walls grow to the full thickness they are to be after birth, but there has been no force to stretch them out to their subsequent diameter.

The force of the injection had been sufficient to drive the fluid through the vessel, but not to distend it.

The fact might be inferred almost without observation and this, perhaps, is the reason that it has not been described.

Soon after the observations were made, specimens were exhibited at a meeting of the State Microscopical Society of Illinois. A brief description was printed at that time in the *Transactions* of the Society, which were published in the Lens.

The above facts seem to be of some practical importance in a medico-legal point of view, as the contracted condition of the vessel indicates with certainty that the full volume of the blood has not been sent to the lungs, and consequently that the child has never breathed.

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Directions For Cleaning Diatoms.

(*Continued from page 110.*)

It should have been remarked in the former paper, that although distilled water is not necessary, except for the final washings, filtered water must be employed throughout, otherwise it will often happen that after the diatoms are cleaned, a glance through the microscope will reveal filaments of algæ from the water, or, what is a far more serious matter, diatoms which do not belong to the gathering may be introduced. In this way fresh-water diatoms may be mixed with those from marine sources, and great confusion may result. In every case, therefore, where water is mentioned in these papers, filtered water is meant.

SULPHURIC ACID PROCESS.

This process is applicable to almost every gathering, whether of recent or fossil forms. When the gathering consists of diatoms without much mineral matter, and the principal object of the cleaning is to oxidize organic matter, it is not necessary to go through the operations numbered 7 and 8, but proceed directly with operation 9. However, in order to make this process applicable to almost every case, we give it in detail. We would advise its use when fossil deposits are to be cleaned; with fresh gatherings which contain much extraneous organic matter (a large admixture of Confervæ for example), and with all specimens which contain much mineral matter (lime, magnesia, clay, silica, etc.). It will be found a particularly good process for guanos and mineral deposits generally.

6. Disintegrate the material, if necessary, by one of the following processes:

a. Place the lumps in a suitable glass, porcelain, or iron vessel, pour on a quantity of water sufficient to cover them, and shave in some common hard soap, so as to make a rather strong solution of soap. Set the dish on the stove where the mass will boil slowly for several hours, replacing the water as it evaporates. The boiling will probably reduce most of the mass to the condition of a fine powder. Pick out the lumps which remain, or pass the mass through a fine sieve, and after washing the fine material, to remove the soap, proceed to the next operation (7). This is probably the best process for siliceous deposits.

b. Boil the lumps in a solution of washing-soda, in the same manner as described in *a.*

c. Boil in filtered water alone, for several hours. This process serves very well in some cases, as with loose clays, marls, etc.

d. Calcareous deposits, as chalks and marls, may be most easily disintegrated by boiling in water acidified with hydrochloric acid. Just sufficient acid should be added to maintain a constant, but not very rapid, evolution of gas.

It has been advised to boil the highly siliceous deposits in strong alkali, but except in the case of specimens which resist the long continued action of the soap solution (*a*), such severe treatment is not advisable. Alkaline solutions act upon the silica of the frustules and would eventually dissolve them, but the soap solution does not seem to act so rapidly as the caustic alkalies or their carbonates.

These processes for disintegrating masses containing diatoms will be successful for most specimens, but they cannot be expected to succeed in every case. When they seem to fail completely, try boiling in strong hydrochloric acid; if this fails, try strong sulphuric acid.

7. The fine powder from operation 6, while still moist, or the fresh material, either wet or dry, should be treated with rather strong hydrochloric acid by boiling in a test-tube, or a glass beaker for a few minutes. This boiling removes most of the mineral matters—lime, magnesia, iron, and at least a part of the alumina. The presence of any appreciable quantity of iron will cause the acid to assume a yellow color; if effervescence takes

place when the acid is added, lime is probably present; the operation must be continued until the effervescence ceases.

Wash out the acid with filtered water, and proceed as in 8. (After some experience the operator will be able to judge whether the process described in 8 will be sufficient to complete the cleaning, or whether he may neglect it entirely and proceed with 9.)

8. Boil the moist material from 7 with strong nitric acid, as described in operation 2 (page 109). In case it is not deemed necessary to proceed with 9, the boiling should be thorough, and the crystals of potassic chlorate should always be used (2). If much organic matter is present, it is always advisable to make use of considerable chlorate, and then to proceed with 9. Wash out the nitric acid, and if the material is quite dark in color, and seems to have much organic mattter mingled with it, it should be dried; however, if it seems to be quite free from organic matter, the drying is not necessary, although the writer usually prefers to do it. Proceed with operation 9.

9. This is the final operation, and if carefully conducted, is sure to be successful in destroying every trace of organic matter.

The residue from 8, or in some cases the raw material, preferably in the dry condition, is placed in a large test-tube, or in what is much better, a porcelain evaporating dish, with a glass funnel inverted over it for a cover, to prevent spattering. Pour over the mass, enough strong sulphuric acid to more than cover it, and heat until dense, white fumes are given off. Then raise the funnel and add crystals of potassic chlorate, cautiously from time to time, and continue the additions until the mass becomes of a clear, white color. The entire operation should not take over fifteen minutes, for any specimen.

When there is considerable organic matter present, the first effect of heating the acid is to char, or carbonize it; and when this takes place, it often seems impossible to succeed with the oxidation. Consequently, if the acid begins to blacken or to become discolored before the dense white fumes appear, a few crystals of the chlorate should be added immediately, but do not add more than are necessary to prevent the blackening, until the acid becomes very hot. This difficulty will not be encountered, if the chlorate is used in sufficient quantity in operation 8.

By following these directions, and using only sulphuric acid of the full strength (pure commercial acid), there will be no danger of forming the very insoluble compound, which troubles many who attempt to work this process.

Allow the acid to become perfectly cool, and then pour it slowly into a large volume of filtered water in a glass beaker, stirring the water constantly with a glass rod. Do not pour the water into the acid, for the heat produced by their combination, might crack the dish.

10. Wash the mass in the beaker until every trace of acid is removed, then proceed as in operation 4 (p. 109).

The principal advantage which the sulphuric acid process possesses over all others, is its powerful oxidizing action. The high temperature at which sulphuric acid boils, enables us to make use of the chlorate under much better conditions than in any other process; and the acid itself dissolves the last traces of iron and alumina, that may have remained after the previous operations.

The Preparation and Mounting of Microscopic Objects.

III. On page 95 it is stated that rings of "sheet-caoutchouc" are useful for mounting diatoms. This is an error: what we intended to say was sheet-gutta-percha, but we did not observe the mistake until after the article was printed.

In *Science* for July 17th, there is an article by Prof. H. L. Smith on "Dry Mounts for the Microscope," in which he speaks in favor of the sheet-gutta-percha for diatoms. He also favors shellac rings, and recommends that the shellac be colored by rubbing it up with "diamond black."

As regards the use of wax in mounting, Prof. Smith was the first to suggest it, but he now writes: "The number of spoiled specimens, especially of diatoms and delicate transparent objects which I can now show, proves that this method of mounting is decidedly bad."

The fault with the method is, that after a time a dew-like deposit will form upon the cover-glass, and perhaps upon the object also. What Prof. Smith writes is the result of long experience, and it is sufficient to lead microscopists to discard the wax-cells entirely, unless they can be covered by some coating of cement, that will prevent the formation of the deposit complained of.

Prof. Smith also says that a deposit of a simular character will form, if asphalt is used for the cells.

In view of all this, the mounter will be puzzled to know what he can use for his cells. It is a difficult question to answer, but we would advise the use of the sheet-gutta-percha for thin cells, shellac for thicker ones, and the curtain-ring cells for the very thick ones, made with wax as described in page 96, but with the wax entirely covered with hard balsam dissolved in benzole.

Mounting in Fluid. Among the many processes for mounting in fluid, only two or three of the simplest are really good, for with most of them the cement will eventually creep under the cover. We vouch for the excellence of those here described, if the directions are carefully followed.

Fluid mounting is applicable to all objects that are sufficiently transparent. It is advisable when the object is too delicate for a balsam-mount and its structure is not well shown in the dry condition.

The fluids employed are usually one of the following solutions: Distilled water; water with 5–10 per cent. of carbolic acid; camphor water; mixtures of water and glycerin; pure glycerin; special preservatives.

The process is the same for all of these, and for any fluid which does not dissolve the cements employed.

The cell must first be made, and for this purpose shellac is the best cement; it should be used rather thick, and a very deep cell can be turned up by means of the knife-blade and the turn-table. A number of cells of different depths should be kept on hand, so as to be perfectly dry and hard when they are wanted for use.

The objects should be perfectly permeated by the fluid in which they are to be mounted, before they are placed in the cell. The mounting is conducted as follows:

a. Choose a shellac cell of a suitable thickness, put it on the turn-table and run a layer of benzole-balsam upon it, using a solution that is just thin enough to flow freely. Set aside for about one minute, or until a thin skin has formed upon the balsam.

b. Invert the cover of a pill-box and lay the slide upon it, then place a large drop of the preservative within the cell, and cause it to flow so as to touch every part of the cell. Transfer the object to the slide and arrange it properly by means of needles.

c. Take a mounted needle in the left-hand, and in the right the cover in a pair of forceps. Place the needle-point on the cell on the left-hand side, and place the edge of the cover against it on the cell; then let the cover down slowly, so as to disarrange the object as little as possible, breathing upon the lower surface, so that the fluid may readily come in contact with it. When the cover is down, press it into the still soft balsam, but apply the pressure only around the outside; otherwise too much fluid is likely to be forced out, and a bubble of air will enter when the pressure is removed. Let the slide stand for a few minutes, then wash it carefully by a gentle current of water from a tap or sponge, and set it aside to dry.

d. When dry, run a circle of benzole-balsam around it, after which the slide can be set aside for months, before the finishing process is carried out. In this condition the object will keep for any length of time if undisturbed, but after a while the balsam becomes very brittle, so that a more elastic cement is required to protect the slide from the effects of rough usage. We are accustomed to set the slides away immediately after the last layer of balsam is applied until a number have accumulated to undergo the finishing operations together.

e. Finish the slides by applying several coats of the mixture of asphalt and gold-size, followed by a final coat of plain asphalt to give a glossy black.

The above process will suffice for mounts in strong glycerin. Many mounters have discarded glycerin as mounting medium because they have failed to find a cement that will retain the glycerin. They have tried shellac, but it has failed them. Now, we speak from considerable experience with glycerin as a mounting medium, and we do not hesitate to assert that shellac will make a perfectly tight and impervious cell for a glycerin mount, and we prefer to use shellac instead of the benzole-balsam for mounting with strong glycerin. The secret of success seems to be in washing off every trace of the glycerin, before the second coat of shellac is applied.

Microscopists are indebted to Mr. C. Van Brunt, of New York, for the process of cementing the cover with benzole-balsam and gold-size and asphalt.

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Improvement in Making Wax-cells.

BY JOHN D. WHITE.

For making wax-cells when they are wanted smoother and handsomer than they can be made with a punch alone, I recommend the following process as simpler and easier than that of Dr. Hamlin, described on page 46. With home-made punches of ordinary brass tubing (cartridge-cases answer very well), cut out rings and disks a little larger than the finished cells are to be, and fasten them to the slides by pressure and gentle warmth, after centering as accurately as possible. Then, with a tool made by bending a small chisel at a right-angle about half an inch from the edge, turn or scrape the cell on a turn-table until it is of the right size. If the tool is sharp, a beautifully polished surface will always result. The chisels which accompany sets of brad-awls are just right, but any flat piece of steel, if not too heavy or clumsy, will do. The cutting edge should be about one-fourth of an inch wide. Punches and all tools used for cutting wax should always be dipped or moistened in starch, prepared precisely as for laundry use. This operates much better than water, or indeed anything else.

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Parasites on Diatoms.

Prof. J. Brun has contributed some interesting notes on "The Diatoms" to *Brebissonia*. The article in the last number of that periodical begins with an account of their parasites, which may prove of interest to some readers of the Journal.

"There is no living creature which has not its parasites! The diatoms, small as they are, also have theirs. So it is true that among the creatures infinitely small, we still find "*le combat de la vie*" and "*la lutte pour l'existence*," and if the large in general eat the small, quite as often the small when united kill the large. Among the diatoms the parasites are always other algæ.

"Five common diatoms, *Nitzschia linearis* and *sigmoidea*, *Synedra splendens* and *Cymbellà maculata* and *cymbeforme* are sometimes found covered with a filamentous parasite having the aspect of large, transparent hairs, straight, rigid, and of a very pale yellowish-green. Strongly illuminated and considerably magnified (×1200), they appear like a series of vesicles united like a string of beads. This is the *Leptothrix rigidula*, Kg. The living frustule is not restrained in its movements, and when (under the microscope) it encounters an obstacle in the water, one observes the filaments bend at their base, but reassume their form immediately that the obstacle is passed. Boiling in water, or the action of nitric acid, removes the filaments which are not, therefore, of a siliceous nature. Potassa distends them and alcohol does not turn them green, thus proving the absence of diatomine.

"It is evidently this parasite that Ehrenberg (Pl. 21, Fig. 11, Edit. 1838) and more recently other naturalists, have taken for motile cilia (organs acting as oars). So said Kützing (Baccil., p. 26 and Figs. 61, pl. 3 and 11, pl. 7), which seems to indicate that he considered that these appendages formed part of the diatoms. I have a preparation in water, in which this same *Leptothrix* adheres at the same time to *Synedra parvula* and to the filamentous alga (*Zygnema*) upon which the *Synedra is itself a parasite;* also another preparation in which it adheres at the same time to *Staurosira parasitica*, and to the *Nitzschia linearis*, which it carries, thus affording the curious phenomena of three parasites superposed in a space of five or six hundredths of a millimetre."

The remainder of the article treats of the development and reproduction of diatoms in a very interesting manner, concluding with some remarks about collecting them.

In this connection, the question presents itself, on what grounds can diatoms be classed as parasites? We may be willing to admit that the *Leptothrix* grows as a parasite upon the diatoms, but even this must be regarded as doubtful until it can be proved that the alga draws its nourishment, at least in part, from the diatom. It does not appear, however, that the filaments are parasitic any further than that they are attached to the diatoms. This is a subject that deserves investigation.

As to parasitic diatoms, we are hardly prepared to believe that diatoms can grow as parasites, in the sense of deriving their nourishment from the plants to which they are attached.

We cannot approve of the use of the term parasite, in the sense which Prof. Brun seems to have applied it in the above translation.

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Classification of the Protista.*

BY ERNST HÄCKEL.

[Translated by Henry M. Douglas.]

Class I.—MONERA, Häckel.

Organisms without organs. The entire body of one of these most simple organisms, consists of nothing more than a bit of plasma or primitive jelly, an albuminoid compound, not differentiated into protoplasm and nucleus. Every moner is, therefore, a cytode, but not a cell. Form mostly indefinite, with shifting projections. Movement sometimes by lobe-feet, sometimes by foot-feet, sometimes by false-feet. Nourishment taken in various ways. Reproduction asexual, by division, budding, or formation of spores. Life in water, mostly in the ocean, also parasitic in other organisms.

Order 1. LOBOMONERA, H. Monera of varying, indefinite form, moving by lobe-feet (lobopodia)—blunt, finger-like projections, mostly without branches, as in amœbæ.

Genus: *Protamœba* (*primitiva, aquilis, etc.*).

Order 2. RHIZOMONERA, H. Monera of indefinite, changing form, moving by root-feet (pseudopodia)—long, fine, thread-like projections, generally branched and coalescing into a net-work, as in the Rhizopods.

Genera: *Protomyxa* (*aurantiaca*); *Vampyrella* (*spirogyra*); *Bathybius* (*Häckelii*).

Order 3. TACHYMONERA, H. (Synonyms: Schyzomycetes, Bacteria.) Monera of definite form, mostly staff-shaped or thread-like, whose rapid tumbling or swinging motions are produced by extremely fine lashes (*flagella*), as in the lash-swarmers (*Flagelleta*). Reproduction asexual, mostly by cross-division. Produce decomposition and putridity of the organic fluids in which they live. Probably the cause of many diseases.

Genera: *Bacterium* (*monas*); *Vibrio* (*lineola*); *Spirillum* (*tremulans*).

Class II.—LOBOSA, H. (Synonym; Amœbina, Rhizopoda, Infusoria, Protoplasta).

One-celled organism (rarely syncytia) whose cell-body is sometimes naked (Gymonolobosa), sometimes partly hidden in shells of various forms (Thecolobosa). Movement by lobe-feet (lobopodia) which appear and disappear at various places on the surface. The nourishment is surrounded by these lobe-feet and pressed into the cells. The protoplasm-body of the cell is frequently separated into a light-colored, firmer, cortical stratum (exoplasma), and a dark, fine-grained, softer medullary stratum (endoplasma). Often it contains one, or several contractile vesicles (vacuoles), sometimes lasting, sometimes changeable. The nucleus is usually simple; rarely there are several present. Reproduction asexual, mostly by division, more rarely by budding, or spores.

The Lobosa live mostly in water, rarely in the earth, or parasitic in other organisms.

* [In publishing this classification of the Protista, it isbelieved that it will be of no little value to students of the minute organisms. It is a classification with which English readers are not generally familiar, and for this reason it will doubtless prove to be of interest.—ED.]

Order 1. GYMNOLOBOSA, H. Lobosa with naked, soft body, without shell.

Genera: *Amœba* (*princeps*); *Podostoma* (*filigerum*); *Petalopus* (*diffluens*).

Order 2. THECOLOBOSA, H. (Synonyms: Lepamœbæ, Arcellinæ, Amœbæ, Cataphractæ).

Lobosa with a shell or cell-membrane, by which the soft body is partly covered.

Genera: *Arcella* (*vulgaris*); *Difflugia* (*oblonga*); *Quadrula* (*symmetrica*).

Class III.—GREGARINÆ, Dufour.

One-celled organisms, or chains of little cells, attached to each other in rows on all sides, by a soft, thick, elastic skin. This cell-membrane is smooth, without any opening, often provided with a hook-shaped attachment. The protoplasm is very elastic and contractile, with numerous granules. The nucleus is large, usually light-colored and spherical, with a lesser nucleus, or nucleolus within. The worm-like movements of the creeping cells take place by contractions of the cortical stratum of the protoplasm, which lies immediately beneath the membrane, and is sometimes differentiated into filaments resembling muscles. All the Gregarines live as parasites in the intestines or body-cavities, more rarely in the tissues, of animals, especially of worms and articulates.

They live upon the juices of the animal which pass through the membrane into the interior of their bodies by endosmosis. Reproduction asexual, by division or by spores; in this case a single greparine, or several Gregarines coalescing, form themselves into a ball, and become surrounded with a capsule. The nuclei then disappear, and the protoplasm breaks up into numerous germ-cells or spores (Porospermeæ, Pseudonavicellæ). Afterwards a moner comes out of every cell, and by the formation of a nucleus, changes to an amœba; when the latter covers itself with a membrane it becomes a Gregarine.

Order 1. MONOCYSTIDA, Stein. One-celled Gregarines.

Gregarine body a simple cell, with a single nucleus.

Genus: *Monocystis* (*agilio*).

Order 2. POLYCYSTIDA, H. Many-celled Gregarines.

Gregarine body, a chain of two or three cells (rarely more) strung together, each cell with a nucleus.

Genus: *Didymophes* (*paradoxa*).

Class IV. — FLAGELLETA, Ehrenberg, (Synonym: Mastigaria.)

One-celled organisms, more rarely cænobia or cell masses, of few or many loosely united cells, moving by one or more flagella—long, thread-like continuations of the protoplasm, which swing here and there like a whip-lash—cell-body sometimes naked, sometimes enclosed by a sheath having an opening from which issues the flagellum. The flagellates seldom grow attached to objects in the water, usually they swim free. In many of them, resting and moving conditions alternate. Propagation takes place by division, chiefly during the resting-state. Nutriment is assimilated sometimes by absorption (endosmosis), sometimes through a cell-mouth (cystostoma). Reproduction asexual, generally by division; more rarely by budding or by spores. Indications of asexual distinction are observed in certain forms (Volvocinæ).

Order 1. NUDOFLAGELLATA, H. Naked flagellates. Flagellates with naked cell-body without a chaplet of cilia.

Genera: *Euglena* (*viridis*); *As-*

tasia (*hæmatodes*); *Phacus* (*longicanda*).

Order 2. Thecoflagellata, H. Sheathed flagellates. Flagellates without a chaplet of cilia; body enclosed by a sheath or shell. The flagella come out from an opening of the shell. Often the shell is fixed upon a stationary pedicle.

Genera: *Salpingœca* (*marina*); *Dinobryon* (*sertularia*).

Order 3. Cilioflagellata, J. Müller. Flagellates with a circlet of short cilia about the middle of the cell-body; the latter is enclosed in a bivalve shell. Between the two halves of the shell, issue the long whip and the chaplet of cilia.

Genera: *Peridinium* (*oculatum*), *Ceratium* (*tripus*).

Order 4. Cystoflagellata, H. Bladder flagellates.

Flagellates without cilia, with a great bladder-like cell-body, which besides the flagellum has a peculiar lash-like appendage, and a staff-like mass within.

Genera: *Noctiluca* (*miliaris*), *Septodiscus* (*medusoides*).

Class V.—CATALACTA, H.

One-celled organisms which are joined for a time into a cœnobium, but afterward live separate. The cœnobia are swimming, jelly-like balls, made up of numerous cells which are joined in the centre of the ball; vibrating cilia issue from the surface. The hermit-cells (monocyta), which arise from the breaking up of the cœnobia, at first move by swimming like the flagellates, afterwards they change into creeping, amœba-like cells, and finally draw together into a globe and become surrounded by a capsule.

A new cœnobium arises within this capsule, by repeated cell-division, and is finally set free. The catalactas are found both in the sea and in fresh-water.

Genera: *Magosphæra* (*planula*); *Synura* (*uvella*).

The Simplest Forms of Life.—IV. Family Volvocina.

Individuals spherical, containing chlorophyll, with two cilia on one end, one or two (seldom three) contractile vesicles within, which can usually only be seen during perfect rest, with nuclei and pigment spot, in families or single, enveloped with transparent jelly, from which the cilia extend. Colonies have a rolling movement.

Individuals united in families in gelatinous envelope,	
families spherical,	
ball hollow, individuals in the periphery,	Volvox.
ball solid, with 4–64 individuals within,	Pandorina.
ball solid with 8 individuals within,	Stephanosphæra.
families tabular, four cornered,	Gonium.
Individuals living singly,	Chlamidomonas.

I. Gen. *Volvox*, Ehr. Individuals spherical, small, in the circumference of a large, hollow, gelatinous ball, which is formed by the close pressing together of the gelatin of the individuals. The latter produce daughter-colonies by cell division, which are pressed into the interior of mother-cell and perfect themselves. There is besides this a kind of sexual reproduction, which was observed by Stein and Busk, but which has been more carefully studied by Cohn and Carter. Large colonies develop certain individuals as females, others as males. The former are the larger and elongate without dividing. The males divide into a large number of linear bodies, which are to be regarded as spermatozoids (from a botanical stand-point as microgonidia). They pass into the cavity of the ball, gather around the female cells (macrogonidia) and become fused with them, which then become surrounded with an envelope with conical, pointed projections (*Volvox stellatus* Ehr.). The chlorophyll is then replaced by starch and red or orange colored oil.

V. Globator, Ehr. (with *V. aureus*, *V. stellatus*, and *Sphærosira volvox*, Ehr.) Ball as large as 0.65d. Common, generally single, at times very abundant in undisturbed ponds.

II. Gen. *Pandorina*, Ehr. (*Botryocystis*, Ktz.) Individuals pressed close together, and therefore angular, surrounded with a common, thick, gelatinous envelope, which, in old colonies becomes double. Multiplication takes place by the breaking up of the colony, rounding of the gelatin about the single individuals, and repeated division within. Generally the individuals within the mother cell, move asunder, become rounded, and the whole assumes the form of a mulberry.

P. morum, Bory. (*Botryocystis, volvox*, Ktz.)

Ball 0.2-0.25d. In stagnant water, common, sometimes very abundant.

P. elegans, Duj. (*Eudorina elegans*, Ehr.) Individual with pigment spot, Balls 0.04-0.125d.

III Gen. *Stephansophæra*, Cohn. Eight spherical, or spindle, or cylindric-shaped individuals, in spherical gelatinous envelope. By three times repeated binary division of each individual, eight new families are produced, which swarm out of the old envelope. In other cases the binary division continues further and there result numerous small, spindle-shaped bodies, each with four filaments (spermatozoa or microgonidia), which finally swarm out. From other colonies, individuals swarm out without having undergone division. These cannot be distinguished from *Chlamidomonas.*

St. pluvialis, C. Balls 0.1-0.15. In small puddles, on stones, etc.

IV. Gen. *Gonium*, Müll. Families of 16 egg-shaped, green individuals, with red stigma, in quadrangular, tabular gelatin. Movement of the colony jumping.

By four times repeated binary division, 16 daughter colonies arise from one old one, which finally become separated and independent. Sometimes the individuals swarm out apparently to pass into the resting condition. The vacuoles (2, rarely 3) lie close under the place where the cilia arise.

G. pectorale, M. Individuals 0.006-0.02d., tables 0.025-0.058. Common, particularly in green water.

V. Gen. *Chlamidomonas*, Ehr. (*Diselmis*, Duj., *Chlamidococcus*, A. B.) Individuals egg-shaped or spherical, greenish or red, with red stigma, not united in colonies.

Ch. pluvialis, A. B. Usually appears in abundance in the spring, to disappear quite as suddenly. In Summer no trace of it can be found. The multiplication of these cells (zoogonidia A. B.) takes place by simple or twice repeated division. Sometimes the division is continued further; then result smaller individuals (microgonidia, A. B.) of different form. After several weeks, the originally elongated cells become spherical, and pass into a resting condition. Their green condition. Their green contents become brown, and colored drops of oil appear within.

EDITORIAL.

—A new weekly scientific periodical has recently been started in this city, under the editorial management of Mr. John Michels. Three numbers have reached us, and already we begin to look forward with pleasure in anticipation of the coming of the succeeding ones.

The editor declares his intention to make his new paper, which is named *Science*, invaluable to "all who desire to be kept *au courant* with the progress of science," and he intends to follow the plan that has proved so successful in the case of *Nature*, which has become one of the most valuable periodicals of the time.

We are glad to welcome *Science*, and we take this opportunity to urge all who are interested in any branch of science, to give the paper their hearty support. It should be borne in mind by the reader as well as by the publisher, that great journals are not made; they grow, and it may take years to bring *Science* up to the standard of excellence and value which *Nature* has attained. In its present condition, it must be admitted that *Science* is far below this standard; nevertheless, there is no doubt that there is a field for such a periodical in this country, and we sincerely hope that it will receive the encouragement and support which the enterprise deserves. It may not be improper for us to add that we are led to believe, from a casual remark which was made in our presence, that *Science* is established upon a good financial basis.

The subscription price is $4.00 per year, which is not too much for a good weekly scientific periodical.

Subscriptions may be sent to "Science," post office box 3838, or to the office of this JOURNAL.

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—The editor of *Science* in the course of an editoral entitled "Coöperation in Science," refers to the New York Microscopical Society in the following words:

"A younger Microscopical Society, established in New York City about three years since, has been organized on an equally faulty basis, and now numbers but thirty members. The coöperation of the right men has never been asked, *and probably would not be accepted*, and in consequence, a future of inactivity and embarrassment may be anticipated."

We have italicized a few words to give them prominence, and we would ask Mr. Michels, who is himself a member of the Society referred to, to favor us with an explanation of their meaning. It is true that the Society is a little particular about its membership. We know of more than one instance when candidates have been rejected because the Society did not consider that they would prove desirable or worthy members.

However, we have yet to learn of the rejection of any worthy man, and we dare assert that every member of that society hopes that it may yet become an organization worthy of the recognition and respect of the best microscopists and scientists in the country.

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Scientific Meetings in August.

We have already referred to the meetings of the "American Society of Microscopists" and of the "American Association of Science" which are to be held this month, the former at Detroit, beginning on the 17th instant and continuing four days, the latter at Boston, beginning on the 25th instant. Once more we take occasion to urge the claims of these two organizations upon the microscopists of the country. The value of annual gatherings like these, which bring together persons who are engaged in scientific work in different sections of this great country, for the interchange of opinions, comparing of observations, and the reading of papers embracing the latest discoveries in their respective branches of study, can hardly be overestimated.

The meetings are sure to be interesting so long as able men of science will give them their support, and their social character makes them enjoyable and long remembered by those who attend.

We remember with great satisfaction the pleasure we enjoyed at the Indianapolis "Congress" two years ago, where we made the acquaintance of a number of the most prominent microscopists in the country, with whose names we were already quite familiar. In no other way could we expect to meet so many persons of allied tastes, under circumstances so auspicious for mutual enjoyment. It is with sincere regret that we find it impossible to attend the meeting at Detroit.

There are other considerations, not so much of a personal nature, which should not be lost sight of by those who are able to join the associations, even though they cannot attend the meetings. It should be observed that the intrinsic value of a scientific paper cannot be made fully apparent by a reading before any assemblage. It is necessary that the paper should be published, and circulated among those who are interested in the subject of which it treats. Unfortunately, it is seldom that original investigators are able to bear the expense attending the publication of the results of their work, and many very valuable papers are lost sight of because the cost of the illustrations that are necessary to render the text intelligible is so great, that few of our periodicals are able to publish them.

The great inducement, therefore, which our large associations offer to original investigators to present their papers, is that they can be published and widely spread among scientists, at home and in foreign countries. For this reason, if for no other, such associations deserve the hearty support of all who are interested in science.

The meeting at Detroit promises to be a very interesting one, and we hope it will be well attended. Professor H. L. Smith is the President, and we think all who attend may feel assured that the meeting will be well conducted by such an able and well-known scientist.

From Mr. Fell we learn that papers will be presented by Professor Kellicott, Mr. H. L. Atwood, Mr. E. H. Griffith and Mr. Fell himself; and he expresses the conviction that there will be more work on hand than can be done, "as the outlook is more favorable than at any previous meeting."

The local circular announces a "public soirée" on some evening during the session, and all who attend the meeting are desired to take their instruments with them. In addition to this there will be a reception at the residence of one of the leading citizens of Detroit, either on the first or the second evening of the meeting.

From Rev. A. B. Hervey and Professor Lattimore we learn that the sub-section of Microscopy of the A.A.A.S. promises to bring together a large number of the best microscopists in the country, many of whom have promised to present papers, and some of these will be fully illustrated. There is also reason to expect a fine display of microscopes and accessories. Mr. Hervey writes: "Every possible opportunity will be given to microscopists who desire to bring and exhibit their microscopes, apparatus or objects, whether they are members of the A.A.A.S. or not. Ample rooms, tables, and light will be provided, and competent persons placed to watch and care for the instruments when the owners are away."

On Tuesday evening, the 31st instant, a reception will be held by the Boston Microscopical Society, in connection with the sub-section of the Association.

We will endeavor to report the work of both the meetings accurately and as fully as space will permit. In order to do this our September number may be delayed a few days later than our advertised time of issue.

The American Society of Microscopists.

The long-promised *Proceedings* of this Society is at last published and we are pleased to observe that the volume is, in every respect, creditable to the publishing committee and to the Society. It embraces the "Proceedings of the National Microscopical Congress," held at Indianapolis in 1878, and of the "American Society of Microscopists," held at Buffalo last year.

The proceedings of both meetings are fully reported, and will prove of interest to microscopists generally, but the most valuable portion of the publication is the "Appendix" which contains the "Annual Address" of the President, Dr. R. H. Ward, and several papers which were read at the Buffalo meeting. Among these Prof. Kellicott's paper "On Certain Crustacea Parasitic on Fishes from the Great Lakes," is illustrated with three full-page lithograph-plates, and another by the same author entitled "Observations on Lerneocera Cruciata" has two plates.

We need not refer to all the papers that are published, for they have already been mentioned in this Journal, but Mr. Merriman's article on "Mounting Double Stainings" deserves the attention of mounters, and Dr. Blackham's tabular "Record of Objectives for the Microscope" is deserving of careful examination.

We do not know the price of the *Proceedings*, but Mr. Geo. E. Fell, of Buffalo, to whose courtesy we are indebted for a copy, will afford any desired information about the Society and its publications.

CORRESPONDENCE.

ABOUT DIATOMS.

To the Editor :—The June number of the Journal is just received, and I am completely astounded that Mr. Stodder failed to discover that the extract from my letter which you unexpectedly published, was, after the manner of my late lamented townsman, Artemus Ward, "rote sarcastic."

I am glad, however, that Mr. Stodder made the mistake he did, as it has brought him to the surface again, and I hope to hear from him through the Journal oftener than we have. His paper in *The Lens* "On the Structure of Eupodiscus Argus," etc., have made Mr. Stodder an authority we cannot afford to lose; and I shall hope for his sake that Prof. Smith's work may soon see the light. I would like to add, for Mr. Stodder's benefit, that I went through the needles eye (microscopically) over twenty years ago; and am not an entire stranger to the study and labor of tracing out the identity of species. Mr. Stodder, however, seems after all to ignore the precise difficulty I had in mind when I wrote you, that is the decision as to which *one* of two or more typical forms, approaches nearest to that of an intermediate form which is clearly one or the other of them, and yet differs in about equal degree from each.

And this difficulty is one not to be helped by books, figures, or even Prof.

Smith's exquisite slides. To illustrate this, I will say that within a few days I received from Prof. Smith, among other slides, one of *Gomphonema Brebissonii* upon which could be found, in addition to the typical form, *G. acuminatum* in varieties that shaded off into very fair representives of *G. capitatum*.

In the same lot of slides were slides of *Gomphonema herculaninm*, and *Cyclotella Oregonica*; and in each of these two slides could be found valves of *Gomphonema* which were probably the same as some of the intermediate varieties of *acuminatum* in the first, yet none of them, looked at alone, would be called *acuminatum*. C. M. VORCE.

NOTES.

—It has long been known that the visibility of fine markings on diatom-frustules was dependent upon the refractive indices of the mounting medium and of the material of which the diatom is composed, the greater the difference the more visible the markings become. Mr. J. W. Stephenson has given a table indicating the relative visibility of silica in various media, which we reproduce as follows:

	Ref. index.	Visibility.
Water, ...	1.33	10
Balsam, ...	1.54	11
Bisulphide of Carbon,	1.68	25
Solution of Sulphur in bisulphide of carbon	1.75	32
Solution of Phosphorus in ditto. . . .	2.10	67

We take the above table from *Science*.

—Our thanks are due to Dr. R. H. Ward for a neat pamphlet containing his address delivered at the meeting of the American Society of Microscopists at Buffalo, last year. We have already published the greater part of his address.

—The prevalent idea that *Hydra* swallows by taking its prey in its tentacles and turning tentacles and all into its stomach, has been contradicted by Mr. Hartog in the *Quarterly Journal of Microscopical Science*. It is quite time that such an error should be corrected, and it is strange that it could be so long entertained, for if any observer will place a *Hydra* in a live-box with a *Cyclops* or other small entomostracan, he will be able to watch the process of capturing and swallowing the animal in a few moments, and it is quite an interesting operation to observe.

—A German writer claims to have detected a thread-like, reticulated structure running through the protoplasm, nuclei and chlorophyll granules of growing cells. He also states that the threads pass from cell to cell, through orifices in the cell-walls. A power of 900 diameters is necessary for these investigations, which were made on the epidermal and parenchymatous cells of *Dracæna* and of *Rhododendron ponticum*.

—It would seem, from the results of some experiments by Prof. Schmitz, of Bonn, that all cells of Thallophytes contain one or more nuclei. In no instance has he found a growing cell without a nucleus. The reagent employed for detecting the nuclei was an aqueous solution of hærmatoxylin.

—Not long ago we received from Mr. C. L. Peticolas, of Richmond, a number of slides of diatoms such as he prepares for sale. We have examined some of them with great care, and we are pleased to express our admiration of the beauty of many of the forms, and for the general excellence of the cleaning and mounting. No cabinet can be quite satisfactory without some of Mr. Peticolas' slides, for we are disposed to regard them as the best lot of diatom-slides of their kind that can be found in the market.

—An aquarium cement, said to be used at the London Zoölogical Gardens, suitable for either salt or fresh-water, is made as follows:

Litharge, fine, white, dry sand, plaster of Paris, of each 1 gill; finely pulverized resin, 1/3 gill. Mix, and make into a paste with boiled oil containing a dryer. Beat well and then allow it to stand four or five hours, but not longer, before using.

MICROSCOPICAL SOCIETIES

CENTRAL NEW YORK.

A regular meeting of this Society was held on the evening of Tuesday, June 29th, at the office of Dr. Aberdein, in Syracuse, President Collins in the chair.

Dr. Aberdein read a paper giving a general statement of the usual method of mounting objects, for the benefit of those members of the Club who had had little or no experience as yet, in that direction.

The President exhibited a couple of specimens of *Hydra vulgaris* under an $\frac{8}{10}$, and a Spencer "professional" $\frac{1}{4}$. Some mounted slides were exhibited by other members.

The same officers were reëlected for the ensuing year, after which the meeting adjourned.

GRIFFITH CLUB, MICH.

On the evening of June 21st, this Club gave a "soirée," which proved to be a very successful entertainment.

After the exhibition of many of the more familiar objects, a series of anatomical specimens were shown by Prof. C. H. Stowell. The two most interesting views he gave were the circulation of blood in a frog's tongue, so shown upon the screen that streams of blood-corpuscles could be distinctly seen chasing each other along the arteries and veins, and finally the beating of a frog's heart. The latter representation was accomplished by "shocking" five or six frogs so as to render them temporarily insensible, and while in this condition destroying the brain with a probe to render them permanently insensible; then by opening the skin upon the stomach, the heart was laid bare and the frog, laid upon its back upon a flat piece of cork, was held so that the heart and immediate surroundings were reflected upon the screen. Although the real size of the heart was smaller than the end of one's little finger, it was magnified to the dimensions of 10 x 14 inches, and the color, shade and pulsations were impressively graphic and true to every detail of of life. The only difficulty experienced was that the intense heat of the lime light cooked the flesh after a few pulsations and required the substitution of a fresh specimen. Prof. Stowell says that, with the exception of two or three class demonstrations at Ann Arbor, this is the first time such an exhibition has been given in public.

ILLINOIS.

At the May meeting of the Trustees of the Illinois State Microscopical Society, a section in Histology was organized for work during the summer vacation.

The first meeting was held May 21st, at which, Dr. Lester Curtis was chosen President, and Dr. Frederick W. Mercer, Secretary.

Meetings are held on the third Thursday of each month.

Exchanges.

[Exchanges are inserted in this column without charge. They will be strictly limited to mounted objects, and material for mounting.]

Polyzoa, Palates of Mollusca, Foraminifera, Sponge and Holothurian-Spicules, Synapta-Anchors, Chirodota-Wheels, Echinus-Spines, Minute Sea Shells, in exchange for Polyzoa, Foraminifera, Histological and Pathological preparations, *etc.* Also, a quantity of Sea Shells in exchange for Land and Fresh-Water Shells.

F. M. HAMLIN, M. D., Auburn, N. Y.

J. J. B. Hatfield, Arsenal Avenue, Indianapolis, Indiana, will exchange Bleached Plant-Sections for good Diatomaceous material. List furnished on application.

Pleurosigmas and other unmounted Diatoms, both Fresh Water and Marine; also Marine Algæ, Ferns, and a large quantity of miscellaneous microscopical material in exchange for good mounted objects.

M. A. BOOTH, Longmeadow, Mass.

To exchange, well-mounted Slides of Hair for mounted or unmounted specimens of hair from the rarer animals; lists exchanged. WM. HOSKINS, 208 S. Halsted street, Chicago, Ill.

Nicely mounted Slides (opaque) of the Coal-tar Derivatives, chemically prepared, crystalline in form, showing their beautiful colors, in exchange for other well-mounted material. Chemical name and formula attached to each Slide. About a dozen varieties on hand. F. L. BARDEEN, M.D., 30½ Meigs street, Rochester, N.Y.

Vanadate of Ammonia, $(N H^4)^2 V O^4$, Slides for the Polariscope in exchange for other Slides.

H. POOLE, Practical School, Buffalo, N. Y.

Slides mounted from injected Frog's Gall-bladder, Liver, Kidney, Stomach, Intestine and other parts, exchanged for other good and interesting preparations. C. BLASDALE, M. D., Jericho, Queens Co., N. Y.

Well-mounted, selected and arranged Diatoms, for good histological, pathological or anatomical preparation. State what you have, and terms of exchange.

W. W. RINER, Greene, Iowa.

Foraminifera from Sponge-sand, Marl-sand, and Chalk; Transparent Prisms of Carbonate of Lime from fossil Shells; Fresh and Salt Water Diatomaceous material; Carapaces of Rhizopods; polished sections of Fossiliferous Limestones, Corals, etc., to exchange for any microscopical material.

K. M. CUNNINGHAM, Box 874, Mobile, Ala.

The American Monthly Microscopical Journal.

Issued on or before the fifteenth day of each month.

Correspondence should be addressed to the Editor, Romyn Hitchcock, 53 Maiden Lane, New York.

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Carbolic Acid in Balsam-mounting.

BY C. M. VORCE.

On page 139 of *Science Gossip*, for June 1880, a correspondent remarks on the use of carbolic acid for mounting in balsam. This was a new idea to me when I read it, and I immediately tried the process with most excellent results. The first experiment was to place a drop of the acid on a slide, into which I dropped a very minute living fly; one of those that swarm around a heap of vegetable refuse, especially fruit; placing the slip on the stage of the microscope, the fly was seen to struggle for but a few seconds, when the limbs, wings and tongue became extended, the whole insect became beautifully clear, appearing as if wholly destitute of viscera, but exhibiting clearly the sexual organs. Now removing the slip, the acid was drained away, a drop of moderately thick balsam was put on, a cover applied and the completed mount examined. It had all the appearance of an ordinary good balsam-mount from turpentine or oil of cloves, but less than five minutes had elapsed since the living fly was dropped into the acid. This was in June, and the slide now shows no change.

Since that time I have used the acid a great deal and esteem it an invaluable aid in the examination of insects, etc., and for mounting small objects, Acari, Hemiptera, etc., in balsam, and very useful in consequence of the speed with which the result is obtained. I think, however, its greatest value is in the examination of specimens put into it alive, for it seems to me even to preserve the fluids of the insect, though it renders them completely colorless. If pressure be applied to an insect thus treated with the acid, the body-walls will be ruptured, and, if in balsam, a colorless, glassy fluid will exude, sometimes carrying distinct cells immersed in it, and this extravasation will remain permanent in the mount. I have tried to obviate this by making an opening in the body-wall and applying pressure to the object while in the acid, then dissecting away the extruded matter before applying the balsam, but the margins of the opening will show an unsightly, ragged edge in spite of all efforts.

Therefore, in all cases where I have used it lately, I have mounted without pressure, using for very minute objects a sufficiently deep layer of balsam, and for thicker objects, such as fleas, bed-bugs, etc., rings of tin-foil, lead or gutta-percha, of sufficient thickness to permit a little pressure but to prevent crushing.

A very advantageous feature of this process is that the acid does not stiffen or harden the object, but it remains perfectly flexible for a long time, and the object may be arranged so as to display its features to the best avantage, although I have not often been able to better the arrangement which the insect has spontaneously assumed in the acid. Insects that have been preserved in alcohol will be cleared in the acid, but slowly and without wholly losing the stiffness and contracted shape assumed in the alcohol, to which fluid the acid seems to be repugnant, as it is inclined to run into drops when an alcoholic specimen is placed in it.

If the microscopist, when he goes on a collecting trip, will take along a small, wide-mouthed bottle of acid and drop into it the small insects he meets, he will, on his return home, find a rich harvest that will occupy his eyes and hands for many an hour. He can examine his treasures and mount them at once, or return them to the acid to await his leisure. I can discover no difference between the effects of immersion for a few minutes and immersion for weeks.

Heat applied to the acid hastens its action, but I do not see that it intensifies it and for my own part I prefer to let the acid act on small insects without heat, and watch the progress of its slow action as it clears up and discloses one feature after another.

In using dammar I have not had such good success as with balsam for in some cases a milky line appeared at the edge of the wave of dammar, which made it necessary to apply more of the medium than was required for the mount so as to drive this milkiness out beyond the cover, leaving a surplus to be afterwards cleaned off, but I have made some good dammar mounts, and think the difficulty can be obviated although I have not had time to experiment with it to determine this.

On injected tissues the acid works well, so far as to show the injected vessels, but renders everything else so transparent and glass-like, as to show no structure with any satisfaction. I learn from Dr. Blasdale that he had long ago tried the acid on injected specimens, and rejected it, on account of the too great transparency and indistinguishableness communicated to the tissue bearing the injected vessels.

The writer in *Science Gossip* states that vegetable tissues are acted on by the acid equally as well as animal tissues, but I have not tried it myself on vegetable preparations. The same writer refers to a communication by himself on the subject, written several years ago, but it must have met with limited notice, for I have not yet met with any one who ever saw it, or who was aware of the availability of the acid for this purpose, excepting Dr. Blasdale, hence I have thought it worth while to give the hint to your readers, to many of whom it is probably new.

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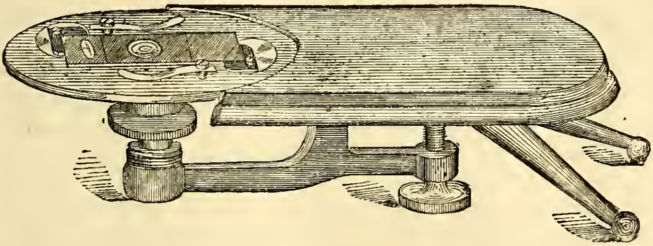
The New "Congress" Turn-table.

The "Congress" Turn-table, invented and first exhibited by me at the "Congress of Microscopists" held at Indianapolis, may be thus briefly described.

Into the upper surface of the rotating plate, diametrically opposite and equidistant from the centre, two circular plates or discs, one inch in diameter, are set, their sufaces flush with that of the large plate. Pivots from the two discs project through the plate, and each carries upon the lower side of the plate a toothed-wheel. A hollow sleeve rotating freely upon the stem of the table carries a third and larger wheel, which gears into the two others and thereby gives rotation to the discs in the top of the plate.

Near the opposite edges of the

two discs, the angular jaws which hold opposite corners of the slide are pivoted (as in Cox's and other forms

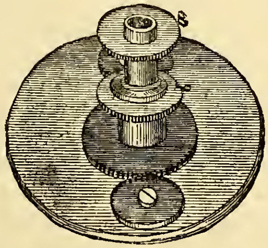


of tables), and it will be seen that by giving rotation to the central wheel under the plate, the jaws may be made to approach or recede at pleasure.

A coiled steel spring, concealed within to the hollow sleeve, serves to close the jaws, while a single motion of a milled head upon the sleeve, opens them to their full extent.

It may be also seen that although the jaws do not approach in a straight line, yet when properly adjusted, a line joining the pivots of the jaws will cut the centre of the plate, whatever the position of the jaws, and they being always equidistant from the centre, it follows that the slide, when clasped between them, must be perfectly centered.

For the purpose of retouching old slides the ordinary clip-springs are retained. An improvement in



the supporting stand claims some attention. In the original "Congress" table, the stand was simply a tripod of iron, this being neater and more graceful than the block of wood, I have lately arranged the tripod so that the hind legs are removable and, being held in position by a clamp-screw, the same screw serves to clamp the instrument upon the edge of the work-table, should this mode of using it be preferred.

This table is made only by John W. Sidle & Co., manufacturers of the "Acme" Microscope.

John W. Sidle.

Lancaster, Pa.

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The Third Annual Meeting of the American Society of Microscopists.

FIRST DAY.

The Society convened at 10.30 A. M., August 17th, 1880, at the Detroit Female Seminary, 82 Fort St., West, a good attendance of members and a few visitors being present.

The meeting was called to order by Dr. R. H. Ward, the retiring President, who introduced President H. L. Smith, of Geneva, N. Y. Professor Smith briefly addressed the meeting in very well chosen words.

Mr. E. W. Wetmore, President of the Griffith Club of Detroit, made a few remarks alluding to the great pleasure with which the Griffith Club, a very young society, extended its welcome to a society but little older, yet which it regarded almost as a parent, and he expressed the hope that benefits would result to both societies from this meeting, as well as pleasure to the members.

Ex-Gov. J. J. Bagley then addressed the Society, welcoming the members in appropriate and humorous terms. He was warmly applauded by the members.

President Smith responded in behalf of the Society, thanking the citizens and their representatives for the hearty welcome extended, and the members and officers of the local Club and others for their admirable efforts for the success of the meeting.

An intermission was taken to allow members to register and pay their dues, after which the Secretary reported the following applicants for membership, approved by the Executive Committee, all of whom were admitted as members, *viz.:* Hiram A. Cutting, J. W. Crumbaugh, M. D., John Phin, L. R. Sexton, S. O. Gleason, M. D., F. S. Updegraff, Lee H. Smith, F. O. Jacobs, W. G. Lapham, M. D., Nathan W. Lord, Sidney H. Short, Gen. Wm. Humphrey, J. T. Main M. D., O. W. Owen, M. D., E. W. Wetmore, Charles R. Ferris, Frederick Seymore.

An invitation from Moses W. Field, Esq., for an excursion to Wyandotte on the steamer *Grace McMillan* was accepted with thanks.

After some merely business proceedings, the Society adjourned until 2.30 P. M.

At the afternoon session there was a much larger attendance, with a fair sprinkling of ladies in the audience, which included also many prominent members of the medical fraternity of the city.

The first paper was read by Geo. E. Fell, of Buffalo, who gave a description of a series of plates, consisting of enlarged, sectional drawings, exhibiting the structure of a human molar tooth. These plates were beautifully and appropriately colored and were so arranged as to infold, thus exhibiting the structure progressively by the successive unfolding of the plates. This paper was received with great interest and attention, but on account of the numerous references to the plates it cannot be given even in a condensed form without them.

Prof. D. S. Kellicott of Buffalo, then read a paper describing a new species of fish parasite found upon the bull-head, and to which he gave the name of *Lerneocera tortua.* Only one specimen was discovered which was on exhibition, beautifully mounted. The parasite occurs buried in a tumor caused by its own presence just back of the pectoral fin. Like others of its class this parasite survives removal for a considerable time. The scientific description of the parasite was illustrated by wood-cuts distributed to the audience by which it was readily comprehended.

W. G. Lapham of Northville, Mich., next read a somewhat lengthy paper entitled "The Relation of Medium Power Objectives to Micro-biology," in which he gave an account of the use of different objectives, particularly a $\frac{4}{10}$, in such work. The writer considered the subject very thoroughly, and drew the conclusion that with a $\frac{4}{10}$ objective of the best class, one can see almost as much as with any higher powers, and can see all that is needful to see in this department of microscopical research, for he might refer his specimens to expert specialists in manipulation, in cases when the use of such medium powers proved insufficient for the elucidation of the ultimate details.

This paper was briefly discussed by Dr. Seiler and others and at some length by Prof. Tuttle and President Smith. The latter pointed out the disadvantages in the plan recommended by the author of the paper and especially the difference of image due to difference in the focal length of the objective by which it is formed. Prof. Tuttle also objected to the conclusions of the author and insisted that the investigator in biology must do the whole work himself and could not successfully leave any part of it to others. He thought that one who confined his microscopical studies to a $\frac{4}{10}$ objective would not accomplish much.

C. M. Vorce of Cleveland, Ohio, read the next paper [see page 170], entitled "Penetration in Objectives, is it a Defect or an Advantage?" The writer discussed the images formed by objectives of the classes which he denominated as "penetrating," and "non-penetrating" or defining lenses, and the deductions to be drawn therefrom. The conclusion reached was that different kinds of objectives were needed for different kinds of work, and that both penetrating glasses and defining glasses were needed, each for its own class of work. He thought if a microscopist could not afford to buy both classes the lower power defining and higher power penetrating objectives were the most generally serviceable, neither kind alone being sufficient for all kind of work. There was no discussion upon the subject of this paper. Ten more new members were admitted.

In the evening many of the members and a number of citizens enjoyed a very pleasurable excursion on the steamer *Grace McMillan* to Wyandotte, and back. About 150 persons were on board.

SECOND DAY.

After the reading of the minutes, etc., the Executive Committee reported the following as approved applicants for membership: The Rev. William D'Orville Doty, Rosa M. Redding, Chas. Shepard, M. D., W. B. Sprague, M. D., Allen Y. Moore, W. G. White, Wm. A. Clapp, John Sloane, Richard H. Mohr, Albert McCalla. The gentlemen named were elected members of the Society.

An invitation to the Society to visit the Detroit Scientific Association's Museum at Harper Hospital in the afternoon, was accepted.

Mr. C. M. Vorce read the first paper of the day, which was entitled "The Microscopic Examination of Writing for the Detection of Forgery, etc."

The speaker treated the subject at length, saying that he had a great deal of interest in the matter, and directed his attention both to the verification of signatures and to general writing. He was free to say that he was as yet by no means satisfied with the results which had been attained, and thought that many valuable additions might be made to this branch of practical microscopy. He had considered first, the general characteristics of writing; second, special characteristics, modifications of or departures from general characteristics. There were five elements which determined the character of a person's hand-writing: the paper, the pen, the ink, the personal qualifications of the writer, and the conditions under which the writing was done. Any one of these being changed from the ordinary conditions, the microscopic conditions of the writing were almost sure to be changed also. So far as the paper is concerned its surface is the only characteristic which affects writing. The harder and smoother the surface the better defined is the writing upon it, and the better chance there is of determining any erasure, change or interpolation. On paper of good quality, with a good pen and readily flowing ink, the lines of writing present a tolerably even contour, depending upon the rapidity, pressure, the amount of ink in the pen, etc. The speaker illustrated at length, on the blackboard, the various widenings or "webs" which are always found at points where two lines cross, explaining how a variation of speed, a change in the kind of ink and other causes, affected this web. Upon rough paper the lines always have a ragged edge; the webbing is if anything less than upon hard, smooth paper. As to the pen he stated that when a steel one was used, the paper always showed a distinct groove or cutting on its surface, especially at the edges of heavy lines. When a pen is old and corroded, the paper looks as though cut with a knife. The various qualities of ink were discussed, together with the effect on the appearance of the writing which copying it in a letter-press has. Some inks will not write well on paper that has been lithographed, running unevenly, as though the paper was greasy. By the fourth condition, the qualifications of the writer, the speaker meant his skill, method, physical ability, etc. A person much accustomed to writing usually writes at a good speed and without hesitation. The writing, in quality, is apt to look alike at all points on the page. Where writing is done slowly it is not so regular and the curves are not so smooth and geometrical. Where a habitually light writer attempts to make a heavy stroke, the shading is irregular. The same is true where a person accustomed to writing with a heavy stroke attempts to write lightly. These differences are such that they can usually be discovered with the aid of the microscope, and when a writer concentrates all his faculties on the appearance and character of the writing it never has the easy, flowing appearance which it otherwise would have. He stated that it was nearly impossible to imitate the tremor in the writing of aged persons. The fifth condition, the circumstances under which the writing was done, had as much to do with its appearance as any other cause. One who habitually uses a flexible gold pen writes very differently with a steel pen. The reverse is equally true. Persons who are accustomed to write sitting usually cannot write as well standing up. The practical application of these and other facts in the examination of writing requires patient investigation, much of it apart from the simple use of the microscope. In the great majority of cases the microscopic investigation is utterly useless without a corresponding outside investigation. The signatures to letters are apt to vary more than those written elsewhere. Letters produced as specimens of a person's handwriting are very apt to prove deceptive. Sometimes it is impossible from expert testimony to determine the character of the suspected writing. As an instance, the speaker related that he had in his possession a genuine promissory note in which a man had misspelled his own name in the signature. Had he died and had there been a contest as to the signature, it could hardly have been decided as anything else than a forgery. Unfortunately, however, the man lived to pay the note, thus spoiling a very good chance for a nice case of expert evidence.

Ex-president Ward discussed this paper at some length. He believed that inquiries of this kind should consist of microscopic analysis in connection with a broad and philosophic knowledge of the habits and peculiarities of the person who might have executed the alleged forgery. Under all circumstances a man's handwriting, he believed, would exhibit, when carefully examined, certain peculiarities which had become as natural to him as breathing, and which he could not rid himself of. A man might imitate a signature in its prominent letters and first syllables very successfully, but it would be simply a miracle if, when he came to the latter part of the signature, some peculiarity of his own handwriting would not unconsciously be imparted to that which he sought to imitate. The very fear of exposure, the nervousness from which few men at such times could completely rid themselves, would ensure the presence of some unconscious trait of the writing which would make its identification where there were two or three words or more almost certain. A well-known case in point was that of Whittaker, the West Point cadet, where among several hundred specimens of the students' handwriting, written carelessly and at times when they had no idea their penmanship would ever be examined by others, the specimens being marked in cypher, several experts, none of them knowing the conclusions which the others had reached, or whose handwriting it was that they had agreed upon, all selected the specimens which were known by the officers to be those of Cadet Whittaker.

Dr. Carl Seiler then addressed the Society on the subject of mounting. He said that the microscopists of both Europe and America were divided into two classes on this important question. Many believed that balsam should be the only material used in most cases and others as decidedly glycerin. He was of the opinion that all tissues which can be hardened and cut into sections are best mounted in balsam, and such specimens as membranes, hairs, cilia, etc., are best mounted in glycerin. If one wished to show delicate, fine lines he should use glycerin. The advantages of balsam are that it does not destroy colors, makes a specimen clear and does not deteriorate. The disadvantages are that the specimen is apt to shrink, also the slowness of drying. The advantages of glycerin are that delicate membranes may be preserved, while its disadvantages are that it always interferes with the coloring. The specimen also tends to deteriorate. Specimens mounted in glycerin are very apt to suffer from leakage. There are substances which in some cases combine the advantages of both, without the disadvantages of either. Among these the speaker mentioned Farrant's medium and dammar cement.

The remarks of Dr. Seiler were the subject of criticism by several members.

In reply to a question of the President as to whether a simple solution of balsam became cloudy in alcohol, Dr. Seiler said if the balsam was evaporated to dryness first the volatile oils were dispelled and the solution would be clear if the alcohol was first warmed.

"Notes on the Structure, Development and Position of an Undescribed Flagellate Infusorium," was the title of a paper read by James H. Fisher. He referred at first to the but little explored domain of the lowest forms of animal life, which so nearly approached the vegetable. The infusorium which he described he found in a small stagnant pond near Mount Hope. The body of the little animal was shaped like a cylindrical flask, green in color, the mouth resembling the neck of a bottle, and provided with a flagellum presumably for both prehensive and sustentatory purposes. The animalcule was minutely described, and its habits are noted. It had no red eye-speck. Spines were equally distributed over it. It could not be identified, he thought, with any known species. He humorously christened it the *Laguncula piscatoria*, or the fisher's little flask.

Mr. Lapham of Northville said he had seen an animalcule almost identical with this, excepting that its outer shell was composed of successive plates. He thought it was a link between the Rhizopoda and the Flagellata.

Wm. H. Walmsley read a paper on "The Use of Wax-cells in connection with White Zinc for Fluid-mounts." He had used the process for many years and described the details of it minutely.

In response to a question, Mr. Walmsley said the cement would sometimes become yellow.

The discussion was here discontinued and the Society adjourned to visit the Museum of the Scientific Association.

In the evening, President Smith read his annual address to the Society and its friends, at Whitney's Opera House. He said he thought they had very great reason to congratulate themselves upon the results attained at the two previous annual meetings. He might also speak of the wonderful improvements which had been made in the microscope; but these would be less desirable than a discussion of some special question. He announced his subject to be "Deep-sea Soundings, and the Relation of Microscopic Algæ to Deep-sea Animal Life, with a few Remarks upon Evolution." He began with a glowing description of the wonders and beauties of the ocean-life. He then related the various stages by which it became known that it was possible for life to exist at great depths of the sea, and recounted the voyages of the United States vessel *Tuscarora*, and the English vessel the *Challenger*, in their efforts to add to human knowledge concerning deep-sea life. He described the methods used to obtain specimens of the animal and vegetable life to be found three or four miles below the surface of the ocean. He then made a logical and lengthy argument to show that the low forms of deep-sea life may furnish another link in the line of proof which is causing scientific men to tend so largely to the evolution theory.

The paper was well received and evidently enjoyed by all who heard it.

THIRD DAY.

The Secretary read a report of the Executive Committee in reference to amendments to the Constitution. The amendments propose the election of honorary members; the election of secretary and treasurer for three years; making the vice-presidents the auditors of the treasurer's accounts, and the treasurer the custodian of the Society's property; making the terms of the officers begin at the conclusion of each annual meeting, and providing that if any member shall fail for two years to pay his dues he shall forfeit his membership. The report was accepted and the amendments will come up for action next year.

The nominating committee reported the following officers for the ensuing year:

President—J. D. Hyatt, of New York.

Vice-Presidents—Geo. E. Blackham, M. D., Dunkirk, N. Y., and W. B. Rezner, M. D., Cleveland, O.

Secretary—Prof. Albert H. Tuttle, Columbus, Ohio.

Treasurer—Geo. E. Fell, Buffalo, N. Y.

Executive Committee—W. H. Brearley, J. H. Fisher, Prof. Albert H. Chester.

The report was adopted.

"Demonstration of Capillary Circulation in Man," was the title of a paper by Dr. D. C. Hawxhurst of Battle Creek. He explained a process for demonstrating the flow of blood in the capillary vessels of the human lip. It had been possible to do this in some of the lower animals, but never before had any one been able to exhibit the capillary circulation in any part of the human body. The lower lip was rolled over a support and the lens adjusted to it. Proper means were taken to steady the head. Clamps were applied to the lips so as to cause an engorgement of the capillary vessels. The method was that of a German scientist. Strongly condensed daylight or gas-light was best. A power of about fifty diameters was used. The course of the blood could be seen, seeming to the observer as if shown through a veil. A bit of ice applied to the surface of the lip arrested for a time the capillary flow. The speaker related many other interesting experiments, explaining the results attained by treating the lip with chloroform, ammonia, acids, glycerin, etc.

Dr. Carl Seiler thought the powers used in this method were too low to be made useful in discovering changes in the blood-corpuscles. He thought the discovery was more in the nature of a pretty experiment than anything of scientific value.

Dr. Hawxhurst thought after considerable practice results could be obtained which a novice could not discover.

"Improvement in Microscope Stage" was the subject of a short address by Dr. Carl Seiler of Philadelphia. He said that last year, at a meeting of the Society, he set forth the necessity for certain improvements in the microscope of the future, one of which was an increased movement of the stage, giving at least four inches play in each direction. Mr. Walmsley, agent for R. & J. Beck of London, had a binocular made by that English firm, embodying the improvements suggested. Dr. Seiler exhibited the instrument, which he said was particularly valuable in examining large specimens, such as sections of tumors, the vocal organs, or anything requiring a large stage movement to bring all parts of the specimen successively into play.

W. H. Bulloch (of Chicago), thought as good an instrument could be made in this country.

Dr. Seiler said one could not be made so cheaply.

Mr. Bulloch described briefly a microscope specially arranged for examining rock sections, with improved facilities for minute measurements, stage adapted to this particular purpose, better methods of illumination for opaque objects, etc.; also a new section-cutter, by which he could cut sections one-thousandth of an inch in thickness.

E. H. Griffith, of the Griffith Club of Microscopy, described the Club's portable microscope. He produced a little morocco-covered case, from which he took a number of disjointed parts of a microscope. These he rapidly placed together, and when the instrument was mounted the unscientific query as to how so large a microscope could be packed away in so small a box, came to the surface.

The first paper of the afternoon, and the last one of the session, was read by T. J. Burrill, Professor of Botany and Horticulture at the Illinois State University. It was upon "The So-called Fire Blight of the Pear and Twig Blight of the Apple Tree." We intend to refer to this article next month.

The committee appointed to examine the specimens of adulterations of commercial articles, and to award the prize, a fine objective, offered by Prof. Griffith, for the best mounted specimens, reported that C. M. Vorce was the only contestant and that his exhibits of coffee and butter were fine ones. He was therefore entitled to the prize.

President Smith presented it to him in a brief speech, and he accepted, regretting that there had been no other contestants.

The subject of publishing the papers in the microscopical journals before they appeared in the Proceedings came up, and the following resolution was adopted after some discussion:

Resolved, That all papers read before the Society should, if accepted by the publishing committee, be withheld by their authors from publication elsewhere until after their appearance in the Proceedings; and that the committee shall be instructed to signify their acceptance or rejection at the close of each session, and shall publish the Proceedings within three months after adjournment if possible.

A resolution offered by Prof. Burrill, that the President and Vice-presidents elect of the Society be appointed a committee to report upon some plan for uniformity in size and naming of eye-pieces and tubes, was adopted.

The report of the Treasurer, Mr. Fell, showed $266.06 on hand, and $450.75 due the Society, of which the treasurer regarded $114.69 as being very certain of being paid, making total assets $380.81. The report was adopted.

Prof. Griffith renewed his offer of a ½-inch eye-piece or its equivalent for the best mounted slides showing adulterations in commercial articles, accompanied with the best thesis upon the specimens submitted. His offer was accepted with thanks.

The society then adjourned to meet in the evening at Merrill Hall.

In the evening there was a "Soirée" at which many fine instruments and beautiful objects were shown.

Among the exhibitors were Mr. Walmsley, Mr. W. H. Bulloch, Mr. Edward Bausch, Mr. Edward Pennock, of J. W. Queen & Co., Mr. L. R. Sexton, with microscopes and objectives by Gundlach, and many others.

One of the Detroit daily newspapers characterizes the "Soirée" as "one of the most successful of its kind, ever held in this country"

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Penetration in Objectives—is it a Defect or an Advantage?

BY C. M. VORCE.

[Summary by the author.]

Penetration in objectives was defined as that quality by which the objective is able to present the images of different planes of an object in such close superposition, that the eye distinguishes them simultaneously, as the images of objects seen by the unaided eye are perceived. He claimed that the images presented to the eye by objectives having this quality of penetration, impress the mind at the instant of view, with a true idea of the bulk and substance of the object, and the arrangement and relation to each other of its parts. The reverse of this, he stated, was true of the images presented by objectives, in which the above described quality had been sacrificed to the attainment of superior definition, and which he called "defining objectives,"as distinguished from the others called "penetrating" objectives.

Comparing the effects of these two qualities of an objective, the writer argued that the mind was more likely to obtain a correct idea of the structure of an unknown object, if the images of it presented to the eye by an objective, resembled in character those received by the eye direct from natural objects, as he claimed was the case with penetrating objectives, than if the mind were compelled to successively compare with each other, the images of separate parts and different planes, and laboriously trace out their relations to each other.

Referring to the objection that penetration was permissible in low-power objectives, he said that penetration was equally as necessary in high-power objectives as in the others, and referred to certain statements of the Rev. Mr. Dallinger, concerning a $\frac{1}{35}$-inch objective, made for him by Powell & Lealand, and which he used in his researches upon septic organisms, published in August, 1878. These statements, the writer claimed, supported the position taken by himself. He quoted Mr. Dallinger's description of the penetrating power and fine definition of the $\frac{1}{35}$-inch lens, as evidence that a superior objective for delicate, original work, required penetration as well as definition. The practical conclusion, he said, was, that neither penetrating objectives nor defining objectives were alone sufficient for all classes of microscopical investigation ; but that both kinds were needed, of all the powers, and if the microscopist was limited in the number of his lenses, he would find the widest capabilities in the low-power defining and high-power penetrating objectives, closing with the recommendation that opticians should endeavor to secure the best possible combination of defining power with penetration in the same objective.

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The Sub-section of Microscopy at Boston.

We have not deemed it advisable to take up much space with a detailed account of the proceedings of the Microscopical Sub-section of the A. A. A. S., but shall confine ourselves to a brief account of the stands and apparatus exhibited, and to the printing of a number of the articles that were read. Some of these, however, will have to lie over for our next number.

On Saturday, August 28th, the following communications were read before the Microscopical Subsection :—

"On the Limits of Visibility with the Microscope," by A. E. Dolbear ; "Minute Anatomy of the Human Larynx," by Carl Seiler, and "Some of the Infusoria Found in Fresh Pond, Cambridge," by S. P. Sharples. Of these, Professor Dolbear's work is of general interest, although it embodies nothing new. The same subject has been examined by Mr. Sorby, and by others, and any further discussion of the visibility of ultimate molecules seems useless, at the present day. Mr. Dolbear spoke substantially as follows : Some years ago, it was thought that the limits of visibility with the microscope would be reached when the object to be magnified was about half a wave-length of blue or violet light in dimensions, say the one-hundred-thousandth of an inch ; but Nobert's lines are now said to be seen like pickets in a fence, and

Beale pictures microscopic fungi smaller than that dimension. So it is worth while to consider the likelihood of our ever being able to see an atom or a molecule. According to Maxwell's measurements an atom of hydrogen has a diameter of about one two-millionth of a millimeter. A molecule may be made up of almost any number of atoms to a thousand or more. A molecule of alum has an hundred atoms, one of albumen nine hundred, and so on. If such groups of atoms are compared in their dimensions, their relative diameters would be as the cube root of their number of atoms, and the alum would be four and six-tenths times the diameter of the hydrogen molecule, and the albumen would be nearly ten times this. That would bring the diameter of the latter down to the two-hundred-thousandth of an inch. If a good microscope will show a point but one four-thousandth of a millimeter, its magnifying power would have to be increased but fifty times in order to show the molecule as a point, while an hundred times would probably reveal something of its structure, if dimension was the only condition required. But we know that what we call heat is the vibratory motion of these atoms and molecules, and, moreover, these vibrations take place at so rapid a rate as to strain our mathematical methods to express it, while the result among the atoms and molecules of this vibratory movement is to give them a greater or smaller latitude of movement,—elbow room, which is called their free path. It varies, being greatest in gases and least in solids. In a gas like hydrogen, at the temperature of zero, this free path is about two hundred times the diameter of the atom, and in water, according to Mr. Hodge's calculations, it is less than the diameter of the molecule. In a microscope, motion is magnified as well as the object, and the swifter a thing moves the more difficult it is to see it. The movements of a molecule must prevent us from seeing it, even though our microscopes might otherwise reveal it. But there is still another reason why we cannot see the molecules;—they are transparent. The sunlight streams through our atmosphere, and does not heat it, and we cannot see it; if a molecule of oxygen were ten times larger than it is, and it could be grasped and held still in the field of the microscope, there is no reason to suppose that it could be seen, because it is perfectly transparent.

In passing, we may remark, for the satisfaction of those who have fine objectives and who cannot make the lines of Nobert's bands, or the markings of *A. pellucida* come out "like pickets on a fence" that in reality such an expression is very much of an exaggeration. The most that can be done with such objects, is to make the lines quite distinct, so that any person can see them by careful focussing.

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Method of Preparing and Mounting Wings of Micro-lepidoptera.*

BY C. H. FERNALD.

For a long time I have been seeking some method, by means of which, the wings of the micro-lepidoptera could be prepared, so that the venation could be studied under the compound microscope, in a manner that would leave no doubt of the presence or absence of the faintest vein in the whole wing-structure.

The removal of the scales by me-

* Read before the Sub-section of Microscopy of the A. A. A. S.

chanical means as resorted to by some, was to me quite unsatisfactory, and in some cases even impracticable.

I therefore tried some of the methods recommended for bleaching the wings of small moths. That described by Chambers, in the *Canadian Entomologist*, was not a success in all cases, but whether not properly tried, I cannot say.

I next tried the method for bleaching the wings, published by Dimmock; and while this seemed to be a success, so far as the bleaching was concerned, the final mounting did not always give satisfactory results; for when mounted dry, the scales, although bleached, were not sufficiently transparent to show clearly the more obscure parts of the structure, and when mounted in Canada balsam, the entire wing was rendered so transparent that only the larger veins were visible, and I found it extremely difficult to get rid of the air-bubbles, which so readily gathered under the concave portions of certain minute wings.

I next tried mounting in cold glycerin; after having been bleached by Dimmock's method, the wings were transferred to the slide direct from the water in which they were washed, then allowed to dry, which was sometimes hastened by holding the slide over the flame of a lamp. When quite dry, a drop of glycerin was added, and the cover at once put on. Where the glycerin penetrated around the edges so as to completely saturate portions of the wing, the scales at once became transparent, and the structure was clearly apparent.

The difficulty still remained to replace the air under the concave portions of the wings with glycerin, so that it could come to and completely saturate every portion of the wing, to the exclusion of all the air.

Recourse was now had to heat, and by holding the slide over the lamp till ebullition took place, the glycerin was found to replace the air without any injury to the wing-structure; and even in those refractory cases when the glycerin was allowed to boil for a considerable length of time, no injury whatever was done to the wing-membrane.

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Permanent Microscopic Preparations of Plasmodium.*

By Simon H. Gage.

The previously published methods of making permanent preparations of the motile or naked protoplasmic stage of the Myxomycetes are but two, so far as I know; and no method of getting the Plasmodium in a desired position has to my knowledge been published.

The old method was to dry the extended Plasmodium, the new is to harden it with osmic acid. Both these methods are defective, for osmic acid changes the color of the protoplasm, and drying causes it to shrink as well as to change color.

The following is a simple and efficient method of extension and preservation: Small pieces of the rotten wood, on which the Plasmodium is found, should be placed on moistened microscope slides with some of the Plasmodium touching the slides. These should be on a piece of window or plate glass, and over the whole should be placed a bell-jar, or other cover, to prevent evaporation. After an hour or more, the glass on which the slides rest should be lifted up to see whether the protoplasm has crawled out upon any of the slides. If any of the slides are satisfactory, lift off the bell-jar and remove the pieces

* Read before the Sub-section of Microscopy of the A. A. A. S.

of wood from the slide. The Plasmodium will remain. The slide should then be put very gently into a mixture of equal parts of a saturated aqueous solution of picric acid and 95 per cent. alcohol; it should be removed in 15 or 20 minutes, and placed, for about the same length of time, in 95 per cent. alcohol; it may then be mounted in Canada balsam in the usual way, but without previous clearing.

The picric acid stiffens the protoplasm almost instantly, but does not shrink it, the alcohol removes the water and allows of Canada balsam mounting.

The above method is especially good for the yellow Plasmodium, as the color is precisely that of the picric acid solution. If white Plasmodium is to be mounted it should be soaked in 25 per cent. alcohol to remove the yellow color of the picric acid, before anhydrating it with strong alcohol.

Experiments have not been tried with Plasmodium of purple and other colors to determine successful methods of preservation, but some slight modification of the above is confidently expected to succeed.

SUMMARY. A.—The Plasmodium will crawl from rotten wood and extend itself on a moistened glass surface.

B.—The extended Plasmodium may be fixed in position by immersing the slide on which it is extended in a solution of picric acid.

C.—The slide may be placed in 95 per cent. alcohol to anhydrate the Plasmodium, after which it may be mounted in Canada balsam.

D.—The yellow Plasmodium retains its natural color if treated in this way.

ITHACA, N. Y.

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The Microscopical Apparatus Exhibited at the Meeting of the A. A. A. S.

Mr. Chas. Zentmayer was present with a number of the beautiful Zentmayer stands, but we did not observe any noticeable improvements in their form. Perhaps this is because the makers do not think they can be improved in design, and we are inclined to the opinion that they are quite right about it. Their workmanship was fully equal to the excellence for which Mr. Zentmayer has been celebrated for so many years. It is always a pleasure to be able to give credit for good work, and we do not hesitate to say that the reputation which Mr. Zentmayer now enjoys as a maker of stands, is justly deserved, and is the result of many years of careful, honest and conscientious workmanship.

Messrs. J. W. Queen & Co. were represented by Mr. Edward Pennock, who has charge of their microscopical department. Their exhibit was a creditable one, and embraced many articles to attract the attention of microscopists. Among the novelties was a very complete travelling microscope, with folding tripod base, double mirrors, rack and pinion, fine adjustment, society screw, and one dividing objective. This instrument stands about ten inches high, and packs into a case about $6 \times 3 \times 2\frac{1}{2}$ inches. Also the new model Crouch's "Histological" monocular, which combines many improvements, and Queen's new sub-stage condenser was also shown.

Mr. W. H. Walmsley, of Philadelphia, who always succeeds in having the latest improvements in microscopes to exhibit at such meetings, was provided with many articles of interest. Among them probably none attracted so much attention as did his new "International Binocular," by Beck. Whatever a person's opinion may be of the utility of such large and heavy stands, it cannot be denied that Beck's "International" is a stand that, so far as any possible requirements of the microscopist are concerned, leaves nothing to be desired. Anything that a microscope is capable of showing can be shown by the "International," and we cannot conceive of any useful addition that could be made to the stand in its present condition. Besides this large instrument, Mr. Walmsley also exhibited the "Large best" and the "Small best," the "National," the "Economic" and others; and with other apparatus a freezing microtome.

Mr. G. S. Woolman, of 116 Fulton St., New York, had on exhibition during the meetings a fine assortment of microscopes, accessory apparatus and objects, that attracted much attention from the microscopists present. A Beck's "Smaller Grand," two "Nationals," a Crouch "Histological" and a Zentmayer large binocular, were prominent among them. The new "Acme" was of special interest, embodying as it does, some of the latest and most desirable features of a microscope. It is a well-made stand, compact and solid, without having great weight, and its moderate price makes it most desirable. Using one of Spencer's new $\frac{1}{6}$-inch of 116° Balsam Angle, Mr. Woolman resolves the *A. pellucida*. Many of the objects shown were quite interesting. A slide of gold crystals prepared by Dr. Watts is of such rare beauty that it is worthy of special mention. Mr. Woolman also exhibited a new cabinet to hold twenty-four objects, all lying flat, and arranged so that any object could readily be selected without loss of time. The cabinet was of black-walnut, well but plainly finished, and of low price. A student's set of Spencer's lenses, and their new $\frac{1}{6}$-inch were noticeable in the collection of objectives.

Mr. L. R. Sexton, of Rochester, N. Y., exhibited a line of Gundlach's physicians' microscopes, and a varied assortment of objectives illustrating the qualities of each of the five classes that are now made by that optician. Among the latter were several new attractive and interesting specimens of work, the most remarkable of which was a homogeneous immersion one-eighth of over 130° balsam-angle, and of corresponding good performance.

Next to this in interest, was a dry-working one-half inch of 110° air-angle, of such ingenious construction, that it may be used on opaque objects, although possessing enough resolving power to easily show the markings on *P. angulatum* by central light. Several other objectives of the same class and equal excellence, especially the quarters and sixths, gave evidence of great improvement in this grade of objectives during the past year, which was more than corroborated by the performance of the glycerin immersion one-tenth of the same class. A full line of the new dividing objectives showed that Mr. Gundlach has made in these a happy combination of two excellent objectives at the price of one. Another novelty was a three-quarters of wide angle, and wonderful working distance.

In his physicians' stands were noted several additional conveniences not possessed by these instruments a year ago—notably the new diaphragm and the sliding adjustments—as well as improvements in graceful proportion and workmanship.

Mr. Stodder did not make any

exhibition of Mr. Tolles' stands, but a number were to be seen in the room, placed there by their owners.

The Bausch & Lomb Optical Company were represented by a few stands, and Mr. L. Schrauer was there with specimens of his workmanship.

EDITORIAL.

—All who have not yet paid their subscriptions for this year, are respectfully requested to do so as soon as convenient. There are many who have not yet paid, and we cannot afford to maintain a large free-list. We have made the same request twice before and unless those who have not paid will do so within a short time, we will be obliged to stop their journals.

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—During the months of July and August the Editor was absent from New York. In consequence, many letters have remained unanswered, that would otherwise have received prompt attention. The Summer is over now, and business has again resumed its regularity, so that no further delays will intefere with the immediate acknowledgement of letters or orders.

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The August Meetings.

In this number of the JOURNAL we have given a brief account of the proceedings of the American Society of Microscopists at the meeting at Detroit, and of the Subsection of Microscopy of the American Association for the Advancement of Science, at Boston.

The Detroit meeting we were unable to attend, so that we are indebted for our knowledge of what was done there to a number of friends who were present, and who have kindly given the information. We are especially indebted to Mr. C. M. Vorce, for preparing the report of the meeting that is published this month. We did attend the meeting in Boston, however, and therefore have personal knowledge of the relations which the Sub-section of Microscopy bears to the Association.

At the risk of giving offence to a few of our readers, we believe that it is now time to consider the relations of the two associations to each other; and if, as we have thought from the beginning, when the proposition to form an "American Society of Microscopists" that should be independent of the A. A. A. S., was made at the "Congress" held at Indianapolis, the two meetings cannot be successfully conducted independently, then it is quite time to also consider which of the two associations is most deserving of support.

First, it is proper to say, that since the American Society was formed, it has had all the encouragement which our humble efforts could give to it; in proof of this we need only refer to previous articles which have been published at different times. In this matter, as in all others, when the welfare of science has been concerned, we have not permitted our personal judgment to assert itself, in opposition to any movement calculated to benefit science or its votaries. We have regarded the establishment of the Society as a worthy experiment, but as one mainly conducted by a few leaders, who had not the necessary support from microscopists generally to ensure its success, nor sufficient experience to direct it properly. In our opinion, the fatal error was committed at the beginning, in Indianapolis, when a majority, of one we believe, not only voted against a proposition to meet in the same place as the A. A. A. S., but seemed determined to hold the meeting at a great distance from that place.

At Indianapolis, the best known, and usually the most influential microscopists, were at first inclined to oppose the formation of a permanent, new organization. It soon became evident that such opposition was useless, so they entered into the new scheme with the desire to make it a success, if possible. They then endeavored to have the meetings take place once in three years, instead of annually, but this proposition was overthrown. Then it was suggested that the meetings should be held each year at the same place as the meetings of the A. A. A. S., by which much time and expense could be saved to many members, and the attendance would be much larger than elsewhere, but this was also voted down, as we have already stated. Among the gentlemen to whom we have referred as being the best known and most influential microscopists, we take the liberty of naming Dr. R. H. Ward, the Rev. A. B. Hervey, and Mr. J. D. Hyatt, and we might add others, but these will suffice to indicate the character, standing and mature judgment of those who were most active in the opposition to the movement.

It seemed as though the matter had all been pre-arranged, so that no amount of argument could prevail against the adopted programme. We do not assert that this was a fact—we merely say that it seemed to be the case, and this presumption is held by many others besides ourselves. As we were engaged on committees working for the establishment of the Society, we can speak with more confidence about the first steps than can many others who were at Indianapolis; we know that very strong and steady efforts were made, by the gentlemen whom we have named and others, to induce the Society to meet in connection with the A. A. A. S.

Now, we do not wish to be regarded as desiring the failure of the American Society of Microscopists, if it can show any reason for its existence. It is the *raison d'être* that should, and doubtless will, determine its future history; if it is shown that the Society can maintain a useful existence, then it will always have our earnest efforts for its welfare.

So much we have written as an introduction to what is of more immediate importance, in relation to the two organizations.

We believe that unless the American Society of Microscopists decides to meet next year in connection with the A. A. A. S. at Cincinnati, that the next meeting will be its last. We have received intimations from gentlemen who were present at the Detroit meeting, to the effect that some of the members there had about concluded that the attractions of the meetings are not sufficient to induce members to undertake long and expensive journeys to attend them. The experience of two meetings has shown that a larger attendance is necessary for the active existence of the Society, and the only way to increase that attendance seems to be by meeting in connection with the A. A. A. S. We hope this will be done; for if it is done, there may be opened for the Society a long career of usefulness.

There is, however, another consideration which we desire to mention in this connection. We do not believe that the really valuable microscopical work that is done in this country, and which would be presented at either the meetings of the Society or of the Association, is sufficient to keep up the interest in both meetings. If this is true, we would desire to have either the Society to disorganize, and the members to join with the Association, or else that the Subsection of the Association should be abolished, so that all the members might join the Society. Which course would be the better one, may well be left for decision next year, when it will doubtless come up for consideration.

This year the microscopical work of neither of the organizations was quite so good as it should have been; but if the two had united their efforts, there can be no doubt that a very interesting meeting would have been the result.

One reason why a large number of microscopists favored the formation of a society independent of the A. A. A. S., was doubtless because they had the impression that the Sub-section of Microscopy had not been well attended, or that it would exclude the reading of very elementary articles about microscopical work. As we have said in a previous article, if the Sub-section has done nothing, it is because microscopists have not given it their support—the fault is not one for which any other persons are responsible. As to the character of the articles that can be read before the Sub-section, we do not hesitate to assert that anything novel and of real worth, no matter how simple or elementary it may be, can always be brought before the meeting; but the careful examination of contributions by competent persons, who may reject them or order them to be read, as they may deem proper, tends to exert a very wholesome effect upon the quality of the articles that are read.

Once more we desire to say, in order that no person may misunderstand us, either wilfully or otherwise, that in writing this we are not moved by any spirit of opposition to the American Society of Microscopists.

We desire the greatest benefit to the greatest number of microscopists; and, if it were possible, we would be glad to see both the organizations of which we have spoken, in a flourishing condition; but since this cannot be, we desire a combination of the two forces, and we hope for such a consummation next year.

In closing we desire to congratulate the American Society of Microscopists upon its choice of Mr. J. D. Hyatt, for President of the next meeting.

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A Criticism.

It is a disgraceful condition of affairs, when the reading public is obliged to tolerate absurd and wilfully incorrect reports of a meeting of scientific men, from the local press of the city in which such a meeting is held; and it is far from creditable to the Editor of a newspaper who will so degrade his journal as to permit of its use for such low purposes.

These remarks are called forth by the character of the reports of the recent meeting of the American Society of Microscopists, that have been printed in the *Free Press*, a leading Democratic daily of Detroit. We will quote some of the strictures that have been made by a well-known gentleman, upon the reports published in that paper.

"The *Free Press* treated us disgracefully, and, indeed, almost ridiculed us. Its reports, though short, were full of errors, some wilful ones. It belittled the matter all it could, and published a false locality for the Soirée, which had to be corrected in open meeting, but probably misled some. Citizens told me that jealousy was at the bottom of all this."

We have been favored with one of the incorrect reports, and are assured that the indignant feeling of our correspondent is fully justified. Those who desire to read the best reports of the meeting that were published in Detroit should obtain copies of the *Post and Tribune*.

We are perfectly well aware that any words of ours will not materially affect the circulation or the business of the *Free Press*, but we owe a duty to ourselves, and to the journalistic profession, to condemn such disgraceful and contemptible work on the part of any Editor. If the *Free Press* will exercise such unlicensed freedom in regard to the work of a scientific organization, simply on account of a personal feeling of jealousy, what reliance can be placed upon its news, either of a political or a miscellaneous character.

No condemnation is too strong for such a journal; but the time has not yet come when men will demand the same accurate and undistorted information from their daily newspaper, as they now require in the ordinary routine of business. When that time does come, the politics of the country will be in a better condition than they are now.

CORRESPONDENCE.

TO THE EDITOR:—In reply to Mr. Hull's inquiry about the proper kind of glass for slides, I would say that my practice has been heretofore to go to hardware stores and other places where glass is sold, and where I generally find several barrels full of glass-strips of varying width and thickness, and from these I have selected such as were fit for my purpose. On making inquiries as to what kind of glass can be had in quantities, I find that the kind used by picture framers and called "French single thick," is well adapted for slides. All of the panes are not thin enough, but they are intended to be about $\frac{1}{16}$ inch in thickness. Such glass has a fine surface, is very clear and free from imperfections.

There is an American imitation of this "French single thick," and from samples shown me, I do not think there is much choice between the two kinds. In choosing, I should select those pieces which look the whitest when held up edgewise to the light, in preference to those that are a deep green. The cost of this kind is a little more than that of common window-glass. Very respectfully,

F. M. HAMLIN.

TO THE EDITOR:—In your July number, Mr. Hull writes to ask where he can get thin glass for slides. I have found that good French plate can be had at a photographer's. By looking through an assortment of photographic plates, perhaps two in a dozen will be found thin enough to cut into slides. Of late I have obtained slides from a glazier who keeps quite an assortment of fine plate glass. A few moments rubbing on a whetstone suffices to remove sharp corners and leaves a slide looking better, if it is cut smoothly, than a more prolonged grinding.

I wish to enquire how to get rid of air-bubbles in using Deane's gelatin. No way that I have tried suffices to avoid this drawback in the use of this medium.

F. H.

NOTES.

—We call attention to the business change of the late firm of Sidle & Poalk, the well-known manufacturers of the "Acme" stand and the "Congress" turntable. The business of that firm is now done by John W. Sidle & Co., of Lancaster, Pa. The new firm has our best wishes for success.

—The first number of the second volume of *The Valley Naturalist* has lately reached us. We doubt not that many of the former subscribers to that periodical will be glad to learn that it has been revived by its former publisher, Mr. Henry Skear, of St. Louis, Mo.

The Editor states that "since the circulation of our 'announcement' in May last, we have received upward of five-hundred subscribers, thus insuring its success." We are pleased to extend our congratulations to Mr. Skear on account of the encouraging prospects for his magazine, and to assure him of our best wishes for its welfare. The subscription price is $1.50.

—During the past Summer we have had the pleasure of visiting Professor H. L. Smith at his home in Geneva, and also the celebrated makers of objectives, the Messrs. Spencers.

At the time of our visit we took great interest in some objectives which Mr. Herbert Spencer manipulated for us. A new ⅛-inch-immersion, still unfinished, with a rather unfavorable illumination showed the lines on a dry *Amphipleura pellucida* better defined than we had ever seen them before. To our amateur eye the lens seemed to be very perfect, but the experience of the makers enabled them to observe defects which would be eliminated before the glass was finished. There is no doubt that the Messrs. Spencers are constantly trying to improve their lenses, and to make them superior to all others if possible. The means which they have adopted to ensure excellent and uniform results, by constant personal supervision of every part of the work and making the final corrections and mountings themselves, are sure to be commended by all who use the Spencer objectives. In passing, we would add that to Mr. Herbert Spencer the credit is mainly due for the present excellence of those objectives.

—We have been greatly pleased with some of the lenses which Mr. Gundlach has made recently. Mr. L. R. Sexton, of Rochester, who is selling Mr. Gundlach's productions, has kindly sent us objectives for examination, from time to time. Among those we have seen we can highly recommend the $\frac{1}{4}$-inch and the $\frac{1}{10}$-inch of class D. The former costs $18.00 and the latter, a glycerin-immersion only, $25.00. It is claimed that the $\frac{1}{10}$ for $25.00 will resolve the *A. pellucida* by simple illumination with mirror and lamp. We have not succeeded in this resolution, as yet, but have no doubt it is quite possible, for we have distinctly seen the lines of No. 19 on the balsam test-plate, with one of these tenths. It also works tolerably well on the Podura-scale. The latest production which Mr. Sexton offers is a ⅛-inch with a balsam-angle above 130°. This has been spoken of by one regarded as excellent authority, as an exceptionally fine lens. The balsam-angle is higher than that of the Zeiss objectives.

Exchanges.

[Exchanges are inserted in this column without charge. They will be strictly limited to mounted objects, and material for mounting.]

Lime sand, composed almost exclusively of microscopic Foraminifera, to exchange for microscopic material. H. A. GREEN, Atco, N. J.

I would like to have the address of some person who has access to an abundance of *Volvox globator.*
W. W. BUTTERFIELD, Indianapolis, Ind.

Polyzoa, Palates of Mollusca, Foraminifera, Sponge and Holothurian-Spicules, Synapta-Anchors, Chirodota-Wheels, Echinus-Spines, Minute Sea Shells, in exchange for Polyzoa, Foraminifera, Histological and Pathological preparations, *etc.* Also, a quantity of Sea Shells in exchange for Land and Fresh-Water Shells.
F. M. HAMLIN, M. D., Auburn, N. Y.

J. J. B. Hatfield, Arsenal Avenue, Indianapolis, Indiana, will exchange Bleached Plant-Sections for good Diatomaceous material. List furnished on application.

Pleurosigmas and other unmounted Diatoms, both Fresh Water and Marine; also Marine Algæ, Ferns, and a large quantity of miscellaneous microscopical material in exchange for good mounted objects.
M. A. BOOTH, Longmeadow, Mass.

To exchange, well-mounted Slides of Hair for mounted or unmounted specimens of hair from the rarer animals; lists exchanged. WM. HOSKINS,
208 S. Halsted street, Chicago, Ill.

Nicely mounted Slides (opaque) of the Coal-tar Derivatives, chemically prepared, crystalline in form, showing their beautiful colors, in exchange for other well-mounted material. Chemical name and formula attached to each Slide. About a dozen varieties on hand. F. L. BARDEEN, M.D.,
30½ Meigs street, Rochester, N.Y.

Slides mounted from injected Frog's Gall-bladder, Liver, Kidney, Stomach, Intestine and other parts, exchanged for other good and interesting preparations. C. BLASDALE, M. D.,
Jericho, Queens Co., N. Y.

Well-mounted, selected and arranged Diatoms, for good histological, pathological or anatomical preparation. State what you have, and terms of exchange.
W. W. RINER, Greene, Iowa.

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A Warm-stage for the Microscope.

BY PROFESSOR E. H. BARTLEY.

Having occasion to use a warm-stage during the winter of 1878-9, and finding some difficulty in maintaining a uniform temperature by any of the simple devices with which I am acquainted, I have constructed and used the apparatus illustrated in the accompanying sketch; which is so easy of construction and answers the purpose so well, that I have thought it worth while to recommend it to others through the Journal.

It consists of a vessel of water (*A*), which is supported on a tripod or a lamp-stand, and capable of being raised and lowered at will; the water in it is kept boiling when in use, by the lamp *C*.

A glass tube (*a a*) about $6^{mm.}$ in diameter and about $30^{cm.}$ long, is bent upon itself at *b* so as to bring the two limbs parallel and within about $1.5^{cm.}$ of one another. One of the ends of this tube is then drawn off to a fine point, as shown at *c*, and is bent at an angle of 45° at a distance of $3^{cm.}$ from this end. The other limb of this tube is connected with the siphon tube *d*, by the rubber tube *f*. *D* is the stage of the microscope; and *e*, *e*, are two pieces of cork which serve as supports for the tube *a a*, and as stops for the slide, and which may be cemented to the stage by mucilage, to make the apparatus more steady.

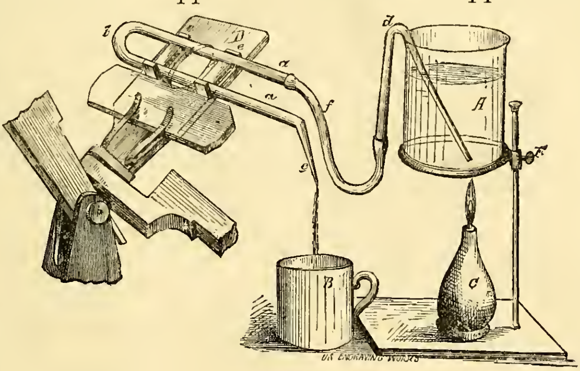

Fig. 26.

I have sometimes replaced these corks by strips of sheet tin or brass, so bent as to serve the same purpose. The tube *a a* is placed in the usual position of the slide upon the stage, and the slide is placed upon it; the light passes between the two limbs of the tube. The vessel *B* receives the water discharged at *c*. As long as the water in *A* is kept at 100° C., and a constant relation is maintained between the height of the water in this vessel and the stage, the temperature of the slide will remain constant as long as the water flows. By raising or lowering *A*, the velocity of the current of water may be increased or diminished, and the temperature of the slide is controlled.

By a somewhat rough measurement of the temperatures obtained with this apparatus, I find it possible to procure a range of about 45°C. 81°F.), or from 27°C. (80.6°F.) to 72°C. (161°F.)

As the normal temperature of the human body is 37°C., it will be seen that the range is all that is needed for the object for which it was intended. The higher temperatures are convenient for favoring chemical reactions under the microscope, or for the evaporation of liquids, or other uses where a gentle heat and uniform temperature are desired.

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The Movement of Diatoms.

All persons who have observed living diatoms are familiar with their curious forward and backward motion, but although many have endeavored to determine the cause of these movements, the subject is still very imperfectly understood. Mr. Julien Deby's excellent article entitled, "What is a Diatom" has been widely known and read by microscopists, both here and in Europe, but the letter which Prof. H. L. Smith wrote to Mr. Deby, soon after his article was published, is not so well known.*

By the use of a pigment in the water, Prof. Smith has been able to study the movement of diatoms to great advantage. The color employed was the ordinary indigo-blue used by water-color painters.

If a living *Pinnularia* be placed in water colored by that pigment, and examined with the median line turned toward the eye, the little particles of indigo will be seen to move along the line, and to accumulate near the centre in a minute ball. Viewed with the connective turned toward the eye, it will be observed that a ball of indigo accumulates about the centre of each valve, and both balls turn about on their axes, just as they would if a minute jet of water were directed against each from an orifice situated at the central extremity of the median line of each valve. When the balls have attained a certain size they suddenly burst, and the particles of indigo pass on along the median line in a direction opposite to that in which the diatom is moving. Immediately after the rupture of the ball, a new one begins to form. The movement of the particles along the median line always takes place in a direction opposite to the motion of the diatom. It is to be hoped that observations of this kind will be continued by others. There are some very curious appearances to be seen in the examination of moving diatoms, and as any person who has patience and good objectives, can readily study the subject, we may hope for an early and a satisfactory explanation of the cause of the motion.

* Prof. Smith's letter is published in the "Annals" of the Belgium Microscopical Society, Vol. IV.

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Apple and Pear Blight.*

The wide-spread and disastrous disease of the pear tree, commonly known as fire-blight, and that known as twig-blight of the apple tree, are due to the same agency. They are identical in origin, and as similar in pathological characteristics as are the trees themselves. The quince, Lombardy poplar, American aspen, and some other trees suffer from the same or similar affections. The immediate cause of the disease is a living organism, which produces butyric fermentation of the material stored in the cells, especially those

* Abstract of an article by Prof. T. J. Burrill, read at the meeting of the A. A. A. S.

of the liber. This organism is allied to, if not specifically identical with, the butyric vibrione of Pasteur, and the *Bacillus amylobacter* of Vantieghem. After referring to the history of the disease in this country, which goes back at least a century, the experiments which were made with the specific poison or ferment, in inoculating healthy trees, and in other ways, were recounted in detail. After it was determined that a specific living organism, the *Bacillus*, was always present in the liber-cells of the affected trees or branches, an isolated acre of ground, upon which there were ninety-four pear trees of different ages and varieties, was selected for the experiments. One method of experiment was to cut off small portions of the bark of diseased trees, and to insert them in healthy trees. The results of these experiments were given in a table, which showed that a large percentage of the experiments were perfectly successful in communicating the blight from the diseased tree to the healthy. Sixty-three per cent. of all the pear trees thus inoculated became diseased. Of the pear trees that were inoculated with the virus from diseased pear trees, fifty-four per cent. became affected; of those pear trees inoculated from blighting apple trees, seventy-three per cent. received the disease. When the poison was taken from the pear trees, to inoculate apple trees, the percentage of successful operations, was much below that obtained when the process was reversed, probably because the apple tree is the more hardy of the two. The virus seems to be quite harmless when it is applied to the epidermal surface of the leaves of the tree; it does not seem to enter through the stomata. Of the entire number of recorded observations, 34.78 per cent. were successful, while of the whole number of inoculations with the knife, 52.07 per cent. were effective. The organism to which the disease is attributed is so minute that a strong magnifying power is necessary to enable one to study it, or to make out its form. It assumes various shapes during its development, and these different forms may usually be seen at one view in the microscope. The characteristic form is that of two oblong joints with rounded ends. Their transverse diameter is about .002$^{mm.}$, and the length of each joint about .003$^{mm.}$ They are comparatively shorter and thicker than the common *Bacterium termo*, and they move less rapidly. If this should prove to be the organism which is the well-known agent in converting starch, sugar, etc., into butyric acid, hydrogen and carbon dioxide, this would not invalidate the assumption that it is the cause of the disease, but it might render the discovery of remedial treatment less hopeful. The most conspicuous change in the tissues of the affected plants revealed by the microscope is the almost total disappearance of starch from the cells.

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Dry Mounts.*

BY PROFESSOR H. L. SMITH.

The very simplicity of this process causes me to wonder why it was not thought of before. I take a sheet of thin writing paper, white or colored, and dip it into thick shellac varnish (shellac dissolved in alcohol), and hang it up to dry. When thoroughly dry it should have a good glaze of the varnish on it (different thickness of paper can be used according to depth of cell required). Out of this shellac paper I cut my rings, and these can

* Abstract from an article published in *Science*.

be made in any quantity, and kept for any time. The process of mounting is simple. The slide is cleaned, and the flat paper ring placed in the centre; on this the cover is placed, having the object dried on it, and the two are held together by the forceps and gently warmed; this serves to attach the ring to the slide and cover, at several points, so that the forceps may now be laid aside. The next step is to take a glass slip (another slide), and laying this on the cover, to grasp the two slides at each end by the finger and thumb of the two hands, and pressing them tightly together, to warm the slide gently; by looking at the ring obliquely, on the underside, one can tell at once when all the air is pressed out, and the adhesion is complete between the cover and the ring, and also the ring and the slide, and they must be held together a moment or two to cool. If the lac is sufficiently thick on the paper the adhesion takes place quickly, and with moderate heat, and there will be no danger of breaking the cover, unless it has been warped in the process of warming, which will sometimes occur when very thin glass has been heated too much for the purpose of burning off the organic matter, or when the support is too small in diameter, or when it is not flat. I think I may be able to induce the leading opticians to manufacture this paper and also the rings for sale; for special purposes the paper might be printed beforehand, so that, when mounted, the ring would show on the underside the name of the preparer, or of the object. I cannot conceive of anything more satisfactory than these rings. Many large objects which would be crushed if one used only the shellac rings made on the slide, by the use of the turn-table, by the giving way of these by softening, and under the necessary pressure for attaching the cover, are perfectly protected by the paper rings. I am satisfied that the balsam mounts will be much less frequently used, as soon as we can find some *sure* dry process. The diatoms, as a rule, show much better when mounted dry and with whole frustules, exhibiting both the side and the front view, also the mode of attachment, etc. The dry mounts are certainly to be preferred when they are desired for anything except pretty objects, and even for this latter purpose there is often a very great difference in favor of the dry mount. Although I have not used these shellac paper rings for any great length of time, yet I can see no reason why they should not be equal to the simple shellac ring for durability, and very much superior to it in other respects.

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Blood-stains as Evidence in Criminal Cases.*

BY CHAS. O. CURTMAN, M. D.

The detection of blood-stains on linen or other articles of apparel, has often a melancholy interest to the medical expert and the criminal jurist. In many cases, the decision of court and jury has hinged upon the evidence afforded, or supposed to be afforded, by suspicious stains found upon the clothing or implements used by persons accused of murder. Not very long ago it was imagined by the public, and even by members of the profession and enthusiastic admirers of the microscope, that human blood might be positively and easily identified by the microscope. Upon the extension of the scope of utility of the spec-

*Read before the St. Louis Medico-Chirurgical Society.

troscope, that instrument has also been held by many to be an unerring detective of blood.

But by degrees the illusion in regard to the positive and unassailable results of the microscope has vanished, and at present, (especially since the thorough investigation of the subject by Dr. J. J. Woodward, U. S. A.) no expert would be found bold enough to assert, in the face of contrary evidence, that he can positively identify human blood by any microscopical device. The blood discs of the dog, especially, are so nearly of the size and shape of human blood, that no means, at present known, will discriminate with absolute certainty between the two, even in the fresh state, much less after having been dried and subjected to the methods of preparation necessary for microscopical investigation. The spectroscope does, with great accuracy, reveal the presence of blood, by the absorption bands characteristic of the hemoglobin, but cannot make any distinction between the various blood-corpuscles affording the coloring matter.

But even were all of those difficulties successfully overcome, and could the minutest distinctions be made between the different kinds of blood, such evidence would, in many cases, be rendered absolutely nugatory by the doubts thrown upon the source of the blood and its manner of transfer to the stained article by the following facts:

Having been applied to, last Winter, to make examinations of suspected blood-stains, the thought occurred to me that there is a possibility of the transfer of human blood by means of predatory insects, such as the mosquito, the bed-bug and similar others. Experiments showed that the crushing of such an insect, loaded with its meal of human blood, will yield a stain of considerable size, much larger than I had anticipated. I then captured some mosquitoes, after they had imbibed their fill of blood, and kept them alive in close confinement. They were then, after different periods of time, crushed and the blood examined, mixed with various menstrua for dilution. In all cases up to forty-eight hours I found a large proportion of the red corpuscles of human blood still unchanged, and quite readily recognizable. I next examined the blood of the mosquito, which had not been permitted to feast on the human subject. The size and color of these corpuscles of mosquito blood are so different from human, that no mistake can possibly arise from this source.

In the last few weeks Dr. E. Evers was kind enough to assist me in a considerable number of micrometric determinations of the human blood taken from the mosquito, after various intervals, and the corpuscles of mosquito blood proper. The task has been a laborious one, owing to various difficulties, not the least among which was the selection of a proper menstruum for dilution. Glycerin in various dilutions, gave excellent definitions of the human blood-corpuscle, but left the margins of that of the mosquito so ill-defined as to make accurate measurements very difficult. After various trials, we found alcohol of about 80 per cent. the best medium for examining mosquito blood, and very fair for the human blood-corpuscle, although both shrink somewhat in the alcohol.

Our results* are as follows:—

Human blood (after imbibition by the mosquito) averages (red corpuscle,) in dilute glycerin, 7.4 micro-millimetres (or $\frac{1}{3200}$ inch);

* These results are the average of more than one hundred careful measurements.

in 80 per cent. alcohol, 6.9 micro-millimetres (or $\frac{1}{4000}$ inch.)

Mosquito blood averages in dilute glycerin, 1.8 micro-millimetres (or $\frac{1}{14000}$ inch); in 80 per cent. alcohol, 1.4 micro-millimetres (or $\frac{1}{18000}$ inch.)

The subject appears to me to be of sufficient importance to deserve further investigations. However much we may regret that another prop is taken from the value of circumstantial evidence, derived from suspicious stains in murder cases, it is best to know and make proper allowance for any weak points of such information. For even if stains should now be fully identified as derived from human blood, the accused may plead in his justification, that they are due to the agency of insects, and cannot be allowed to furnish any proof of his guilt.

Since reading the above paper before the Society, investigations on the bed-bug (as yet very few in number) appear to show that the imbibed human blood is destroyed far more rapidly in them than in the mosquito. In one individual, after twelve hours, not a trace of the human blood-corpuscle could be detected.

St. Louis, Mo.

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A Mechanical Finger.

I have constructed for my microscope mechanical fingers in two ways which may be followed by any one desiring such an appliance and having a stage forceps only, or still better, a forceps and a nose-piece also.

(1) By taking a strip of pine wood half an inch thick, and of suitable length and breadth, and giving it a suitable shape, making a hole in the larger end of such size, that when lined with a bit of cloth, it fitted tightly on and over the nose of my one-inch objective. In the smaller end was made another hole into which a slightly tapering cork was pressed from above, in order to carry the forceps. Having fastened a bristle into the jaw of my stage-forceps, by means of a drop of glue, and made a small hole for a guide, the shank of the forceps was forced into the cork and fastened in position with sealing-wax, and the finger was complete, with no expense but an hour's labor.

(2) With still less labor, I substituted my nose-piece for the above wooden carrier; screwing the cork into the nose-piece, instead of the extra objective, and attaching the forceps as before.

In either case, the elasticity of the cork holds it in place with sufficient firmness to admit of its being rotated with finger and thumb, so as to move the point of the forceps with the bristle to the right or left as may be desired. The lifting of the object is done by means of the joint in the forceps.

Although the fingers here suggested may not be as perfect as those of a more costly and finished construction, yet combining as they do all movements essential to any finger, they may be used in an emergency, and in skilful hands will be found capable of effective work. J. Sullivant.

Columbus, Ohio.

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On the Presence of the Forms of Life in the Central and Lateral Surface Waters of Lakes and Ponds.

BY EPHRAIM CUTTER, M. D.

I have seen it stated that over 500 municipalities and towns in this country are supplied with hydrant water. As a physician I have been much interested in studying the influence of water as food, particularly in relation to its fauna and flora. In order to study the subject it is necessary to make microscopical examinations, and these have been, as far as I know, confined to the water drawn from the hydrant or faucet. It has been supposed that these forms of life have come from the deeper portions of the lakes, and that the central, surface waters of the lakes were comparatively free from them. In order to set the matter at rest, in my own mind, I have made examinations of the central, surface waters of Cochituate lake, Crystal lake, Wakefield, Mass., Horn Pond, Woburn, Long Pond, Shiverick's Pond, Fresh Pond, Falmouth, Mass., Jamaica Pond, Frog Pond, and the pond in the Public Garden, Boston. In all these cases the evidence obtained has been positive and decisive, so that I think it is of value as showing that the botany and zoölogy of the central surface waters of these lakes is represented by a large number of species for microscopical examination; indeed the waters of Frog Pond, on Boston Common, is a mine of specimens for a microscopist.

Now, my object in this communication is to call attention to this subject with the view that if I am mistaken in its novelty, I may be corrected, and if not, to invoke those in different parts of the country who may be so disposed, to make examinations of the various surface waters of the ponds in their vicinity, that are used for drinking purposes, and report to this journal, so that one can get an idea of the subject based on extensive examinations, conducted by a large number of observers in different parts of the country. When this is done, it will be a help to the physican who studies water as food.

Perhaps it may be proper for me to allude to my own methods of collection. I go out in a boat to the central part of the pond, provided with a tumbler or dipper, a three-quarter inch India-rubber tube, an old lawn hose-pipe a foot long, with a bag four and a half inches long by two and three-quarters of an inch in width, made of the best cotton cloth, tied on the end of the tube. I then pour water into the tube with the tumbler or dipper until the water begins to sink slowly, then I stop pouring and let the water run off until its surface can be seen through the walls of the bag; the string is untied, the bag removed and its contents suddenly poured into the empty tumbler or dipper; the bag is then gently turned inside out and gently sopped in the water which has beed poured into the tumbler. Having done this, I begin to twist the bag from above downwards, and allow the drip to run into the tumbler or dipper. This is a modification of Prof. Reinsch's process, with whom I have studied.

For a microscope, I have found my horizontal tube Amici, and a one and a half inch eye-piece and a Tolles, third class,one-fifth objective, with a low angle and long working distance, to be satisfactory. I find a brass cell, such as formerly came with the French microscopes,two and one-half by seven-eighths inch, and three-eighths of an inch deep, with a glass bottom, to answer very well, only instead of using the deep cavity, I reverse the cell and employ the shallow cavity. This method may not be liked by some, but I like it, as I have room, and examine the plants uncovered and free. The tremulous motion of such a body of liquid is an objection, but barring this, I find that I get a more thorough knowledge of the character of the water than in any other mode I am acquainted with. I find this cell method excellent for the examination of urine. I give these modes and means not because I think they are any better than others, but because I think that every observer has the right, in justice to himself and others, to allude to his tools.

At some future time I hope to be permitted to present a more complete account of my own labors in this direction.

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Microscopical Collections in Florida.*

BY C. C. MERRIMAN.

It has been my fortune during the past two Winters to spend a few weeks in the regions of Central Florida. Lake Harris is the most southern and the most beautiful of the cluster of lakes which forms the source of that exceedingly picturesque river, the Ocklawaha. With high banks, and surrounded by a belt of hummock land as rich as any that Florida affords, this lake is becoming settled upon, and its lands are fast being taken up by enterprising southerners for orange-groves and pine-apple plantations. The sojourner will find the society of this lake-settlement intelligent and hospitable beyond anything that would be expected in so new and pioneer a country. The vegetation of this almost tropical region is so full of interest to the microscopist, and the causes conducing thereto so peculiar, that I have thought them deserving of especial mention and illustration.

The absence, or at least the rarity of frosts injurious to vegetation in these lake districts, gives the longest possible season for the growth and maturity of such organs as are best, or especially, adapted to the exigencies of Florida plants. There is a period of rest, usually comprising about the three Winter months, after which vegetation takes up and continues its growth again as if there had been no period of interruption; so that practically there is a continuous development of plant life, whether annual or perennial, from birth to death.

The soil of Florida, as of all the South-Atlantic sea-board, is sandy and naturally barren. No polar glaciers have ground up for these regions, as for the Northern States, a rich and abundant alluvium, sufficient in itself for the production of a rapid and vigorous vegetation. The South has apparently only the siftings of our Northern soil, carried down to the ocean by rivers, and then washed up by the sea-waves to form their interminable sandy plains. But to compensate for this natural infertility of soil, the atmosphere, especially of Southern Florida, abounds in all the elements of plant growth. The winds which come up from the Gulf on the one side, or the Atlantic on the other, are charged with moisture, and bear also minute quantities of nitric acid and saline compounds; while the exhalations from the swamps and marshes furnish in abundance the salts of ammonia and carbonic acid. Now to utilize these precious products from the air, it is necessary for plants to have peculiar organs, such as absorbing glands, glandular hairs, stellate hairs, protecting scales, and a variety of other special appendages. All these have been developed by time and necessity, in remarkable profusion and perfection in the vegetation of Southern Florida. Although the meagre soil produces no nutritious grasses, and scarcely enough of an honest vegetation to keep an herbivorous animal from starving; yet

* Read before the Sub-section of Microscopy of the A. A. A. S.

there is an abundant flora such as it is—air plants, parasitic growths, insectivorous plants, and strange herbs seeking a livelihood in any other way than the good old honest one of growing from their roots. It is this fact which makes the microscopical interest of botanical researches in Central Florida. One can scarcely examine with a two-thirds objective the flowers, leaves or stems of any plant growing there without discovering some beautiful or striking modification of plant hairs, or scales, or glands, or other absorbing or secreting organs.

We will notice first the Onosmodium as found in Florida—*O. virginianum.* It grows from Virginia south, but is more glandular I think in Florida than any where else. It will be almost the first plant one would stop to observe on entering the pine woods—a dark-green, narrow-leaved, biennial herb; its straight stem of the second year's growth, about a foot high, bearing a raceme-like cluster of flowers, coiled at the end, and straightening out as the flowers expand. The leaves of this plant are thickly studded on both sides with stiff transparent hairs, lying nearly flat on the surface, and all pointing towards the tip end of the leaf. At the base of each hair is a cluster of glandular cells, amounting sometimes to fifty or more, arranged in beautiful geometrical forms. When pressed and dried in the herbarium, the body of the leaf turns to a dark green, almost black, and on this back-ground, with a half-inch objective, the hairs stand out like sculptured glass, and the glands like mosaics of purest pearls. I think it is the most attractive opaque object that can be shown under the microscope.

That these glandular cells, covering as they do nearly half the surface of the leaves, especially the upper surface, and differing from all other vegetable cells, subserve an important purpose in the sustenance of the plant, there cannot be any doubt; but just what that purpose is, or what is the mode of operation, I think, has never been ascertained.

In the same locality will very likely be found the most beautiful of all the croton plants, the *C. argyranthemum.* Unlike the other Crotons, which are bushes, this is an herb growing only about a foot high, with a milky sap which exudes when the stem is broken. The leaves are silvery, verging in some cases to a bronze color, and are thickly covered on the upper side with most remarkable and beautiful stellate scales. The flower-buds and stems when pressed, make much more beautiful opaque objects than the leaves.

The object of these scales is without doubt, to prevent the too rapid evaporation of the moisture stored up in the plant. They are the exquisitely woven blankets which preserve the precious juices so laboriously gathered. The same kind of covering is spread over the leaves and stems of all the air-plants of Florida, and doubtless for the same purpose. The well-known Florida moss, although not a moss, but a member of the pineapple family (*Tillandsia usneoides*), is an exceedingly beautiful object under the microscope. Each hanging stem is overlaid with filmy white scales, every one of which is fastened in its place by what would seem to be the stamp of some miniature seal on golden-tinted wax. This plant as ordinarily seen on the live-oaks near cities, is a dirty-looking and unattractive object, and goes by the name of "black moss." But in out-of-the-way places, removed from the dust and smoke of settled localities, it is pearly white, and exceedingly beautiful both to the naked eye and under any power of magnification. Florida moss should be preserved with only very slight pressure, just enough to make the threads lie straight. After it has dried in this way, small cuttings may be mounted in the ordinary cells for opaque mounting.

On the high banks of the lake, and in the adjoining fields may be found the large-leaved and vigorous-growing Calicarpa (*C. Americana*), sometimes called the French mulberry, a bush growing some five or six feet in height. The under side of the leaves of this plant are nearly covered with little round, yellow, sessile glands, flattened on top and marked off into eight or ten sections by ribs like those on a melon. They are in immense numbers—something like thirty thousand to the square inch —over half a million on a good sized leaf. Under a light net-work of branching glandular hairs, viewed with a two-thirds objective, these polished amber-colored disks glisten like a spangle of golden beads. The same kind of glands is found on the leaves of many other shrubs in Florida—the sweet myrtle (*Myrica cerifera*), the low ground blueberry (*Vaccinium tenellum*), a certain bush or dwarf hickory (*Carya glabra*) and some others. These glands have been variously called resin dots, resin glands, and odoriferous glands. So far as I can judge, however, they are not connected with any resinous or odoriferous secretions. From their almost perfect resemblance to the terminal bulb of the mushroom glands of the Pinguicula and Drosera, which are known to be absorbing glands, the probability is that these also serve to absorb moisture and ammonia from the atmosphere and from rains. Although I am free to acknowledge that the position of the glands, being for the most part on the under side of the leaves, militates somewhat against this view of their purpose.

Great care will have to be taken in pressing and drying vegetable specimens in the moist climate of Florida. The little threads of the mould fungus will be sure to creep over the surface of the leaves, spoiling them for microscopical material, if they are not quickly and effectually dried. For this purpose it is well to have a good supply of the bibulous botanical paper, and to change the specimens every day to fresh sheets for at least four or five days. The sheets after being once used, should be spread out in the sun to dry. A weight of about thirty pounds may be used for the pressure.

The objects heretofore mentioned are all for opaque mounting. Almost every preparer of slides has his own favorite method for this kind of work. I myself prefer the use of the transparent shellac cells. Clarified shellac is dissolved in alcohol, and filtered through cotton-wool under a bell-glass, and with the application of heat. The solution is evaporated down until it is so thick that it will only just run—almost a jelly. In this condition it can be put on a slide with a camel's hair brush on the turn-table, and very quickly worked up into a ring with the point of a knife, used first on the inside to make the cell of the size wanted, and then on the outside to turn the cement up into a compact ring. Two or three applications of the cement, with intervals of a day or two after each, will make cells of sufficient depth for all ordinary specimens. These cells dry quite slowly; and if artificial heat is used, it must be increased only very gradually, otherwise vapor of alcohol bubbles will make their appearance in them. A small ring of Brunswick black may be made in the inside of the cell, to which when thoroughly dry, the object may be fastened with a very little liquid marine glue. In this case both sides of the leaf can be seen, which is often desirable. In all opaque mountings a minute aperture should in some way be left open into the inside of the cell, so that it shall not be hermetically sealed up. This little precaution will save an innumerable number of failures.

The collector in Florida will not fail to secure a supply of the leaf stems of the castor oil plant (*Ricinus communis*). In regions beyond the influence of frosts, this plant grows continuously from year to year, and becomes quite a tree. It is only in such a growth that the spiral tissue of the fibro-vascular bundles is fully perfected. The castor oil plants grown in our climate during one short season, will furnish very little spiral tissue, mostly spotted ducts and scalariform cells. There is no more beautiful object for multiple staining than thin longitundinal sections through the woody fiber, the vascular tissues, and the pith cells of well matured leaf-stems of the castor oil plant. I will briefly describe my process of making these stainings. After being decolorized in chlorinated soda, the sections may be left for half a day or more in a solution of carmine in water containing a few drops of aqua ammonia; then for half an hour in a rather weak solution of extract of logwood in alum water, and finally 10 to 15 minutes in a weak solution of anilin violet or blue in alcohol. From this they can be carried through absolute alcohol into turpentine, and mounted in balsam at any time thereafter. If successful in this staining you will have the pith cells in red, the spiral tissue in blue, the wood cells in purple and the stellate crystals in green or yellow.

But the chief objects of interest to the microscopist in the vegetation of Florida, are the insectivorous plants. Not only are they more abundant, and, as I think, more perfectly developed in the central lake regions of Florida, but some varieties are found there differing, it seems to me, from any found elsewhere. I desire particularly to mention one which I discovered, and which perhaps might be entitled to rank as a new species.

In a lagoon-like basin at the side of a small lake near Lake Harris, in water from two to three feet deep, I found numerous specimens of the insectiverous plant known as the Drosera or sun-dew, growing thriftily and floating about among the scattered water-weeds, without any attachment whatever, indeed with very little root of any kind, the dead leaves that hung down in the water seeming both to buoy it up and to hold it upright. This plant differs from all the described species of Drosera, so far as I have been able to ascertain, in having an upright, leaf-bearing stem from four to five inches long, in floating free on the water, and in having unusually long, vigorous and numerous leaves. As I never found this floating Drosera in any other location, and as there was an abundance of the ordinary *Drosera longifolia* growing on the adjoining shore, I could not resist the suspicion that at this very spot in some past time a plant of the *longifolia* had by accident become uprooted, and floated out on the water—that finding it could capture insects even better on the water than crowded among shore plants, it adapted itself permanently to its new location and modes of growth. It appeared to me quite within the bounds of probability that here was an instance of the evolution of a species *in loco*.

The Drosera or "sun-dew" is found on the margins of nearly all small ponds and permanently wet places throughout the south. It is a small red plant, growing close to the ground, and glistening in the sunlight. Its little whorl of expanded leaves forms a circlet as beautiful as any flower, and often so very small that I have frequently mounted whole plants with flower-stalk and buds on one slide. Each leaf of the Drosera has, spread out on its upper surface and edges, from two to three hundred arms, called tentacles because endowed with the power of motion, and of such varying lengths that when naturally incurved their ends just meet at the center of the leaf. Each tentacle has at its extremity a pad, like an extended palm, with a ridge raised lengthwise upon it, and in this palm is a bundle of spiral vessels connected with the same tissues in the leaf. Now all these tentacles secrete and exude from the glands at their ends a little drop of a very adhesive fluid; and the glistening of these drops in the sunlight on their usually bright red back-ground, gives to the plant its beauty and its name of the "sundew." An insect attracted to and alighting on these leaves is inevitably held fast. The tentacles by which it is held very soon begin to bend towards the center of the leaf, carrying the fly with them. Then in some mysterious way, intelligence is communicated to the other tentacles, and they too begin to turn towards the center of the leaf, in the course of an hour or two completely covering the captured prey. If the insect is caught entirely on one side of the leaf, then only the tentacles of that side inflect. The glands after envelopment, exude a gastric fluid which dissolves the nitrogenous matter in the body, after which, by another change of function, they absorb and carry down into the plant all this nutritious little feast. In the course of three or four days the tentacles again expand and prepare themselves for another capture.

There are several reasons which lead me to believe that these unique and most wonderful organs of the Drosera are a direct and special development from the common, simple mushroom glands, which are found on many plants, and which have for their primary function to absorb moisture and ammonia from the atmosphere and from rains. I found on the calyx and flower stem of the Drosera an abundance of these mushroom glands. Indeed the flower stem with its buds furnishes by reason of them, an exceedingly beautiful object for the microscope, both in a natural state and when prepared by double staining.

I have found it quite a general rule as regards plants, that whatever organs, such as stellate hairs or glands, the leaves may possess, the calyx and stem of the flower will show them in far greater luxuriance and beauty. The stellate hairs of the Deutzia, the Crotons, and the Shepherdias, are far more numerous and striking on the flower buds than on the leaves. The mushroom glands which are found on the leaves of the Saxifrage and Pinguicula, are multiplied many fold in number and attractiveness on the calyx and flower stem of these plants. So I regard that this was once the case with the Drosera; and that the mushroom glands, which are now found on the flower, were then common to the leaves. A process of evolution has transformed them on the leaves into those wonderful motile arms adapted to the capture of insects, but has left them unchanged on the flower, where that function would be of no use to the plant. I occasionally find in my preparations a solitary mushroom gland among the tentacles of the leaf—a remnant of a race that has been supplanted. There is found in Portugal a plant very similar to the Drosera, the Drosophyllum, which has still only the mushroom glands on its leaves, and catches insects in great quantity by loading them down with the viscid secretion which these glands abundantly pour forth.

To exhibit the very delicate structure of the leaf and tentacles of the Drosera, it is necessary to color them but slightly. The danger will be in over-staining; therefore, after decolorizing and immersing for a few hours in the carmine solution, the specimens should be exposed to only a very weak fresh solution of logwood for fifteen or twenty minutes. If the anilin blue is resorted to at all, it must be in a very weak solution. A mounting of a leaf and a stem with flower buds in one cell in camphorated or carbolated water, makes a very pretty and complete slide for the Drosera.

The Utricularia is a floating, carnivorous plant which grows in the shallow water of quiet ponds. On the surface of the water from five to seven leaves are spread out like the spokes of a wheel, and from the centre of these leaves the plant sends upward its flower stalk and downward its root-like branches, floating freely in the water. Among the thickly branching fibres of these long submerged stems, are perched innumerable little bladders or utricles, not much larger than the head of a pin, each provided with a mouth, at the bottom of a sort of funnel of bristles, closed with a cunning little trap-lid which opens inward, engulfing and imprisoning whatever minute creatures or substances may happen to be resting on it. In these sacks during the growing season, we will find numerous microscopic water fleas, mites and beetles, with grains of pine pollen and other floating particles. The organic bodies will be found in all stages of digestion, showing that the plant derives nourishment from such captured prey; and apparently its only means of livelihood is trapping.

When taken from the water and dried under slight pressure, the submerged portions of the Utricularia will be found literary covered with diatoms; and many very interesting chrysalids of water-insects will be found attached to them. These will all be washed off if the plant is bleached in chlorinated soda. To preserve them it will be necessary to remove the color in alcohol, and besides to handle very carefully. The staining can only be single; and I have found a weak solution of eosin in water, to be the best material for coloring, showing at the same time the structure of the utricles and the captures contained in them. Specimens of new growths, showing the just forming utricles and the peculiar circinate mode of growth, should be included on the slide. The mounting should be in camphorated water.

The Pinguicula, another of the insectivorous plants, is found abundantly on the more open plains, and not far from wet places. It is a compact rosette of very light green leaves, growing close to the ground, from the centre of which rises a single flower-stalk, eight or ten inches high. The leaves have their edges turned up, forming a shallow trough, and on the upper surface are mushroom glands, which exude a viscid secretion. Insects are caught and held by this sticky substance until they die. The nutritious matter is then dissolved out by an acid secretion, and is ultimately absorbed into the substance of the plant by the glands on the leaf. The edge of a leaf when excited by a capture will bend over upon it for a short time; merely for the purpose, I think, of more effectually securing it, and of bathing it in the secretions. The calyx and flower-stalk, as I have already mentioned, are thickly covered with the same mushroom glands that are found more sparingly on the leaves. I have never seen any evidence that the flower appendages took any part in the digestion of insects. They seem to be rather in the nature of an ornamentation than of anything useful. For exhibition, therefore, or for double-staining, the calyx and flower stem will be found by far the most attractive part of the plant. The best way to preserve them, as well as all such small material, until wanted for use, is to put them green into a common morphia vial with a few drops each, of alcohol and water, and then to cork and seal them up tight with melted beeswax. To prepare them for the slide these objects may be treated precisely as recommended for sections of castor-oil plant, but should be mounted in a weak solution of glycerin in camphorated water.

If cells are made of rings punched out of the thin sheets of colored wax, used by artificial flower makers, and then coated with either liquid marine glue, or a mixture in equal parts of gold size and gum damar, dissolved in benzole, this method of liquid mounting may be as easily and safely performed as mounting in balsam. In very many cases simple water, made antiseptic in any manner, will be found far preferable to any other media, both for retaining the full and distended forms of minute organs, and for bringing out the delicate markings of vegetable structure which the highly refractive balsam would entirely obliterate.

There is only one other insectivorous plant found in Florida—the pitcher plant—*Sarracenia variolaris*, a species growing only in the South-Atlantic States. It is found in low and wet places among the open pine-barrens, but is not as abundant as the others which have been mentioned. The leaf is a hollow, conical or trumpet-shaped tube, with a flange or wing running up one side, and a hood which arches over the orifice of the tube. During the growing season this tube is usually more than half filled with water, which we must suppose secreted by the plant itself, because the hood effectually sheds all rain water from it. Crowded into the bottom of the tubes of mature leaves, we shall almost invariably find a mass of the hard and indigestible parts of insects. These creatures have been in some way attracted into that suspicious looking receptacle, and once in have been unable to get out again. A mere partially covered tube, however, with a little water in it, is by no means a fly-trap. Not one insect in a hundred would fall into that well and drown, if there were not some special device absolutely preventing it from crawling upward. Now a microscopical examination of the inside of the hood and tube of the pitcher plant reveals the most skilful contrivances for securing insect prey that could possibly be imagined. In the first place, there are in the upper part of the receptacle and about the mouth, great numbers of sessile glands which secrete abundantly a sweet fluid, very attracting to ants and flies. Further, there is on the inner surface of the hood and mouth, a formidable array of comparatively long pike-pointed spines, all pointing backward and downward. These grade off into shorter, more blunt, but still exceedingly sharp-pointed spines, which overlap each other like tiles on the roof of a house. This kind of coating lines the tube for a third of the way down, the spines growing finer until at last they grade off into regular hairs which line all the lower part of the tube; spines and hairs all pointing downward. An insect attempting to retrace its steps after its ambrosial feast, would find nothing which it could penetrate or grasp with the hooklets of its feet; and the wetness of the spines, from the constantly overflowing glands, would probably prevent it from making use of any other device that insects may have for climbing glazed surfaces. As a matter of fact no creature comes out of that prison house, unless it be with the single exception of one cunning spider, which in some way finds a safe and rich retreat under the hood of its great vegetable rival.

The bodies of the captured prey fall into the fluid in the tube and are macerated or decomposed, but without any signs of putrescence. Therefore the plant must at once absorb the animal matter, for otherwise this would cause the infusorial life, which is called putrefaction.

In order to show the internal structure of the pitcher plant leaf, it will be necessary to separate the cuticle which bears the spines and glands from the rest of the leaf. To do this, pieces cut from the leaf, and preferably those showing the transition from one kind of spines into another, after being soaked in water, may be put into common nitric acid, and this brought up to the boiling point over an alcohol lamp. They should then be immediately washed in several waters, when it will probably be found that the cuticle, both the inner and the outer, has already separated from the parenchyma. The specimens will need no further bleaching, and may be stained either in eosin, dissolved in water, or in anilin blue in alcohol. As there is only one kind of tissue to be stained, it will be impossible to get more than one color in them. They should be mounted, or kept in water very slightly acidulated with carbolic acid.

I cannot but regard the pitcher plant as the most highly developed, and the most specialized in its organization of any of the insectivorous plants. It differs more widely from ordinary vegetation, and has more special and adapted contrivances about it, than any of the others. Now, as I believe that the truth of the modern evolutionary theory will be eventually brought to the test by well-studied monographs, made by microscopists, on some such highly differentiated organic structures as this pitcher plant, I do not deem it a disgression to present here briefly some inferences which seem to me to arise from the developmental history of this particular plant. Of course, if the pitcher plant was developed from other and ordinary plants, it had at one time the simple plain leaves of common herbs. It must have early commenced in some way, to appropriate insect food on these leaves, because every essential change was for the betterment of the plant in this respect. The stem of the leaves soon began to put out flanges or wings on each side—the phyllodia of the botanists, which are not uncommon among plants. And these outspread wings must have assisted in the absorption of insect food that was washed down among them.

Then the edges of the wings turned up, and curved around towards each other, until finally they met and grew together, forming a tube and a much more complete receptacle for decomposing animal bodies. A South American genus, the *Heliamphora*, is just in this condition at the present time. Then from some unknown cause and in a way exceedingly difficult to explain, our *Sarracenia* changed entirely its manner of capturing insects. The leaf bent over the orifice of the tube, forming the hood, and those remarkable spines and tiled plates were developed on the inside of the hood and tube, growing backwards, contrary to the order of Nature. When all this was accomplished and fully completed, but not before, our plant could commence its career as the most successful trappist of either the vegetable or the animal kingdom.

Now, according to the Darwinian theory, all these transformations were the result of innumerable slight and accidental variations, each one of which happened to be so beneficial to the particular plant concerned, that it got the start of all the others, and every time run them all out of existence. One cannot tell how many million times this extinction and reproduction must have occurred, before our marvellously perfect little fly-trap was finally produced. Excuse me if I confess that not all the canonical books of Darwin are sufficient to make me put faith in the miracles of accidental evolution. I believe in the fact of the gradual development of the organic kingdoms; for all science teaches it. But, I believe it was governed and guided by forces more potent than accident or chance. The Being, or the first cause, if you will, that originated the simple elements of matter, and endowed them with the power and the tendency to aggregate into developing worlds, might equally as well have endowed certain of them with the power and the tendency to aggregate into ever advancing organisms. There is no chance, in the myriad forms of crystalline and chemical substances; then why should there be in the scarcely more varied colloid forms of living matter? In a world that unfolds from chaos in one steady line of progress, that shows only design at every advancing stage, I must logically place somewhere at its commencement the almighty fiat of a Designer.

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The Simplest Forms of Life.—V. Family Hydromorina.

Individuals in naked, berry-like families which move by rolling and jumping They are little larger than those of *Uvella virescens*, but are distinguished from them by the thick coat of the individuals which seems to be split in the middle.

Genus. *Hydromorum*, Ehr. (formerly *Polytoma*, Ehr.)

H. uvella. Common among algæ in fresh water.

VI.—Family, Dinobryina.

Body spherical, metabolic, in a transparent, beaker-shaped capsule. By budding and the attachment of the younger capsules upon the margins of the older, tree-like colonies are formed, which frequently become detached from their original place and swim about free.

Genus. *Dinobryon* Ehr. Sheath transparent, animals whitish, with red stigma.

D. sertularia, Ehr. L. (of the capsule) 0.04. Common among water plants.

VII.—Family, Peridinea.

Body covered with an opaque, spherical or irregularly shaped, rough, two-shelled carapace, which shows a spiral furrow in the middle, with slender flagella in front. Color yellowish or greenish brown.

Body spherical without any prolongation, Peridinium.
Body irregular, with prolongations, Ceratium.

I. Gen. *Peridinium*, Ehr. Carapace spherical, without prolongations. The body within sometimes with a reddish drop of oil, (*Glenodinium*, Ehr.) Multiplication by division, in which the two parts of the carapace break or spring apart. The young, naked forms, cannot be generically distinguished. Sometime a large number are found enclosed in a common crescent-shaped cyst, the development of which has not yet been observed.

P. tabulatum, Cl. L. (*P. cinctum* Ehr., *Glenodinium tabulatum*, Ehr.) Carapace oval, consisting of large, polygonal, pieces. Transverse furrow somewhat oblique. L. 0.055. Common.

P. apiculatum. Carapace ovoid, constructed of large, polygonal pieces, which are furnished with small points on the borders, and are separated by a smooth space. L. 0.05. Not uncommon between algæ, characeæ, etc.

P. cinctum, Cl. L. (not Ehr.). Carapace ovoid, smooth, not made up of different plates. Common among algæ.

2. Gen. *Ceratium*, Schrank. Carapace of irregular shape, with thorn like, straight or curved prolongations.

C. cornutum, (*Peridinium cornutum*, Ehr., *C. hirundinella*, Duj.). Carapace four sided, convex above the underside concave, the anterior, posterior and one lateral corner extended into various prolongations. Movement wavering. L. *bis* 0.166. In ditches where Chara grows.

EDITORIAL.

—Subscribers in England, or on the Continent of Europe, who have not paid for the *Journal* for this year, can send the amount due, to either Mr. Thos. Curties, of London, or to Mr. I. C. Thompson, of Liverpool.

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—We regret to state that we have not yet received a sufficient number of subscribers to cover the actual expense of publishing the "Catalogue of the Diatomaceæ." About thirty additional subscriptions are necessary, and until these are received the work cannot be begun. Among the many Microscopical Societies of this country, only two or three have ordered the "Catalogue," and at least half the subscriptions that have been received are from residents in foreign countries. However, we are still confident that the requisite number will be obtained within a few months, and that the work will soon be under way.

The issue of the "Hand-book of Adulterations" will be also delayed until spring. We have found it impossible to prepare the manuscript in time to publish the book this fall.

———o———

—We have been favored with a complete set of the "Annales de la Société Belge de Microscopie." The Belgium Microscopical Society was organized in July, 1874, and the first volume was published in 1875, entitled the "Bulletin des Séances," which forms the first volume of what have been since called the "Annales." From a pamphlet of ninety-five pages, the "Annales" have grown in four years, to a volume of over four hundred pages, replete with valuable information. We have examined them with much interest, and it is with regret that we have to confess that there is not a Microscopical Society in this great country that can offer an equivalent publication of its own, as an exchange for them. It would seem that there must be something radically wrong about our Microscopical Societies, but just what it is and how to correct it, are questions very hard to answer. Certain it is, however, that there is hardly a Microscopical Society in this country that is doing any work of sterling scientific value. The meetings are often very interesting, and much really useful information is imparted by the members, but further than this we cannot go. As educators of the general public, our societies certainly are of great value, but we hope the time will come when they may justly rank among the best scientific organizations of the time.

We have always thought that in France the microscope is less generally used than it is even in our own country. Nevertheless the "Annales" before us indicate that those who do employ it there have used it to good advantage, and we are not sure but the Memoirs published by the Belgium Society with 83 members are more numerous, and quite as valuable, as those published by the great Royal Microscopical Society of London.

———o———

Synopsis of Diatoms of Belgium.

The first fascicle of Dr. Henri Van Heurck's "Synopsis of the Diatoms of Belgium" fully bears out the promises of the "Prospectus," which we have already noticed. The figures are well drawn, and accurately reproduced by the photographic process employed. The fascicles consist entirely of plates, each one faced by a list of the names of the diatoms figured. There are no descriptions whatever, the text being confined to a single volume, which will be published after all the plates are issued. The classification adopted is that of Prof. Hamilton Smith, with a few modifications. What makes the work particularly useful to those who are unfamiliar with diatoms, is the fact that species and even varieties are figured so carefully that the novice can distinguish them without the aid of descriptions. For this reason, the body of the work is quite as useful to those who do not read French, as to those who do, and as the classification itself has already been published in *The Lens*, this too is accessible to English readers.

The first fascicle consists of ten plates, embracing 260 figures.

As the fascicles are to be issued at such long intervals, the complete work can be purchased by those of very limited means, requiring only an expenditure of from $1.50 to $3.00 every three or four months, according to the number of plates in each fascicle, and every microscopist who has the least interest in diatoms, would find the work very useful.

The second fascicle is announced to appear about the first of this month, and will contain twenty plates.

CORRESPONDENCE.

INJECTING APPARATUS.

To the Editor:—I have read with much interest Mr. White's description of the injecting apparatus in your August number. My friend, Dr. Henry Froehling, of this city, uses one of somewhat similar construction, yet simpler. Mr. White uses hydraulic pressure, with a fourth pipe through the cork of the receiver to prevent overflow and destruction of the injecting fluid. But may not the pressure of the water be so great, that while one's attention is occupied with the process of injecting, the water will overflow? In Dr. Froehling's apparatus, air is used instead of water and it is applied by means of a Davidson syringe. This is somewhat more tedious than the water process, but there is no danger of causing any overflow. The receiver is a "passive recipient" in the form of a demijohn, and the canulae are of glass (home-made,—as many of our instruments should be).

Why is it that works on microscopy do not describe any but the most costly apparatus? In my experience, those most interested in this branch of science are the least able to bear the heavy expenditures of money which the books require. Then let us try to invent cheap instead of costly instruments.

CHAS. H. COCKEY, M. D.

BALTIMORE, Sept. 1880.

GLASS FOR SLIDES.

TO THE EDITOR:—To the inquirers in the JOURNAL about glass for slides, my experience may be of use.

Between the years 1877 and 1878, I made many inquiries for glass for this use, at all the principal glass importing houses in Boston, New York and Philadelphia. I wanted a reasonably good article, thin, clear, flat, smooth, and at the lowest price. At last I settled on a glass bought of Adolf Forster, 206 Church Street, Philadelphia (in 1877 and 1878), and sold by him as "Thin ¾ white plate glass." This was in sheets 10½ x 17 inches, thirty sheets in a box. This he had (1877-78) sold at 65 cents per single sheet, or 60 cents per sheet by the box. A sheet cuts into 56 slides, there is a little waste. I cut my slides myself, taking off the rough, sharp edges on a stone.

This glass is a polished plate glass, with good surface, and somewhat bluish-green in color. From 650 slides cut from glass bought in 1877, I selected 50 of the thickest and 50 of the thinnest. The thickest 50 averaged 1.43$^{mm.}$, in thickness, the thinnest 50 averaged 1.18$^{mm.}$ A lot cut in 1878 averaged 1.22$^{mm.}$ thick. I have paid as high as 40 and even 60 cents per dozen for slides not so good as these are. Yours truly,

WM. H. BREWER.

NEW HAVEN, Conn.

[Prof. Brewer has favored us with some of the slides above mentioned, for examination. They are very thin and clear, and are the best home-made slips we have seen.—ED.]

BALSAM BOTTLE.

TO THE EDITOR:—In your July number at page 139, is a description of a new mounting bottle for balsam, damar, etc. The device is simple and effective, but in my hands the mouth of the bottle is sure, sooner or later, to receive a touch of the balsam, and then the cork is apt to stick and twist off, and bits of cork to drop into the balsam. I have had a wooden plug turned for my balsam bottle, through the centre of which a hole is bored. Through this is inserted an ordinary rubber-topped dropping-tube. So far this arrangement has worked better with me than a cork.

W.

DRY MOUNTS OF POLLEN.

TO THE EDITOR:—In making a dry mount of the pollen of some kinds of flowers, as for instance, the red salvia, a dewy appearance may be noticed on the cover-glass between the pollen grains. In the case of the red salvia, this "dew" has not been affected by two hours heating in the "dryer" of a kitchen stove, so I take it that it is not water, but some viscid medium from the anther. The damp appearance does not interfere with examination of the pollen grains, but it is rather unsightly, and I would be obliged if somebody would suggest a means to get rid of it.

A. L. W.

OBJECTIVES.

TO THE EDITOR:—Mr. L. R. Sexton, of Rochester, has been kind enough to send me, from time to time, some of Mr. Gundlach's objectives, among others the 1-10-inch of class "D." It having been claimed that this objective would resolve *A. pellucida* by simple illumination with mirror and lamp, when I received the objective, I tried it on a balsam-mounted Möller's test plate, and thought that a glass at the price it is sold, would do well, if it would resolve the longitudinal lines on number 16, but to my surprise it resolved these, as well as numbers 17, 18 and 19.—I then tried number 20, not expecting to succeed, however, but to my great surprise and delight, did succeed to plainly resolve the lines on *A. pellucida*, and I did not use anything except mirror and lamp for illumination.

Another glass sent to me was a 4-10 inch of 100° (with removable front, for use on opaque objects); now, though I am not of the opinion that a 4-10 is all one needs in histology, I believe that a 4-10, if a good one, is the most useful objective in histology, for, with this 4-10 inch, I can, by the use of low eye-pieces, get a low enough power for coarse structures and preliminary investigations, and it will give a clear, perfectly-defined image, with a 1-8 inch solid eye-piece. By its aid I have followed and demonstrated the nerve terminations in the cornea (gold staining) where Powell & Leland's 1-4 inch, first class (class 1872) did not give satisfactory results.

HENRY FROEHLING.

NOTES.

—In reference to the statement on page 175, concerning Mr. Tolles' stands at the meeting of the A. A. A. S., Mr. Stodder desires us to state that he "exhibited ten of Mr. Tolles' stands of six different constructions, and one binocular eye-piece, all contributed by friends who owned them."

—The boxes of the Postal Microscopical Club, which were held by the officers during the Summer, have been started again on their circuits. The benefits to be derived from the operations of the Club, might be greatly increased; if more care were exercised by the members, in selecting the slides for purposes of instruction.

—Mr. D. S. Holman has recently devised, what seems to be the most perfect compressorium that has yet been invented, It differs from all others in being so arranged that the large cover-glass is fixed, while the under-glass is moved up to it by means of a screw. The advantages of such an arrangement are very obvious. Mr. John A. Ryder, in the *Journal of the Franklin Institute,* states that he has studied the anatomy of the beautiful *Corretha plumicoris* with the instrument, with great satisfaction, and it has enabled him to demonstrate the presence of the "polar vesicle" in the earliest stages of the development of the shad.

A combination of the animalcule cage and the siphon slide, also devised by Mr. Holman, seems to be a very valuable contrivance. In a siphon slide, shad have been hatched under the microscope.

We believe that the Holman compressorium is not now in the market, and it is said that its excessive cost (about $8 or 10) will prevent it from coming into general use. We hope some makers of microscopical apparatus, will provide a cheap and useful substitute, if it is possible.

Exchanges.

[Exchanges are inserted in this column without charge. They will be strictly limited to mounted objects, and material for mounting.]

Well-mounted, typical Pathological and injected Histological preparations, in exchange for other well-mounted slides, Diatoms, Algæ and Fungi preferred.
HENRY FROEHLING,
59 N. Charles Street, Baltimore, Md.

Diatomaceæ from Lake Michigan (Chicago water supply), mounted or raw material; also diatoms from other localities, to exchange for well-mounted Diatomaceæ or other objects of interest. B. W. THOMAS,
1842 Indiana Ave., Chicago, Ills.

Lime sand, composed almost exclusively of microscopic Foraminifera, to exchange for microscopic material. H. A. GREEN, Atco, N. J.

I would like to have the address of some person who has access to an abundance of *Volvox globator.*
W. W. BUTTERFIELD, Indianapolis, Ind.

Polyzoa, Palates of Mollusca, Foraminifera, Sponge and Holothurian-Spicules, Synapta-Anchors, Chirodota-Wheels, Echinus-Spines, Minute Sea Shells, in exchange for Polyzoa, Foraminifera, Histological and Pathological preparations, *etc.* Also, a quantity of Sea Shells in exchange for Land and Fresh-Water Shells.
F. M. HAMLIN, M. D., Auburn, N. Y.

J. J. B. Hatfield, Arsenal Avenue, Indianapolis, Indiana, will exchange Bleached Plant-Sections for good Diatomaceous material. List furnished on application.

Pleurosigmas and other unmounted Diatoms, both Fresh Water and Marine; also Marine Algæ, Ferns, and a large quantity of miscellaneous microscopical material in exchange for good mounted objects.
M. A. BOOTH, Longmeadow, Mass.

To exchange, well-mounted Slides of Hair for mounted or unmounted specimens of hair from the rarer animals; lists exchanged. WM. HOSKINS,
208 S. Halsted street, Chicago, Ill.

Nicely mounted Slides (opaque) of the Coal-tar Derivatives, chemically prepared, crystalline in form, showing their beautiful colors, in exchange for other well-mounted material. Chemical name and formula attached to each Slide. About a dozen varieties on hand. F. L. BARDEEN, M.D.,
30½ Meigs street, Rochester, N.Y.

Slides mounted from injected Frog's Gall-bladder, Liver, Kidney, Stomach, Intestine and other parts, exchanged for other good and interesting preparations. C. BLASDALE, M. D.,
Jericho, Queens Co., N. Y.

Well-mounted, selected and arranged Diatoms, for good histological, pathological or anatomical preparation. State what you have, and terms of exchange.
W. W. RINER, Greene, Iowa.

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A New Stereoscopic Ocular.

In a long and very instructive article in the *Zeitschrift für Mikroskopie*, Dr. E. Abbe has described a new binocular arrangement which he has devised, and which seems to possess several important advantages over those in use at the present time. It may be briefly described, with the aid of the illustration, as follows, omitting any special reference to the mechanical arrangements for setting

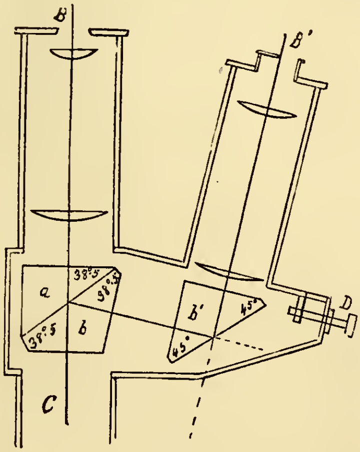

FIG. 27.

and adjusting the prisms: *a* and *b* Fig. 27 are two prisms so combined that they form a thick, plain plate of glass, the continuity of which is interrupted by a very thin stratum of air between the prisms, inclined to the axis at an angle of 38°.5. The thickness of the layer of air is less than 0.01^{mm}. The rays from the objective, when they reach the air, are partly transmitted and partly reflected. The transmitted rays pass on through the prism *a*, and form an image of the object in the ocular *B*. The reflected beam, as shown in the figure, emerges from the lateral face of the prism *b* at an angle of 13° from the horizontal, and suffers total reflection from the face of prism *b* into the ocular *B'*, the axis of which is inclined about 13° to the axis of the primary tube. The distance of the two oculars from each other is adjusted by means of the screw at *D*, or by drawing out the oculars themselves.

The oculars are of the ordinary two-system kind; but on account of the different distances which the direct and the reflected rays respectively have to travel to reach the eye, the difference in the magnification thus produced is corrected by using oculars of different constructions.

The most usual form of binocular microscope is restricted in its application to rather small magnifications; Tolles' and Stephenson's binoculars, however, are not subject to this objection, but the former greatly increases the length of the tube, or, when this defect is corrected, the optical action of the objective is deranged because it is then used with a shorter tube than it was intended for. Stephenson's binocular works well, although it requires a tube of special construction which cannot be also used as a monocular.

In the above described arrangement of Dr. Abbe, however, all these defects or objections are overcome. It will be observed that the plan differs from all others in that the beam of rays from the objective is not bisected, but by a symmetrical division of the rays by partial reflection, which may be effected at any part of their course, the necessary conditions for binocular vision are secured. The binocular eyepiece can be used with any desired magnification, and can be made to give either stereoscopic or pseudoscopic effects, at pleasure, by the use of suitable diaphragms in or above the oculars. The intensity of the reflected rays is scarcely ⅓, while that of the axial ray is about ⅔ of the entire light; but this considerable difference in the brightness of the two images is not only not a defect in the apparatus, but is a real advantage, for experience has shown that the production of a good stereoscopic effect requires one perfect and clear picture, beside which the other may, without noticeable detriment, be far less perfect, and it is to be presumed that the same result would follow any difference in brightness. Moreover, one eye is more sensitive to light than the other, and the difference in the intensity of the two images is an advantage, on account of this physiological peculiarity.

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Rubber Cell for Opaque Objects.

Mr. H. F. Atwood has invented a new kind of cell for opaque mounting, which we illustrate this month. The following account is taken from the circular with which Mr. Atwood has favored us:—

"A considerable experience in mounting opaque slides during the past few years has convinced me that much of the labor incident to it could be avoided, if a cell of suitable material and shape could be produced at a nominal cost. This, I think, has now been attained, and I take pleasure in submitting one for which I claim convenience, cheapness, and general utility. With it the amateur can produce a slide fully as perfect, and with as great a degree of neatness as can the professional. The cell is

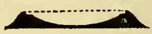

Fig. 28.

of hard rubber, highly polished, and of attractive shape; the base is solid, thus giving a black background of rubber; around the top is a ledge fitted to receive a one-half inch cover-glass; this, being secured by a trifle of shellac, or any similar cement, completes the mounting. The cell may be attached to a glass slip by any cement, before or after preparation. For exchanges it offers superior advantages, inasmuch as the cell, with objects enclosed, may be sent through the mails independent of the glass slips, the recipient attach them. In this way a saving is made in postage, and no risk of loss by slips being broken in transit.

They will solve the problem which often perplexes the student or collector who is crowded for cabinet room. Many objects for future reference may be mounted in this simple cell, numbered and put away without a slide, a cabinet drawer holding two hundred of them, while but forty slides could be accommodated in the same space."

The new "Acme" Microscope.

Messrs. John W. Sidle & Co., of Lancaster, Pa., already well-known as the manufacturers of the small "Acme" stand, which is now designated as "No. 3," have just perfected a larger stand, the "Acme No. 2," a cut of which is now presented to microscopists for the first time. The small "Acme," which was the result of the combined knowledge and skill of Professor J. E. Smith and Mr. Sidle, rapidly became a favorite with microscopists, and has had, we believe, a large sale already. The larger stand is more complete, as may be seen from the illustration. The description which is here given applies to the binocular, but holds good for the monocular also.

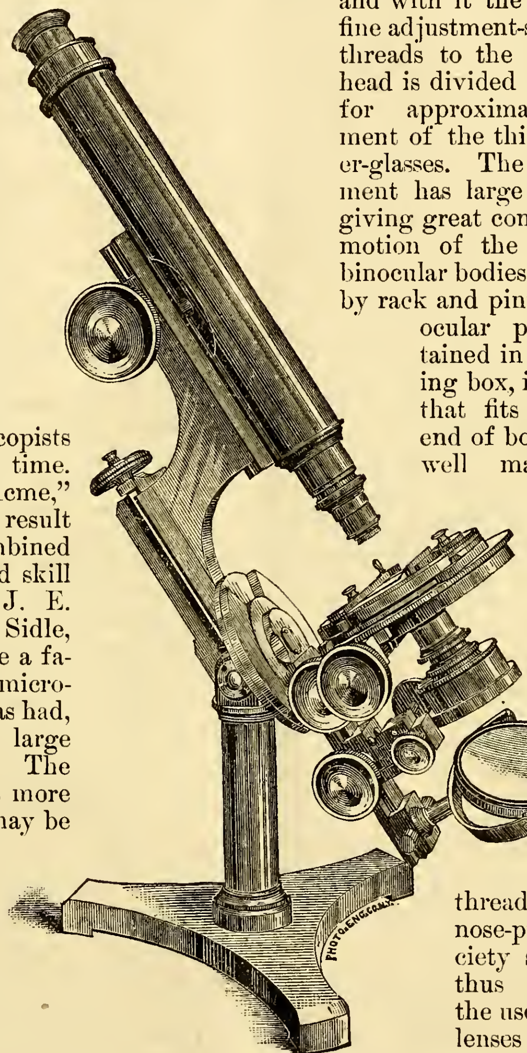

Fig. 29.

The stand is entirely of brass, highly finished, and stands about 17 inches high when in use. The bodies are of full length, 9⅛ inches from the lower end of the nose-piece to the upper end of draw-tube; thus, with length of lens-mounting, giving the standard length of ten inches. The fine adjustment moves the entire arm, and with it the bodies. The fine adjustment-screw has fifty threads to the inch, and the head is divided into 20 parts for approximate measurement of the thickness of cover-glasses. The coarse adjustment has large pinion-heads, giving great control over the motion of the bodies. The binocular bodies are adjustable by rack and pinion. The binocular prism is contained in the usual sliding box, in a nose-piece that fits in the lower end of body tube by a well made bayonet-catch. By removing the nose-piece, a clear field is given to lenses having the 1¼ in. screw and by screwing into this thread an ordinary nose-piece with society screw, one is thus prepared for the use of low power lenses of wide angles without having them handicapped by the several diaphragms of the binocular arrangement. This is an improvement which we regard as one of considerable value. Most binocular stands do not permit of the employment of wide angled objectives to their best advantage. The stage is large and firm, the simpler form having a black glass top with sliding object-carrier. All the stages rotate, and are furnished with a means of centering by lift and press screws. All are provided with a slip for Maltwood finder. The mechanical stage furnished with this stand has motion of about ⅞ of an inch at right angles, by rack and pinion and quick-thread screw, and is also provided with a black glass top. The stages are thin, admitting the use of very oblique light. For light of still greater obliquity, the stage may be turned over so as to have the object slide on the lower slide of the stage. The fitting on which the stage reverses is graduated in single degrees for twenty degrees upon either side for experiments in resolution of lined objects. This is accomplished without throwing the object out of the center of the swinging substage. The substage swings on a circle of 3¾ inches diameter, and is graduated to degrees; it moves along the swinging bar by rack and pinion. The sub-stage may be centered in the optic axis by two milled heads. This centering arrangement is of new construction, and is contained in the space between the substage ring and the slide, thus doing away with the clumsy ring and set-screws found on some of the substages by other makers.

The foot is a large tripod filled with lead for weight, and may be removed from the pillar, or may be turned in any position in reference to the stand.

The mirror is large, and is both plane and concave. It is so mounted that the entire mirror and frame may be removed, and a toy wax-candle (in holder) inserted for measuring angle of lenses.

The engraver has not done justice to the stand. The graduation on the circle has been omitted, and the connection between the sub-stage and the bar is not shown.

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A Catoptric Immersion Illuminator.*

BY JOHN WARE STEPHENSON, F. R. A. S., TREAS. R. M. S.

As the subject of immersion illuminators is now before the Society (and I am very glad it is so, for without their help the full resolving powers of the recent large-angled objectives cannot be utilized), it may not be out of place to lay before the Fellows a brief account of an immersion condenser of very simple construction which I devised in 1877.

The diagram shows the form and size of the instrument which I now use, although it is sufficiently obvious that other sizes, in the same ratios, may easily be made—in fact, I have such.

The apparatus is simply a plano-convex lens of flint glass, worked on a one-inch tool, and having a diameter of 1·2 inches, which is

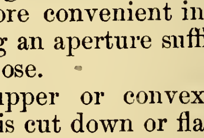

FIG. 30.

then "edged" down to one inch, as being more convenient in size, and as giving an aperture sufficient for our purpose.

The upper or convex side of the lens is cut down or flattened, so as to gives a surface $\frac{4}{10}$ of an inch in diameter, with which the slide is to be connected, when in use, by a drop of oil or water.

It matters not which fluid is used as long as the objective has a numerical aperture not exceeding

* *Jour. Roy. Mic. Soc.*

1·33 (the index of water), and it is very improbable that this will ever be exceeded to any *great* extent, as 1·50 is the *ideal* maximum of even an oil-immersion.

The upper curved surface of the lens is silvered, and beneath the lens, a flat silvered plate, $\frac{1}{60}$ of an inch thick, and corresponding in size and position with the upper flattened surface, is balsamed.

It will be seen that the incident ray is normal to the under-surface, impinges on the curved silvered surface, and is thus thrown back on the plane, or under-surface of the lens, whence the more oblique rays, falling beyond the critical angle, are totally reflected, and converge to a focus, giving a numerical angle of $1.30 = 120°$ in balsam.

The object of placing a silvered glass disk beneath the lens is twofold: in the first place it reflects the less oblique rays which fall within the critical angle, and in the second it tends to diminish the spherical aberration which in this zone might otherwise be felt.

The stop is placed about $\frac{1}{8}$ of an inch, or less, below the condenser, and the opening used is of a lens-shaped form, as giving a broad beam without any appreciable spherical aberration in so narrow a zone of light.

It will be found that this instrument will work through any ordinary glass slip, gives a brilliant light, and, having no refracting surface, is necessarily achromatic, whilst the spherical aberration, as previously pointed out, is inconsiderable.

If used with a dry lens of the highest power on a balsam-mounted object, the light, unable to pass the upper surface of the covering-glass, is thrown back on the object, giving opaque illumination; on the other hand, with dry objects adhering to the slide, the well-known dark-ground illumination can be obtained with any objective I have yet seen.

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The Illumination of Opaque Objects under High Powers.

BY ALLEN Y. MOORE.

For some time past, I have used what I believe to be a new method of illuminating opaque objects under high powers, which is so cheap and so effective that I herewith give a description of it.

The object must be mounted dry, on the cover, and the wall of the cell should be narrow, and of transparent cement, such as Canada balsam, dammar, etc. Now, all that is necessary, is to get the light to enter the slide at the "plus angle," and this I accomplish by using a Woodward prism *d*, having immersion

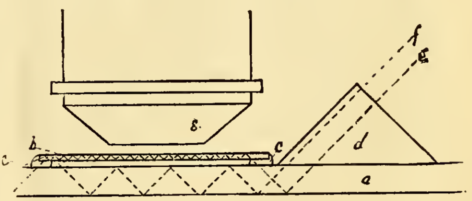

FIG. 31.

contact with the slide. Fig. 31 illustrates this: *a* represents the slide, *b* the cover-glass, *c* the cell-wall of transparent cement, *e* the front of the objective, and *f* and *g* the paths of two rays of light.

First, following the path of *f*, it is easily seen that its action is the same as that of Wenham's reflex illuminator — brilliantly illuminating objects, transparent or translucent, that may be on the slide. For this purpose it is, of course, unnecessary to have the cell-wall transparent. Following the ray *g*, it is readily seen that it enters the cover and traverses it, brilliantly illuminating any object adherent thereto. The diagram renders further description superfluous.

Though the result will be the same if the prism is either above or below the slide, it is better to have it above as there is then no danger of letting any light pass outside of it, and entering the slide at less than the angle of total reflection. To make this device still cheaper, the prism may be dispensed with and a small drop of glycerin, balsam or other highly refractive fluid put in its place.

Only dry-objectives can be used with this illumination, for the stratum of fluid, of an immersion lens would prevent reflection from the upper surface of the covering glass.

I have used this method with magnifying powers of four thousand diameters—having plenty of light and good definition. I do not mean to claim that this is equal to the more expensive methods—such as the vertical illuminator, etc., but still it is of use at times and is exceedingly economical. It may not be new, but I have never heard of its having been in use before.

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On Mounting and Staining Pollen.

At a recent meeting of the New York Microscopical Society, Dr. W. H. Bates, of Brooklyn, exhibited some of the most beautiful slides of stained pollen. They were prepared by the Rev. J. T. Brownell, and the process was described as follows:—

1. Place a small quantity of pollen on the centre of the slide.

2. Place a small drop of staining fluid (anilin dissolved in alcohol) upon the pollen.

3. Wash, by dropping on pure alcohol until all trace of sediment, or of stains upon the glass among the pollen grains, and washed away.

4. Wipe clean with a dry cloth drawn over the end of a pointed stick, turning the slide rapidly on the turn-table.

5. When thus cleaned and quite dry, put on a drop of spirit of turpentine.

6. Put on the balsam, and cover.

A few kinds of pollen are distorted by the action of alcohol. Some of these can be stained by the use of an ammoniated solution of anilin. Those that will not bear this solution may be mounted unstained, beginning at process 5. The slides that were shown bore evidence that Mr. Brownell is one of the neatest and most tasteful of mounters.

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Concerning Eye-pieces.

It is well known that the magnifying power of the eye-pieces made for the microscope by different makers varies considerably. Some time ago Mr. W. H. Bulloch, of Chicago, sent a series of measurements of eye-pieces to the Editor of this Journal. The results are given below. The rule which Mr. Bulloch followed for determining the focal length of the eye-pieces may be stated as follows: *Multiply the focal length of the eye-lens and field-lens together and divide the product by the distance between the lenses (which is half the sum of their focal lengths).*

Example: What is the focal length of an eye-piece, the field-lens of which has a focus of 2.5 and the eye-lens a focus of 1.25 inchs? Calculate as follows: $2.5 \times 1.25 = 3.125$. $2.5 + 1.25 = 3.75$ and $3.75 \div 2 = 1.87$ (distance between the lenses). $3.125 \div 1.87 = 1.67$ which is the focal length required.

In the summary of results given below the eye-pieces of the same denomination are given together. The first two numbers designate the focal lengths of the field and eye-lenses respectively, the last number the equivalent focal length of the eye-piece.

"A" OR "No. 1" EYE-PIECES.

Beck,	2½, 1¼=1.66.
Crouch,	2¼, 1¼=1.6.
Grunow,	2⅛, 1¼=1.58.
McAllister,	2⅜, 1⅜=1.73.
Merz,	2⅜, 1⅝=1.91.
Powell & Lealand,	2⅝, 1⅜—1.79.
Verick,	1¾, 1¼=1.46.
Zentmayer,	2½, 1½=1.88.
French,	$2\frac{3}{16}$, $1\frac{5}{16}$=1.62.

"B" OR "No. 2" EYE-PIECES.

Beck,	1.75,	.87	=1.16.
Grunow	1.625,	.87	=1.13.
McAllister	1⅝,	⅝	= .89.
Merz (N° 1½),	2,	1.	=1.33.
Swift,	2,	1	=1.33.
Tolles (Student)	1½,	¾	=1.
Verick,	2.25,	1.125	=1.5.
Zentmayer	1.625,	.8	= .91.

"C" OR "No. 3" EYE-PIECES.

Beck,	1.10,	.55	= .74.
Merz,	1.35,	.5	= .47.
Swift,	1.25,	.625	= .84.
Verick,	1.71,	.63	= .92.
Zentmayer,	1.25,	.625	= .84.

From the above figures it will be observed that the equivalent focal length of "A" eye-pieces varies from 1.46 to 1.91, of "B" eye-pieces from .89 to 1.33 and of "C" eye-pieces from .47 to .92.

It will readily be seen that the present method of designating eye-pieces, as "A, B, C," or as "No. 1, No. 2," etc., conveys no definite information as to their magnifying power. Mr. Bulloch does not claim that the rule given above for calculating the focal lengths is accurate, but the results are sufficiently exact for practical purposes.

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A Series of Hints in regard to Mounting.

BY C. M. VORCE.

CARBOLIC ACID IN MOUNTING.—I find that an object which has been macerated in potash can be mounted in balsam without drying by the following procedure. Take the object from the potash solution and arrange it on a glass slip, for which purpose a piece of window-glass two inches square is very convenient. If necessary wash it with pure water, using a camel's hair pencil if you wish, then drain away the water and wipe around the object, add strong potash solution and after it has been in contact with every part of the object for a few minutes drain it away and again wipe the glass as close around the object as practicable. Add carbolic acid (pure) in considerable excess, and warm the slip gently; this causes the object to become opaque but do not be disconcerted by this. After a time, say 15 minutes for a small thin object, warm the slip and pour off the acid, and again wipe. Add more clear acid and transfer the object to a mounting slip, which is easily done without injuring the object as follows: Lay the slip on a box or block of about its own width, and half an inch or more in height, pour the acid from the square slip on to the middle of the mounting slip and, reversing the square slip, bring it down upon the drop of acid, so that the object may first touch it when, with a little care, the object will settle down into the acid without being much, if at all, disarranged. If necessary it is then arranged under the dissecting microscope, and when brought into the desired position, if it is clear and quite transparent, the acid is drained away, balsam added and the mount completed.

If found to require cleaning, it can be done with needles and a brush as in ordinary cases. If clean but not transparent, warm and set away under a bell-glass until it is fit to mount, making another change of acid if necessary. In all cases it is best to take the last change of acid from a bottle kept specially clean and pure for that purpose. Objects macerated in acetic acid can be treated in the same way.

Dropping tubes.—The most convenient way of applying fluids and reagents in microscopical work that I am acquainted with is to pass a common "medicine dropper" through the cork of the bottle containing the fluid used. This idea is not original, I saw it in some publication, I do not remember where, but it deserves renewed notice. I have used such a medicine dropper to hold and apply glycerin jelly, with great satisfaction. It is filled from the general supply while warm, and after cooling is fitted into the cork of an empty bottle where it is kept while not in use, so as to avoid dust and mould. The small quantity in the dropper is quickly warmed over the lamp when needed, and just enough can be put on the slide without causing any air-bubbles. Several slides can be mounted from the dropper without refilling it. Tubes longer than a medicine dropper, drawn to a very fine orifice and capped with the bulb of a medicine dropper are also very convenient for innumerable purposes.

Wax-cells.—So much has lately been said about wax-cells that I think a little more cannot be amiss. I have some that are utterly destroyed, and more that are very much injured by the deposit on the under side of the cover. The worst of these were mounted by one who was given to using turpentine to soften the wax; this is probably the cause of the deposit in these slides. My own mountings are very free from this trouble, although all made with wax-bottomed and asphalt-covered cells. I think the reason of this is that my cells are mostly made a long time before they are used. My business is such that I can only devote time to microscopy in the mornings and evenings. Hence most of my work is interrupted by twelve-hour intervals. To save time I make up a lot of cells at once, using double thick pond-lily wax and brass curtain rings, sometimes a little flattened. To make the cell, I place the ring on the wax and press it down with a slip, then with a wet penknife blade, I cut around the ring outside and lift it out. The disc of wax is then punctured from below with a needle in 2 or 3 places near the middle, and if not already raised a little in the centre, it is gently bent with the finger, so that when placed on the slide it will touch only at the edges. The ring is now placed on the centre of a slip in the turn-table, and gently pressed to make it adhere. Then removing the slide it is held over a lamp, keeping it level; the wax first softens at the ring and as the softening proceeds towards the centre, the air escapes through the needle holes and blisters are prevented as the wax settles down upon the slide. Before the wax actually melts, the slide should be removed and returned to the turn-table to see if it is still centered. If the wax does melt, no harm is done unless the ring slides from its place before it cools. When cool the ring is firmly fixed and it is then coated on the turn-table with Brunswick black, though perhaps shellac would be safer from liability to the "sweating." Having prepared from 4 to 6 dozen cells of different sizes, they are laid away in drawers, and after a time, 3 days to 3 weeks, as my work allows, I coat the cells again. And when this second coat is dry, any time after a week, I consider the cells fit for use. In mounting I use nothing to fasten the object to the wax, but press it down with a needle or a shaved splint of whalebone, or the finger end in many cases. Objects in fluid I allow to evaporate in the cell and leave covered from one night to a day or two, as may be. When I come to cover the cells I use covers cut by my own cover cutter just large enough to rest inside the brass rings without falling through. Then the angle between the edge of cover and top of the cell is filled up with wax by means of a pointed knife-blade, using the wax as putty is used on a window. The mounts can now be left for finishing till a leisure time, but I usually apply a light coat of cement before putting them away, and at any time afterward when I find time I go over them again and usually a third time before finishing. I have cells made seven months ago, and when I come to use them for mounting, I shall feel no dread of their afterward becoming dim.

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Blood-corpuscles.

An article recently published in the *Medical Record*, by F. H. Cathcart, M. D., afford a very interesting summary of the views which prevail at the present day concerning the origin of blood-corpuscles and their structure. A few extracts from that article cannot fail to be of interest. It is difficult for us to conceive of the conditions of physiology at the time when the circulation of blood was unknown, and it is not surprising that we should hear of strange notions and absurd fancies which held sway at that time—three centuries ago. The following extracts are taken from the article mentioned above:—

"Now, it might be interesting, perhaps, to give an elaborate account of the ideas men early entertained respecting this important tissue; but as most of these are so absurd, and the labor to collect them so great, it may here be agreeably dismissed. Suffice it to say, however, that not only was the circulation totally unknown, not even suspected by them, but the blood itself held no place of any value in the curious speculations that formed the basis of their systems. Its existence in the economy was regarded rather as an accident than as a means of nutrition, and the vessels in which it is contained were supposed to subserve quite a different end. Hippocrates did not discriminate at all between arteries and veins. Aristotle did recognize the difference, but yet held the blood as subsidiary to the vessels. He differed from his predecessors in maintaining that the veins arose in the heart, while they maintained that they arose in the head. Galen endorsed essentially the same ideas, except that he looked upon the liver as the source of the veins. So great was the authority of these men and the reverence for them during the middle ages, that none dared to dispute them, and their empty assumptions held their ground. Even Mondino, who dissected at Bologna, 1315; Achillini, Scarpa, and Messa, in Italy; Sylvius and Stephanius, in France; Vesalius, a native of Brussels; Fallopius, his successor at Padua, and Eustachius, said naught to contradict them. The infortunate Servetus, 1552, was the first to distinctly speak of a circulation now termed pulmonic; but the value of this truth is, in his work, much clouded by the traditional fancies of the age concerning the "vital spirit." For this assertion, Servetus and his book, *Christianismi Restitutio*, were burned the following year, and only two copies of this curious book are now extant. His discovery would, no doubt, have fallen into oblivion, had not Rialdus Columbus, 1559, publicly corroborated it. Light was now dimly dawning upon anatomists, and it seems queer to us, in this progressive age, that when, besides the above, Andrew Cesalpinus noticed the swelling of veins below ligatures, and Fabricius, of Acquapendente, showed that the valves of veins discovered by Sylvius opened toward the heart—it seems queer, I say, that Fabricius did not discover the circulation, but left that glory to be reaped by his pupil, William Harvey, 1616–1628. So true is it, observes Cuvier, 'that we are often on the brink of a discovery without suspecting it;' so true is it, I might add, that a certain succession of time and of persons is generally necessary to familiarize men with one thought before they can advance to that which is next in order. * * *

"The corpuscles, from the singularity of their appearence and organization, have attracted an unusual share of attention, and have been the subject of almost innumerable observations and experiments. They were discovered by Swammerdam in 1658, afterward by Malpighi in the hedge-hog, in 1661, who at first thought them to be globules of fat. Leeuwenhoek, in 1673, detected them in human blood and examined them very critically, and it was from this time that their study commenced in earnest. They were first described as globules floating in the liquor sanguinis; but, as observations were multiplied, errors and absurdities were advanced *pari passu*. Leeuwenhoek himself invented a fanciful hypothesis, which had a long and powerful influence over the most enlightened of physicians—that the red corpuscles of the blood were composed of a series of particles descending in regular gradations: thus, each corpuscle was supposed to be made up of six particles of serum, and each particle of serum of six particles of lymph, etc., etc. This hypothesis, for which to our mind there is not the slightest foundation, was so suited to the mechanical genius of the age that it formed the basis of many learned speculations, and even a feature in some pathological ideas of Boerhaave. It maintained its hold until the time of Haller, when it was replaced by another one.

"Next to the observations of Leeuwenhoek, those of Hewson were the most elaborate, and had at least the appearance of great accuracy. He described the "red particles" as consisting of a solid centre surrounded by a vesicle filled with a fluid. He informs us that by adding water to them they swell out. He also mentions the effect of chemical agents on their form, etc. * * * The red corpuscles were also examined by Torré, Monro, and Dr. Young. Torré supposed them to be flattened, annular bodies composed of parts cemented together. To Monro they exibited the appearence of circular flattened disks with a dark spot in the centre —due, he conceived, not to a perforation, as Torré had imagined, but to a depression. * * *

"For many years the red corpuscles we indisputably held to have a definite cell-wall; but some time past, notably in the last few years, a change in opinion has been made, and now in most of the text-books on physiology it is expressly stated that they do not have one. The peculiarity and persistence of the form of these corpuscles, their behavior on the application of pressure, and the presence of one line only to distinguish the difference in density of the contents of the cell and its surrounding medium, when two should exist—namely one to denote the difference in density or degree of refraction of the cell contents and its wall, and a second to show a like difference between the cell-wall and its surrounding medium, whatever that may be—are certainly in favor of the latter view. Investigations of Dr. Jos. G. Richardson seem to go to contradict this view and to hold to the old.

"The conclusions reached by him were based upon observations on human corpuscles, and on those of the menobranchus or proteus. Objective used, $\frac{1}{50}$ inch. He states and clearly proves the corpuscle to be composed of "hæmato-crystallin freely soluble in water," and a second substance, "whitish in hue and insoluble in water." But when he considers this latter as constituting a cell-wall, it is then that we cannot but differ from him. * * *

"The criticism of Dr. Richardson's deductions, ably stated by a reviewer, lies in this: 'that because these phenomena are compatible with the supposition that there is a cell-wall to the corpuscle, he thinks they cannot be compatible with any other view.' * * *

"Indeed, the explanation of Rollett of the structure of the corpuscles is most consistent with the observations of microscopists. He considers the corpuscle as formed of "oikoid" (analogous to stroma), which takes up the hæmato-crystallin in solution — but that there is no cell-wall. That something—name it 'stroma,' 'oikod,' 'shell,' which you please—does remain when the coloring matter is dissolved out, no one can deny. This is better named structureless, jelly-like "frame-work," which it may, but to us undoubtedly is, though Dr. Richardson considers it to be the cell-wall. * * *

"The question now naturally arises, that if these morphological constituents of the blood have elicited so much study and controversy, so much investigation, and withal are so important in the economy, what is their origin, their mode of development, of evolution? What is their relation to one another? What bearing do they have on other organs of the body, and what is their significance in pathological processes and morbid conditions? In all vertebrates, two sets of corpuscles are developed at different periods of life: a first set exists until the lymph and chyle-corpuscles appear; a second, which are developed from the last two. The former are simply the embryonic red corpuscles. Now, in order to comprehend the origin of these cells in the embryo, we may first state the outlines of embryology. By the process of segmentation the blastoderm is formed which represents the germ of the future being. Its two or three layers each give rise to distinct tissues and parts of the body. They are the epiblast, the mesoblast, and hypoblast. The mesoblast, with which we are concerned gives origin to the connective-tissue group, the muscles, lymphatic and vascular systems, and their accessories—hence the blood. The corpuscles and vessels are formed in the germinal area, the area vasculosa. These, termed 'embryonic red corpuscles,' are plain, spherical masses of protoplasm, containing a nucleus. They are slightly larger than those of adult life, and appear at the same time as the vessels and heart. The cells of the mesoblast, from which these are developed, are called 'embryonic cells,' and are granular and spherical. From them the most widely differentiated tissues are developed. Each one appears to have its peculiar mode of expression of vitality impressed upon it, and hence some go to form connective tissue, and others the embryonic nucleated red corpuscle. In their development into the latter they become clearer, and are slightly tinged with hæmoglobin. At the same time that this formation is occurring, lymph-corpuscles are pouring into the circulation from the lympathic glands. As seen by Remak in the embryo fowl, the nucleated red multiply partly by division. Kölliker noticed the same thing in the mammal (the rabbit); so did Frey and Paget. When, in the development of the embryo, the lymph-corpuscles appear and are added to the blood, they supersede the embryo-corpuscles; and it is noticeable that this occurs in the frog at the time of the disappearance of the external branchial, and in the chick by the closure of the visceral branchial clefts. Kölliker, confirmed by Weber, asserts that this transformation into red nucleated cells can occur in very early fœtal life throughout the entire circulation, but of course, ceases when the true white corpuscles and the non-nucleated red ones appear. The nucleated red are lost sight of about the third to fifth month of fœtal life in man, though the exact time is not definitely known.

"Thus, it is evident that there are two sets of red corpuscles in man and mammalia—a temporary embryonic set, which are globular and have nuclei, and a permanent mature set devoid of nuclei, but biconcave. * * * Besides these red, we have also the common white corpuscles. Hence, it seems evident to us that we cannot but be prepared to recognize the embryonic set of red corpuscles of mammalia as the analogues of the mature set of red corpuscles of oviparous vertebrates, while the colorless or primogenial corpuscles are analogous to the pale globules of the blood of adult vertebrates, and to the prevailing or characteristic corpuscles of the blood of many vertebrates. This sustains the fact of a temporary structure (red nucleated embryo corpuscle) in the mammalia, corresponding to a permanent one in the ovipara; so that, in its course toward the highest type, there are temporary phases in which the blood of the mammal is analogous to the permanent state of the blood of oviparous vertebrates and of invertebrate animals. * * *

"After stating that the white corpuscles originate in the lymphatics and the spleen, the author proceeds to explain the origin of the red cells: "To Neumann, of Königsberg, belongs the credit of having thrown light upon the subject, and also of having inaugurated investigations which have proved of direct benefit to our knowledge of disease. He claimed the marrow of the bones to be an organ involved in the formation of blood-cells. * * * Capillary vessels are in this tissue, their meshes being twice the diameter of the capillary vessels around them. The meshes have rounded angles, and are polygonal in shape. They are more numerous next to the bone than at the other parts of the tissue. The finest capillaries found in the marrow he stated to have this peculiarity, that they are larger than the ultimate capillaries of the periosteal and osseous network. In the spongy tissue they were not cylindrical, but seemed like sinuses, and the marrow was in immediate contact with the bone. Here and there in the marrow were found fine laminated fibres in wavy bundles. From these radiated in various directions very elegant arrangement of fibres, medullary cells, amorphous matter, and capillaries. * * * The first thing noticed by Neumann and Bizzozero was that certain cells in the marrow presented amœboid movements like white corpuscles. They are numerous, and in structure appear to be identical with "leucocytes." Besides these there were noticed other cells structurally like white blood-corpuscles, but having a distinct yellow or red tinge and a nucleus—in short, characters which to us, as well as to Neumann, Bizzozero, Eales, and Hand, seem to place them as transition types between the white and red corpuscles. * * *

"We have thus shown that in the red marrow of the bones we have a tissue abundant in 'lymphoid' elements, and resembling, if not identical with 'adenoid' tissue, the tissue constituting the lymphatics and the spleen; second, that in the meshes of this tissue there is an abundance of capillaries, the peculiarity of which is that their calibre is considerably larger than the arteries immediately supplying them; third, that in these meshes and their capillaries we find 'medullo-cells,' 'lymphoid cells,' resembling the white blood-corpuscles, transitional cells which are red and nucleated, true red blood-corpuscles non-nucleated, and between these extremes all shades of transition. Now, with these data, the question at once arises: What is the connection between them? Are the 'lymphoid' cells in the blood derived from those in the 'medullary tissue,' or are the ones in the latter derived from those in the blood? We cannot but believe that the former opinion is the correct one; not that we would wish to assert that all the white blood-corpuscles are formed from the 'medullary tissues,' but that it takes part in their production, the same as we have shown to be the case with the lymphatic glands and the spleen. These cells find their way into the blood-current by a process of immigration, in a manner the same as in inflammation they find their way out. * * *

"The process of transformation of the 'lymphoid-cells' of the medulla, or of the white blood-corpuscles into red ones, appears to us, judging from the intermediate forms seen in the spleen and in the red marrow of bones to be as follows: the granulations in the 'medullary lymphoid-cells' (analogous to white blood-corpuscles), diminish from the periphery, and seem to collect more or less about the central nucleus, and thus produce the cell with a large 'granulated nucleus;' at the same time the rest of the cell becomes tinged reddish, and we have formed the 'transitional' nucleated red blood-corpuscle. Now, as to the manner in which this latter becomes a non-nucleated one opinions still differ, and various explanations are advanced by the different observers. Bizzozero and Hand hold that it is the freed nucleus of the former; that the granulations of the nucleated red 'transitional' cell disappear, and the nucleus is liberated to increase in size and form the red corpuscle.

"With this opinion we do not agree; rather do we believe the red 'transitional' form to be changed in its entirety into the red; that the 'lymphoid cell' or white corpuscle gives origin to the red by a transformation of its entire structure. They do not differ from us as to the fact that the red cells are transformed from the white in the bone marrow, but only as to its method. Our reasons for believing that the change is entire rather than partial in structure are: 1st, no one has ever seen the rupture of the enclosing cell-wall of the 'transition' form that must occur if the latter be true, and in the event of it not occurring, the endogenous method is fallacious; 2d, in her modes of development, nature always adheres to fixed law alike for all homologous and analogous conditions. Her principle in the evolution of a specialized 'expression' out of a generalized one is not that when the former appears there is a consentaneous disappearance of the latter, but that it remains and is only modified by its more highly developed constituent. * * * On the transformation of the red nucleated cell into the red non-nucleated one, there is no necessity to consider a rupture of the wall and the escape of a nucleus; rather let us believe that the nucleus disappears by specialization, and imparts its own inherent vitality to the new red blood-corpuscle, by virtue of which it is distinguished in its functions from the white corpuscle and its transitional forms."

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The Destruction of Germs.

If contagious diseases and putrefaction are caused by the development of living germs, as is generally supposed, then it becomes of importance that we should be able to destroy these organisms. An article in *The Popular Science Monthly*, gives an account of some interesting experiments upon the destruction of such germs. Clothing materials were impregnated with putrifying fluids and dried. When dried slowly and placed in a suitable fluid, the bacteria immediately developed, but if heated to a temperature of 125° to 150° C, they produced no change in the solution. Among the substances that kill the bacteria may be mentioned various mineral poisons, benzoic acid and its salts salicylic acid, quinia and carbolic acid. The latter substance, which is such an active poison to bacteria, has been discovered as one of the products of bacterian fermentation; alcohol is also found under similar circumstances and is also a poison to the organisms. "The discovery of the curious relations of these two substances gives a new light upon the cause of the spontaneous destruction of bacteria in strongly fermenting fluids, and encourages us to look for other substances having a similar origin and a like action."

To test this question experiments were made with a mixture of chopped meat and water with the following results:—

1. As preventives of decomposition:—

   Indol in a proportion of 1: 1,000 of the mixture.
   Kresol in a proportion of 2: 1,000.
   Phenylacetic acid in a proportion of 2.5: 1,000.
   Carbolic acid in a proportion of 5: 1,000.

2. As aseptics—killing transplanted organisms by poisoning the supporting fluid:—

   Scatol in a proportion of 0.4: 1,000.
   Hydrocinnamic acid in a proporportion of 0.6: 1,000.
   Indol in a proportion of 0.6: 1,000.
   Kresol in a proportion of 0.8: 1,000 of the mixture.
   Phenylacetic acid in a proportion of 1.2: 1,000.

Carbolic acid in a proportion of 5.0: 1,000.

3. As antiseptics—wholly destroying all living bacteria :—

Scatol in the proportion of 0.5: 1,000 in 24 hours.

Hydrocinnamic acid in the proportion of 0.8: 1,000 in 24 hours.

Phenylacetic acid in a saturated solution (1.0: 400) immediately.

Indol in a saturated solution (1.0 : 900) in 24 hours.

Kresol in the porportion of 5.0: 1,000 in 24 hours.

Carbolic acid in the proportion of 20.0: 1,000 immediately.

It is surprising that carbolic acid, the favorite antiseptic, is the weakest on the list.

"These facts seem to justify us in looking for specific desinfectants and prophylactics among the aromatic products of chemical decomposition. They also give a strong air of plausibility to the theory that the bacteria produce, through the chemical changes of which they are the direct cause, the most effective substances that can be used to destroy them. The idea is logically deducible from the theory that the germs of disease finally produce their own destruction by the operation of their growth and development, and helps us to comprehend the cyclical course which is characteristic of most infectious diseases.

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Cleaning Diatoms by Mr. G. C. Morris' Method.

I have no doubt that many who read Mr. Galloway C. Morris' article on page 38 of the American Monthly Microscopical Journal wished, like myself, that platinum ware did not cost three cents per grain, or else that some cheap substitute could be devised. Now I wish to say that ordinary porcelain gallipots are a perfect substitute for the expensive platinum crucible. In my experiments, I have used the smallest size; about an inch high by the same in diameter. Mix your material with the bisulphate of potash as directed in Mr. Morris' article, fill your gallipot between a quarter and half full, and set it down in the glowing coals in the stove. The bisulphate immediately begins to fuse and boils up as black as pitch. If the pot is not too full it will not boil over but rises up and sinks back again and again until as the sides of the pot begin to be red, the boiling mass becomes clear and the bottom of the vessel is seen glowing hot through it. When the boiling ceases, lift out the pot and let it cool, and dissolve the grayish white mass in the bottom, as directed by Mr. Morris.

This idea of using cheap apparatus does not in the least detract from the credit due to Mr. Morris, who is certainly entitled to the thanks of every diatomist for devising a method as effective and certainly far easier than the complicated process of boiling in acids.

A. L. Woodward.

Syracuse, N. Y.

EDITORIAL.

—Subscribers are requested to read the "Announcement" of the Journal for 1881, which is published in our advertising pages. Judging from the present prospects this Journal is destined to occupy the field of microscopy in this country, as the recognized authoritative periodical devoted to that subject. There may be a semblance of conceit about this assertion, but we have now reason to believe that it is true. Our readers embrace the most intelligent and able microscopists of the country, and even at this late day our subscription-list for 1880 is steadily increasing. We rely for success upon honorable and correct business principles, and an earnest endeavor to develop our small periodical into one that shall be well worthy of its pretentious name.

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—In another place will be found a communication from Mr. D. S. Kellicott, noting the discovery of the infusorian described in our first number, *Ophrydium adæ*, in the Niagara river. It would greatly add to the interest and value of the JOURNAL if subscribers would send us similar letters, when they find any recently described or uncommon forms of microscopic organisms. The infusoria of this country are almost unknown. There is hardly a doubt that some microscopist will soon find a rich field for original work among them. The recent publication of Saville Kent's *Manual of the Infusoria* is sure to give a new impetus to their study, which we sincerely hope will not be long in manifesting itself in this country.

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—M. C. H. Delogne, a well-known student of the diatoms, announces a series of mounted preparations of the diatoms of Belgium, which are to be sold in sets of 25, in a substantial and elegant box, having the appearance of a book. Many of the forms will be from gatherings from which the diatoms figured in Dr. Van Heurck's *Synopsis* were selected, and the nomenclature corresponds with that of the *Synopsis*. The price of each series of 25 slides is 25 francs, or $5.00. We will forward subscriptions of those who may desire to obtain the sets.

—The Biological and Microscopical Section of the Academy of Natural Sciences, of Philadelphia, held its annual microscopical soirée on the evening of the fifteenth of October. We were unable to be present, but from what we have since learned, as well as from what we know of the energy that has been shown by the Philadelphians in preparing for these exhibitions heretofore, we have no doubt that the soirée was a great success. Messrs. R. and J. Beck have sent us an attractive card giving an account of their exhibit, which surely must have greatly contributed to the interest in, and appreciation of, the objects that they displayed.

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—The first part of Saville Kent's *Manual of the Infusoria* has reached us, and it fully bears out the promise of the Prospectus. It is a most excellent work, and deserves a more careful notice than we are able to prepare for this number; next month we will endeavor to do it justice.

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The Spirogyra of Paris.

M. Paul Petit has recently published a valuable pamphlet of about forty pages, illustrated by twelve full-page plates, on the *Spirogyra des environs de Paris*. The work is a model of its kind, and the drawings are very accurate and true to nature. Each species is figured both in the growing and in the conjugating condition, when the latter has been observed. Heretofore, it has been a very difficult matter to name the plants of this genus, for even the most accurate description does not enable one to distinguish between the species with confidence. Thirty-six species are described and figured. Most of these are also found in this country, but there are a few which are found here that are not described, and several Parisian species have not been observed in the United States. Among our most common species are *Sp. quinina* and *Sp. rivularis*, neither of which are given in the pamphlet; *Sp. fluviatilis* closely resembles our *rivularis*.

———o———

About Objectives.

Not long ago a gentleman remarked to us that he thought it was about time for somebody to put an end to the absurd and extravagant writing in which a certain class of microscopists have lately indulged, concerning the value of very wide angular apertures and unusual magnifications. The way he proposed to end the matter was by putting some very pointed questions to the writers referred to, such as: "What discoveries or new observations have you made with your fine objectives?" Surely this is a very practical and sensible suggestion, for every microscopist knows very well that the recent wide angled-lenses have really contributed almost nothing to our knowledge, in the hands of American investigators,—certainly nothing that is at all commensurate with their cost, as compared with other lenses of equal excellence but of smaller angular aperture. It is true that they are, in certain respects, superior to the latter, and in the hands of a few investigators they have proved to be invaluable aids; but it is none the less true that their superiority is confined within such very narrow limits, that only those who are engaged in work that requires just those qualities, will find such objectives to be worth their additional cost. It is to be understood that we refer to persons who are engaged in what is justly called scientific investigation. At the same time, we would clearly state it as our well-formed opinion, that one of the greatest improvements in the microscope that has been made since Lister's discovery of aplanatism, is the application of the principles of homogeneous immersion. This application has led to great increase in the optical capabilities of the microscope, and no one who thinks at all can fail to understand that the value of the instrument, as a means of research, has increased thereby. However, there are but few, comparatively, who have need of the special advantages which the greatly increased angular apertures afford, and when the choice of the student whose means are limited, is between a $\frac{1}{6}$-inch at $34.00, and a better one at $70.00, the cheaper lens will always be sold, unless the other can be shown to be much more useful. Even among those who fully appreciate the advantages of large angular apertures (and the gentleman above referred to is one of these), it will usually be found that the medium apertures are considered to embody the most useful qualities for routine work, and the only way to effectually combat this opinion, is for those who favor the universal employment of the large angular apertures to do some original work and prove their claims to be well founded. This they can never do by mere arguments on paper, which are surely not strengthened by the use of slang phrases and vulgar expressions.

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Nectar.

Mr. William Trelease is the author of a very interesting pamphlet, published by the Department of Agriculture, treating of nectar, its occurrence and uses. It is illustrated by an excellent plate, showing the structure of nectar glands and various structures connected therewith. Nectar, as defined by the author, is "a fluid always sapid, usually sweet, often odorous, which is elaborated in any part of a plant, remaining where formed, or making its way to some other part; its *raison d'être* being the necessity for the removal of some useless or injurious substance, or for some provision to attract nectar-loving animals to the plant for some definite purpose." Nectar is secreted by glands which, when they occur outside of the flower, consist of modified epidermal tissues—within the flowers their structure is more varied. The floral and extrafloral glands may occur as modifications or appendages of various organs—pistils' stamens, corolla, calyx, bracts, involucre, peduncle, etc. The secretion from floral glands seems designed to aid in the fertilization of the flowers by attracting insects or birds. This is true of the secretion in the flower of the cotton-plant. The same plant also secretes nectar from the floral involucre. During the night these glands are visited by thousands of moths of *Aletia* and *Heliothis*, when these moths are laying their eggs. As the flowers of the cotton-plant suffer from the attacks of the larvæ of those insects, it seems hardly reasonable to suppose that the nectar has been acquired by natural selection to attract the enemies of the plant. However, the secretion also draws the enemies of the larvæ, and thus, perhaps, compensates in a measure for the injury that would otherwise result. Probably the extra floral nectar was originally developed by natural selection, that it might attract some animal to protect the plant from the depredations of some leaf or flower-eating creatures. The so-called "honey-dew" is sometimes produced by *Aphides* or plant-lice; it is also found as a product of the plant, but is never secreted by glands.

Mr. Trelease considers, with Darwin, that all nectar was at first merely an excretion, and that the material used in the elaboration of nectar by large, specialized and active glands, can be readily spared by the plant without impairment of its vigor.

CORRESPONDENCE.

OPHRYDIUM ADÆ.

To the Editor:—I wish to make note of the fact that I have found in the Niagara River, at Buffalo, N. Y., the infusorium, *Ophrydium adæ*, described by Dr. Hermann C. Evarts at page 1 of the January number of this Journal. I find the jelly-like masses under the loose stones along the pier, so far, only on the river side; the largest masses are about one-third larger than those found by Dr. Evarts; those taken here have a larger number of "chlorophyll granules" than he ascribes to his. I have verified the greater part of the excellent original diagnosis. D. S. K.

Buffalo, N. Y., Oct. 11, 1880.

CARBOLIC ACID MOUNTING.

To the Editor:—Mr. Vorce's article on "Carbolic Acid in Balsam-Mounting," published in the September number of this Journal, recommends an admirable process which has been perfectly successful in my hands, but one from which I think an important item has been omitted. The writer in *Science Gossip*, to whom Mr. Vorce refers, says: "When I mention carbolic acid, I mean the best crystallized, which can be bought at any chemist, who will, on being asked, add just sufficient water to keep it fluid." This, to me, seems important, unless Mr. Vorce has been equally successful with the ordinary solutions for sale by the druggists. As there is considerable difference in the price, will he kindly say which he has used?

Trenton, N. J. A. C. S.

NOTES.

—Messrs. J. W. Queen and Co., of Philadelphia, have prepared a series of

24 slides of botanical specimens, which will certainly prove to be very useful for both private study and class-demonstration. Among them we find the following: protoplasm and nucleus in cells of *Cypripedium pubiscens*, pitted cells, annular, spiral and scalariform vessels in different stems, medullary rays, lactiferous tissue, glandular hairs, oil-glands, chlorophyll-grains, aleurone (protein grains), cystoliths, raphides, etc. The price of the collection, in a neat case, is only $15. The same firm are the authorized agents in this country for the *English Mechanic and World of Science*, a very excellent, weekly periodical, which costs $3.25.

—The mechanical stage movements will probably always be in favor with those who are accustomed to them, but we believe that most workers with the microscope prefer the simple glass object-carrier. However, it is sometimes important that a certain space should be examined very thoroughly, and for this purpose, some mechanical movements seem to be necessary, if we may judge by the results of some experiments by a German investigator, which may be summarized as follows:—

With magnifications of 50, 100 and 200 diameters, the field of view is respectively about $2^{mm.}$, $1^{mm.}$, and $\frac{1}{2}^{mm.}$ in diameter. Hence, to examine every particle on a surface of one square-inch would require that the object should be moved, for the different powers 350, 700 and 1,400 times. A square-foot was marked with numbers from 1 to 1,000, and photographed upon a slide in squares of respectively 1, ½ and ¼-inch. These photographs were examined in the usual way, noting the numbers that came into the field of view. It was found that about 300 per cent. of the numbers were not seen at all, while on the other hand, a large number of them were seen two and three times.

—*The Specialist and Intelligencer*, is a new monthly medical publication, "devoted specially to the publication of original and selected articles on diseases of the eye, ear, throat and skin, venerial diseases, etc., and to a complete record of medical literature. The Editor is Charles W. Dulles, M. D., of Philadelphia. The *Intelligencer* has been merged into this new journal. Published by Presley Blakiston, 1012 Walnut Street, Philadelphia.

—We have seen some of the rubber cells which are described on another page; they are very neat in appearance and deserve to be used quite generally by microscopists. They cost but thirty cents per dozen, and can be obtained from most dealers in microscopical goods.

MICROSCOPICAL SOCIETIES

ILLINOIS STATE.

The regular meeting was held on Friday evening, October 8th. The President, B. W. Thomas, in the chair, Mr. W. H. Bulloch described a new stand which he had recently constructed, designed especially for lithological work, but which can readily be converted into an instrument suitable for ordinary work. The speaker stated that he used the adjective *new* with considerable hesitation, as his claims in that direction had, in the past, been so strongly disputed. Some features were, however, new to him; these, he proceeded to describe. The stage was made to rotate concentrically on the plan adopted in his large instruments, and was graduated to read with a vernier to minutes. Both the mirror and substage were mounted on graduated circles, and arranged so as to swing over the stage, either separately or in unison. The substage was made in two cylindrical fittings. The lower one, carrying the polarizing prism, could be readily swung to one side, while the upper carried the achromatic condenser. The polarizing prism was mounted with a circle graduated to degrees, and was fitted with a stop for marking the position of the prism. The analyzer was mounted above the objective somewhat after the manner of a Wenham prism, and could be slid in and out of position with the same facility, and also carried, if desired, a quartz film. The stand was also provided with a goniometer eye-piece.

Dr. Detmar exhibited sections of animal tissue, which, he claimed, were but 1-1500 inch in thickness, and briefly described the instrument used in cutting them. Mr. Beck, of London, who was present, suggested that some of the surplus American ingenuity of the members might advantageously be expended in inventing a section-cutter for diatoms.

The Secretary illustrated his method of mounting balsam slides. By the use of very hard balsam contained in a chemist's dropping bottle, a slide could be finished in a few minutes, ready for the cabinet. He also called attention to a peculiar algoid growth which had made its appearance in his apparatus for making dialized iron, and which to the naked eye somewhat resembled a nostoc. The water in which it grew was pretty strongly charged with ferric chloride and ammonium chloride, and contained free hydrochloric acid.

Mr. Beck was invited to address the Society, upon which he made a few remarks, dwelling on cordial feeling existing between the microscopists of England and the United States.

ELMIRA, N. Y.

This Society has been recently formed. A special meeting was held on the 9th of October, the President, Dr. Gleason, in the chair.

The first lecture of the evening was delivered by Dr. Krackowizer. Subject: "The Histology of the Liver." He described first the structure of the liver, illustrating with drawings upon the blackboard, the queer entanglement of veins, arteries and ducts that serve for a network to hold the liver-cells that seemed to be sifted into the interstices, and showed how the cells were forced to assume various forms by reason of their environment. He then spoke of the function of the portal veins and gall-ducts, clearly pointing out how these structures could be distinguished one from the other, under the microscope.

The next paper was entitled "The Amœba," by the President. He referred to the amœba as being a "living fluid"—a primitive cell, which had been aptly described as having the ability to move without muscles, to eat without a mouth, and to digest without a stomach; living and thriving without exhibiting any evidence of a vascular or nervous system. He spoke of the pulsating vacuole, and speculated upon its probable significance; whether or not it might be a possible organ of respiration. He compared the amœba with the white corpuscle of the blood, and related how some observers had seen the white corpuscle engulf the red one, appropriating it, apparently, to its own use, as an amœba would feed upon an alga. He then queried: Might not these white corpuscles be living cells of protoplasm, differentiated, in some mysterious manner, in the arteries and veins of our bodies, and converted into the different tissues?

WELLESLEY, MASS.

The first regular meeting for the College year took place October 27th, with the President, Miss Hayes, in the chair. After the reading of the minutes of the last meeting, the following papers were read:

On Mosses, by Miss F. B. Mussey, including: first, a description of the parts of mosses, especially the fruit—capsule, calyptra, operculum and peristome, with drawings showing varieties of these in different mosses; second, methods of reproduction of mosses.

The second paper was on the "Structure and Functions of the Pollen Cell," by Miss G. A. Painter, which was well illustrated by original drawings and specimens prepared for the microscope.

CENTRAL ILLINOIS.

A Microscopical Society was organized in Springfield, Ill., on the 23d of September, and was incorporated on the 19th of October, as the Microscopical Society of Central Illinois. The Secretary is Mr. T. B. Jennings. It has our best wishes for prosperity.

Exchanges.

[Exchanges are inserted in this column without charge. They will be strictly limited to mounted objects, and material for mounting.]

For diatoms *in situ* on Algæ, send mounted slide to K. M. CUNNINGHAM, Box 874, Mobile, Ala.

Well-mounted, typical Pathological and injected Histological preparations, in exchange for other well-mounted slides, Diatoms, Algæ and Fungi preferred.
HENRY FROEHLING,
59 N. Charles Street, Baltimore, Md.

Diatomaceæ from Lake Michigan (Chicago water supply), mounted or raw material; also diatoms from other localities, to exchange for well-mounted Diatomaceæ or other objects of interest. B. W. THOMAS,
1842 Indiana Ave., Chicago, Ills.

Lime sand, composed almost exclusively of microscopic Foraminifera, to exchange for microscopic material. H. A. GREEN, Atco, N. J.

I would like to have the address of some person who has access to an abundance of *Volvox globator*.
W. W. BUTTERFIELD, Indianapolis, Ind.

Polyzoa, Palates of Mollusca, Foraminifera, Sponge and Holothurian-Spicules, Synapta-Anchors, Chirodota-Wheels, Echinus-Spines, Minute Sea Shells, in exchange for Polyzoa, Foraminifera, Histological and Pathological preparations, *etc.* Also, a quantity of Sea Shells in exchange for Land and Fresh-Water Shells.
F. M. HAMLIN, M. D., Auburn, N. Y.

J. J. B. Hatfield, Arsenal Avenue, Indianapolis, Indiana, will exchange Bleached Plant-Sections for good Diatomaceous material. List furnished on application.

Pleurosigmas and other unmounted Diatoms, both Fresh Water and Marine; also Marine Algæ, Ferns, and a large quantity of miscellaneous microscopical material in exchange for good mounted objects.
M. A. BOOTH, Longmeadow, Mass.

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Riddell's Binocular Microscopes: An Historical Notice.

BY SURGEON J. J. WOODWARD,

Bt.-Lieut. Colonel, U. S. Army.

In April, 1879, a large binocular microscope, made quarter of a century before by the Grunow Brothers, of New Haven, Connecticut, for Dr. J. L. Riddell, then Professor of Chemistry in the University of Louisiana, was presented to the Army Medical Museum by the widow of that distinguished microscopist. It has excited considerable interest among those who have examined it since that time, and I have been requested to make it the subject of a brief notice, which I have been the more readily induced to do, because, although the proper merit of Riddell as a discoverer in this connection has been handsomely acknowledged by such high Continental authorities as Harting and Frey, and even by some English writers,* it has been strangely ignored by others, and even so fair,

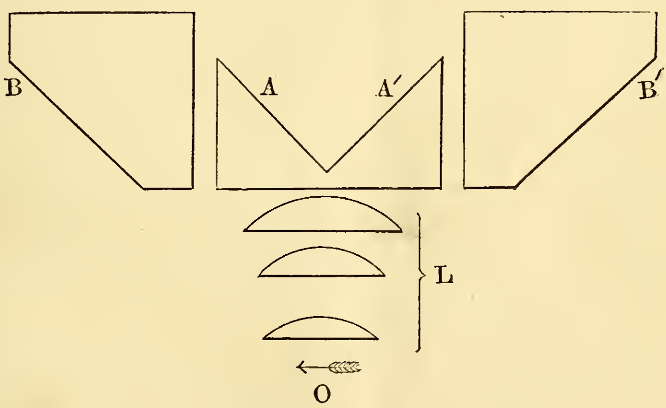

FIG. 32.—Arrangement of prisms above the objective in Riddell's first plan.

* P. Harting—*Das Mikroskop*, (I cite the 2d German edition,) Braunschweig, 1866, Bd. I, S. 194; see also Bd. III. S. 239: "Dem Nordamerikaner Professor Riddell gebührt das Verdienst, zuerst den wahren Weg angegeben zu haben, den man zur Erreichung dieses Zieles einzuschlagen hat."

H. Frey—*Das Mikroskop*, 5te Auflage, Leipzig, 1873, S. 32: "Einem Amerikaner, Riddell, verdankt man die Herstellung der ersten Instrumente dieser Art;" i. e. truly stereoscopic.

Among the Englishmen, who have justly accorded to Riddell the priority belonging to him, I may mention with honor Samuel Holmes—"The Isophotal Binocular Microscope," *English Mechanic and World of Science*, No. 800, July 23, 1880, p. 464—who, however, appears to have been unacquainted with Riddell's perfected instrument as described in this paper.

and usually so accurate, an author as Dr. Wm. B. Carpenter has fallen into the error of asserting that "the first really satisfactory solution of the problem was that worked out by MM. Nachet;" * an error which is the more remarkable in view of the manner in which Riddell's discovery was published and discussed in England, and of the use made of it by the opticians of that country.

According to his own account, the original binocular microscope of Prof. Riddell was devised during the year 1851, but it was not until the following year that it was actually constructed in a form available for use. October 2, 1852, he exhibited the completed instrument to the Physico-Medical Society of New Orleans, and described it in a communication published in the *New Orleans Monthly Medical Register* for October, 1852 (p. 4). According to that communication, the plan is essentially as follows: "Behind the objective, and *as near thereto as practicable*," (the italics are mine, J. J. W.), "the light is equally divided, and bent at right angles, and made to travel in opposite directions, by means of two rectangular prisms," (Fig. 32, *AA'*), "which are in contact by their edges, that are somewhat ground away. The reflected rays are received at a proper distance for binocular vision upon two other rectangular prisms," (Fig. 32, *BB'*), "and again bent at right angles, being thus either completely inverted, for an inverted microscope, or restored to their original direction. These outer prisms may be cemented to the inner, by means of Canada balsam, or left free to admit of "adjustment to suit different observers. *Prisms of other form, with due arrangement, may be substituted.*" (Again the italics are mine, J. J. W.).

Prof. Riddell claimed that his instrument was "equally applicable to every grade of good lenses, from Spencer's best sixteenth to a common three-inch magnifier," and that it could be used "with or without oculars or erecting eye-pieces." He laid stress on the fact that a true stereoscopic effect was thus obtained: "It gives the observer perfectly correct views, in length, breadth and *depth*, whatever power he may employ; objects are seen holding their true relative positions, and wearing their real shapes;" but he laments that, "In looking at solid bodies, however, depressions sometimes appear as elevations, and *vice versa*, forming a curious illusion." October 1, 1852, Prof. Riddell sent a copy of the communication, he was about to make to the Physico-Medical Society, to the *American Journal of Science and Arts*, by which, however, it was not published till January, 1853 (Vol. XV, 2d Series, p. 68). From this it was reprinted in the *Quarterly Journal of Microscopical Science* for April, 1853, (Vol. I, p. 236).

On account of the pseudoscopic effect, which impaired the satisfactory performance of his instrument, Prof. Riddell soon acted upon his suggestion that "prisms of other form" might be substituted, and devised an improved arrangement by which that difficulty was completely obviated. The new instrument was exhibited to the New Orleans Physico-Medical Society, April 2, 1853, and described in a communication, an abstract of which was published in the *New Orleans Monthly Medical Register* for that month, (p. 78). In this instrument but two prisms were used: "They

* Wm. B. Carpenter—*The Microscope and its Revelations*, 5th ed., London, 1875, p. 60.

must be of such form, that the faces, at which the light is immergent and emergent, shall form equal angles with the face on which the internal reflection occurs" (*loc. cit.*), and with this arrangement "to produce orthoscopic binocular vision, simple, not erecting eye-pieces are required." May 25, 1853, Prof. Riddell sent a copy of the abstract just cited to the *Quarterly Journal of Microscopical Science*, in which it was reprinted (Vol. I, 1853, p. 304).

July 30, 1853, Prof. Riddell exhibited this improved binocular to the American Association for the Advancement of Science, and made a communication on the subject which was published in the Proceedings of the Association (Vol. VII, 1853, p. 16), and also in the *New Orleans Medical and Surgical Journal* for November, 1853 (p. 321). In this communication he began by describing and figuring the optical arrangement of his original binocular (Fig. 32, *supra*, is copied from this paper). He then pointed out that the pseudoscopic effects he had encountered, when this arrangement was applied to the compound microscope, were avoided, if it was employed without eye-pieces, and exhibited *a binocular dissecting microscope made in this way*, remarking: "In the smaller instrument before you, this arrangement is observed. Used without eye-pieces, it gives a stereoscopic and perfectly satisfactory result. This instrument was constructed for a dissecting microscope. I use it with lenses, whether plain, doublets, or achromatics, from ½ inch to 3 inches focal length. The image is erect and orthoscopic." But he adds: "If over *B* and *B'*, single oculars be placed, the binocular vision is found to be pseudoscopic; that is, depressions appear as elevations and elevations as depressions. With erecting, or double eye-pieces, analogous to those of the terrestrial telescope, the vision again becomes orthoscopic. On this account, I prefer to reserve this form of instrument for use without eye-pieces, in the manner described, and to construct the compound binocular miscroscope on a plan which I will soon explain."

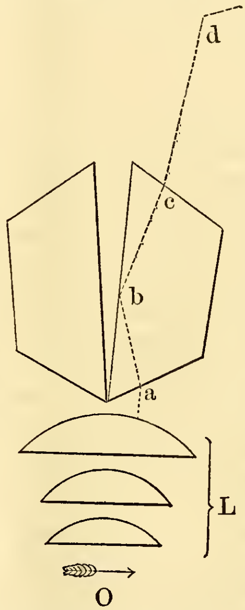

FIG. 33.—Arrangement of prisms above the objectives in Riddell's second plan.

This new plan was represented in the paper from which I cite by a cut of which the annexed figure (Fig. 33) is a copy.

Immediately above the objective (*L*), two prisms are placed, on the long side of which total reflection takes place, the light on each side pursuing the path indicated on the right side by the dotted line *a*, *b*, *c*, *d*. "The light through the objective which impinges upon *a* is, that part of it which enters the prism, refracted to the left, so that it meets with the reflecting surface *b*. Suffering total reflection it emerges from the surface *c*, where from the necessary identity of the immergent and emergent angles, it is refracted to the right, so as exactly to compensate for its previous refraction to the left." The equal angles, formed by the short with the long side of the prisms in this instrument, were actually 45°; the effect to be expected from other angles was discussed in the paper. The instrument was an upright one, and the two tubes were adjustable both at top and bottom, "so that their inclination to each other may be varied; and the whole arrangement slides at pleasure, horizontally, in order to adapt the distance to the eyes of different observers." Arrangements for adjusting the angle of the prisms to each other in accordance with the varying position of the two tubes were also provided.

In this instrument, as the inventor pointed out, "orthoscopic vision is produced by the ordinary single oculars." As to the mode of illuminating the objects examined, he observes: "Opaque objects may be illuminated by the bull's-eye condenser; and transparent objects by two concave mirrors, aided by two diaphragms or screens, or one large 'concave mirror and two screens. At night, two candles may be used conveniently with one mirror. To illuminate for the higher powers, a single achromatic condenser suffices.'" As the instrument was incapable of being inclined, two adjustable rectangular prisms were provided to fit over the eye-pieces, by means of which the image could be "viewed at any inclination between vertically and horizontally, which may be convenient to the observer." But these prisms had a further effect which Riddell did not overlook. He had observed that, although his new arrangement, used with ordinary eye-pieces, gave orthoscopic vision in the sense that the natural elevations and depressions in objects examined truly appeared as such, yet the image was erected in one plane, while in the other it was not; and he pointed out that the erection would be completed by the use of the rectangular prisms above the eye-pieces: "It will be seen," he writes, "that the prism at *A*" (one of the two just above the objective), "has the effect of erecting the image in one plane; while the small prism at *D*"(above the corresponding eye-piece), "can be placed so as to erect it in the plane precisely transverse. Thus the movements upon the stage will be seen through the instrument to be natural or erect."

The character of the binocular vision obtained by this instrument was described by Riddell in glowing language. As the observer gazes, the objects examined, "seemingly hung in mid air, stand out in all the boldness and perfection of relief, and definiteness of position in width and depth, which he has been accustomed to realize without glasses in the natural objects around him."

Riddell sent a copy of this remarkable communication to the *Quarterly Journal of Microscopical Science*, by which it was reprinted in the number issued in January, 1854 (Vol. II, p. 18). Immediately after reading his paper to the American Association for the Advancement of Science, he requested the Grunow Brothers to construct for him a more finished instrument on the plan of the working model of the improved binocular compound microscope then exhibited and described above. Mr. Wm. Grunow of New York, in reply to an inquiry on the subject, wrote me, May 20, 1879, that this request was made of the Grunow Brothers, then in New Haven, Connecticut, in August, 1853, and that the instrument was finished and sent to him in March, 1854. This is the identical instrument presented by Mrs. Riddell to the Army Medical Museum.

Meanwhile, the very first announcement of Riddell's discovery had attracted considerable attention both in England and on the Continent. Prof. C. Wheatstone, F. R. S., promptly sent to the Microscopical Society of London a paper "On the binocular microscope, and on stereoscopic pictures of microscopic objects," which was read April 27, 1853 (*Trans.*, Vol. I, 1853, p. 99). This distinguished gentleman, whose investigation of the subject of binocular vision is deservedly famous, had, when he wrote, seen only the reprint "in the last number of the *Microscopical Journal*" (*i. e.*, the number for April, 1853), of Riddell's paper in the *American Journal of Science and Arts* for January, 1853. He stated that he had himself long been convinced "that a binocular microscope would possess great advantages over the present monocular instrument;" and that, shortly after the publication of his first memoir on binocular vision in the Philosophical Transactions for 1838, he had "called the attention both of Mr. Ross and Mr. Powell to this subject, and strongly recommended them to make an instrument to realize the anticipated effect; their occupations, however, prevented either of these artists from taking the matter up." He further remarked: "The year before last, previous to the publication of my second memoir, I again urged Mr. Ross, and subsequently Mr. Beck, to attempt its construction, and for a short time they interested themselves in the matter, but ultimately relinquished it for want of time, and in my opinion over-estimating the difficulties of the undertaking." He then briefly announces Riddell's success, adding: "The method Mr. Riddell employs is similar to the one I recommended to Mr. Beck."

After having thus claimed for himself the merit of Riddell's discovery, he endeavored to detract from its importance, remarking that "A binocular microscope is, however, by no means a novelty, and its invention dates nearly two centuries back," giving in substantiation of this statement an account of the double microscope of Cherubin, (1677,) to which I shall again refer further on. Subsequently he discussed the question of the production of pseudoscopic effects with the binocular microscope, and observed: "The pseudoscopic effects when inverted images are presented, and the natural appearances when erecting eye-pieces are employed, have not escaped the observation of Mr. Riddell." He did not of course know that when he wrote, Riddell had already perfected a method for overcoming this difficulty without "the use of erecting eye-pieces;" and such a possibility does not appear to have occurred to him.

Following close upon the communication of Prof. Wheatstone, a paper "On the application of binocular vision to the microscope" was read to the Microscopical Society of London by Mr. F. H. Wenham, May 25th, 1853, (*Trans.*, Vol. II, 1854, p. 1.) Mr. Wenham cites the same paper of Riddell's that had arrested the attention of Wheatstone. He had of course been unable to see Riddell's instrument, but reports that he had carefully tried to reproduce it from the description, "and find that the prisms alter the chromatic correction of the object-glass, and also materially injure the definition." Not only did Mr. Wenham, according to his own account, fail to satisfy himself in his attempt to copy Riddel's original plan, but several modifications which he himself devised were tried "with no good result." On the whole he succeeded best when he "altogether dispensed with reflecting surfaces," and obtained binocular vision by placing an achromatic prism behind the objective, so as to act by refraction only. It is true, as he relates, that without employing erecting prisms, the use of which by Riddell he criticises, his arrangement would be "to some eyes pseudoscopic," but he suggests that "Probably habit would enable us to judge of their true form without being under the necessity of resorting to a special expedient for the removal of the deception."

In the Spring of 1854, Mr. Wenham having now read Riddell's description of his second plan, as reprinted in the *Quarterly Journal of Microscopical Science* for January, 1854, published an additional memorandum (Jour. cited, Vol. II, 1854, p. 132), in which he deprecated "the rather glowing account which the American Professor gives of the performance of his microscope," asserted (on the basis of his own failures, of course, for he had not yet seen Riddell's instrument), that—"The binocular microscopes up to the present time have done but little else than afford a glimpse of the splendid and substantial appearance that nearly all microscopic objects may be expected to bear when the instrument is brought near to a state of perfection," and naively declared, "I have abandoned all attempts at making a binocular microscope with two objectives, as I found that I could not get even a pair of $1\frac{1}{2}$'s to bear upon the object together."

Mr. Wenham vainly continued his efforts to perfect a refracting binocular for several years subsequently, and as late as June 13th, 1860, read to the Microscopical Society of London a paper "On an improved binocular microscope" (Trans., Vol. VIII, 1860, p. 154), in which he reports his success in obviating the pseudoscopic effect of his earlier instrument, by modifying the compound refracting prism in such a way that the rays passing through its right side were sent to the left eye, and *vice versa:* and claimed "that the *thinness* of the achromatic refracting prism gives it a great advantage in the quality of definition over the double system of reflecting prisms that has been proposed."

How well this improved instrument performed I do not know, but it could not have been very successful, for less than six months later Mr. Wenham abandoned it for a simple and successful modification of the reflecting prism of Riddell. December 12th, 1860, he read to the Microscopical Society of London (*Trans.*, Vol. IX, 1861, p. 15), his paper "On a new combined Binocular and single microscope," in which he described and figured the binocular arrangement that has since been so generally connected with his name. In this arrangement a single reflecting prism only was used, which received the rays proceeding from one-half of the objective: the rays from the other half proceeded without passing through any prism to one eye, while those which were intercepted by the prism underwent in it two internal reflections, and emerged at such an angle as to reach the opposite eye. He obtained in this way a degree of success that, to use his own language, "considering the nature of the principle, could not have been anticipated."

Meanwhile the discovery of Riddell had attracted no less attention on the Continent of Europe. P. Harting, the distinguished Utrecht professor, relates (*Das Mikroskop*, Braunschweig, 1866, Bd. III, S.

239), that he no sooner read Riddell's article in the *American Journal of Science and Arts* (January, 1853), than he wrote to Nachet, the well-known Parisian optician, and requested him to make one for him, but with a slight alteration, viz.: he desired that the two lateral prisms should be placed wider apart than Riddell had done, so that the instrument might be used simultaneously by two different observers, from which the Dutch professor frankly confesses he anticipated at that time more advantageous results than from a stereoscopic microscope. Nachet replied promptly that Riddell's discovery was already known to him, and that it had occurred to him also that the same principle might be used in constructing a microscope for two observers, as well as a binocular, but that he thought the same objects could be attained in a somewhat different way, and for this reason declined immediate compliance with Harting's request.

Nachet's object appears to have been in the case of the binocular to avoid the pseudoscopic effect of Riddell's first plan, and this in point of fact he achieved, though not until after Riddell had done so, in a different way, for although his paper "On a microscope adapted for anatomical demonstrations; and on a binocular microscope" appeared in the same number of the *Quarterly Journal of Microscopical Science*, (Vol. II, 1854, p. 72,) as Riddell's paper, yet this was not until nine months after the perfected instrument of Riddell had been exhibited to the Physico-Medical Society, and described in the New Orleans *Monthly Medical Register*.

For a precise description of Nachet's plan I refer my readers to his paper just cited; the objections to it have been sufficiently discussed by Dr. Carpenter in his work on the microscope, (*op. cit.*, p. 61.) It certainly had the advantage over Riddell's first instrument of obviating the objectionable pseudoscopic effect, yet it did so on Riddell's own principle—that is by means of reflecting prisms—and not more efficiently than was done by Riddell's second instrument, which is also prior in date of construction to the instrument of Nachet.

It is clear, therefore, that Dr. Carpenter's affirmation, cited at the beginning of this paper, that Nachet's solution of the problem of stereoscopic vision with the microscope was the first satisfactory one is true only, if Riddell's perfected instrument, which anticipated it in time, was so far inferior to it in performance as to be fairly styled not satisfactory. So far from this being the case, however, I find the Riddell instrument, now in the possession of the Museum, gives very satisfactory binocular vision indeed, and can only suppose that Dr. Carpenter has in some way failed to become acquainted with it, when I find him in the same work, and still without any reference whatever to Riddell, praising the excellent performance (*op. cit.*, pp. 64-5) of the erecting binocular microscope of Mr. J. W. Stephenson, F. R. M. S., which in its essential optical parts is a mere copy of Riddell's second intrument.

Mr. Stephenson's erecting binocular, as first made, was described by that ingenious gentleman in a communication read to the Royal Microscopical Society, June 8, 1870, "On an erecting binocular microscope," *The Monthly Microscopical Journal*, August 1, 1870, p. 61. It will be seen on examining this paper that he obtained binocular vision by placing close behind the objective "two truncated rectangular prisms," which, as he describes and figures them, are not only identical in form and function, but are of almost precisely the same size (compare Fig. 1, illustrating his paper with Fig. 33 in this paper), as those of the second instrument of Riddell. But the American microscopist is not even mentioned either in this or in his second paper by Mr. Stephenson, who explains that in the truncated prisms thus used "the dispersion caused by refraction at the first" is "corrected at the second transmitting surface" without apparently being aware that Riddell had already pointed out this mutual compensation of the two refractions in the same arrangement of prisms in his paper read at Cleveland in July, 1853.

Like Riddell, Mr. Stephenson perceived that by the use of the two truncated rectangular prisms alone the images of objects seen were laterally erected; and like Riddell he proceeded to complete the erection by the use of another rectangular prism placed above the first pair in such a position as to effect a second lateral erection at right angles to the first. I have pointed out that Riddell attained this object by placing a small rectangular prism above each eye-piece, and these prisms being movable, the observer could look through them at any desired angle, although the tubes of the microscope remained vertical. Mr. Stephenson, however, placed his additional rectangular prisms immediately above the first pair, and made it so large that a single prism answered for both tubes; at this point the two tubes carrying the eye-pieces were inserted into the upright tube containing the prisms at an angle of 75°, which he thought the observer would find "with this stand as convenient as any."

This arrangement, however, was of course less perfect than Riddell's use of two rectangular prisms, one for each tube, would have been, and Mr. Stephenson soon perceived this, for in a subsequent paper, read to the Royal Microscopical Society, March 6, 1872 (*The Monthly Microscopical Journal*, April 1, 1872, p. 167), he described several improvements in his instrument, one of which was that he cut his large third prism in half, and cemented the two pieces together "at such an angle that the light enters and emerges at right angles to the surfaces," instead of obliquely, as it did in his first instrument; thus making his arrangement optically the same as Riddell's, except that the upper rectangular prism of each tube was below the eye-piece instead of above it.

He also modified the angle at which his two tubes were inclined, to the optical axis of the objective, making it 66½° instead of 75°, and he made the pair of reflecting prisms next the objective very much smaller than he had done before; indeed "their dimensions are so far so reduced that they are capable of being inserted into the object-glass itself; this is accomplished by placing them in a small brass tube, which is fixed in and projects beyond the nozzle of the instrument, but without in any way affecting the screw." This last alteration was undoubtedly a real improvement on the original instrument of Riddell, and greatly benefits its performance with the one-fourth and one-eighth objectives; but it was after all merely carrying out Riddell's principle, cited above, that in obtaining binocular vision with the microscope, the reflecting prisms should be placed "behind the objective, and as near thereto as practicable."

For this improvement in the mechanical construction of the instrument, and for any advantage that may result from placing the second pair of reflecting prisms below the eye-pieces instead of above them, I am quite ready to accord full credit to Mr. Stephenson; but it is quite clear from the facts recorded in this paper that, with these exceptions, the whole credit of the optical part of his "erecting binocular" belongs to Riddell. I do not, of course, accuse Mr. Stephenson of intentional wrong in arrogating to himself the merit that really belongs to the American microscopist who so long anticipated him; but it has been his misfortune to forget, or not to have become acquainted with, the widely published work of his predecessor; and it has become my duty to vindicate the truth of history, as I have done in these pages. I do not doubt that Mr. Stephenson, after taking the trouble to read Riddell's papers as reprinted so many years ago in the *Quarterly Journal of Microscopical Science*, will hasten to accord full credit to Professor J. L. Riddell, whose principles and methods he has so fruitfully followed.

Meanwhile the original device of Riddell which, as we have seen, he himself had pointed out at the Cleveland meeting, gave orthoscopic vision when used without eye-pieces, was brought much earlier into general use. The optical parts of the binocular dissecting microscope then exhibited by him have been strictly copied in the binocular dissecting microscopes made since by Nachet of Paris, and at a later period by R. and J. Beck of London, both of which are still deservedly popular.

Dr. Carpenter, in the work I have cited, gives an excellent description of the optical arrangement of this instrument, which, however, he erroneously credits to Nachet (*op. cit.*, p. 84), and remarks: "To all who are engaged in investigations requiring very minute and delicate dissection, the author can most strongly recommend MM. Nachet's instrument" (*op. cit.*, p. 85). I agree perfectly with this opinion, but "Nachet's instrument" is simply a copy of Riddell's. To Mr. R. Beck Dr. Carpenter ascribes (*op. cit.*, p. 83), a different arrangement, in which two of Riddell's four prisms only are used to bring one-half the cone of rays from the objective to one eye, while the other half of the cone reaches the other eye without the interposition of any prism. To this arrangement, Dr. Carpenter says, Nachet's (that is Riddell's) is greatly superior. The Becks appear to have arrived at the same opinion, for a binocular dissecting microscope purchased of them for the Museum about ten years ago, is made strictly after Riddell's pattern.

Nachet certainly at least deserves the credit of having highly appreciated this first plan of Riddell, for he not merely employed it for his dissecting microscope, but extended its usefulness by applying it to the ophthalmoscope, thus obtaining binocular vision with that instrument. The binocular ophthalmoscope of Murray and Heath is also made on the same principle, differing only in the mechanical contrivances employed. (See A. Zander, *The Opthalmoscope*, translated by R. B. Carter, London, 1864, p. 58 *et seq.*)

One word before concluding with regard to the remark of Professor Wheatstone, who, as we have seen, declared after reading the reprint of Riddell's first paper, that a binocular microscope is "by no means a novelty, and its invention dates nearly two centuries back." The true history of these early attempts will be found in the work of Harting (*op. cit.*, Bd. III, S. 101 *et seq.*), from which it would appear that the binocular microscope of Cherubin (1677) was preceded by one invented by Lippershey (1609), and another by Antonius Maria de Reita (1645), and followed by others described in the works of Zahn (2d ed., 1702), and Bion (3d ed., 1726). Harting has correctly pointed out (*op. cit.*, Bd. III., S. 239), that the plan employed in all these earlier attempts was simply to fasten together two separate microscopes in such a way that they could be looked through simultaneously with both eyes; a plan which was necessarily limited in its application to very low powers, even when the adjoining lateral portions of the two object glasses were cut away so as to allow their closer juxtaposition, as was done by Cherubin.

With these earlier efforts, therefore, the discovery of Riddell has nothing in common. He undoubtedly deserves the credit of having discovered and first published the optical principle, on which all the most successful binoculars made prior to the present year depend. He first showed that the cone of rays proceeding from a single objective may be so divided by means of reflecting prisms, placed as close behind the posterior combination of the objective as possible, that orthoscopic binocular vision can be obtained both with the simple and the compound microscope; and this principle, whether carried out as he himself did, or in the slightly modified manner adopted by some of those who have attempted to improve upon it, has been until the present year the only plan upon which really satisfactory binocular microscopes have been constructed.

The remarkable paper recently published by Prof. E. Abbe of Jena ("Beschreibung eines neuen Stereoskopischen Oculars," *Zeitschrift für Mikroskopie*, 2te Jahrg., Heft 8, 1880, S. 207; also this JOURNAL, p. 201), marks a new era in the history of the binocular microscope. Abbe secures binocular, but not stereoscopic vision, by means of reflecting prisms, and then obtains the stereoscopic effect, which can be made at pleasure either orthoscopic or pseudoscopic, by merely cutting off with suitable diaphragms the outer or inner halves of the cone of rays above the eye-lens of each eye-piece. I have every reason to believe that his instrument (which I have not yet had the pleasure to see, although I have sent for it) as manufactured by Carl Zeiss of Jena, will be an improvement upon the binoculars at present in use with the compound microscope. But, however this may turn out, the arrangement devised by Riddell for the dissecting microscope can hardly be superseded; and even with the compound microscope his plan, or some of its modifications, will probably continue to be employed to a certain extent.

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Cercaria Hyalocauda.—Hald.

BY HERMANN C. EVARTS, M. D.

After having kept the common pond snail (*Physa heterostropha*, Say) for several days in a shallow dish, containing water, I observed the above-mentioned larval form of a Trematode.

These cercaria actually came from the snail, and in large numbers, but only for two or three hours in the afternoons, when the sun was shining brightly in the dish. They could be seen escaping from almost all parts of the body; none, however, were observed coming from the lower part of the foot. After their escape they would swim about for a moment or two in the neighborhood of the snail, then move away, usually near the surface of the water, to the sides of the dish.

In form the body, when contracted, was globular, and this form was maintained by the animal while actively swimming about; occasionally it would cease swimming, allow itself to settle upon the bottom of the dish, or some other object, and then extend its body, which then assumed a somewhat triangular form. During the extension of the body the tail invariably became contracted and quiet,—then conversely the body would contract, becoming again globular, and the tail would become extended and lash about with great rapidity.

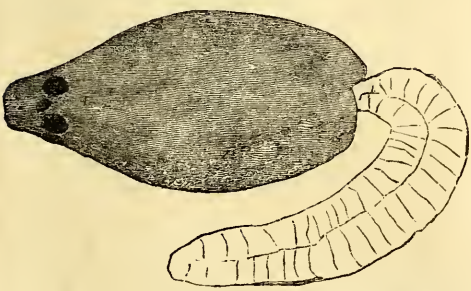

FIG. 34.—The triangular form; the animal has fallen upon some object, as the side of the dish, and its body is undergoing alternate contraction and extension; it is really preparing to encyst itself.

When viewed with the naked eye the bodies appeared to be of a light color, but under the microscope the color was dark, and it is probable that the cyst of the succeeding stage is darker than the original body of the larva. With an inch objective, the bodies appeared to be composed of granular material—no intestinal cavity visible—two. distinct eye-spots were seen near the anterior extremity, and just behind and between these was a third dark, pigment spot, which was not as distinct as the eye-spots. An anterior, suctorial disc or mouth was observed on the underside, near the anterior extremity of the body, but no additional suctorial disc or acetabulum was to be found.

The tail was semi-transparent—light colored—and capable of very great expansion and contraction, showing that it possessed great muscular power. As it contracted, distinct transverse grooves or furrows were seen, which alternated with others on the opposite side. In general form it was nearly cylindrical, slightly flattened vertically, larger near its attachment to the body, but gradually tapering to the extremity; just posterior to the attachment to the body it was constricted, but became slightly enlarged to form a globular head for attachment to the animal.

FIG. 35.—The body as fixed; the process of encysting having already begun; the tail finally disengages itself by lashing about violently.

If allowed to remain in the large dish undisturbed, they would retain this form for a considerable time—perhaps from fifteen to twenty minutes—but if transferred with a few drops of water to the stage of the microscope, they quickly prepared to encyst themselves. This process was indicated by the animal becoming very restless, rapidly extending and contracting its body and tail. A little later, the acts of contraction and extension were more prolonged, although the body continuously underwent violent contortions. In due time the body assumed the globular form, and attached itself

Fig. 36.—The tail has become detached; the body remains in the cyst, which is completed. Figures 34 and 36 are magnified 100 times. Fig. 35 rather less.

to the glass; it then began to secrete a glutinous substance forming several layers around the body. During all this time the tail continued to lash violently about. While the cyst was forming, the granular contents of the body were seen to move about in it, and this movement continued from ten to twenty minutes after the body was completely encysted. A few seconds after the cyst commenced to form, the tail, from its violent movements, detached itself and swam away. This act was performed by the body of the tail going through evolutions resembling a figure eight and what seems remarkable, these caudal appendages retain their vitality for a considerable length of time, indeed, may continue to be active long after the contents of the cyst have ceased to move.

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Plants in Florida.

BY WILLIAM FARNELL.

I have just read Mr. C. C. Merriman's article on "Microscopical Collections in Florida." I was pleased to find that some one had taken some interest in observing the insectivorous plants of Florida. I have lived in Jacksonville more than three years, and have had many a pleasant ramble in the woods and forests, in the pine-barrens, and among the swamps, and have collected some of the plants growing there. In one pine-barrens, west of Jacksonville, the *Drosera brevifolia* is very plentiful in March and April, and I have collected it frequently. I have not met with *Drosera longifolia*, but I believe they are much alike, the one has a longer petiole to the leaf than the other—with this exception I believe they resemble each other. I have collected them at all times in the growing season, and have some now in my Herbarium. I think I have seen them in all their stages of growth, but I have never seen a fly or any other insect caught in the leaf. I believe I am not mistaken in the plant. The description given in the Journal answers exactly to the plant I have collected. If Mr. Merriman has seen a fly or any other insect caught by them, may I ask him to say so, and what kind of insects are generally caught. Do they assimilate the whole insect, both soft and hard parts? I have taken some interest in these plants, and I shall be pleased to have an account from an eye-witness, one who has seen the fly in the trap. With regard to the pitcher plant *Sarracenia variolaris*, they are plentiful near the swamps in the neighborhood of Jacksonville, and I have collected bundles of them, and brought them home, and cut many of them open, and examined their contents—the mass of hard and indigestible parts of insects—and I have found them to be, the legs, heads, and antennæ of ants and small beetles, and one day as I opened one a large centipede ran out. But below this mass of the debris of insects, at the very bottom of the tube, I have invariably found a white worm, with strong black mandibles, which led me to think that the worm got many a dainty meal from the insects that were caught. When I have collected them late in the season, I have found a hole near the bottom of the tube which I was led to think the worm had made to get out. But how the warm got there I am at a loss to know. I believe the worm is the larva of some insect. I have taken them out, and have examined them under the microscope while living, and I have dried one, and have it now mounted as a microscopical object.

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Mounting Opaque Objects.

We have seen a good deal lately on the subject of dry mounts and the use of wax-cells, and the latter are almost universally condemned now, though within a year or two a great many methods for mounting, in which wax is used, have been described. I have tried every one of these methods, but have given them all up, and now use nothing but cells cut out of different thickness of tin-foil, and finished on a lathe. My method of mounting is as follows: The object is first fastened to the slide, which is centered on the turn-table, by means of a weak solution of gelatin, gum-water, or Brunswick black. For very small objects a small circle of the gelatin is turned in the centre of the slide, and then allowed to dry. The objects are arranged on the spot, and then, by carefully breathing on the slide, they are fixed in position. If larger objects are to be fixed to the slide a spot of gelatin or gum that the object will entirely cover is put on, and after drying, the object is fixed in the same way. For larger and heavier objects a circle of Brunswick black is turned, and after it has been thoroughly hardened by heat, so that when cool a needle point will not mark it easily, the object is arranged on the spot and fastened by warming again.

In whatever way the object is fastened, the next thing to be done is to lay the slide on the plate and heat it until it is perfectly dried and ready to be covered.

The slide is then centered on the table and a circle of shellac, which has been thickened and colored with Chinese vermillion, is run around the specimen, at such a distance from it that its inner edge is just larger than the cell to be used. The cell is then laid on, centered, and pressed hard to set it. If the slide is slightly warm and the cement thick, it will not run at all, but will hold the cell firmly in place, so that the cover can be put on at once. If it is thin it must first be allowed to harden somewhat. When ready, as it will be in a few moments if properly managed, a ring of the same cement is run on the cell and the cover is then laid on, pressed down, clipped in position, and the mount laid aside to harden. It is well in an hour or so to remove the clip and run cement in the joints between cover-glass cell and slide, in order to be certain that no air-holes remain. It can then be re-clipped, and set aside until the cement is perfectly hard. The mount is complete and will last a long time if proper care is taken of it. I think for security it is well to put on additional rings of cement more elastic than the shellac, and to make a final finish for the sake of appearance. I, therefore, put on a ring of white zinc cement which completely fills up the joints, and makes a smooth surface from cover-glass to slide. This must harden several days, and the slide is then complete, unless additional rings are run on for a finish.

In making the rings on slides it is not always easy to make the edges true, and sometimes the cement spreads too far. In such cases I turn them down with the point of a knife until they suit. If the cement is taken just at the right time this is easily done, and it improves the appearance very much.

Albert H. Chester.

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The Stem of Pumpkin for Illustrating Plant Histology.*

The stem of the common pumpkin (*Cucurbita Pepo*) is admirably adapted for use in the laboratory to illustrate many kinds of cell-structures, and the larger part of the tissues of the higher plants. It is of a convenient size to be held for sectioning, and after remaining in a sufficient quantity of strong alcohol for awhile becomes very solid, so that exceedingly thin sections are easily obtained. The cells are comparatively large and a power of 250 to 500 diameters will demonstrate almost every detail.

A cross-section of the stem shows without magnification five small fibro-vascular bundles lying beneath the five angles of the stem, with the same number of much larger bundles situated between them, but deeper. These are imbedded in the fundamental tissue, and the whole surrounded by a cortical rind. The centre of the stem is hollow, due to rupture of the fundamental tissue from expansion by growth. Other features of the stem can be made out without a microscope, but it is best to revert to them after their full significance is understood.

An enumeration of the kinds of cells and tissues to be met with will answer the purpose of this notice, as no extended description is intended. The cortical rind is composed of epidermis and hypoderma. Three forms of cells belong to the epidermal system—simple epidermis cells, hairs, and guard-cells of the stomata, the latter best studied in cross-sections of the stem. The fundamental system comprises the large-celled, thin walled parenchyma in which the fibro-vascular bundles lie, and the hypodermal tissues. The parenchyma is colorless and varies little except in size of the cells. The hypoderma consists of two layers, encircling the stem, partly performing the office of imparting strength, and partly containing assimilative protoplasm. The innermost of these is of uniform thickness and made up of slender wood-cells. Thin transverse septa are occasionally met with, which are usually regarded as subsequent formations, but may be, however, the persistent partitions of cells that generally coalesce completely to form single wood-cells. The wall of the cells is differentiated into three lamellæ—a middle one, with one on either side—and has simple pits not penetrating the middle lamella. These pits are twisted in such a way that they have the appearance of being situated at the intersection of the arms of an oblique cross, when seen in front view. To determine their structure requires careful examination with a high power. Between the wood-ring and the epidermis lies a ring of tissues of very considerable importance, but not homogeneous like the last. It consists of parenchyma containing chlorophyll, in which lie numerous masses of collenchyma in contact with the epidermis but not extending quite deep enough to come in contact with the cortical wood. The

* From *The Botanical Gazette.*

stomata are all situated in the part of the epidermis touched by the chlorophyll bearing parenchyma, which is readily distinguished upon the exterior of the stem as interrupted lines of darker green.

The fibro-vascular bundles are open, two-sided bundles, but peculiar in having an additional phloem portion on the axial side. The xylem and the outer phloem are separated by the cambium, in which the progressive transformation from simple uniform cells to the various mature cells of each portion can be traced. Both the axial and outer phloem consist of sieve-tubes, interspersed with long, slender parenchyma cells, the two together forming "soft bast." These are excellent examples of sieve-tubes: the perforated end-partitions, the broad thin spots and sieve-plates of the side walls, and the conspicuous protoplasmic contents are readily made out in detail. The xylem contains all gradations between the extreme form of annular vessels with widely isolated rings, on the one hand, through spiral, reticulated, scalariform, to pitted vessels, on the other hand. The structure of the walls of these vessels can only be studied satisfactorily under high powers. Between and about the vessels is wood-parenchyma.

To sum up the Tissues of the stem of *Cucurbita :*

- Epidermal system :
  - Epidermis.
  - Stomata.
  - Hairs.
- Fundamental system :
  - Interfascicular parenchyma.
  - Hypoderma.
    - Cortical wood.
    - Cortical parenchyma.
    - Collenchyma.
- Fibro-vascular system :
  - (Cambium).
  - Phloem.
    - Sieve-tubes.
    - Phloem parenchyma.
  - Xylem.
    - Vessels.
      - Annular.
      - Spiral.
      - Reticulated.
      - Scalariform.
      - Pitted.
    - Wood parenchyma.

To these should doubtless be added laticiferous tissue sometimes detected in the phloem. It will be observed we have illustrations here of the three tissue systems; of all the principal sorts of tissues, except sclerenchyma, *i. e.*, parenchymatous, fibrous, laticiferous, sieve, and tracheary tissues; with several well-marked varieties of the first and second. The only prominent varieties not included are cork, bast, and tracheides, modifications respectively of parenchymatous, fibrous, and tracheary tissues. It would probably be difficult to select any one common example that more admirably illustrates tissues and tissue elements, and, withal, so simply constructed for histological study.

J. C. Arthur,
University of Wisconsin.

EDITORIAL.

—To all our readers we extend a hearty Christmas greeting, and our best wishes for a happy and a prosperous New Year.

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—The success which has resulted from our efforts to establish a monthly journal devoted to microscopy, during the first year of its existence, has far exceeded our anticipations; and we are pleased to state that the success of this Jour-

NAL is assured. We have great reason to feel satisfied with the result of our first year's experiment. The JOURNAL was started at a time when business was dull, and when it could not be expected that the public would respond liberally to our Prospectus. No sooner had our definite announcement appeared that the JOURNAL would be published than the price of paper began to advance, and this increase continued until it materially affected the cost of even our small publication. Later, to the astonishment of microscopists generally, the *American Journal of Microscopy and Popular Science* again appeared upon the field. It was generally supposed that that periodical had gone the way of all the former publications of the redoubtable Mr. John Phin, alias "The Handicraft Publication Co.," alias "The Industrial Publication Co." However, the above mentioned periodical did see the light once more; and after partly fulfilling the obligations of 1879, the numbers for 1880 have been issued with most remarkable regularity—considering.

It was thought by many that the revival of that paper would greatly influence the circulation of this one, and while we have no doubt that it did affect us somewhat, the result clearly shows that this JOURNAL is fully capable of maintaining itself against any opposition from the older one.

We still believe what we have thought from the beginning, that two periodicals devoted to microscopy cannot exist together in this country and both pay expenses. This JOURNAL during the year 1880 *has* paid its own expenses. It has done so independently of the business which it has brought to the Editor through his own advertisements. Hence, it cannot be said that it is published as an advertising medium. It is in no sense such a publication. Its principal value to the proprietor, as well as to the subscribers, is as a newspaper; when it fails to satisfy the demands of its readers in that respect, it will necessarily cease to be published. The limited business which it brings to the publisher as an advertising medium would by no means pay for its publication.

We are assured of success in future by the encouragement received this year, but still more by the confidence which we have always felt that any business that is conducted honorably, carefully and systematically, will ultimately succeed.

For information about the JOURNAL for next year, the reader is referred to the announcement published elsewhere.

We have to extend our hearty thanks to subscribers for their liberal support during the first year, to contributors for their valued articles, and to dealers in optical goods for their great liberality in advertising.

——o——

The Infusoria.

The *Manual of the Infusoria*, by Saville Kent, which was referred to last month, is destined to rank among the most valuable contributions to this department of study that has yet been published. Pritchard's work, which up to this time, has been the standard of reference, is now far behind the time, and it is rarely that a copy can be obtained. Stein's great work, three parts of which are issued, will always be a monument to the industry and ability of its author, will not be so useful to the general microscopist because of its great cost, which practically places it beyond their reach. The three parts cost over $71. However, Mr. Kent has embodied the knowledge of the Infusoria which we possess in the work of which the first part is now before us. This part contains one hundred and forty-four quarto pages of clear text, and eight full-page plates engraved on metal from drawings by the author.

The text is descriptive, and very readable, even to persons who do not use the microscope. The first chapter is devoted to a general history of the infusoria from the time of their discovery by Leewenhoek, in 1675, to the year 1880. In this chapter we find some interesting reminiscences of Leewenhoek, including his first account of his discoveries in the form of a letter dated October 9th, 1676. We cannot refer to many other names associated with the history of the subject, some familiar to all microscopists, as Ehrenberg, Dujardin, Von Siebold, Pritchard, and others not so well-known, but must pass on to the second chapter, which treats of the sub-kingdom Protozoa. The text is supplemented by a table giving the sections, classes and other divisions of the Protozoa, which may be stated to embrace all those forms which we recognize as Rhizopoda, Flagellata, Ciliata and Tentaculifera. Of these the Infusoria, as limited by the author in this work, embraces all of these forms exclusive of the Rhizopoda, and two orders of the Flagellata—the Mycetoza and the Spongida. Owing to the close relations of the Spongida to some of the Flagellata, however, the fifth chapter of the work is devoted to a brief consideration of the nature and affinities of the sponges, many species of which are figured in the plates.

We have been particularly interested in one or two paragraphs which relate to the distribution of infusorial spores upon blades of grass, hay, etc., for the reason that they corroborate some observations made by us during the past Summer, which, however, were not regarded as perfectly reliable. It appears from Mr. Kent's observations that the blades of grass are loaded with the germs of infusorial life, which only await the vivifying influence of rain or dew to afford the microscopist a world of living forms. In examining the hairs of growing blades of corn last Summer, we noticed the presence of numerous infusoria, which we thought at the time came from the leaves, and now we are positive that it was true.

To enable the reader to form an idea of the author's style of writing, the following quotation will suffice:

"With the Infusoria we encounter not only the as yet known most minute, but also the most elementary and simply formed productions of the Creator's handiwork, though, for all that, none the less complete and excellently finished. Among the Infusoria, making a free adaptation of the admirable thesis propounded by the illustrious Oken, we find in their primeval shape the very bricks and mortar out of which the entire superstructure of the organic world has been erected. * * * The divine fiat 'Dust thou art, and unto dust thou shalt return,' thus received unconsciously at the hands of Oken a practical and truly remarkable illustration. Finally, among the world of Infusoria we arrive at that dim boundary line, too subtle and obscure for arbitrary definition, that separates, or more correctly blends into one harmonious whole, the two departments of the animal and vegetable worlds; and here, moreover, with all reverence be it said, we approach, if anywhere, the confines of the organic and inorganic, and are brought face to face with that already half-lifted veil behind which lies, waiting to reward our patient search, the very clue to the deep mystery of Life itself."

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Diseases of Animals.

The Department of Agriculture has recently published a valuable volume which treats of "The Contagious Diseases of Domesticated Animals." The investigations have been continued since the publication of a former report on this subject, principally by Dr. Detmers, of Chicago, and Professor Law.

Dr. Detmers finds that swine plague is infectious and contagious, and that it is easily communicable by direct inoculation, and by the presence of the infectious matter in food or drinking water. He thinks bacilli found in the blood and other fluids, and in the excretions of the animals, constitute the infectious principle. Inoculation with baccilli, cultivated in milk, will produce the disease. The malady seems to be propagated by running water, in which the microphytes may multiply, or by currents of air which may carry the infection to the distance of a mile. Dr. Detmers' report is accompanied by a plate of numerous drawings from the microscope.

The report of Dr. D. E. Salmon, who has been studying the Southern cattle fever, is quite full and very instructive. He considers that this fever is probably caused by a living poison, although he has not yet discovered any fungus in the blood to which the disease might be attributed. A previous observer, however, discovered a micrococcus in the blood of Northern cattle that were affected with the disease. The clear and logical manner in which the subject is discussed is worthy of the highest commendation.

The remainder of the volume is devoted to a consideration of pleuro-pneumonia, rinderpest, and several other diseases to which domesticated animals are subject.

CORRESPONDENCE.

OSWEGO, N. Y., Nov., 1880.

TO THE EDITOR:—I had the other evening an opportunity to use that famous 1/8 that Mr. Willis has spoken so highly of, and it astonished me. I am not a very expert manipulator, but I got the lines on *pellucida* almost without trying, every time. But I am not able to own so magnificent and costly a glass. Last spring I made up my mind that a 4-10 would be one of the most convenient glasses I could have, if one could be made of high angle, having good resolution, large working distance, and so constructed that it could be used upon opaque objects. I wrote to Mr. Gundlach, asking him if he could make such a glass of about 110°. He seemed to think that I asked for contradictory qualities; the large working distance seemed the greatest difficulty. Finally he made the glass. I can use it I find, in examining water, without any cover-glass, and by removing the cover of the front lens, I can use it upon opaque objects as readily as I could a one-inch of 60°, while I can resolve *angulatum* with a 2½-inch eye-piece, as an opaque object. I have tried it with Gundlach's ½-inch periscopic eye-piece, and it gives good light and fair definition. With a No. 3 eye-piece I get excellent definition and resolution, and can do anything that ordinarily needs to be done. With a ½-inch eye-piece I get 500 diameters, and with my aplanatic amplifier 1,000, and magnificent resolution, while with a ¼-inch eye-piece I get 1,000, without the amplifier, and about 2,000 with it. So you see that I have from 60 to 500 diameters within easy range, and most perfect resolution and definition, combined with large working distance, a thing which I have never seen in any other glass, and especially in any other 4-10. I can commend this 4-10 to any one who, like myself, is too poor to go up higher, and with a 2-inch of 12°, a ⅔ of 27°, and this 4-10 of 110°, I am equipped for a large scope of work. I do not believe that one can do every thing with a 4-10, but it seems to me that until one can afford to go up to a ⅛ of 1.40 like the one I used the other night, he can feel very rich with these.

S. A. WEBB.

TO THE EDITOR:—In determining the value of the spaces of an eye-piece micrometer by seeing how many of its spaces are covered by one space on the stage-micrometer, I find that I get the same result by using the "A" eye-piece that I do by using the "B" eye-piece.

The eye-piece micrometer used was one of Zentmayer's disks, and the stand one of his "Histological" stands.

If you will publish an explanation in your next magazine, you will much oblige several of your subscribers.

K.

[Doubtless many others have observed the fact mentioned by our correspondent. The explanation is that the relation between the field-lenses of the two oculars is such that the rays from the objective are bent out of their original course to just such a degree that the eye-lenses magnify the image of the stage micrometer in about the same proportion as they do the spaces of the eye-piece micrometer. By consulting the table on page 207 it will be seen that the relations between the field and eye-lenses are not the same in all instruments, and therefore the observation of our correspondent would not always be true.—ED.]

NOTES.

—The interesting discovery of hæmoglobin in the aquiferous system of an Echinoderm — *Ophiactis virens* — has been announced by M. Foettinger. The coloring matter was distinguished by the spectroscope as oxyhæmoglobin; it occurs in nucleated cells, and also in others not nucleated.

—Considerable attention has lately been given to the influence of light upon the movement of plants. E. Stahl has observed that sometimes the chlorophyll grains move within the cells, while at other times the entire cells place themselves in certain positions as regards its direction. Swarm-spores usually turn their anterior end toward weak light, but reverse this direction when the illumination is stronger. When a filament of *Vaucheria* is illuminated with light of a certain intensity, it grows at a right angle to the direction of the rays, but if the light becomes less strong, the plant grows directly toward it.

—In the course of some investigations on the pathology of anthrax, Prof. W. S. Greenfield was led to observe that the *Bacillus anthracis* lost its power of communicating the disease by inoculation, after cultivation through successive generations in a nutrient fluid (aqueous humour). The disease was never produced by any generation after the twelfth. The morphological characters of the organism remained unaltered.

—Messrs. George P. Rowell & Co. have favored us with a copy of the *American Nawspaper Directory* for 1880. It is a large, elegantly bound volume of over one thousand pages, and contains much concise information for advertisers and publishers. The publishers give some interesting figures in regard to the magnitude of the work of collecting the information about newspapers. This is the twelfth annual issue, of which over ten thousand copies have been printed, at a cost of over $12,000, indicating that the advertising business of that firm must be very great.

—We have received some very interesting and rare slides from Mr. John King, of Cincinnati, who has given special attention to the preparation of crystals of the alkaloid Hydrastia for use with the polariscope. Hydrastia may be dissolved in alcohol and the solution evaporated on the slide, but the best way to obtain beautiful crystals for the polariscope is to fuse a portion on the slide, and place the cover over it before it cools. Although it is said to be somewhat difficult to prepare good slides of this material, it is certainly capable of yielding very brilliant effects, as Mr. King's slides conclusively prove.

—Professor Chester has sent us a slide of gold-crystals, mounted according to the method which he describes in this number. The slide presents a very pleasing appearance, and leaves nothing to be desired in this respect. The crystals of gold prepared by Prof. Chester are very beautiful, under the microscope, especially those which have assumed the fern-leaf form. They can be obtained from the dealers in microscopes.

MICROSCOPICAL SOCIETIES

LIVERPOOL, ENG.

Meeting held November 5th, Dr. Hicks, the President, in the chair.

Rev. Wm. Banister read a communication he had received from Mr. G. E. Massee, of Scarbre, on certain Fungi. Mr. Massee succeeded in growing spores of *Spumaria alba*, and found that threads of different kinds appeared on two or three points of the surface of the spore. One kind is of a very celluloid character; the other consists of oval cells multiplying by generation until a torula-like chain is formed which divides, becoming nucleated, each cell increasing rapidly in size and remaining a resting-spore for nearly a year, and not taking any amœba-like form. After this some immature spumaria appeared in a pulpy, homogeneous mass, in which were numerous bright specks, each being a focus, around which the plasma formed naked cells of amœboid character, or Plasmodium. After three days all movement ceased, the cells assumed a spherical shape, a bright nucleus appeared, and within twenty-four hours the cell wall was absorbed, and the mature spirulose spores set free.

The paper of the evening was read by F. T. Pane, Esq., F. R. C. S., on "The Structure, Growth and Development of Bone."

A minute description was given of the microscopical characters of bone, showing it to consist of layers of hardened fibres and bone-cells arranged in peculiar concentric circles called Haversian systems. Blood-vessels occurred at intervals, but the nourishing fluid was brought in intimate contact with the tissue by means of the bone-cells. Bone was classed as a connective tissue, and its origin was traced from the first appearance of this tissue in the embryo to the formation of membrane on one hand, and cartilage on the other.

Exchanges.

[Exchanges are inserted in this column without charge. They will be strictly limited to mounted objects, and material for mounting.]

For diatoms *in situ* on Algæ, send mounted slide to K. M. CUNNINGHAM, Box 874, Mobile, Ala.

For exchange: mounted thin sections of whalebone, soapstone, serpentine, albite, feldspar, etc.; also opaque mounts of several very beautiful fossiliferous limestones.
Rev. E. A. PERRY, Quincy, Mass.

Fine injected specimens of kidney, tongue and liver, also very fine slides of human tooth, prepared according to the method of Dr. Bödecker, showing the protoplasmic net-work between the dentinal canaliculi, in exchange for first-class histological and pathological slides, or other good specimens.
J. L. WILLIAMS, North Vassalboro, Me.

Slides of hair of *Forantula*, very curious; also crystalline deposits from urine, to exchange for well-mounted slides. S. E. STILES, M. D.,
109 Cumberland St., Brooklyn, N. Y.

Well-mounted, typical Pathological and injected Histological preparations, in exchange for other well-mounted slides, Diatoms, Algæ and Fungi preferred.
HENRY FROEHLING,
59 N. Charles Street, Baltimore, Md.

Diatomaceæ from Lake Michigan (Chicago water supply), mounted or raw material; also diatoms from other localities, to exchange for well-mounted Diatomaceæ or other objects of interest. B. W. THOMAS,
1842 Indiana Ave., Chicago, Ills.

Lime sand, composed almost exclusively of microscopic Foraminifera, to exchange for microscopic material. H. A. GREEN, Atco, N. J.

I would like to have the address of some person who has access to an abundance of *Volvox globator*.
W. W. BUTTERFIELD, Indianapolis, Ind.

Polyzoa, Palates of Mollusca, Foraminifera, Sponge and Holothurian-Spicules, Synapta-Anchors, Chirodota-Wheels, Echinus-Spines, Minute Sea Shells, in exchange for Polyzoa, Foraminifera, Histological and Pathological preparations, *etc.* Also, a quantity of Sea Shells in exchange for Land and Fresh-Water Shells.
F. M. HAMLIN, M. D., Auburn, N. Y.

J. J. B. Hatfield, Arsenal Avenue, Indianapolis, Indiana, will exchange Bleached Plant-Sections for good Diatomaceous material. List furnished on application.

Pleurosigmas and other unmounted Diatoms, both Fresh Water and Marine; also Marine Algæ, Ferns, and a large quantity of miscellaneous microscopical material in exchange for good mounted objects.
M. A. BOOTH, Longmeadow, Mass.

To exchange, well-mounted Slides of Hair for mounted or unmounted specimens of hair from the rarer animals; lists exchanged. WM. HOSKINS,
208 S. Halsted street, Chicago, Ill.

Nicely mounted Slides (opaque) of the Coal-tar Derivatives, chemically prepared, crystalline in form, showing their beautiful colors, in exchange for other well-mounted material. Chemical name and formula attached to each Slide. About a dozen varieties on hand. F. L. BARDEEN, M.D.,
30½ Meigs street, Rochester, N.Y.

Slides mounted from injected Frog's Gall-bladder, Liver, Kidney, Stomach, Intestine and other parts, exchanged for other good and interesting preparations. C. BLASDALE, M. D.,
Jericho, Queens Co., N. Y.