JOURNAL

OF THE

ROYAL MICROSCOPICAL SOCIETY;

CONTAINING ITS TRANSACTIONS AND PROCEEDINGS,

AND A SUMMARY OF CURRENT RESEARCHES RELATING TO

ZOOLOGY AND BOTANY

(principally Invertebrata and Cryptogamia),

MICROSCOPY, &c.

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FELLOWS OF THE SOCIETY.

FOR THE YEAR

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MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

Practical Remarks on Microscope Construction.†—Dr. H. E. Hildebrand makes some practical remarks on Microscope construction :—

I. The Continental stand and its fine-adjustment. The author points out that in teaching establishments where as many as two hundred Microscopes may be used by a large number of pupils, the weak points of the stand are soon brought to light. There are certain parts of the Microscope which become injured with great regularity—viz. the micrometer-screw has become unsteady; the prism has suffered bending or rotation; the prism flange, or the hinge-block under the object-stage, have loosened their connection with the stage-plate. In this connection the author discusses the question as to where and how the Continental stand should be held in moving it from one place to another. The most convenient method, and the one consequently most often adopted by scholars, is to use the prism-socket as handle. The effect of this is to subject the micrometer-screw, the prism, as well as its fastening, to considerable pressure, torsion, bending, rotation, and displacement; and when once a defect is started it magnifies itself with astonishing rapidity. Although this method of manipulation must therefore be reckoned as faulty, yet it appears on the other side that it would be highly desirable that the prism-socket should be suitable as the handle to the instrument, not only in its position but also in its construction. To render this possible the socket should be rigidly connected with the object-stage, and the prism with the body-tube.

There are two ways by which this could be effected. One is to pass the spindle of the micrometer-screw through a boring in the prism and fix it at the bottom of the socket. The screw-head in the old position acts then on the prism, which is pressed upwards by a spring. This method, however, was rejected, since it appeared that there was not sufficient guarantee for the absolutely correct motion of the prism. The second way of attaining the object in view is to throw out from the socket connected with the object-stage a projecting piece over the upper end of the prism, and from this piece to control the ascending prism by means of the micrometer-screw. The projecting piece rises from the upper face of the socket with three arms *a a a*, passes through openings *o o o* in the part *p* of the tube-support which surrounds the upper part of the prism, and widens itself above the end of the prism into a round disc *s*, through the middle of which the micrometer-screw passes (figs. 1, 2, 3). The figures show how hinge-block, object-stage, and support, in which the prism-socket is screwed, are formed out of one piece of cast iron. A chamber at the lower end of the socket serves to receive the spiral spring for maintaining a central pressure on the

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Zeitschr. f. wiss. Mikr., xii. (1895) pp. 145-54.

prism. The arm of the tube-support for connection with the prism broadens itself into a thick round plate p, in the middle of which the

Fig. 1.

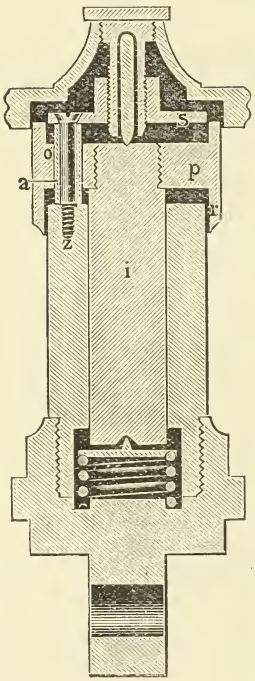
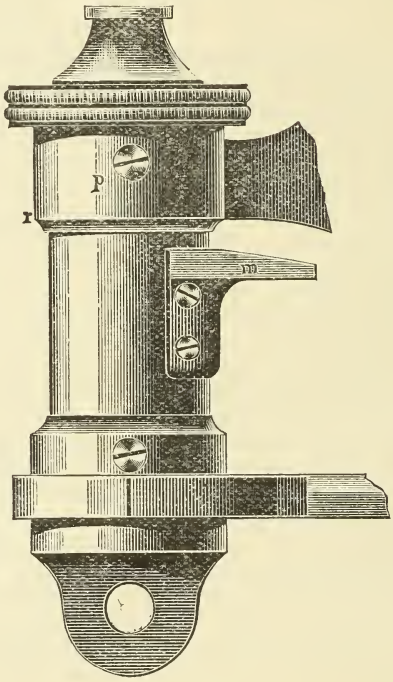
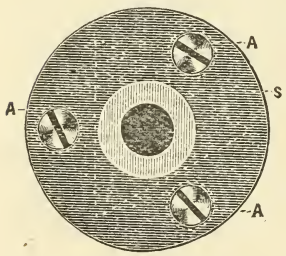


Fig. 2.



prism i is screwed, while a supporting ring r projects downwards over the prism-socket. The projecting piece from the socket consists of many parts. In the upper end of the socket three screw-holes (z; fig. 1) are made; over these are placed three hollow bolts $a\ a\ a$, which pass through the holes o of the plate p. Corresponding to the three holes in the socket are three holes in the plate s (figs. 1, 3), through which and the hollow bolts pass three screws, binding the parts into a single whole.

Fig. 3.



To give the fingers a firmer grasp of the socket in lifting the Microscope, and to protect the mechanism of the fine-adjustment from injury in the process, a projecting plate m is attached to the socket just beneath the tube-support.

II. The adjustment by sliding tube. This method of adjustment, the author thinks, has received but "stepmotherly" treatment at the hands

of the makers. Many instruments in which this mode of adjustment is used are faulty, either from the socket being somewhat oval, or from the lower opening being wider than the upper. The movement of the body-tube in the socket is also generally much too hard.

Fig. 4.

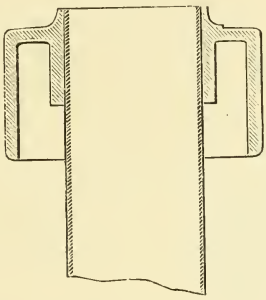
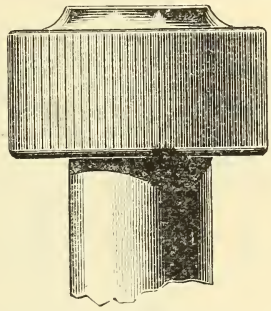
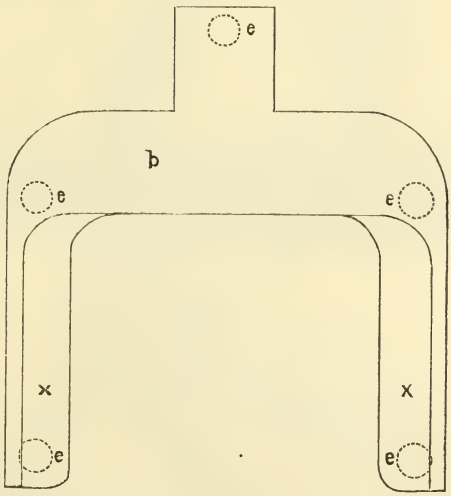


Fig. 5.



An improvement which the author has devised consists in replacing the ordinary small and thin ring for the manipulation of the body-tube by a much larger one. This (figs. 4 and 5) consists of a round disc, 2 in. in diameter, which is surrounded by a hoop, 1 in. broad, and

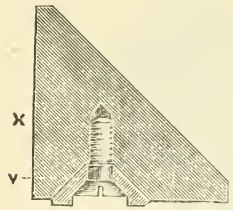
Fig. 6.



provided with a milled edge. By this device the movement of the body-tube is rendered much more smooth and certain, as the result of which the author has noted that with this modified tube much fewer cover-glasses are broken by beginners.

III. The horse-shoe foot. The author considers that in the Continental stands now made the horse-shoe foot is far too small. This defect is especially noticeable in the smaller models, which are very liable to be overturned by a comparatively slight shock. The space between the two arms of the horse-shoe is also not sufficiently wide for stable equilibrium. As a model for the correct shape of the foot, he points out the instrument which was constructed thirty-five years ago by Merz in Munich. The requirement that the boundary of the supporting surface shall be as far as possible from the vertical line from the centre of gravity, is sufficiently satisfied by the curvature of the horse-shoe being here replaced by an almost straight bar *b* (fig. 6), which, at a comparatively great distance from the column of the stand, throws out in front, on right and left, with a sudden turn, the two parallel three-sided prismatic arms *x x*.

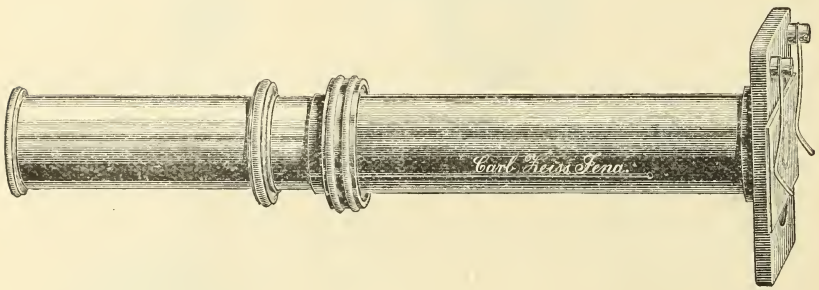
Fig. 7.



The foot is broader than long in about the proportion of 7 : 6. The width between the arms is nearly equal to the diameter of the object-stage. Five circular leather discs *c* of a half-inch diameter, distributed as shown in the figure, support the foot. These discs are screwed on to the foot, as seen in fig. 7.

Zeiss' Hand-Microscope.*—This instrument, shown in half full size in fig. 8, is intended for class demonstration. The sliding-tube, after

Fig. 8.

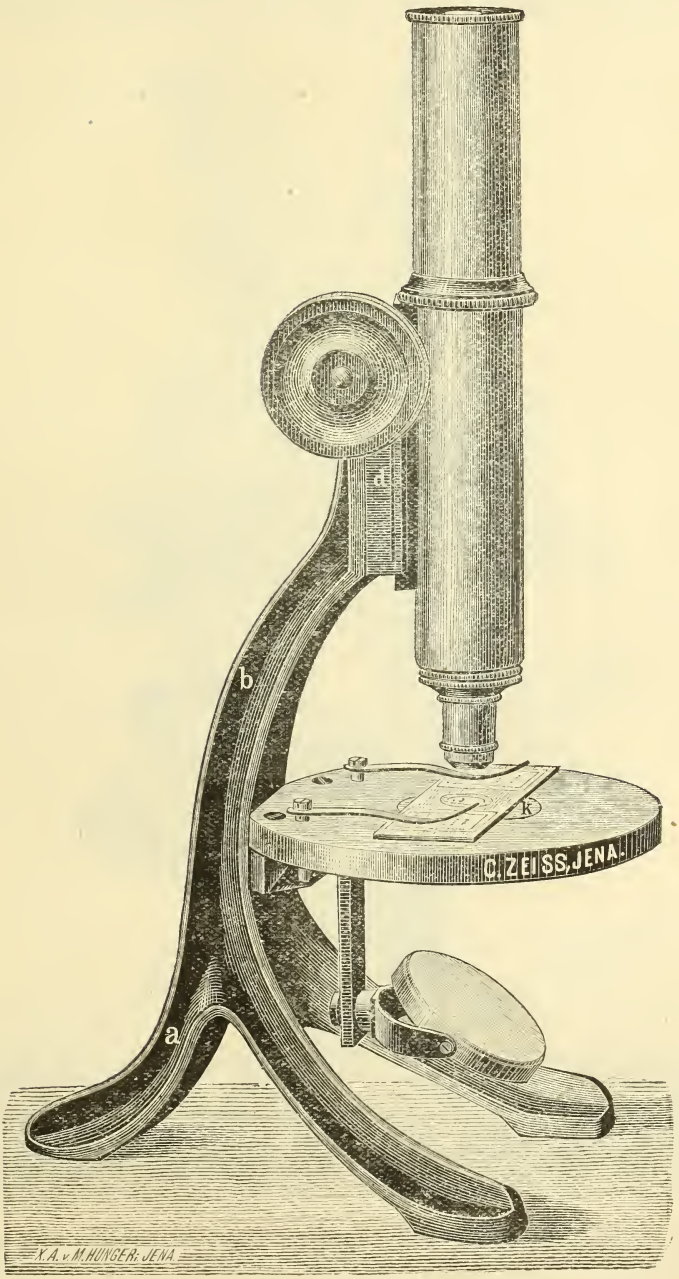


adjustment, can be securely fixed by a clamping ring. Fine-adjustment can be effected by altering the position of the eye-piece. In use it is directed towards the window or lamp.

Zeiss' Stand IX.†—This stand (fig. 9) is intended as a simple auxiliary stand for laboratory and technical purposes. It has a plain large stage of 100 mm. diameter, with large aperture, which can be decreased by dropping in a diaphragm. The adjustment is by rack and pinion, the construction of which admits of the use of medium powers.

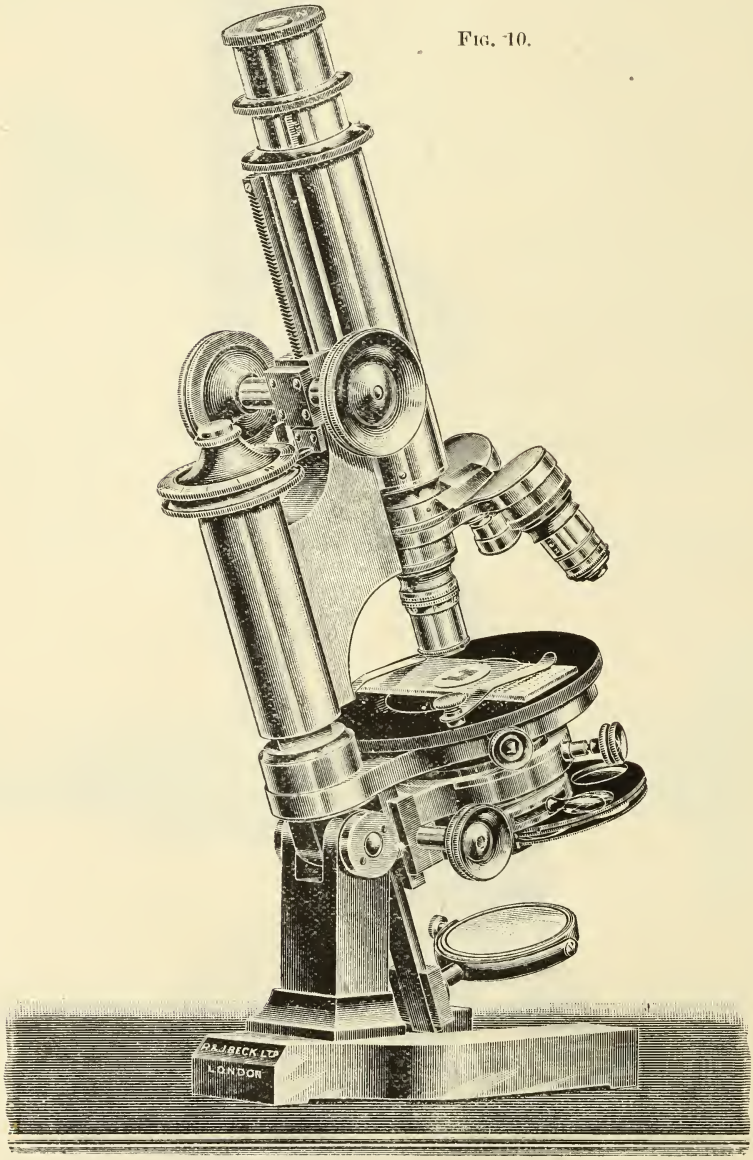
* Zeiss' Catalogue, No. 30, 1895, p. 56. † Op. cit., pp. 56–7.

Fig. 9.



Beck's Large "Continental Model" Microscopes.—Fig. 10 represents one of Messrs. Beck's large Continental model Microscopes

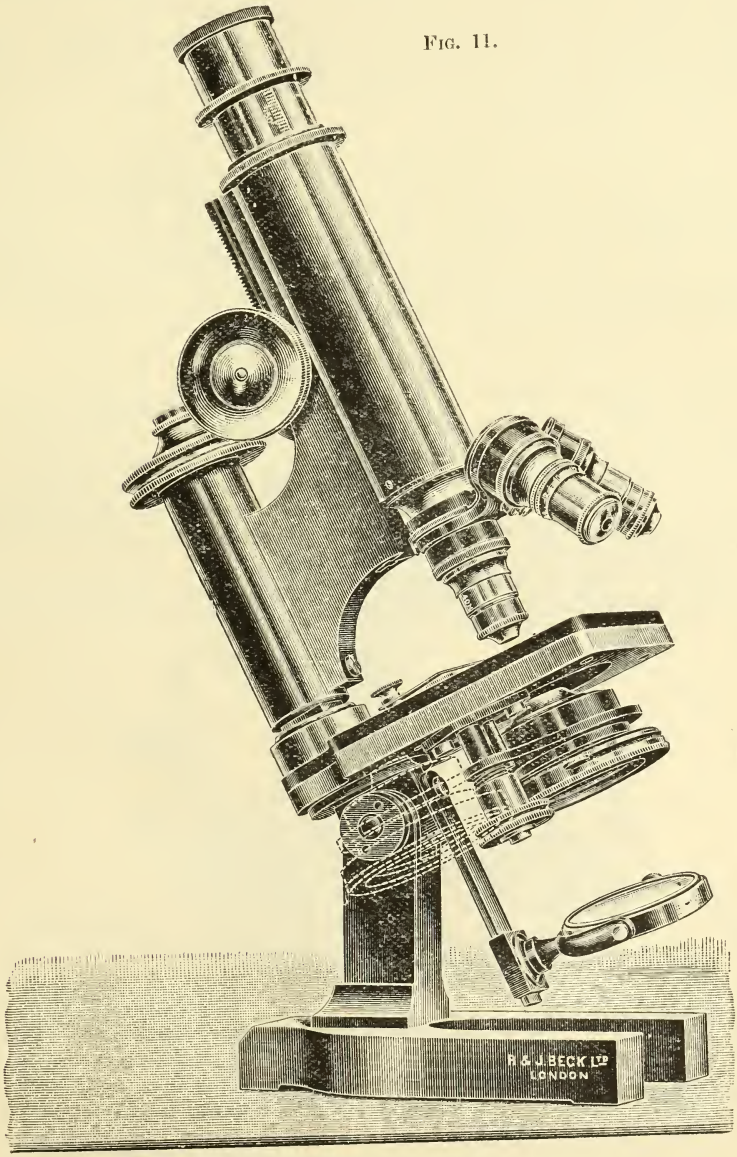
FIG. 10.



which is fitted with a circular rotating and screw centering stage, rack-and-pinion focusing and screw cent. ring substage. The coarse-adjust-

ment is by means of the usual rack and pinion of the spiral form, and the fine-adjustment, which is built perfectly solid, has been constructed

Fig. 11.



upon an entirely new principle, has little or no wearing points, is exceedingly delicate in its action, and is not liable to derangements. The

fine-adjustment milled head is divided, and has a pointer for recording the depth through which the focusing has been made. The draw-tube is graduated in the mm. scale, and shows exactly how much mechanical tube-length is in use (the tube-length being reckoned from the top of the draw-tube to the bottom of the nose-piece of the instrument). The base is perfectly solid, standing upon three flat points. The instrument being attached to a single pillar, allows plenty of room for working the substage adjustments.

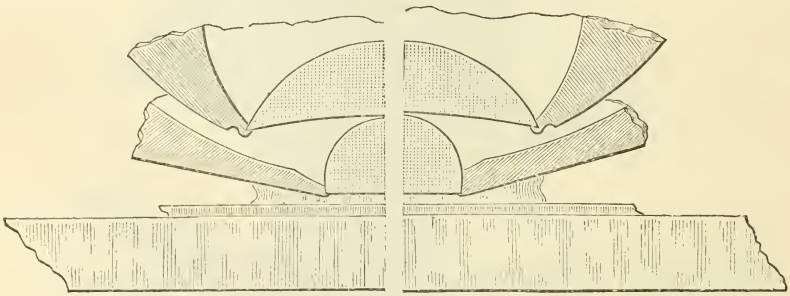
Fig. 11 represents another of Messrs. Beck's large Continental model Microscopes, but has different stage and substage adjustments. The large square stage is furnished with a vulcanite plate, and when the stage clips are removed, allows of a very large object or large culture plate being examined. The substage is arranged on a swinging arm, with a spiral focusing adjustment, and will carry any of the regular sized substage condensers. The construction of this instrument is almost identical with that of the other.

(2) Eye-pieces and Objectives.

Zeiss' Apochromatics.*—The well-known special characteristics of these objectives, which distinguish them from all other microscopic lenses, are: (1) the union of three different colours of the spectrum in one point of the axis, i.e. the elimination of the so-called secondary spectrum; and (2) the correction of spherical aberration for *two* different colours, in contradistinction to the usual correction for one colour only in the brightest part of the spectrum.

The apochromatic lens 2 mm. of 1·40 mm. aperture, owing to the hyper-hemispherical form of the front lens, which is supported by a very

Fig. 12.



narrow ridge at the edge of the setting, demands careful treatment. For this reason, although it possesses a greater resolving and defining power and gives a brighter image than the apochromatic 2 mm. of 1·30 aperture, for regular work preference should be given to the latter in which the front lens has a much firmer setting. In fig. 12 the left side

* Zeiss's Catalogue, No. 30, 1895, pp. 8–13.

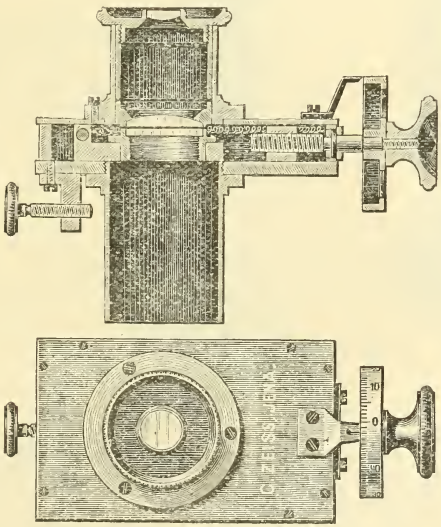
represents the apochromatic 2 mm. aperture 1·40, showing the front lens held by the lower ridge only; while the right side shows the apochromatic 2 mm. aperture 1·30 with the much wider setting.

As regards the durability of the apochromatic lenses, the firm state that all glasses used in their construction having been amply tested through several years' experience, offer a fair guarantee for their permanency, at any rate in temperate climates. In tropical climates their use is not advised. In damp or hot climates they should not be kept in closed receptacles, as they are liable to be affected by stagnant damp air.

The apochromatic 2·5 mm, aperture 1·60 (monobromide of naphthalene immersion) has hitherto been used successfully for the examination of Diatomaceæ only, since no mounting medium of sufficiently high refractive index, which can be used for other organisms without destroying their structure or colour, has yet been found.

Zeiss' Screw Micrometer Eye-piece.*—In this instrument for exact measurements, which is shown in sectional elevation and plan in fig. 13, the glass plate with crossed lines is moved across the field by means of the micrometer-screw. The instrument is provided either with a

Fig. 13.



Ramsden or with a compensating eye-piece, and is clamped to the upper end of the body-tube by means of the screw shown on the left side of the figure. Each division of the divided drum corresponds to 0·01 mm. of the objective image.

Zeiss' Eye-piece for Observing Axial Images.†—This eye-piece for axial images (fig. 14) consists of a Huyghenian eye-piece No. 2 with

* Zeiss' Catalogue, No. 30, 1895, pp. 74-5. † Op. cit., p. 86.

sliding eye-lens combined with a collective system consisting of two single lenses, the lower one of which may, by means of a sliding tube, be focused with respect to the upper focal plane of the objective.

Fig. 14.

Czapski's Ocular Iris-Diaphragm with Eye-piece.*—This apparatus, for the accurate examination of the axial images of small crystals, consists, as seen in fig. 15, of a small iris-diaphragm fitting in the upper

Fig. 15.

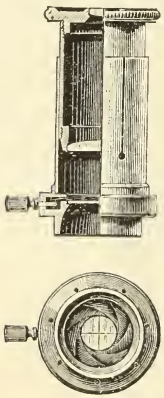
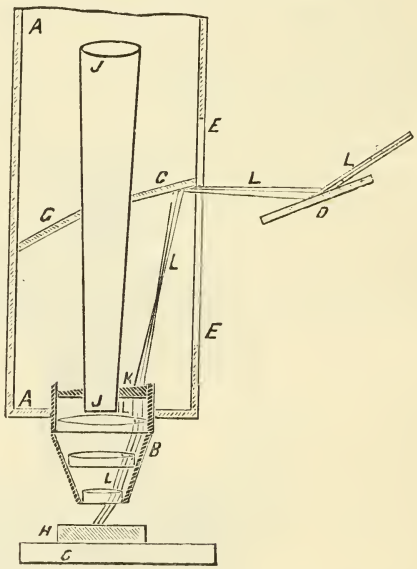


Fig. 16.



end of the tube, with a sleeve attached, in which slides a Ramsden eye-piece. In the figure, A shows the longitudinal section, and B the iris-diaphragm seen from above.

Microscope for Opaque Objects.†—M. C. Fremont describes the method of illumination which he uses for opaque objects under the Microscope. The method is somewhat similar to that adopted in the Zeiss vertical illuminator, but instead of the reflecting prism the author uses a mirror. The pencil of light L (fig. 16) reflected from the mirror D, passes through the opening E E into the body-tube A of the Microscope, where it meets the concave mirror C. This mirror is movable,

* Zeiss' Catalogue, No. 30, 1895, p. 87.
† Comptes Rendus, cxxi. (1895) pp. 321–3..

and can be raised or lowered so as to transmit the light through the lenses of the objective B. A prism K is interposed in order to render the pencil of light parallel to the axis of the Microscope before it enters the objective.

The mirror C and the prism K are pierced to allow of the passage of a conical tube J, through which the image of the preparation H formed by the objective is observed.

Fig. 17.

M. Marey, in reference to this new apparatus, considers that it might find useful application in the reproduction by chromophotography of the movements of microscopic creatures. With the ordinary illumination the objects detach themselves on a luminous field, and the successive photographs are taken on a movable plate. It would be preferable, with a dark field, to photograph successive images of the object on the same immovable plate; and the possibility of doing this for microscopic objects might be realised with M. Fremont's instrument.

(3) Illuminating and other Apparatus.

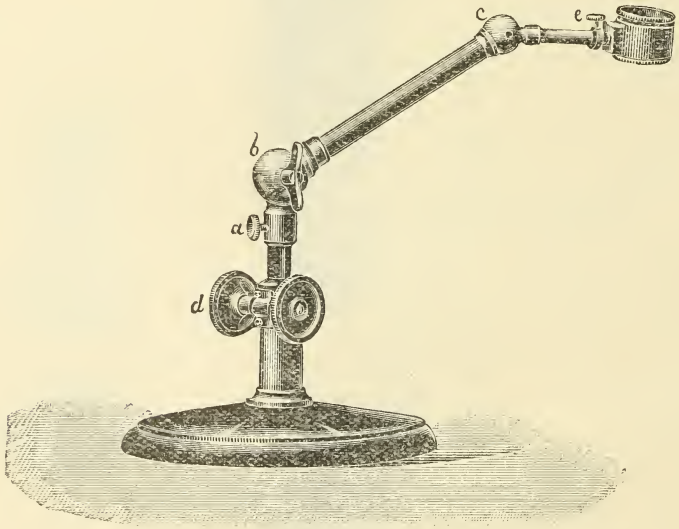
Zeiss' Vertical Illuminator.*—This serves to illuminate opaque objects from above. As seen in fig. 17, it is inserted in the form of an

* Zeiss' Catalogue, No. 30, 1895, p. 65.

adapter between the tube and the objective. Light entering through a lateral opening in the revolving sleeve R is reflected downwards by the prism P, which covers half of the aperture of the objective, and is concentrated upon the object by the objective. To obtain the proper incidence of the rays, the fitting carrying the prism is made to rotate about the optic axis. The prism P can within certain limits be inclined about an axis parallel to its edge by means of the milled head *k*.

Zeiss' new Lens-holder.*—Prof. A. Zimmermann has devised the new lens-holder shown in fig. 18. In its external form it is very similar to the older Zeiss model. An important feature which distinguishes it from this is that the whole upper part can be rotated about a vertical axis, and clamped in any position by the screw *a*. The displacement of

Fig. 18.



the lens in the vertical plane is effected as in the older model by means of two joints *b* and *c*. The second distinguishing feature of the new instrument is that both joints can be simultaneously arrested with *one* screw. Figs. 19 and 20 explain the method, devised by Herr M. Berger, by which this is effected. In these figures the two joints *b* and *c*, with the arm *f* between them, are shown in two positions at right angles.

The movement of the joints *b* and *c* will be so much more difficult the closer the joint-faces are pressed together. By means of the screw *g* such a pressure can be simultaneously applied to both joints. This is effected by means of the iron rod *h* in the tube *f*, one end of which is rigidly connected with the ball-joint *c*, while the other end has a conical hole, in which fits the conical end of the screw *g*. When the screw is screwed farther into the joint *b*, the rod *h* is displaced to the left, and the

* Zeitschr. f. Instrumentenk., xv. (1895) pp. 322-3.

two ball-joints pressed tightly against the corresponding sockets of the tube *f*. In order to prevent any rotation of the tube *f*, there is a screw *i* on the lower socket, which slides in the same groove of the ball-joint *b*,

Fig. 19.

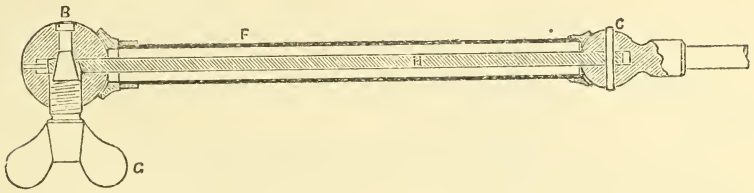
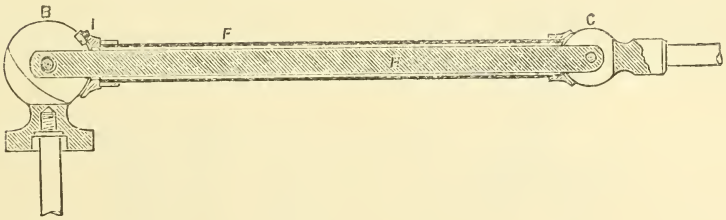


Fig. 20.



as the rod *h*. As regards the rest of the apparatus, the exact adjustment is effected by the rack and pinion at *d*, and the lens itself fits into a spring socket, and is fixed by means of the screw *e*.

Micropolariscope for Projection.*—Mr. F. C. Van Dyck describes the form of apparatus which he has used for projection work. The figure (fig. 21) shows the general arrangement, but does not indicate proportions.

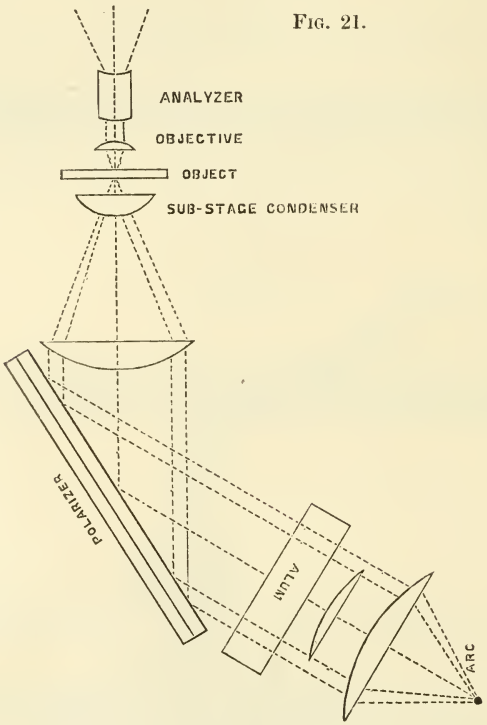
The light from an arc-lamp, in which an electro-magnet keeps the crater steadily directed towards the condenser, after passing through the pair of lenses constituting the condenser and through the alum-cell, falls in parallel rays upon the polariser. The parallel rays reflected from the polariser are converged by the second condenser-lens so as to come to a focus upon, or nearly upon, the object. A substage condenser is also sometimes necessary. As objective the author has used with good results a 7/8 bought of Queen and Co., and of higher powers a 1/2 of Tolles and a 1/4 of Bausch and Lomb. The analyser is a Nicol prism about 3/4 in. across the face.

As regards the alum-cell, the liquid was about 5/8 in. in thickness, and consisted of a mixture of equal volumes of cold saturated alum solution in water and strong glycerin. The polariser is made of twelve plates of as colourless a glass as possible. To prevent contact and formation

* Amer. Micr. Journ., xvi. (1895) pp. 154-6.

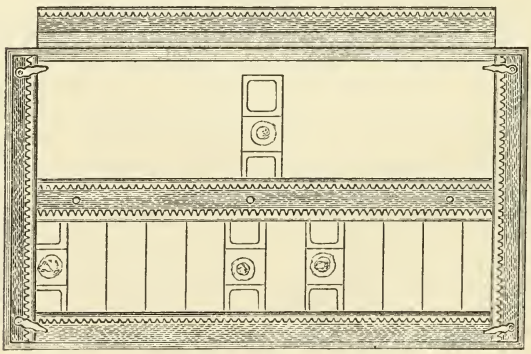
of mould between the plates, a narrow strip of paper soaked in a solution of corrosive sublimate in alcohol was pasted around the margin on one side of each plate.

Fig. 21.



New Case for Microscopical Preparations.*— In this new case, shown in fig. 22, the slides lie in two or three rows close together, and

Fig. 22.

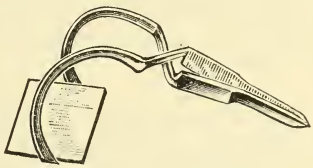


* Zeitschr. f. Angewandte Mikr., i. (1895) pp. 74-5.

are firmly clamped by hinged flaps on the sides or in the middle of the case, which are held down by two small clips.

New Clip for holding Cover-Glasses.*—Dr. Seiffert has devised a new clip for holding cover-glasses. As seen in fig. 23, the cover-glass is held on the sharp edges by the spring points of the clip, and is released by pressing on the handle. The curvature of the points is to allow the cover-glass to be immersed in the colouring solution in a dish, and to remain there while still held in the clip.

Fig. 23.



Microscopic Filter.†—Dr. P. W. Shimer has devised the apparatus shown in figs. 24 and 25 for concentrating upon a slide or cover-glass the suspended matter in measured amounts of water or urine. Fig. 24 shows the arrangement for a cover-glass, fig. 25 that for a slide. The filter-tube is a graduated tube, 5 in. long and 5/8 in. internal diameter, open and ground at both ends. The filter B, which has a perforation the size of the bore of the tube, and consists of thin blotting-paper

Fig. 24.

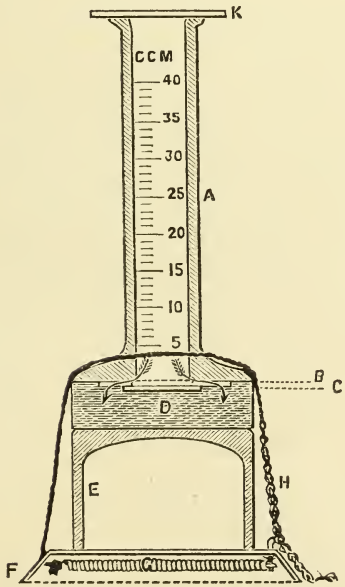
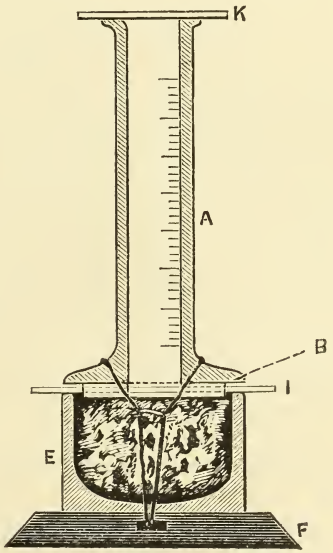


Fig. 25.



or manilla paper (when bacteria are to be collected), is saturated with water and made to adhere to the base of the tube, which is then pressed down over the cover-glass C (fig. 24) or slide I (fig. 25), by means of the spring G and chain H. In fig. 24, D is a pile of blotting-paper, which is

* Zeitschr. f. Ang. Mikr., i. (1895) p. 84. † Micr. Bull., xi. (1894) pp. 22-3.

replaced in fig. 25 by a sponge J; E is a porcelain vessel. The liquid is slowly drawn off in the direction of the arrows, leaving the suspended matter on the slide or cover-glass. The rate of filtration, which can be regulated by the pressure of the spring, and in some cases by pressure of air from an inflated rubber bag, must be so slow that no suspended matter is carried into the filter. For the larger organisms in water 20 ccm. should take three hours; for bacteria, 1 ccm. should take twenty-four hours, and for urine analysis, 2 to 20 ccm. should take from one to two hours.

(4) Photomicrography.

Some New Points in Photomicrography.*—Mr. W. H. Walmsley calls attention to a new form of camera which he has recently introduced under the name of the "Autograph." It was devised in order to remedy some defects in the instrument known as the "enlarging, reducing, and copying photomicrographic camera," which the author placed on the market early in 1882.

The base, or platform, of polished wood, 26 in. long, stands upon three very short feet, the front end being heavily weighted. At the other end of the platform is bolted a stout iron frame, 24 in. long, which carries the camera. The latter slides freely in parallel grooves, and can be fixed in any position by a binding screw which passes through a slot. By means of a joint at its base, the frame carrying the camera can be inclined and firmly held at any angle.

The camera-box is furnished with leather bellows extending to twelve inches, and is fitted with a reversible back, carrying both focusing screen and plate-holder. The ground glass of the focusing screen can be replaced by plate-glass when very fine adjustment is to be made. The plate-holder is double, and fitted with inside kits to carry $3\frac{1}{4}$ by $4\frac{1}{4}$, $2\frac{1}{2}$ by $2\frac{1}{2}$, or lantern plates, as well as the full size plate, 4 by 5.

For focusing when the Microscope is in the horizontal position, a short rod is attached to the base board on the right hand of the camera. It carries at one end a large milled head, and at the other a pulley-wheel with V-shaped groove in its periphery, a corresponding groove being also turned in the micrometer screw of the Microscope. This pulley wheel slides along the rod so that it can be placed in a line with the fine-adjustment screw, where it is firmly held by a screw. A fine cord passing round the two grooves effects the movement of the micrometer screw when the milled head is turned.

The platform is long enough to carry Microscope, lamp, and bull's-eye condensing lens.

As regards artificial illumination, the author considers that the new acetylene gas lamp is the ideal light for photomicrography.

Advances in Photomicrography.†—Herr G. Marktanner-Turneretscher gives an account of the advances which have been recently made in photomicrographical work. He draws attention to new and improved apparatus, and gives brief abstracts of the various papers on the subject recently published, most of which have been already noticed in this Journal.

* Amer. Micr. Journ., xvi. (1895) pp. 369–78.

† Eder's Jahrb. f. Photog. u. Reproductionstechnik, 1894 and 1895.

(5) Microscopical Optics and Manipulation.

Collar-Adjustment of the Objective as affected by a Change of Eye-pieces.*—Dr. A. C. Stokes remarks on the general ignorance amongst amateur Microscopists of the use of the collar-adjustment in the change of eye-pieces, and regrets that so little stress is laid on this point in the standard Microscopical text-books. He gives the following table to show the range of alterations for various eye-pieces and objectives. The object examined was *Pleurosigma angulatum* on the Thum test-plate (styrax), with concave mirror 30° from axis.

Eye-piece.	Tolles 4/10, 120°.	Zeiss 1/4, 144°.	B & L. 1/5, 130°.	Gundlach 1/5, 135°.	Spencer 1/5, 135°.	Spencer 1/5, 163°.
Bulloch's A, × 4½	0	17½	6½	8	8½	8
P. & L.'s Comp. A, × 5 ..	1	17	7	8	9	8
Griffith's B, × 7·6	11½	15	6½	8	8	7½
Zeiss' Comp. 8	10½	16	6	7½	7½	7
Bulloch's B, × 9	11	13	5	7½	8	7
Bulloch's C, × 12	11½	15	6½	8	8	7½
Tolles' solid 1/2, × 20 ..	11	13	5	7½	8	7
Zeiss' Comp. 27	10½	16	6	7½	7½	7

(6) Miscellaneous.

Modern Microscopy.†—The second edition of this capital little manual has been enlarged by about 80 pages, the new matter being pretty equally distributed between "Microscopy" and "Methods." To the former is appended a short chapter on the influence of diffraction on the resolving power of objectives, by Dr. Johnstone Stoney, F.R.S., and to the latter a list of tissues and organs with the most suitable fluids for hardening, staining, and mounting them—a useful feature; Mr. Hopewell Smith's process of preparing teeth, and Mr. Rousselet's method of preserving Rotifers. The favourable opinion expressed in this Journal on the first appearance of this work is fully justified by the present issue, and a beginner could not possess a more excellent and reliable guide. At the same time it may be as well to draw the author's attention to one or two blemishes which should be removed in future editions. Steinheil is spelt *Steinbeil*, and Kellner *Kelner* in both, and if fig. 6 ("un modèle de luxe") is a model of anything but misapplied ingenuity, the makers would probably supply a newer cliché with a more modern form of fine-adjustment.

Optics and Mechanics at the North German Commercial and Industrial Exhibition at Lubeck, 1895.‡—Dr. Max Ferenczy, in an article with the above heading, mentions amongst other exhibits those made by the firm of Zeiss. These included an exhibition of the methods in which the lenses for Microscopes and other optical instruments were prepared. The glass is first roughly shaped on a grindstone. On a

* Micr. Bull., xi. (1894) pp. 18-9.
† 'Modern Microscopy,' M. I. Cross and Martin Cole, London, 8vo, 182 pp.
‡ Central-Ztg. f. Optik u. Mechanik, xvi. (1895) pp. 238-9, 247-8, 257-9.

rotating grinding apparatus it is then given the spherical surface of determined radius, using emery of gradually increasing fineness. Then follows the polishing. To determine whether the lens has the correct form it is fitted in or on a normal concave or convex form of glass or rock-crystal, when any difference of surface is recognised by the production of Newton's rings.

β. Technique.*

(1) Collecting Objects, including Culture Processes.

Improvement in the Plate-Cultivation Method.†—Dr. Pfaffenholz recommends a platinum brush for smearing sputum, diphtheritic membrane, &c., on agar or gelatin plates. An important requirement of the stroke-method is a sufficiently firm consistence of the agar; this may be attained by adding the agar to the bouillon after the latter has been neutralised with soda.

Demonstrating the Presence of Bacillus coli communis in Water.‡—Dr. Th. Smith has for four years used the following method for detecting the presence of *B. coli communis* in water. A series, usually ten, of fermentation flasks is provided with 1 per cent. dextrose-bouillon and 0·1–1 ccm. of the water added. If, after three or four days, one or more of the flasks be found to contain 40–60 per cent. of gas in the closed tube, if the reaction be strongly acid, if the increase of the bacilli be slight and quite ended by the fourth day, the presence of *B. coli* may be regarded as certain. Such tubes almost always contain pure cultivations, as plate-cultures of the sediment will show. The isolation must, however, be made within the week, for the acid formed from the sugar soon kills the culture. If the water be very impure, it must be freely diluted on account of the great number of fermenting bacteria present; among these are *Proteus* and *B. cloacæ*, whose gas reaction is easily distinguished from that of *B coli*. *Lactis aerogenes* offers greater difficulties.

Method for Hermetically Sealing Cultures of Bacteria.§—Dr. C. F. Dawson seals cultures as follows. The end of the tube is flamed and trimmed down level with the mouth of the tube, on which is then placed a cover-glass of the same size as the mouth. A piece of sheet gelatin is next stretched over the mouth of the tube and temporarily fixed with a rubber band. After the gelatin has set, for of course it is applied warm, the band and edge of the gelatin are trimmed off close under the flange. The gelatin cover, which will be quite dry in about half an hour, is coated with shellac varnish made from the following formula:—Absolute alcohol 100 parts; white shellac 45 parts; balsam of copaiba 4 parts. Allow to stand for a fortnight and use the supernatant fluid.

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Hygien. Rundschau, 1895, No. 16. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 467.

‡ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 494–5.

§ Amer. Mon. Micr. Journ., xvi. (1895) pp. 322–4.

Sputum as a Nutrient Medium for Bacteria.*—Dr. W. Steffen regards sputum as a natural cultivation medium, especially for pneumococci, strepto- and staphylococci, and diphtheria bacilli. The sputa most suitable are the clear mucoid and pneumonic expectoration, and these may be added to other nutrient substances or prepared alone in test-tubes. Any coarse impurities are first removed and the sputum sterilised in the usual manner.

Qualitative Bacteriological Examination of Water.†—Herr van der Sleen made comparative researches on three kinds of water (marsh, river, and spring). Chemical examinations of the three varieties were carefully made from time to time. For the bacteriological analysis 1 ccm. of the marsh and spring water and 0·1 ccm. of the river-water were used and the rapidly liquefying colonies on gelatin were killed with a drop of glycerin and sublimate. Observations were made on the influence of temperature and the alkalinity of the medium. In all 400 bacteria and 77 species were described and photographed. The value of filtration was also tested by passing the impure water through a sand filter, and afterwards through an Anderson's purifier. No better results were obtained than by using the sand filter alone; the $KMnO_4$-figure was however lowered.

Besides the 77 species of Bacteria *Penicillium glaucum* and pink yeast were found. No cholera bacilli were detected, though a vibrio closely resembling cholera was sometimes present. Among the organisms repeatedly observed were *Proteus vulgaris* and *mirabilis; Bacillus coli, subtilis,* and *ramosus;* many putrefactive bacteria, e. g. *fluor., liquef., aureus, longus, tenuis, non-liquef., punctatus,* and *gasoformans.*

Bactericidal Action of Metals.‡—Attention is called to a paper by Dr. Meade Bolton on the effects of various metals on the growth of certain bacteria. This gentleman has tested the bactericidal effect of various metals. For the most part agar plates were used, and bits of metal were put on as soon as the agar was inoculated with the microorganism. In some cases the metals were absolutely pure; in some cases they were commercial but marked chemically pure; in one set brass foil was used, and a few preliminary experiments were made with impure metals. A notable result is that it is those metals that are resistant toward chemical reagents in general which fail to show any reaction, or do so only to a limited extent. On the other hand, the metals that are readily attacked by chemical reagents all exhibit a marked inhibitory action on the growth of the bacteria. The effect is, therefore, probably due to a solution of the metal in the medium, and putting bits of metal on the cultures is really equivalent to the addition of a small amount of that salt of the metal formed by the action of the nutrient medium.

* Inaug. Diss., Berlin, 1894. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 464.

† Haarlem, 1894. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) p. 465.

‡ Amer. Natural., xxix. (1895) pp. 933-6.

(2) Preparing Objects.

Investigation of Ova.*—Mr. M. D. Hill preserved certain quantities of ova, immediately after fertilisation, in a mixture of corrosive sublimate and acetic acid, at intervals of about five minutes, until the first cleavage plane made its appearance. This usually took place about 1½ hours after fertilisation, but the time varied greatly with the temperature of the surroundings. After being hardened in alcohol, the eggs were embedded in paraffin, cut into sections, and stained with Heidenhain's iron-hæmatoxylin.

Investigation of the Attractive Sphere.†—In his study of the attractive sphere of the interstitial tissue of the liver and gonad of *Paludina vivipara*, Dr. C. De Bruyne made exclusive use of Hertmann's fluid for fixing purposes. The longer the period of fixation, the better the results. Safranin was used as a colouring reagent.

Investigation of the Presence of Iron Compounds in Animal and Vegetable Cells.‡—Dr. A. B. Maccallum describes at some length his methods of study. In his first communication on the method of demonstrating micro-chemically the occurrence of "masked" iron, the reagent, whose use he described, was called in a general way ammonium sulphide. This is a term properly applicable only to the compound represented by the formula $(NH_4)_2S$, but is sometimes given to solutions which contain either ammonium hydrogen sulphide (NH_4SH), or to polysulphides of ammonium, or to mixtures of the $(NH_4)_2S$ and (NH_4SH). Further experiment has led the author to the conclusion that (NH_4SH) is more active than the di-ammonium salt, and that none of the polysulphides of ammonium have any action whatever on iron in its "masked" form. Information is given as to the best way of preparing the reagent, which should not be kept in stock. The tissues which were teased out for treatment were always hardened in alcohol wholly free from iron in solution. To facilitate the teasing out, Dr. Maccallum frequently used sections made with a clean steel knife covered with absolute alcohol. The conclusion is come to that ammonium hydrogen sulphide may be regarded as a reagent of very great value in the investigation of masked compounds of iron, and it must constitute the final test for this purpose whenever the accuracy of other reagents is called in question. To get the best results with the use of acid alcohols, the tissues must be well hardened. If the tissues are fresh, or imperfectly hardened, the application of acid alcohols for the time sets free the organic iron, but the structure of cellular elements is more or less changed by the acids. This change will not be found to occur when the tissues have been carefully hardened. Strong alcohol of 90 to 95 per cent. was found to be the best hardening reagent. It can, by redistillation, be made free from iron, and when it is of absolute strength it neither extracts any of the iron compounds (hæmatins excepted) from tissues, nor allows these to diffuse. The objections to all other hardening reagents than alcohol are pointed out.

* Quart. Journ. Micr. Sci., xxxviii. (1895) pp. 316 and 7.
† Bull. Acad. Belge, lxv. (1895) p. 242.
‡ Quart. Journ. Micr. Sci., xxxviii. (1895) pp. 179-205.

Preparing Bone Sections.*—Dr. M. Matschinsky, in his study of the matrix structure of bone, made his sections as follows:—A thin plate sawn off the bone is filed smooth on one side (watchmakers' files are recommended); the smooth side is glued to a stone or glass and the rough side smoothed; the translucent slice is taken off and rubbed between two pieces of ground glass with emery powder; then it is polished with the finest hone till the surface shines. All this—a familiar enough process—takes, he says, about 10–15 minutes.

The section is then placed in distilled water, then in 1 per cent. silver solution, and exposed to light. When a brown colour appears it is removed, washed in distilled water, dried in blotting-paper, and very carefully repolished. Another method is to leave the section in the silver solution in *complete* darkness for a couple of hours; in this case the impregnation is deeper.

Study of Reproductive Cells of Elasmobranchs.†—Mr. J. E. S. Moore, in his study of the spermatogenesis of Elasmobranchs, cut up the testes of various species into pieces about the size of half a cubic centimetre, and fixed them in various ways. The most successful preparations were obtained after the use of Flemming's strong solution, Hermann's fluid, osmic acid in various strengths, and corrosive sublimate, both with and without acetic acid. Valuable comparative material was obtained by treating the testes with glacial acetic acid and washing quickly in water, by teasing up the fresh material in acid carmine, by fixing in a 2 or 3 per cent. solution of formic aldehyde, by the use of Carnoy's fluid, and last, but not least, by a formic acid method which he hit upon quite by accident. This consisted in placing small fragments of the living testis in a 50 per cent. solution of formic aldehyde for a few seconds, and then transferring directly to 50 per cent. alcohol, after which they were treated for sectioning in paraffin, in the usual way. By this means the chromosomes were in some cases rendered admirably distinct, but the fixing, so far as the author has yet tried it, renders the material difficult to stain.

Investigation of Cerata of Dendronotus.‡—Mr. J. A. Clubb allowed specimens of *Dendronotus arborescens* to expand in a little sea-water, and then deluged them with sulpho-picric acid, which by a rotatory movement of the hand is made to whirl round in the vessel. This treatment has the effect of fixing Nudibranchs before they can retract. Even with the more delicate species of Eolidæ, which, with almost all other methods, break away the cerata from the body, this method is usually successful. The specimens are allowed to stand in this fluid, changed once or twice, for two or three hours, according to size. They are then transferred to gradually increasing percentages of alcohol, rising up to about 75 per cent.; they are afterwards stained *in toto* in picrocarmine, treated with acidulated alcohol, dehydrated, imbedded in paraffin in the usual way, and cut with the Cambridge "Rocking" microtome.

Preparing Flukes for Investigation.§—Mr. W. G. Maccallum describes a new method of preparing flukes for study. The worm should

* Arch. f. Mikr. Anat., xlvi. (1895) pp. 290–305 (1 pl.).
† Quart. Journ. Micr. Sci., xxxviii. (1895) pp. 276 and 7.
‡ Proc. and Trans. Liverpool Biol. Soc., ix. (1895) pp. 222–3.
§ Veterinary Mag., ii. (1895) No. 7, 10 pp., 8 figs.

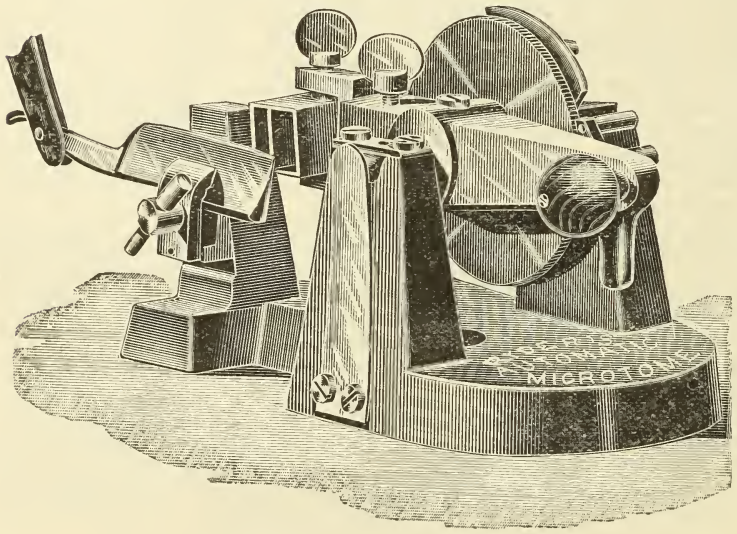
be killed in glacial acetic acid, and left in it for 5 to 10 minutes. It should be removed thence directly into aqueous alum cochineal or alum carmine solution for a half to one minute, then washed and mounted in water, the cover slip being ringed with Canada balsam or gold size. As may be supposed, however, these specimens are not very permanent, and become clouded on long standing.

Preparation of Flower-Buds.*—M. M. Raciborski recommends the following process for preparing flower-buds from herbarium specimens for microscopical examination. The specimen is steeped for some hours in alcohol; then for two or three hours in water, and finally for 24 hours in 50 per cent. ammonia at a temperature of about 40° C. After the ammonia has been removed by water, and then by alcohol and toluol, the object is imbedded in paraffin and fixed to the slide by white of egg. In flower-buds taken from specimens that had lain long in the herbarium, the position of the tapete-cells in the embryo-sac could frequently be made out, and even the nuclei of the pollen-grains could be detected.

(3) Cutting, including Imbedding and Microtomes.

Automatic Microtome.†—The late Prof. J. A. Ryder devised the new microtome shown in fig. 26 in order to facilitate the preparation of

Fig. 26.



sections for large classes, and also for the rapid preparation of series of sections in embryological work. It differs from the majority of auto-

* Flora, lxxxi. (1895) Ergänz.-Bd., pp. 152-3.
† Amer. Micr. Journ., xvi. (1895) pp. 216-20.

matic microtomes by being small and compact, and does not cut in an arc like the Cambridge Rocking Microtome.

The working parts are an oscillating lever, provided at one end with a clamp and at the other with a simple handle. This lever rests on trunnions supported in triangular notches at the top of the two pillars between which the lever oscillates. At the cutting end of the lever a spring pulls the lever down and effects the sectioning. The lever is adjusted for the successive sections by a hollow screw, through which passes the trunnion on the side away from the knife. This screw is fixed to a toothed wheel by the side of the lever. The toothed wheel and screw are actuated by a pawl fixed to the side of the lever near the handle. A fixed stop on the under side of the lever brings the lever to rest at a constant point in its downward course. An adjustable section throws the pawl out of gear after a given number of teeth have been turned through, so that it is possible to adjust the apparatus for cutting sections of any desired thickness. Sections can be cut from ·0025 mm. to ·0625 mm. in thickness.

(4) Staining and Injecting.

Subcutaneous Injections of Methylene-Blue.*—Herr S. Meyer has used this method for the demonstration of the elements of the central nervous system of Mammals. For the peripheral system, it is inferior to intravenous injection; but Herr Meyer obtained, for instance, an extremely distinct staining of Purkinje's cells in the cerebellar cortex. Success depends on two factors, the amount of stain which the animal will stand, and the length of time during which it can operate. Some of the results are striking, but the method seems cruel as the convulsions and agony tend to be prolonged.

Alizarine.†—Dr. B. Rawitz recommends alizarin and alizarine cyanine for the differentiation of cell and nucleus. As neither are stains in the strict sense, the sections must be first treated with corrosive fluids ("*Beizflüssigkeiten*"). The methods evidently require much care, and we must refer for details to the original paper.

Modified Use of Hæmatein.‡—Dr. B. Rawitz recommends the use of glycerin-alum-hæmatein solution in order to avoid over-staining with hæmatein or hæmatoxylin. The receipt for the mixture is given in Rawitz's 'Leitfaden für histiologische Untersuchungen,' 2nd edition. One to three drops of the concentrated solution are added to 25–50 ccm. of distilled water, and the objects are left there for 24–48 hours. Over-staining never occurs.

Flagella Staining.§—Dr. Pitfield recommends the following solution for staining flagella. The solution is made in two parts, which are filtered and mixed when required for use.

(A) Saturated solution of alum, 10 ccm.; saturated alcoholic solution of gentian violet, 1 ccm.

(B) Tannic acid, 1 grm.; H_2O, 10 ccm.

Both solutions are to be made with cold water.

* Arch. f. Mikr. Anat., xlvi. (1895) pp. 282–90 (1 pl.).
† Anat. Anzeig., xi. (1895) pp. 294–300. ‡ Tom. cit., pp. 301–3.
§ Medical News, lxvii. (1895) p. 268.

(5) Mounting, including Slides, Preservative Fluids, &c.

Fixatives.*—Dr. O. vom Rath recommends six fixatives. The first is picric-osmio-acetic acid:—1000 ccm. saturated filtered solution of picric acid in distilled water, 1 grm. crystallised osmic acid, and 4 ccm. acetic acid. The second is picric-osmio-platinum chloride-acetic acid :—200 ccm. concentrated aqueous solution of picric acid, 25 ccm. 2 per cent. aqueous osmic acid, 1 grm. platinum chloride dissolved in 10 ccm. water, and 2 ccm. glacial acetic acid. After this fixative the objects are to be treated with wood-vinegar, or 20 per cent. tannin solution, and with gradations of alcohol. Thirdly, vom Rath recommends picric-platinum chloride-acetic acid for cells with much fat, yolk, or similar contents :—200 ccm. saturated aqueous solution of picric acid, 1 grm. platinum chloride in 10 ccm. distilled water, and 2 ccm. glacial acetic acid. The fourth mixture is picro-corrosive-acetic acid ; the fifth picro-corrosive osmic acid or picro-corrosive-osmio-acetic acid. For collecting, when picric acid is apt to get spilt on hands and clothes, the author recommends the following:—200 ccm. absolute alcohol, 1 grm. corrosive sublimate, 2 ccm. glacial acetic acid.

Canada Balsam.†—According to Herr G. Marpmann, Canada balsam is frequently adulterated with other resinous substances, the mixture often being quite useless for microscopical purposes on account of its drying too slowly, becoming cloudy or crystalline. Pure Canada balsam is a bright yellow, clear, slightly opalescent substance, soluble in chloroform and xylol ; forming cloudy solutions with alcohol, acetone, and benzine, because a part remains undissolved. When dry it forms a perfectly transparent hard layer, and does not become cloudy or crystalline.

The author then goes through, in considerable detail, numerous tests for detecting impurities in and adulterations of Canada balsam. These tests are far too numerous to mention, but the method seems, though tedious, easy, and for those requiring a perfectly pure and trustworthy mounting medium, useful.

Mounting Marine Animals as Transparent Lantern Slides.‡—Dr. H. C. Sorby finds that the methods which give good results vary much in the case of different animals. Some must be arranged on the glass and dried quickly soon after having been caught, whereas others, such as jelly-fishes, must be treated over and over again with moderately strong alcohol to dissolve out all the salts. In some cases various staining materials must be used to bring out the structure, and some should be decalcified. Usually the animals are killed by keeping them for a short time in diluted alcohol, and then arranged on the glass after as much of the alcohol as will drain out is lost. They are dried in a current of air. In some cases they must be thoroughly soaked with clear gum before becoming quite dry. Finally, when quite dry, they are mounted in Canada balsam, and the edges of the cover-glass very completely bound round.

* Anat. Anzeig., xi. (1895) pp. 280–8.
† Zeitschr. f. Angewandte Mikr., i. (1895) pp. 8–11, 38–46.
‡ Rep. Brit. Ass., 1895, p. 730.

MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

Microscopes and their most important Accessories for Crystallographic and Petrographical Investigations.†—Herr C. Leiss gives a full descriptive account of the various Microscopes and accessories for crystallographic and petrographical purposes which have been supplied by the firm of Fuess, of Berlin.

Among the instruments which have not already been described and figured in this Journal are the following:—

Small model (IV. and V.), shown in fig. 27. The stand is of the tripod form. The rack-and-pinion adjustment is sufficiently delicate for the use of fairly high objectives, such as Nos. 7 and 9. At the lower end of the body-tubes are the screws *c* for centering the objective. The latter is not screwed on, but is held by a spring clamp *k* in a short conical adapter. Immediately above the clamp *k* at K is a slit for the reception of the Biot-Klein quartz-plate, gypsum, and mica plates, &c. In the lower part of the body-tube is the opening for the analysing prism N of the Glan-Thomson construction, which gives the greatest field of view. Another slit at B serves to receive the Bertrand lens. The draw-tube R is provided with a projecting ring, which carries the index for the divided circle of the auxiliary analyser A used for stauroscopic measurements, &c. The ocular lens of the Huyghens eye-piece is held in a movable socket, so that each observer can adjust on the cross-wires. For the observation of axial images, in connection with the Bertrand lens a Ramsden eye-piece is provided which is furnished with a glass micrometer.

The rotating stage is divided in degrees, and carries a vernier reading to 5 minutes. On its upper surface are two rectangular divisions.

Under the stage, attached to the stand is the socket H, which is adjustable by rack and pinion, and carries the polarising nicol. Above the polariser is screwed a condensing lens. For the interchange of parallel and convergent light there is a special arrangement for the rapid insertion and removal of the hemispherical lens for convergent light. In the hollow space between the base-plate of the stage and its upper plate is a small plate, from which projects an arm terminating in a ring which holds the hemispherical lens. When the polariser with its weak condensing lens is raised, it catches up the hemispherical lens and raises it with it up to the plane of the object-stage. When the polariser is lowered, the hemispherical lens follows its movement until it reaches the ring of the movable arm, when it can be moved aside out of the axis of the Microscope.

The larger models (I.–III.) have been described in this Journal, 1886, p. 843; 1891, p. 393; and 1892, p. 665.

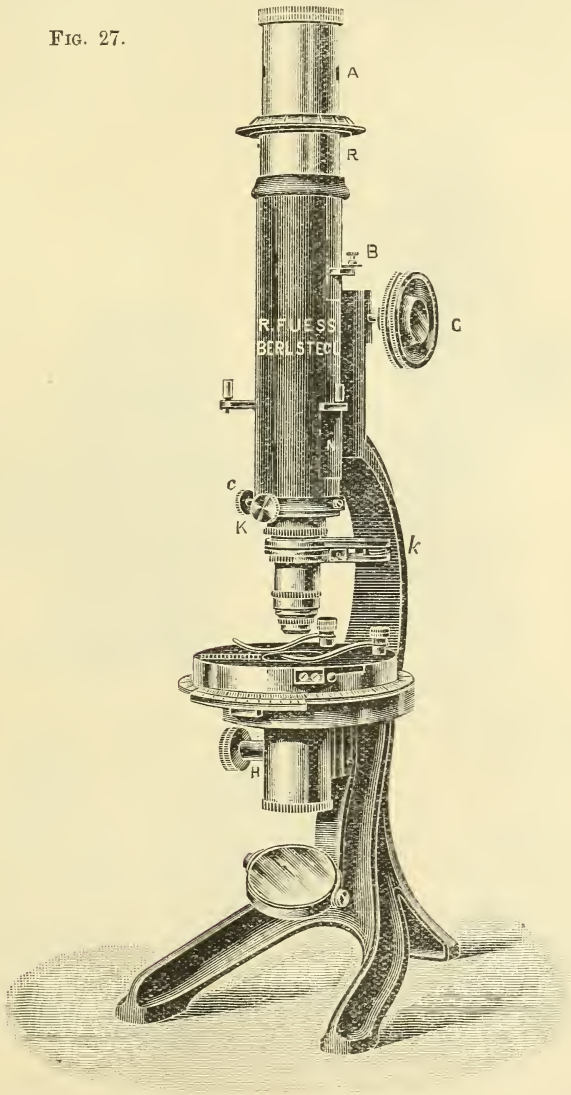
Improvements which have been recently introduced are an arrangement for rotating the inner nicol, and the insertion of an iris-diaphragm

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Zeitschr. f. Angewandte Mikroskopie, i. (1895) pp. 97–109, 129–38, 193–206.

beneath the Bertrand lens. The rotation of the nicol is effected by the head *d* (fig. 28), and the angle is read off on the divided quadrant T. The two principal positions (0° and 90°) are marked by stops.

Fig. 27.



Accessory Apparatus.—Of especial importance in mineralogical investigations for the determination of differences of refraction in rock constituents is the iris-diaphragm. Fig. 29 shows how the iris-diaphragm beneath the stage is connected with the holder of the polariser.

Its position is between the Nicol's prism and the lower lens of the condensing system which is attached to the polariser. For the observation of objects in light of definite wave-length, the Rollet spectropolariser as modified by Dippel and Abbe (fig. 30) is serviceable. It is connected with the Microscope by the insertion of the tube R in the socket of the polariser. The light reflected from the mirror *s* passes through the polarising nicol P*o* to the movable slit, and thence through the collimator C and the prism combination P P to the objective O, which

Fig. 28.

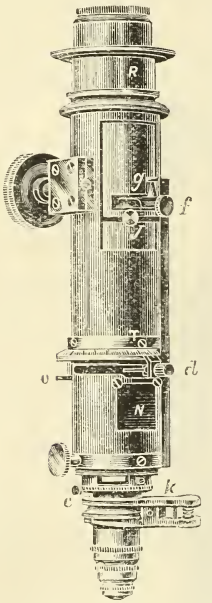
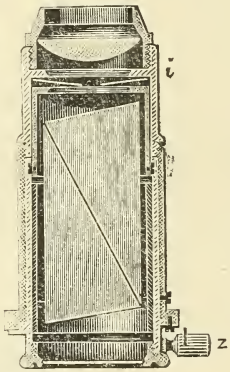


Fig. 29.



projects a spectrum upon the object to be examined. By reflection on a prism face, a scale of wave-length is projected, together with the spectrum, in the plane of the image. The scale is illuminated by the mirror *s pl.*

The screws *s* and *s'* serve to adjust the prisms so as to bring corresponding positions of the spectrum and scale into coincidence. To bring definite parts of the spectrum in the middle of the field, the objective O can be displaced by the slide *u.*

For the observation of minerals with wide axial angle Fuess prepares a special condenser and objective system (immersion), whose lenses are cut out of strongly refracting flint glass.

Of axial angle apparatus which can be attached to the Microscope-stage there are several varieties.

In the apparatus shown in fig. 31, for the measurement of the axial angle in very small plates, the principle of Adams is used; in larger plates or crystals the usual medium of immersion is a strongly refractive liquid.

On a base-plate which is clamped to the stage by the binding-screw M rises the stand S with the divided circle T, which is provided with a vernier reading to 5 minutes. The rod carrying the glass hemispheres of the Adams apparatus, between which the crystal plate is laid, can be rotated by the arc D for the adjustment of the plane of the optic axes.

Fig. 30.

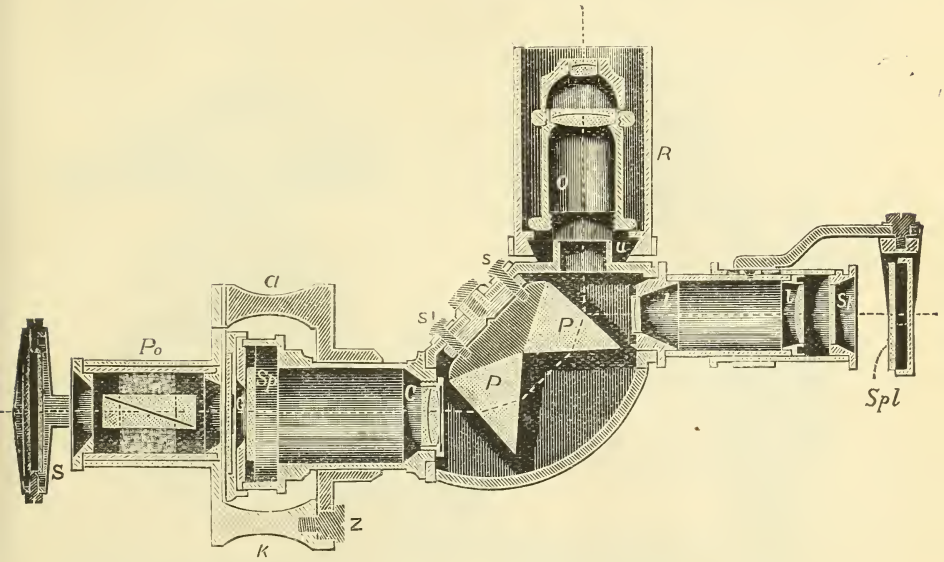


Fig. 31.

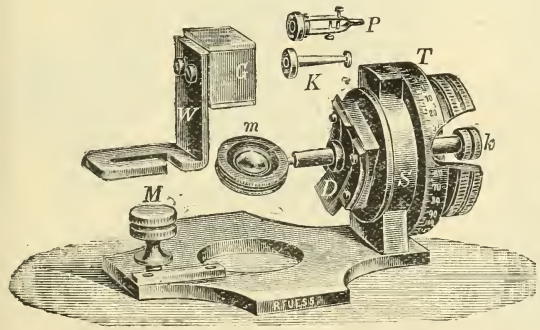
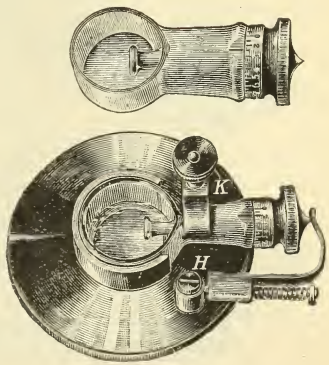


Fig. 32.



The two hemispheres can be removed when desired, and replaced by the crystal-holder P or K. For axial measurements in liquids, the vessel G is used. This is attached to the angle-plate W, which is clamped to the base-plate by the screw M.

The simple apparatus devised by C. Klein for the optical examination

of crystals in media having approximately the same refractive index as the mean refractive index of the crystal is shown in fig. 32.

The rotating pin carrying the crystal projects into the cylindrical vessel containing the immersion liquid. The pin is steadied by the spring H, and the glass apparatus is firmly held to the circular base-plate by the clamp K.

Fig. 33.

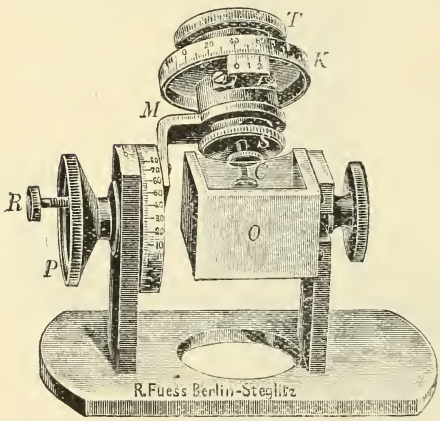


Fig. 34.

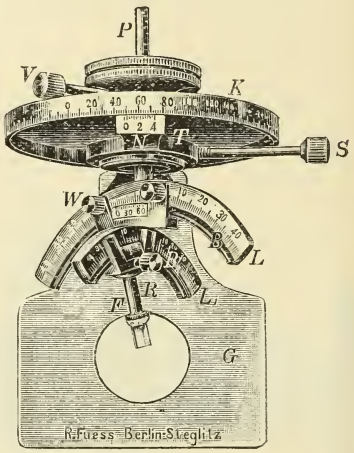


Fig. 35.

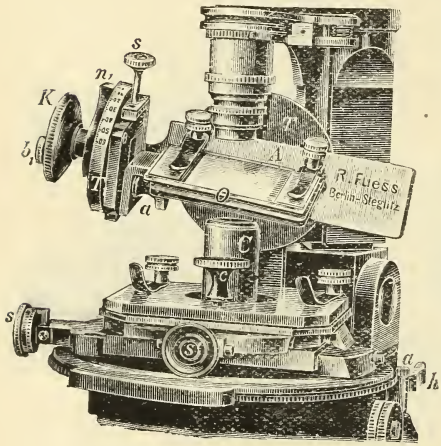
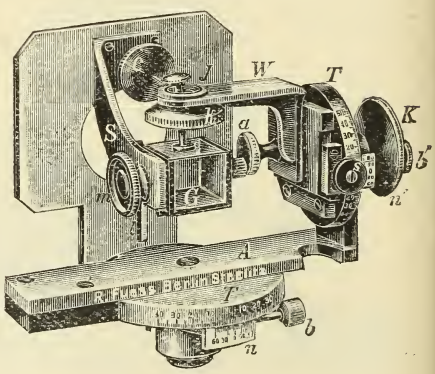


Fig. 36.



In fig. 33 is shown a more complete apparatus, in which two rotations at right angles can be given to the crystal. For this apparatus the Microscope must be in the horixontal position. The divided circle M is rotated by the head P and is fixed by the screw R. The movable axis carries the divided circle K and the object-holder C.

Klein's large universal apparatus (fig. 34) serves not only to determine the extinctions of the different faces of a zone and to ascertain the directions of the optic axes, but also to measure the axial angle. The Microscope is placed in the horizontal position. At right angles to the base-plate G rises the holder T, with the divided circle K, which is fixed by the screw S. The rod P can be displaced in the direction of the axis and fixed by the screw V. The lower end of the rod P carries the two arcs L and L_1 for the adjustment of the crystal.

Fedorow's universal stage for observation in parallel polarised light (Type I.), as made by Fuess, is represented with the neighbouring parts of the Microscope in fig. 35.

The base-plate of the apparatus carries an upright with the axis of the divided circle T. On the inner surface of this the plate A is fastened; at right angles to this rests the support for the movable axis of the divided circle T, at right angles to the first. On the side of this turned

Fig. 37.

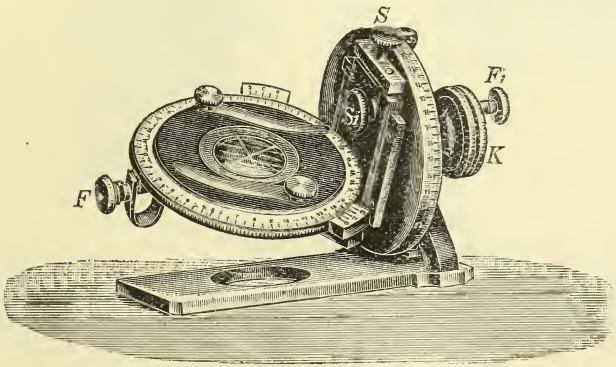
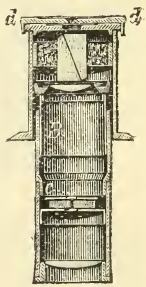


Fig. 38.



towards the Microscope is the sliding-piece, adjustable by the screw *s*, which carries the object-stage O.

For investigations in strongly refracting liquids the apparatus has the arrangement shown in fig. 36. In place of the object-stage O the holder W is attached by the screw *a*. The vessel containing the liquid is carried by the support S. When filled it can be brought into position from below and clamped by the screw *m*.

Fedorow's universal stage (Type II.) is shown in fig. 37. From a base-plate which can be firmly clamped to the stage rises the upright carrying the vertical divided circle. On the inner surface of this is attached the sliding-piece (as in Type I.) which supports the holder of the horizontal circle.

Of special eye-pieces, the one shown in fig. 38 is provided with a Calderon calcite plate or the Bertrand quartz plate, and is used for the determination of the directions of extinction in weakly doubly refracting substances. In order to enable the observer to look exactly at right angles to the stauroscopic plate, a diaphragm *d* is placed over the

analyser, and the field of view is correspondingly limited by the diaphragm *c*.

For exact microscopic measurements in the field of view such as cannot be effected by the ordinary glass micrometer, a screw eye-piece micrometer is used. It is particularly adapted for the measurement of the apparent separation of the optic axes. It consists of a long four-sided box, in which, by means of a micrometer-screw and counter spring, moves a slide A, in the central opening of which is a diaphragm, across which at an angle of 30° two spider webs are stretched.

Fig. 39.

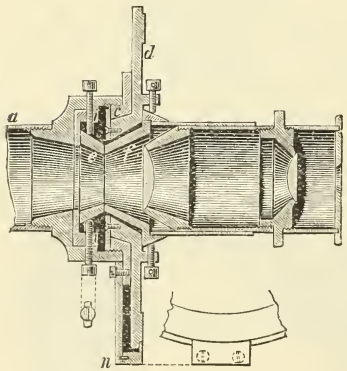
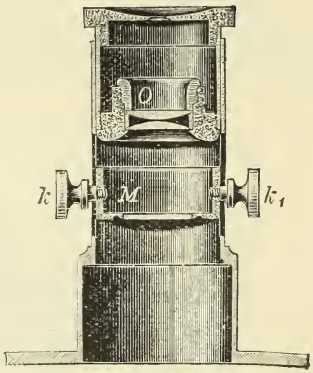
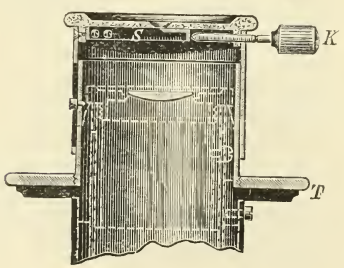


Fig. 40.



The eye-piece goniometer, seen in fig. 39, serves for the measurement of plane angles. The tube *a*, which fits into the body-tube of the Microscope, carries in its upper part the diaphragm *e*, which is held by four screws *i*. Over this is drawn a thread passing exactly through the axis. With the circle *d* divided in half-degrees is connected the Ramsden eye-piece with the diaphragm *f*. The latter is approached as near as possible to the diaphragm *e*, and also carries a thread centered exactly in the axis.

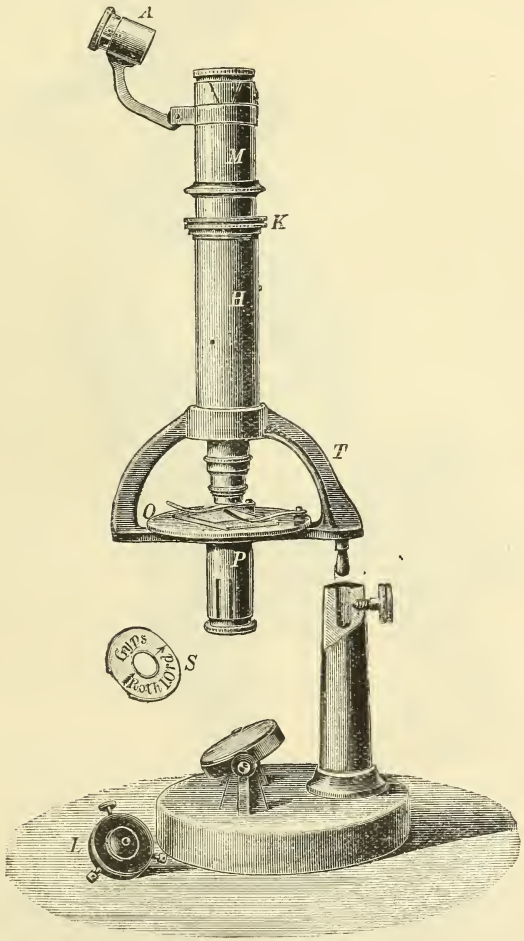
Fig. 41.



In fig. 40 is shown the measuring apparatus of Becke for use when the axial images are observed by Klein's method of placing a lens above the Czapski eye-piece. In a tube fitted over the Czapski eye-piece is the aplanatic lens O. Under this is the micrometer-scale M, which can be adjusted in the direction of the axis by the two milled heads *k* and *k'*. For the observation and measurement of the axial image, the Klein's lens is placed above the Ramsden eye-piece, adjustment is made with the objective O, and the micrometer M is raised or lowered so as to coincide in position with the image formed by the Ramsden eye-piece.

Exner's micro-refractometer (fig. 41) serves for the determination of the difference of refraction of two strongly refracting substances in a rock-section. The apparatus is brought over the end of the body-tube T in the position of the analyser.

Fig. 42.



An instrument suitable for instruction on the optical properties of rocks and minerals is the demonstration Microscope shown in fig. 42. The body-tube M slides in the socket H, and can be clamped by the ring K. The analysing nicol A is movable about a hinge, and can be rotated in its socket, which is provided with a division. Gypsum and mica plates can be inserted between it and the eye-piece. Above the

polariser is a condensing system of two lenses, the upper of which can be removed for observation in parallel light. For observation of the axial

FIG. 43.

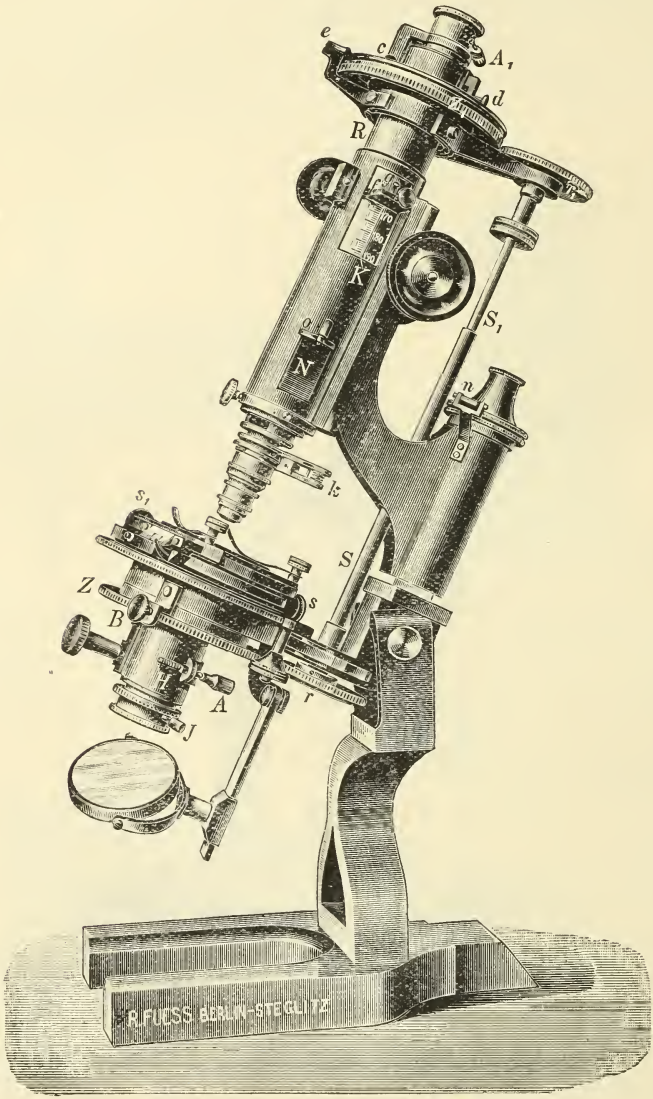


image with magnification, the Klein's lens L is attached to the analyser by the three screws.

The Fuess Microscope, in which the Dick principle for the simul-

taneous rotation of the two nicols has been adopted, has already been described in this Journal, 1892, p. 668. In its latest most perfect form it is represented in fig. 43. This model is provided with a rotating stage and centering arrangement for the objective.

In another model, having the same form and size, the stage is fixed. Fuess also supplies a cheap instrument, non-inclinable, and without fine-adjustment, but having the same arrangement for the simultaneous rotation of the nicols.

(2) Eye-pieces and Objectives.

A Modern Microscopic Objective.*—Mr. H. Orford looks upon the Abbe diffraction theory as one of the "untenable theories" which were advanced "years back, when the instrument was known only to a few scientists." He is willing to admit, however, one good effect which has resulted from it, viz. that it has settled for ever striving after useless magnifying power in objectives with small apertures, and has led opticians to construct lower powers of large aperture. He endeavours to demonstrate the benefit derived from the larger aperture by reference to the pinhole experiment of Lord Rayleigh, which consists in looking at a piece of fine wire gauze through a small and a large pinhole in a black card. If the gauze be gradually removed until the meshes can be no longer seen through the small pinhole, they will again become visible on looking through the large pinhole. That this result is not merely due to the greater intensity of the light is shown by another experiment, which consists in looking at the gauze through two scratches (one vertical and the other horizontal), about 1/16 in. long, on a piece of blackened glass. The gauze is held so that the wires are horizontal and vertical to the scratches on the glass, when at a certain distance it will be found that the vertical scratch will only show the horizontal wires, and the horizontal scratch only the vertical wires.

The result of the author's experience as a manufacturer of lenses of some years' standing is that a Microscope objective should have large aperture, but that aperture is worse than useless unless it is properly corrected.

Abbe's Spectroscopic Eye-piece.†—This instrument (figs. 44 and 45) is specially constructed for the examination of absorption-spectra of microscopic objects. The achromatic upper lens is adjustable so as to focus on the slit between the lenses. The mechanism is actuated by a screw, so as to effect the symmetrical contraction and expansion of the slit. The screw H serves to limit the length of the slit, so that the image of the object may completely fill it when the comparison-prism is inserted.

Above the eye-piece is placed an Amici prism of great depression which may be turned aside about the pivot *k*, so as to allow of the adjustment of the object being controlled, the prism being retained in its axial position by the spring catch L. A scale of wave-lengths is projected on the spectrum by means of a scale-tube and mirror attached

* Journ. New York Micr. Soc., xi. (1895) pp. 106–10.
† Zeiss' Catalogue, No. 30, 1895, pp. 88–9.

to the prism-casing. The screw P serves to adjust the scale with respect to the spectrum.

The instrument is inserted in the tube in place of the ordinary eye-piece, and is clamped by the screw M in such a position that the mirrors

Fig. 44.

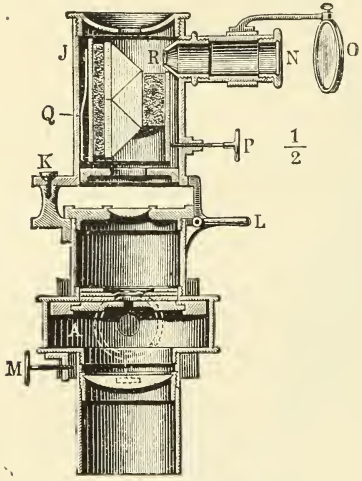
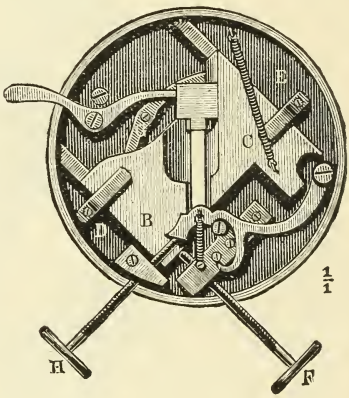


Fig. 45.



A and O, which respectively serve to illuminate the comparison-prism and the scale, are simultaneously illuminated by sunlight.

Determination of the Focal Length of Objectives.*—M. P. Francotte regrets that opticians do not mark their objectives with their focal lengths instead of by letters or by arbitrary numbers. He finds that with a tube-length of 160 mm., using the compensating eye-piece 4 of Zeiss, the value of one division of a micrometer eye-piece in which 1 mm. is divided into 100 parts, is equal in microns to the number which expresses the focal length of any objective used. For any other eye-piece the same result follows by varying the tube-length. Thus, if the length of the tube be fixed once for all for any eye-piece, in order to find the focal length of an objective, it is sufficient to determine with the aid of the objective and an objective micrometer the value of one division of the eye-piece micrometer; the number of μ obtained is then the same as that which expresses in millimetres the focal length sought.

Eye-piece with Iris-Diaphragm.†—Dr. O. Zacharias calls attention to a new eye-piece recently brought out by Zeiss, which has proved very serviceable in biological work.‡

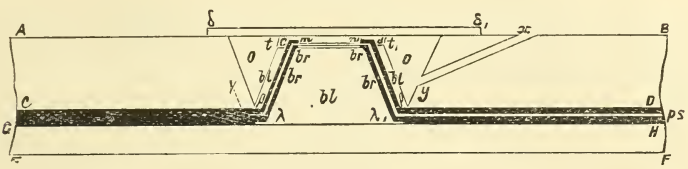
* Bull. Soc. Belge de Microscopie, xxi. (1894–5) pp. 208–15.
† Biol. Centralbl., xvi. (1896) pp. 30–1.
‡ See this Journal, *ante*, p. 120.

(3) Illuminating and other Apparatus.

Apparatus for Electrolysis under the Microscope.*—Dr. W. Kaiser describes the apparatus which he uses for electrolysis and for electro-physiological experiments with infusoria and bacteria under the Microscope.

The apparatus is represented in section and plan in figs. 46 and 47. In fig. 46, E F G H is an ordinary slide, on which is cemented by Canada

Fig. 46.

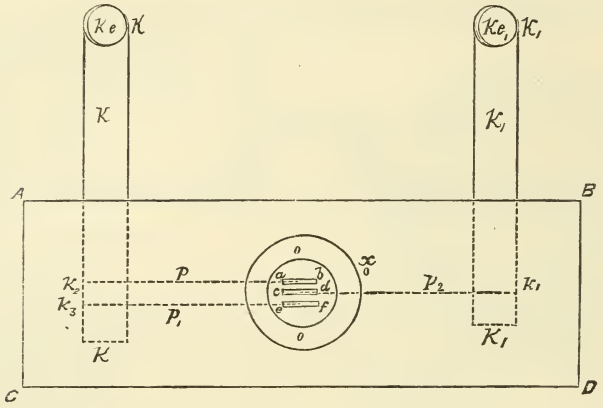


balsam the conical glass block *bl*. This block is pierced by six holes, of which only the two middle ones at *br* are visible in fig. 46. Underneath, where the block is cylindrical, these borings, which are parallel in pairs, meet at an obtuse angle the borings $\beta\,\beta$. The ends of the six borings on the upper face of the block are seen in fig. 47, at *a b c d e f*. Through these openings are drawn the three platinum wires which serve as electrodes in the apparatus. Only the upper parts of the wires between *a* and *b*, *c* and *d*, *e* and *f*, are left free. These parts, *a b*, *c d*, *e f*, of the wires are parallel to each other, and about 5 mm. long. The outer wires *a b* and *e f* are 0·2 mm. thick, the middle wire *c d* is 0·1 mm. thick, and 1 mm. distant from the other two. In fig. 46 the further course of the wire *c d* is shown as a white line on a black ground. At *c* and d_1 and at λ and λ_1 the wire is bent at an obtuse angle. On the right it passes from λ_1 to p_2, but on the left it ends at γ. The pieces λ_1, p_2 and $\lambda\,\gamma$ are imbedded in black sealing-wax, or rather are between two glass plates cemented together by sealing-wax. For on the slide E F G H (fig. 46) is cemented a thick object-holder A B C D conically bored through in the middle, so as to fit over the block *bl* and leave a groove *o* round it, as seen in fig. 47. The glass block *bl* (fig. 46) is about 0·1 mm. lower than the thickness of the plate A B C D, so that when a cover-glass δ–δ_1 is placed over the aperture o–o_1, there is room for a drop of liquid t–t_1 (fig. 46) between the cover-glass and the upper surface of the glass block on which are the platinum wires. Fig. 47 shows the apparatus as seen from above, and explains how the platinum wires are connected with the terminals of the battery. The middle wire *c d* which forms the cathode has its branch p_2 on the right soldered to the strip of copper foil k_1, while on the left the ends p and p_1 of the outer wires *a b* and *e f*, which together form the anode, are soldered to the copper strip k. The copper strips are firmly held by the cement between the plates, and project about a decimetre beyond them to the clamping-screws $k\,l$ and $k\,l_1$ to which the wires from the battery are attached. A drop of the liquid to be examined is brought on to a cover-glass δ–δ_1

* Sitzungsber. Akad. Wiss. Wien, civ. iii. (1895).

which is then placed over the opening *o* and attached with a little grease. The platinum wires *a b*, *c d*, *e f* then lie in the liquid, which is prevented from passing into the borings by the latter being filled by a cement which is not attacked by acids or alkalies.

Fig. 47.

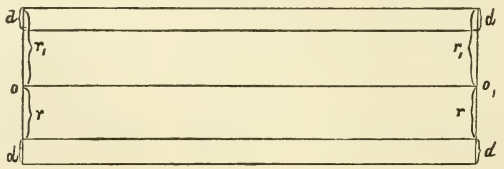


To prevent the cover-glass from being displaced owing to the disengagement of gases during the electrolysis, a channel *y x* (fig. 46) is cut, by which they may pass off.

With medium-power objectives the three wires all come within the field of view, but with stronger objectives only one wire can be observed at a time. For this reason the thickness of the middle wire has been made one-half that of the other two, and this wire in electrolytic experiments is used as the cathode on which the metal is deposited.

The apparatus can be used for both qualitative and quantitative electrolysis, and for electrophysiological experiments.

Fig. 48.



In electrolytic experiments, the metal (copper, gold, mercury, &c.) is deposited on the middle wire, and determined by observation under the Microscope or by chemical tests.

The use of the apparatus for quantitative results is not much insisted on by the author. The method consists in measuring the thickness of the metallic deposit on the cathode. Fig. 48 represents this cathode magnified. If r denote the original radius of the wire, r_1 its radius after

the deposition of the metal, h its length, d half the increase in thickness (so that $r_1 = r + d)_1$ and v_x the volume of the deposited metal, then

$$\begin{aligned} v_x &= h_1 \pi r_1^2 - h \,.\, \pi r^2 \\ &= h \pi (r + d)^2 - h \,.\, \pi r^2 \\ &= h \pi (2 r d + d^2). \end{aligned}$$

If s denote the specific gravity and p the weight of metal deposited,

$$p = s \,.\, v_x = s \,.\, h \pi (2 r d + d^2).$$

Thus, if the specific gravity of the electrically deposited metal and the original thickness of the platinum wire are known, the weight of metal deposited can be determined by measuring with the micrometer the increased thickness ($2 d$) of the wire. The use of the apparatus for electrophysical experiments needs no particularising.

Micrometry.*—Mr. E. G. Love passes in review the various methods in use for determining the actual size of microscopic objects.

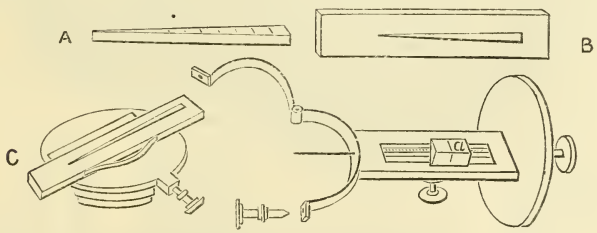
The earliest efforts in this direction, such as those of Leeuwenhoek and Jurin, consisted in comparing the microscopic object with other objects, such as grains of sand, of which the size was known.

In 1742, Benjamin Martin described an eye-piece micrometer consisting of a screw pointed at one end, and carrying at the other a hand which passed over a dial divided into twenty parts.

In 1747, Cuff devised a micrometer consisting of a lattice of fine wire in a circular frame to be placed in the focus of the eye-piece. Baker made a similar micrometer of human hair.

The needle micrometer shown in fig. 49 was designed by Adams.

Fig. 49.



It was clamped to the body-tube, the needle passing through a small opening in the eye-piece. The number of revolutions of the screw was registered by the prism a, while each division of the divided circle indicated 1/1000 in. The value of the revolutions of the screw was determined by means of a sectoral scale (fig. 49, A, B, and C) upon the stage.

In 1840, Jackson devised an improved form of Martin's eye-piece micrometer. In this micrometer the scale was on glass, and was mounted

* Journ. New York Micr. Soc., xi. (1895) pp. 97–105.

in a metal frame, which could be inserted in a slit in the eye-piece, which was a negative one.

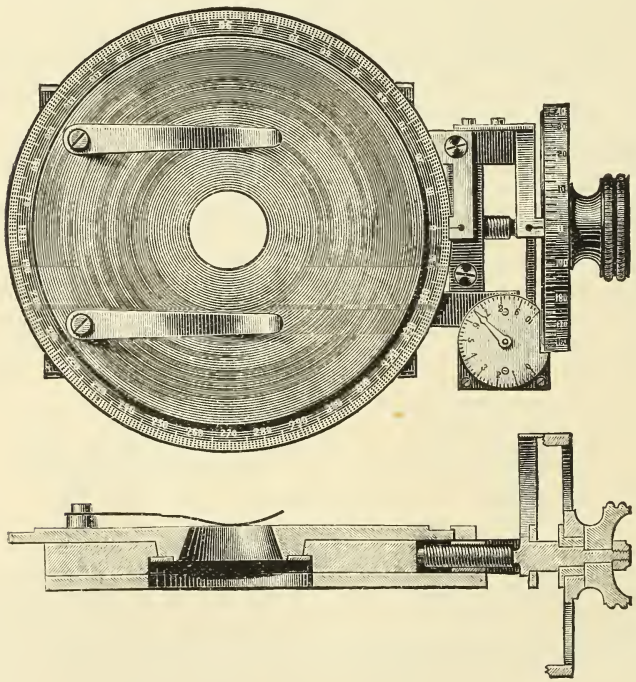
Of the micrometer eye-pieces with movable scales, the author describes that of Ramsden, which was first used for telescopes. It consists of a positive eye-piece, in the focus of which two parallel wires or cobwebs are stretched across the field. One of these is fixed, while the other can be moved by means of a screw provided with a divided head. Entire revolutions of the screw are registered by a metal comb on the lower side of the field.

Nelson has modified this micrometer so that both wires can be moved *en bloc* across the field.

Lastly, photomicrography supplies an accurate means of measuring objects. The image of the stage micrometer is thrown upon the ground glass, and then can be measured or photographed, as desired.

Zeiss' Stage Screw Micrometer.*—This apparatus, shown in fig. 50, is intended for the exact measurement of objects too large to be included

Fig. 50.

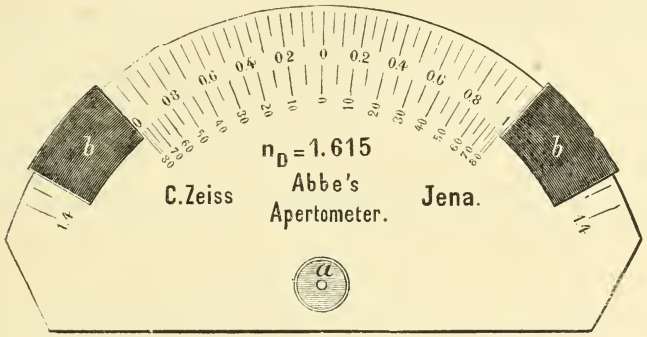


in one visual field of the Microscope. A sliding-piece actuated by a micrometer-screw, carries a rotating disc with divided circle, the divisions of which indicate 0·002 mm. The screw measures up to 10 mm.

* Zeiss' Catalogue, No. 30, 1895, pp. 75-6.

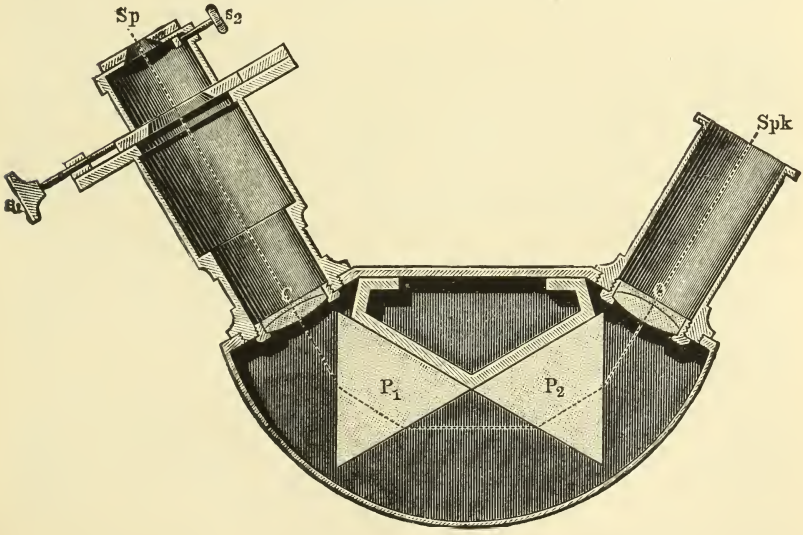
Abbe's Apertometer.*—This apparatus, for determining the numerical and angular aperture of objectives,† is seen in its latest form in fig. 51.

FIG. 51.



Hartnack's Illuminating Apparatus for Monochromatic Light.‡—In this apparatus, shown in fig. 52, the light from the slit Sp is rendered

FIG. 52.



parallel by the collimator C, and after passing through the pair of prisms P_1 P_2 is projected upon the object by the objective O. The different colours of the spectrum can be made to successively traverse

* Zeiss' Catalogue, No. 30, 1895, p. 29.
† See this Journal, 1878, p. 19, and 1880, p. 20.
‡ Zeiss' Catalogue, No. 30, 1895, pp. 66–7.

the field of view by adjusting the position of the slit by means of the screw s_1. The screw s_2 serves to regulate the width of the slit.

The apparatus is connected with the Abbe illuminator by a centering collar.

Microscope-Stage with Iris-Diaphragm.*—Dr. W. Behrens describes the stage with iris-diaphragm made by Meyer & Co., to facilitate the change from condenser-illumination to diaphragm-illumination. The aperture of the stage is larger than usual, having a diameter of 23 mm. The short cylinder with the iris-diaphragm is fixed by a round brass plate, screwed into the under part of the stage. On the right this plate is cut away to make room for the handle of the iris-diaphragm, which is so long as to project beyond the side of the round stage. Beneath the diaphragm is the condenser, which on racking down can be turned to one side.

(4) Photomicrography.

New Method of Illumination for Photomicrography.†—Mr. J. Hunter draws attention to the fact that a paper under the above title was read by him before the Scottish Microscopical Society in 1891. The method there advocated, and more fully described in the present paper, has many points in common with the method described by Dr. Köhler in a paper in the Zeitschr. f. wiss. Mikr. in 1893, an abstract of which appeared in this Journal, 1894, p. 261. The optical conditions in the two methods are essentially identical; in both an evenly illuminated disc, instead of an image of the source of light, is thrown upon the slide by a condenser. The author's scheme, however, differs from that of Dr. Köhler in the detail that in it, instead of the ordinary plano-convex lens C,‡ he uses a triple form of condenser consisting of a flint-glass shell, a correcting lens of crown glass, and the interspace filled with pure water. This produces a very perfect form of aplanatic condenser possessing many capabilities. Minor differences are that the diaphragms at *s b* and J are dispensed with, and that an equi-convex lens is used instead of the plano-convex lens at S *l*. In the course of a detailed account of his method, the author strongly advocates the use of corrected condensers, and states that superior results should be expected from his apparatus owing to the use of the aplanatic condenser instead of the ordinary plano-convex lens in Dr. Köhler's arrangement.

The merits of the new system are:—(1) The whole field is uniformly luminous. (2) The illuminating rays are parallel. (3) The extent of luminous area, as well as angle of aperture, can be easily altered to suit the objective. (4) The heat of the flame is rendered harmless by position. (5) The water compartment of the condenser obviates the use of an alum-cell. (6) Monochromatic light can be readily obtained by dropping the required tint into the water of the lens. (7) In the same way the lens may act as a colour-screen. (8) The correction of the lens is very perfect. (9) Edge interference

* Zeitschr. f. wiss. Mikr., xii. (1896) pp. 292–5.
† Proc. Scottish Micr. Soc., 1894–5, pp. 229–56.
‡ See this Journal, 1894, p. 261, fig. 23.

bands are completely absent. (10) The difficulty of centering the usual small type of condenser is avoided.

For the purely theoretical considerations connected with the system, which the author discusses, we must refer the reader to the original paper.

Method of Photographing Large Microscopic Sections.*—Mr. W. Forgan uses, for photographing objects having a diameter of over an inch, a single landscape lens of about 4½ in. focus. It has a diameter of about 1 in., is used with a stop at F 16, and gives excellent definition. It is screwed into the front of the camera so that the Microscope is altogether dispensed with, the slides being held on a separate carrier-board.

A piece of glass, obscured on both sides, is placed between the specimen and the illuminant to diffuse the light. The author strongly recommends burning magnesium ribbon as the source of light.

B. Technique.†

(1) Collecting Objects, including Culture Processes.

Increasing the Toxin Production of the Diphtheria Bacillus.‡—Dr. Freiherr v. Dungern has found that the addition of human ascitic fluid to artificial nutrient media is a good means for increasing the virulence of diphtheria bacilli, at least in so far as the production of toxin is concerned. For making diphtheria antitoxin it is important to be in possession of a strong toxin.

Cultivation Medium for Diphtheria Bacillus.§ — Dr. Tochtermann recommends the following serum medium for cultivating diphtheria bacilli. A 2 per cent. watery solution of agar is treated with 1 per cent. pepton, 1/2 per cent. common salt, and 0·3–0·5 per cent. grape-sugar, and the whole filtered. The filtrate is heated from a quarter to half an hour with sheep's blood-serum in equal parts, or of three of serum to two of the agar solution. The filtrate is then put into tubes and sterilised in the usual way.

Improvements in the Technique of the Diphtheria Culture Test.‖—Dr. A. P. Ohlmacher makes very rapid and successful diagnoses of diphtheria by means of the following modifications of the ordinary procedure. To the culture medium a decided alkaline reaction is imparted by adding to the glucose-beef-pepton-bouillon a saturated solution of sodium hydroxid, drop by drop, until a pronounced blue colour is obtained with red litmus paper. The alkalinised bouillon is added to the serum before its coagulation. The medium, when rapidly coagulated, forms a smooth, moist, slanting surface. This kind of surface, which is a *sine*

* Proc. Scottish Micr. Soc., 1894-5, pp. 221-2.

† This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

‡ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 137–41.

§ Centralbl. f. Inn. Med., Oct. 5, 1895. See Epit. British Med. Journ., ii. (1895) par. 507.

‖ Medical News, May 4, 1895.

qua non for this procedure, is then inoculated with exudate from the suspected throat, and the tube incubated for four hours at 37°·5–38°. A platinum loop is then rubbed over the surface, after which the loop is well rubbed on to a minute drop of water on a cover-glass. When spread and dried the film is stained.

The author states that an incubator is not necessary for detecting diphtheria bacilli, as they can be grown at room temperature in about eighteen hours sufficiently copiously to give a good preparation, though, as in the previous case, there will be no naked eye evidence of the existence of a colony.

Method for Preparing very active Diphtheria Toxin.*—Prof. C. H. H. Spronck has found that the most important condition for obtaining very active diphtheria toxin is to use bouillon which does not contain a trace of glucose. For this purpose meat as old as possible should be used. The author employs two per cent. pepton, containing no glucose, and for safety adds to the bouillon, after it has been alkalinised with 0·5 per cent. sodium carbonate, a small quantity of carbonate of lime. With these simple precautions a diphtheria bacillus of medium virulence can be made to furnish in 3–4 weeks, a toxin killing with a dose of 0·2 ccm. a kilogram of guinea-pig in 24 hours.

Platinum Wire Brush for Inoculating Culture Media with Diphtherial Matter.†—Herr Pfaffenholz uses a platinum wire brush for smearing material suspected of being diphtherial on culture surfaces. Its special advantage is that it can be easily and perfectly sterilised. It is made by melting into a glass rod about a hundred pieces of very fine platinum wire, in lengths of 1½–2 cm.

Cultivation Medium for Diphtheria Bacilli.‡—M. J. Amann has obtained very excellent results with the following medium for cultivating diphtheria bacilli. To the white of an egg are added 0·5 per cent. NaCl, 1 per cent. meat-peptone, 1 per cent. grape-sugar, and 10 per cent. distilled water. The mixture is poured into a Petri's capsule, and steam sterilised. Good cultures are obtained after incubating for 8 to 12 hours.

Demonstrating the Presence of Bacillus Coli in Water.§—Sig. F. Abba adopts the following method for demonstrating the presence of *B. coli* in water:—To a litre of the water to be examined 100 ccm. of a medium composed of grape-sugar 200 grm., pepton 100 grm., salt 50 grm., carbonate of soda 5 grm., water 1000 grm., are added. To the mixture 0·5 ccm. of a 1 per cent. alcoholic solution of phenolphthalein is added. The whole is then distributed among five or six Erlenmeyer's flasks and incubated at 37°. At the same time agar plates in Petri's capsules are incubated in order to evaporate off the condensation water. If *B. coli* develop on the bouillon, the contents of the flasks are decolorised in 8–16–24 hours. Should decolorisation occur, a loopful of the

* Ann. Inst. Pasteur, ix. (1895) pp. 758–65.

† Hygienische Rundschau, 1895, No. 16. See Bot. Centralbl., lxiv. (1895) pp. 357–8.

‡ Arch. Sci. Phys. et Nat. Genève, i. (1896) pp. 169–70.

§ La Riforma Med., 1895, No. 176. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 224–5.

bouillon is smeared over an agar plate, and afterwards examined for the bacteria which may have grown up.

Typhoid bacteria also decolorise the bouillon, but more slowly, 3–4–5 days.

Influence of Variations in Composition of Gelatin on Development of Water Bacteria.*—Messrs. Sedgwick and Preston found that the same water when examined at different laboratories gave no constant results. Even in the same laboratory the results were different when the composition of the nutrient gelatin was different. For the purpose of ascertaining the cause of these varying results, the authors have examined into the constituents of the ordinary gelatin and the importance thereof for the growth of different water bacteria. Accordingly, the importance of the amount of acid, of pepton, of meat, of gelatin, and of salt for forwarding the growth of water bacteria was tested. It was found that 0·2 of 1/20 normal acid per ccm. of nutrient gelatin gave the best results, but the amount of acid was found to be dependent on the pepton used. Increase in the amount of pepton aided the development of the water bacteria; on gelatin which contained 15–20 grm. pepton per litre, far more colonies appeared than upon the ordinary gelatin, which contained only 5 grm. If, however, salt was in excess, the growth of the bacteria was hindered; and if it were omitted far more colonies appeared. The meat used was not found to exert any special influence. The gelatin which gave the best results was that known as hide-gelatin; bone-gelatin and ordinary gelatin promoted the growth of water bacteria in mass.

Demonstrating Wild Yeasts in Trade Yeasts and New Beer.†—Herr H. Will has tested Hansen's method of examining for wild yeasts by cultivating in 10 per cent. saccharose, with addition of 4 per cent. tartaric acid. He found that the results were in accord with those of the older procedure, and that the time was shortened by the addition of tartaric acid. This method also facilitates the recognition of *Saccharomyces apiculatus*, which could be demonstrated in 57 per cent. of trade yeasts and new beers. In the sugar solution it developed with the typical lemon-shaped cells, which permits its easy recognition, though, if it do not show this characteristic shape, it may be overlooked.

Cultivation Medium for Nitrite Ferment.‡—Dr. M. W. Beyerinck has successfully cultivated the nitrite ferment of the ammonia salts on agar plates by preparing this medium in the following manner:—A not too thick layer of agar, previously filtered after having been dissolved in distilled water, is allowed to set in an Erlenmeyer's flask. The surface is then covered with distilled water and the medium left to itself. The soluble organic substances diffuse out into the water, and bacteria spontaneously develope therein. After a few days the water is poured off and renewed. This is repeated several times. In a week to 14 days, according to the thickness of the layer, the soluble organic

* American Public Health Assoc., x. (1895) p. 450. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 222.

† Zeitschr. f. gesammte Brauwesen, xvi. pp. 29–30. See Bot. Centralbl., lxiv. (1895) pp. 269–70.

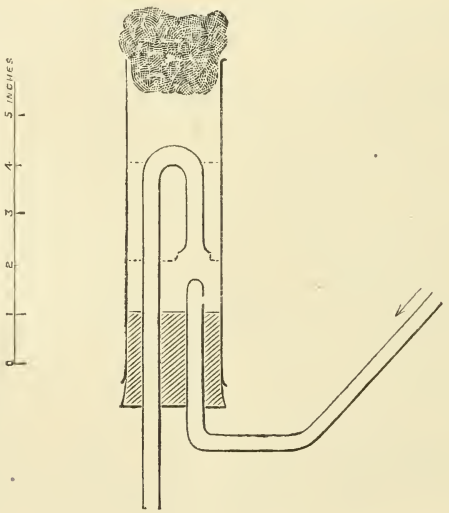
‡ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 258.

matters are removed. To this mass may now be added a saline mixture, suitable for forming nitrites, and also calcium carbonate. The whole is then boiled to kill off any bacteria. This method is far simpler than the silicic acid method. The salt recommended to be added is $NH_4NaHPO_4 + 4H_2O$ in the proportion of 0·2 per cent. Besides this, chloride of potassium 0·05 is also inserted. The chalk makes the reaction neutral, or slightly alkaline.

Cold Sterilising Bougie Filters and other Apparatus.*—MM. Couton and Gasser use two solutions for cold sterilising porcelain bougie filters, one a dilute solution of calcium chloride, the other a dilute hydrochloric acid. Neither solution need be prepared afresh every time, but can be used for ten purifications. The bougies are placed in each solution for a quarter of an hour, first in the eau de Javelle, and afterwards in the acid. The calcium chloride decomposes the albuminoid substances which block up the pores; the hydrochloric acid afterwards unites with the calcium, and chlorine is set free. This gas decomposes the impurities, and the process is finished by washing out with pure water. Bougies which had previously given 1–2 litres per hour, after having been treated by the cold purifying procedure, gave 9–12 litres. The bougies remained germ-free for 10 days; after 28 days there were 880–1310 germs per ccm.

Apparatus for Removing definite Quantities of Fluid Cultivation Media.†—Dr. R. Kretz has devised a very simple and easily sterilisable

Fig. 53.



apparatus for drawing off small quantities of bouillon, &c., in an exact and facile way. The apparatus is merely a siphon with intermitting

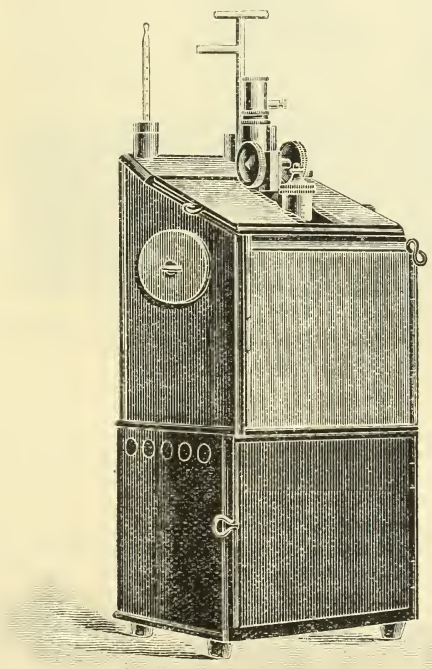
* Rev. d'Hygiène, 1895, 17, 4. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 299.

† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 73–4 (1 fig.).

action, and is easily made by cutting off the bottom of a test-tube and plugging an end with a caoutchouc stopper perforated in two places (for the long arm of the siphon and for the inflow tube). The long arm is about 14 cm. long, and the short one varies from 1·5–3·5 cm. according to the quantity required to be drawn off. The inflow has a small opening at the side, and in order to avoid bubbling is only pushed in so far that the fluid pours out at the lowest level. To the free end of the inflow pipe a rubber tube which can be clamped, may be attached and to this a glass tube to be immersed in the nutrient medium. By squeezing the air out of the rubber tube, the inflow current is started, and may be regulated by the clamp. In order to facilitate ready working and complete evacuation, the short arm of the siphon is expanded into a funnel-shape, and the funnel must be so wide as to allow the outflow quantity time to escape before the inflow reaches the mouth of the siphon.

Simple Thermostat applicable to any Microscope.*—Mr. G. H. F. Nuttall has devised a very simple thermostat, which can be adapted to any form of Microscope. The illustrations show the apparatus open and

Fig. 54.

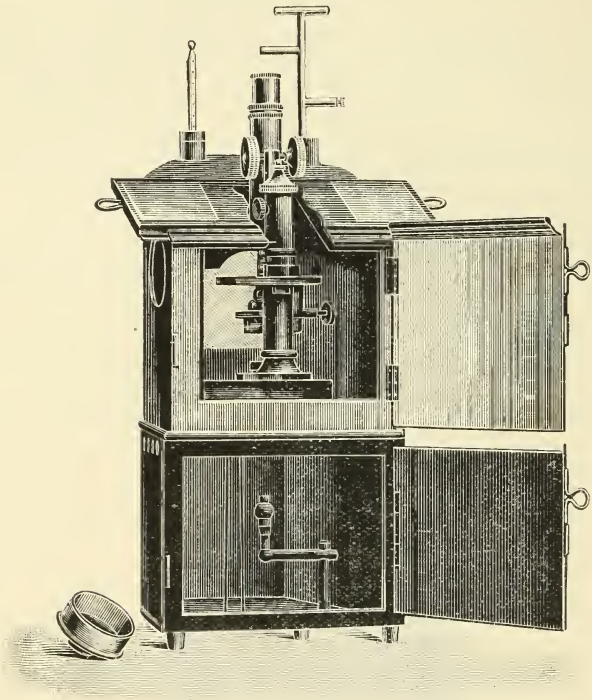


closed; it is made of copper, and has the following dimensions:—breadth 16 cm., length 18 cm., height in front 20 cm., behind 13 cm.

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 330-2 (2 figs.).

The top is sloping and the sliding panels are cut out so as to allow the Microscope to project, and are accurately fitted to the instrument by means of felt. In front are a square glass window, the thermometer, and regulator; on the left is the opening for inserting slides. The

Fig. 55.



doors are behind. To the right side may be fitted the arrangement for moving the slide to and fro and up and down, but this is rarely necessary, and much increases the price.

Filtering Fluid containing Bacteria.*—Prof. O. Bujwid says that now he only uses Chamberland's porcelain filter, having given up the Berkefeld on account of its brittleness, slowness, &c. For filtering toxins the author works the filter from without inwards, and thus obtains a closed sterilised space for receiving the filtrate. Though a new bougie filters very quickly for 1/2–1 hour, its pores soon get blocked, and in order to avoid this the bougie should be removed, and its surface wiped with a rag moistened with distilled water. While this is being done the rubber tube should be tightly clamped. This purification should be performed every one or two hours. Filtration over, the pores of the

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 332–3.

filter should be freed of albuminous matter by passing distilled water through several times, after which the bougie may be sterilised in an autoclave. If purified in this way, bougies can be used a long time without firing them. With a one bougie filter it is easy to get 3–5 litres of fluid in 24 hours.

Easy Method of Preparing Serum Agar.*—Messrs. A. A. Kanthack and J. W. Stephens use ascitic, pleuritic, or hydrocele fluid for making serum-agar. The procedure is as follows:—To every 100 ccm. of the exudate 2 ccm. of a 10 per cent. solution of caustic potash is added. To this is added 1·5–2 per cent. agar previously soaked in acidulated water, and the mixture boiled until the agar is dissolved. The fluid is then hot-filtered, and to the filtrate 4 to 5 per cent. of glycerin should be added. After this it is poured into test-tubes and sterilised. The addition of 0·5–2 per cent. of grape sugar in no way improves this mixture as a cultivation medium. Before adding the caustic potash to the serous fluid a small quantity of the latter should be boiled in a test-tube, and in case it should be highly albuminous, when it will set solid, the serum should be diluted with at least twice its bulk of distilled water, and then to every 100 ccm. of the diluted fluid 2 ccm. of KOH and 1·5–2 grm. of agar are to be added. Unless this precaution be adopted the whole mass will gelatinise and be useless.

Improved Solid Watch-Glass.†—Dr. A. C. Mercer describes an improved form of solid watch-glass which, when a series is superimposed,

Fig. 56.

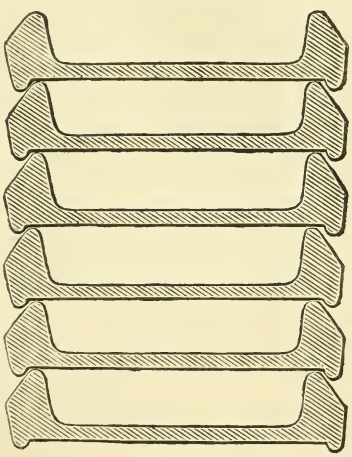


Fig. 57.

makes a secure pile. The size, shape, and method of using may be easily gathered from the illustrations. The writing (fig. 57) is not intended to be permanent.

* Lancet, i. (1895) pp. 835–6.
† Trans. Amer. Micr. Soc., xvii. (1896) pp. 371–4 (3 figs.).

Methods for Collecting and Estimating the Number of Small Animals in Sea-Water.*—Dr. H. C. Sorby, when collecting moderately small animals, uses a brown holland bag, at the bottom of which there is an arrangement by which brass wire sieves with meshes of various sizes can be fixed to a sort of bayonet-joint. Another method is to collect water in a special bottle at various depths, and to pour 2½ gallons through a sieve with openings of about one-hundredth of an inch in diameter. From this the animals are washed off into a few ounces of water. The numbers of the various kinds are afterwards counted in a small deep narrow trough filled over and over again until the whole quantity has been examined. The number of each kind per gallon can then be easily calculated.

(2) Preparing Objects.

Examining Spermatheca in Newts and Salamanders.†—Dr. B. F. Kingsbury adopted the following procedure:—Serial sections of the cloaca were made transverse to the long axis of the body, to which were added, in *Plethodon*, *Desmognathus*, and *Amblystoma*, series cut sagitally. The cloaca was dissected off and placed in Fish's mixture (50 per cent. alcohol 1000 ccm., mercuric chloride 5 grm., picric acid 1 grm., glacial acetic acid 10 ccm.). It was then washed in 50 per cent. alcohol one day, and passed through successively 70, 82, and 95 per cent. alcohols, ether-alcohol equal parts, remaining one day in each. It was placed in 1½–2 per cent. collodion for two days and 6 per cent. collodion for three days, and imbedded. The collodion was hardened in chloroform and cleared in Fish's castor-thyme oil mixture, in which the sections were cut. They were arranged in serial order on the knife, from which they were removed by tissue-paper, and then placed upon the slide; all oil possible was absorbed with tissue-paper, and the sections secured by melting the collodion with a few drops of ether-alcohol. A few minutes (5–10) in 95 per cent. alcohol sufficed to remove all the oil, when they were treated as usual. Gage's hæmatoxylin, with eosin, erythrosin, or picric-alcohol, as a counterstain were employed; Vasale's clarifier (xylol 3 parts, carbolic acid 1 part) was used. This was supplemented by teasing fresh spermathecæ upon the slide to detect the living zoosperms.

Microscopical Diagnosis of Uterine Growths.‡—Mr. H. G. Plimmer points out the importance of histological examination of uterine tumours, and deals with the modern methods of investigation. During the past three years he has examined 92 cases of uterine tumours, 72 of them from the cervix being diagnosed as cancers, though 12 of these were found to be benign in nature. The tissue to be examined should be placed in the following solution for 24 hours: sodium chloride 7·5 grm., glacial acetic acid 10 ccm., distilled water 1 litre, mercuric chloride to saturation. It should then be washed in running water for 2–3 hours, and then in alcohols of increasing strength up to absolute for three consecutive days. The sections are best stained with Mayer's hæmalum and contrast-stained with 1 per cent. solution of Congo red. Kühne's aniseed oil method, preceded by fixation in 30 per cent. solution of formalin, is also adopted

* Rep. Brit. Ass., 1895, p. 730.
† Trans. Amer. Micr. Soc., xvii. (1896) pp. 261–95.
‡ Reprint from British Gynæcological Journal, Nov. 1895, 14 pp.

by the author. The use of Congo red is strongly advocated, as it is found to be of great service in differentiating in doubtful or oblique sections the gland epithelium from atypical epithelium. The former is stained strongly red, while the cytoplasm of the cancer-cells remains almost uncoloured.

There are numerous other hints of great value in the author's paper, and though short, the information therein indicates a mastery of the subject.

Collection and Preservation of Zoological Specimens.*—As the result of his experience on the West Coast of S. America, Dr. Ludwig H. Plate gives a number of useful hints to collectors. For the narcotisation of the smaller marine animals he strongly recommends cocaine, 20 or 30 drops of a 5 per cent. solution of which should be added to 100–200 ccm. of sea-water. Various details as to subsequent treatment, and the packing and transport of specimens are also given. The paper concludes with a discussion of methods of dredging, and a complete description of the method of obtaining fish by means of dynamite.

Investigation of Minute Structure of Cestodes.†—Dr. E. Zernecke, in his investigation of various Cestodes and cystic worms, got the best results from the use of the rapid Golgi method. As is well known, a large quantity of material is necessary when using this method, and the author was fortunate to find in the market of Rostock fish which contained a large number of *Ligulæ* or their larvæ. A *Ligula* taken fresh from the body was killed in a moderate degree of extension by the use of the chrome-osmic mixture. After one or two hours the animals were taken out of this solution and cut into pieces about 1 cm. long. These were placed in a fresh supply of the solution for three or four days at a temperature of 25°. On being dried they were treated with a solution of ·75 per cent. silver nitrate 25 g., to which one drop of formic acid was added. The pieces remained in the silver solution two or three days, were then imbedded in liver, and cut into sections. Smaller pieces were imbedded, after a short process of dehydration in absolute alcohol, in some drops of celloidin. The sections, after clearing, were stained, and then developed in Kallius's hydrochinon developer. As this method only does for very thin sections, thicker sections were more satisfactorily treated with liquid paraffin after the method first introduced by Prof. Blochmann. As control sections the author made use of a series treated with concentrated aqueous solution of corrosive sublimate, or alcoholic corrosive sublimate, and preserved in 90 per cent. alcohol. Sections 5–10 μ thick were generally treated with the orange *g.* hæmatoxylin.

Simple Method for Demonstrating the Germinal Pore in the Spore Membrane of Rust Fungi.‡—Dr. Dietel has found that the pores in the spore-membrane of *Uredineæ* can be easily seen if slight pressure be made on the cover-glass. The germinal pores then appear like bright spots, even in spores with colourless membranes.

* Zool. Anzeig., xix. (1896) pp. 40–6.
† Zool. JB. Abth. Anat., ix. (1895) pp. 93–6.
‡ Zeitschr. f. Angewandte Mikroskopie, i. (1895) pp. 69–71.

Fixing-Material for Meristem.*—Herr G. Rosen recommends the following:—A mixture of 10 gr. sublimate, 300 gr. distilled water, and 3 gr. glacial acetic acid; for Ferns, a mixture of 6 parts alcohol, 1 part glacial acetic acid, and 2 parts chloroform. As staining reagents he employs iodine-green-fuchsin and Heidenhain's hæmatoxylin-iron-alum in combination with Bordeaux R or Rubin S.

Test for Cholesterins.†—M. E. Gérard gives the following test for distinguishing between animal and vegetable cholesterins:—If the former are treated with concentrated sulphuric acid, a yellow colour is produced, and a white precipitate on diluting with water; while the latter are coloured red by sulphuric acid, and yield a green precipitate on the addition of water.

Microscopical Examination of Meat for Tubercle Bacilli.‡—Dr. Morsy examines meat for tubercle bacilli by placing a small piece of a gland between two slides and pressing them firmly together. The films on the slides are then dried over the flame of a lamp. Upon the film are placed some cubic centimetres of carbol fuchsin, and the slide warmed for ten minutes. The fluid should not be allowed to become dry. The slide is then washed in water and afterwards decolorised in an acid mixture. When sufficiently decolorised the slide is washed again in water, and then contrast-stained with malachite-green. The preparation is again washed with water, then treated with absolute alcohol, and finally dried in the air. It may now be examined by just dropping on the surface a little cedar oil, no cover-glass being used. The tubercle bacilli appear as dark red thin threads, the tissues and cells and other organisms being green, except a diplococcus occasionally met with in tuberculous pus. This coccus cannot be confounded with a tubercle bacillus, partly on account of its shape, but partly also because it does not retain the red so well as the tubercle bacillus.

The carbol-fuchsin solution is made as follows: 1 grm. of fuchsin is dissolved in 20 ccm. of alcohol, and then 5 ccm. of carbolic acid and 90 ccm. of water are added. The formula for the decoloriser is—hydrochloric acid 3·0, common salt 2·0, water 100·0, alcohol (90 per cent.) 500·0. The counter-stain is made by dissolving malachite-green 1·0 in 100 of alcohol and 100 water.

Cocain in the Study of Pond Life.§—Prof. H. N. Conser finds that the following method is suitable for fresh-water Bryozoa. Several colonies are placed in a solid watch-glass with 5 ccm. of water, and as soon as the animals have expanded, 1 or 2 cgrm. of cocain are dropped on the edge of the water at two or three distant points. After about 15 minutes, 1 per cent. chromic acid is poured into the watch-glass and left to act for half an hour or more, when it is replaced by water. In half an hour the process is repeated; then alcohol is gradually added until it reaches about 80 per cent. of the immersion fluid. The free-swimming Rotifers readily succumb to the influence of the cocain, but the family Melicertidæ hold out a long time; the quantity of cocain

* Beitr. z. Biol. d. Pflanzen (Cohn), vii. (1895) p. 233.
† Comptes Rendus, cxxi. (1895) p. 723.
‡ Zeitschr. f. Angewandte Mikroskopie, i. (1895) pp. 71–4.
§ Trans. Amer. Micr. Soc., xvii. (1896) pp. 310–1.

must therefore be relatively large in their case, and when all movements cease they should be killed with 20 per cent. formalin, as chromic acid precipitates cocain in strong solution. An after-treatment with chromic acid in 1/2 per cent. seems to harden better than formalin alone. When a colony of Melicertidæ is subjected for 15 minutes to a 1/2 per cent. cocain solution and then transferred to another watch-glass with pond water, the individual Rotifers come out of the tubes and attach themselves to the bottom of the glass in perfect condition for study.

(3) Cutting, including Imbedding and Microtomes.

Photoxylin.*—Prof. P. Mitrophanow sings the praises of photoxylin, which was introduced into microscopic technique by Krysinski (1887). For sectioning purposes it compares well with celloidin in transparency and suitable consistence. It is also exceedingly useful in the treatment of very minute bodies, which may be imbedded first in photoxylin and then in paraffin. It may also be used with great success in preserving fine preparations, embryos, and minute animals, in a certain order on glass plates, for museum and demonstration purposes.

Preparing Lipoma Tissue.†—Dr. Vedeler prepares adipose tissue by first fixing in 5 per cent. sublimate solution, and then treating the piece with ether repeatedly renewed until all the fat has disappeared. The pieces (0·5 cm.) were then hardened in alcohol, stained with hæmatoxylin and eosin, and imbedded in paraffin. If the fat had not entirely disappeared the paraffin would not penetrate.

Frazer's Sliding Microtome.‡—Mr. A. Frazer describes a sliding microtome, which is intended for students and others who may desire an instrument less costly than those constructed on the Thoma-Jung or Schanze model. The sliding parts of the instrument are similar to those in the Schanze model, but the part which raises the object is constructed after the Cathcart design. A further simplification consists in making the knife-holder of such a shape that it will hold an *ordinary* razor.

(4) Staining and Injecting.

Methylen-Blue Staining.§—Prof. M. Lavdowsky has found that the following fluids are more or less satisfactory vehicles for the pigment in vital methylen-blue staining:—(1) Pure blood-serum. (2) White of egg. (3) Ammonium chloride. (4) Ammonio-chloride of iron. The two last are only used in from 1/10–1/2 per cent. solutions in water or egg-albumen. Blood-serum, a perfectly indifferent physiological fluid, should be taken from an animal of the same genus as that to be experimented on. After the blood has been allowed to stand for about twelve hours the serum is decanted off and then filtered into a tall narrow vessel. If the amount be scanty, it may be diluted with an equal bulk of 0·5 per cent. of common salt solution, or 0·1 per cent. aqueous ammonium chloride solution. Directly the methylen-blue is quite dis-

* Arch. Zool. Expér., iii. (1895) pp. 617–21.
† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 274.
‡ Proc. Scottish Micr. Soc., 1894–5, p. 211.
§ Zeitschr. f. wiss. Mikr., xii. (1895) pp. 177–81.

solved in this fluid, the tissue to be examined should be treated therewith. Hen's egg albumen is by far the best solvent for methylen-blue, not only because it gives satisfactory pictures, but also because it is easily and rapidly prepared. The white of one or two fresh eggs is filtered, and to the filtrate is added 1/4–1/2 per cent. methylen-blue solution in sodium or ammonium chloride, or the methylen-blue in powder may be mixed with the albumen directly. Should the examination be a protracted one, the author dilutes the fresh albumen with an equal volume of 0·5 per cent. sodium chloride or 0·25 per cent. ammonium chloride solution; and when the pigment is dissolved therein it is filtered, after which it is ready for use.

In all the fluids the solution of the methylen-blue is made by adding to them only just sufficient of the pigment as will make 1/10–1/4 per cent. clear solution; or to the powder may be added solutions of sodium or ammonium chloride, and these afterwards mixed with serum or albumen.

In certain special cases satisfactory pictures may be obtained by spreading the tissue to be examined on a slide, keeping it moist with serum or albumen, afterwards adding a few grains of the methylen-blue powder. This procedure is more rapid than the ordinary method, and even this may be hastened by adding a little of the dry pigment during examination. When properly carried out, only the nerves, their endings, and the cells are stained, and the time required is from three-quarters to one hour, though occasionally double this time is necessary.

Criticism of Golgi's Method.*—Dr. B. Friedlaender points out that in Golgi's method several delusive appearances are inherent, and shows from special preparations of egg-albumen, celloidin, the earthworm, and also from old preparations, that precipitates occur which are barely distinguishable from those indicative of nervous tissue. The intention of the author is not so much to contest the general validity of the conclusions arrived at by Golgi's method as to point out sources of error intrinsic to the method.

Very Dilute Hæmatoxylin Solutions.†—Prof. O. Israel notes the advantages of slow staining with very dilute solutions, to which Rawitz recently called attention. This, he says, is a familiar method, and much used. Alum-solutions of the various hæmatoxylins are all useful, and very dilute solutions of carmine and some anilins (e. g. R. Pfeiffer's carbol-fuchsin) give beautiful results.

(5) Mounting, including Slides, Preservative Fluids, &c.

Preserving Rotatoria. —Mr. C. F. Rousselet has a second paper on the methods of preserving Rotatoria, in which, as many of our Fellows know, he has been peculiarly successful. His principle, that of narcotising, killing, fixing, and preserving in a watery-fluid not appreciably denser than water, remains the same, but a number of improvements have been made in the details of the process. Of the reagents before advised it is now recommended that osmic acid be omitted from the preservative

* Zeitschr. f. wiss. Mikr., xii. (1895) pp. 168–76 (1 pl.).
† Anat. Anzeig., xi. (1895) pp. 454–6.
‡ Journ. Quekett Micr. Club, 1895, pp. 5–13.

fluid. Like others, Mr. Rousselet finds that formalin is a preserving material which may be made of much use. By itself it does not fix the Rotifers at all well, but it has the very valuable property of preserving the animals without the least shrinkage or turgescence, and as perfectly transparent as the fixing process leaves them. A very weak solution of ·25 per cent. or less of osmic acid should be allowed to act for a very short time only. If the animals become coloured a little by the osmic acid, the colour can be removed by passing them for two or three minutes through peroxide of hydrogen. For narcotising, the following mixture was found to give better results than 2 per cent. cocain alone:—2 per cent. of cocain, 3 parts; methylated spirit, 1 part; and water, 6 parts. Different species vary very much in the length of time they require for narcotisation. In killing, it is merely necessary to introduce a drop of osmic acid on to the animals under water, and then almost immediately transfer them to some fresh water in another block, and then again to two or three more lots of distilled water, so as to get out all traces of the acid. Finally they should be placed in 2·5 per cent. formalin. The author gives some useful hints as to how different species should be treated. He thinks that he is justified in saying that this unpreparable group, as Mr. Bolles Lee has styled the Rotifers, is now fairly conquered. Mr. Rousselet hopes to be able to form in time a complete type collection of the known Rotatoria.

Making and Finishing Wax Cells.*—Mr. M. Pflaum makes wax cells by first drawing an asphalt (in benzol) ring wider than the intended ring on the slide. With a mixture of wax and paraffin in equal parts, a cell of the required depth is drawn, and immediately covered with asphalt cement. The slide is finished by fastening the cover-glass with shellac dissolved in alcohol. For greater permanence a ring of zinc white cement is put over the shellac, and for adornment any colour of King's lacquer.

Japanese Method for Sticking on Paraffin Sections.†—Herr F. Reinke highly recommends a method adopted in Japan for making paraffin sections adhere to slides and glass plates. It is a combination of the albumen method of Mayer and the water method of Gulland, and consists in putting a very thin layer of albumen-glycerin on the glass plate and then dropping on a little distilled water. The section having been laid on the top, the excess of water is removed with blotting-paper, and then the preparation is dried at 30°–35°.

According to Herr v. Erlanger,‡ this Japanese adhesive method has been known for years. This writer saw it used by Cambridge students at the Zoological Station at Naples in the winter of 1891–2, and was informed that the procedure had been in vogue there for some time.

Mr. A. B. Lee also writes to a similar effect, and mentions that the method was published by Duval, and also by Henneguy in 1891.

Formalin as a Disinfectant.§—MM. van Ermengem and Sugg examined the disinfecting power of formalin on pathogenic bacteria,

* Trans. Amer. Micr. Soc., xvii. (1896) pp. 374-6.

† Zeitschr. f. wiss. Mikr., xii. (1895) pp. 21–3. ‡ Tom. cit., pp. 186–7.

§ Arch. de Pharmacie, 1894. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 91.

clothes, &c., at 13°, and from 36°–48°. In the first experiments *Bacillus rubiginosus* and *B. anthracis* were put under a bell-jar with formalin. In from 3–12 hours all the spores were quite dead (with 5 per cent. carbolic acid this end is not attained in six days). Sporeless bacteria died in a quarter of an hour. In test-tubes closed with cotton-wool the spores were not killed before 48 hours; but if the wool were damped with formalin, it only took 24 hours. In the next series the experiments were conducted on a larger scale. The results were quite favourable, but too much formalin was required to wet the clothes, and the smell from them was very unpleasant. The chief advantage is that disinfection can be carried out at ordinary room temperature and the clothes not damaged, as is so frequently the case at a temperature of 100°. In the third series the temperature was increased to 50°. At this temperature anthrax spores were killed in a quarter of an hour. Books were completely disinfected at 60°.

Formaldehyde and Formol.*—Messrs. G. H. Parker and R. Floyd deny, it seems to us justly, Mr. A. B. Lee's allegation that their previous paper on formol has added to the confusion which has arisen in regard to formaldehyde, formaline, formol, and formalose. They recommended, for preserving a sheep's brain, 2 per cent. solution of formol, which surely means a mixture of 2 volumes of formol with 98 volumes of water. That formol is 40 per cent. formaldehyde was clearly stated. The brain in question is, after six months, in excellent preservation.

Formalin in the Zoological and Histological Laboratory.†—Mr. D. S. Kellicott thus summarises the advantages of formalin for zoological purposes. It is cheaper than any other method that gives good results; it gives results in much less time; the colours are better preserved, and there is less change of form by shrinkage or by swelling; its penetrating power is excellent, notably for insects, Crustacea, Molluscs, and Vermes. Its disadvantages are that it is extremely volatile, and jars have to be sealed with care. The water solution will freeze, and not all museums are at all times above 0° C. In 5 per cent. solution formalin is also a useful histological reagent.

Mr. Wright's Method of Mounting Foraminifera. —Mr. Malcolmson describes the method employed by Mr. Wright, of Belfast, for preserving Foraminifera.

The slide on which the specimens are mounted consists of two parts, a tray and a holder. The tray is composed of a piece of cardboard 3 in. by 1 in. in size, on which is pasted a piece of paper, having a series of divisions numbered 1 to 100 printed in black upon it. Another piece of cardboard, from the centre of which a rectangular piece has been removed, is fixed to the front of the first piece of cardboard, and the specimens are mounted one by one upon the black surface. The holder consists of an ordinary 3 in. by 1 in. glass slip, a piece of cardboard of the same size, and a piece of paper large enough to enclose the whole.

The card is glued to the centre of the paper, the tray is placed on

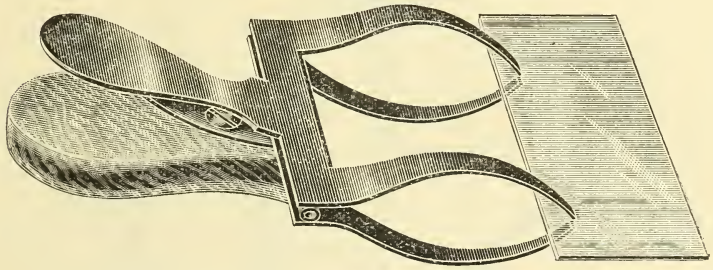
* Anat. Anzeig., xi. (1896) pp. 567–8.
† Trans. Amer. Micr. Soc., xvii. (1896) pp. 331–5.
‡ Proc. Scottish Micr. Soc., 1894–5, pp. 212–3.

the top and covered with the slip, and the edges of the paper are then turned up and attached to the upper surface of the slip.

For mounting the smaller species, a thin layer of gum is placed upon the divisions. The specimens are picked out with a small brush moistened with water, and applied to the gummed surface.

Holder for Slides and Cover-Glasses.*—Herr R. Abel describes the sort of clamp for holding slides or cover-glasses which he has used with

Fig. 58.



advantage for a long time past. As in an ordinary letter-clamp, the arms are opened by pressure on a plate provided with a spring. (See fig. 58.)

(6) Miscellaneous.

Technique of Microscopical Anatomy.†—MM. A. B. Lee and L. F. Henneguy have just issued the second edition of a treatise on the technical methods of microscopical anatomy. The present volume has been entirely recast and considerably enlarged. This work is the outcome of the 'Microtomist's Vade-Mecum,' a handbook of the methods of microscopic anatomy, published in London in 1885, and differs therefrom chiefly in amplifications in one direction and suppressions in the other. Many old methods have been omitted and replaced by newer ones, and many new features have been added. The additions are chiefly connected with staining, especially with carminic acid, hæmatein, and anilin pigments. The chapter on cytological methods has been entirely recast, and those on the nervous system considerably amplified. Among the suppressed portions is the chapter on bacteriology, so that the present work appeals chiefly to histologists, embryologists, and zoologists. The treatise is divided into two parts, the first comprising general methods, while the second is devoted to special embryological and histological procedures.

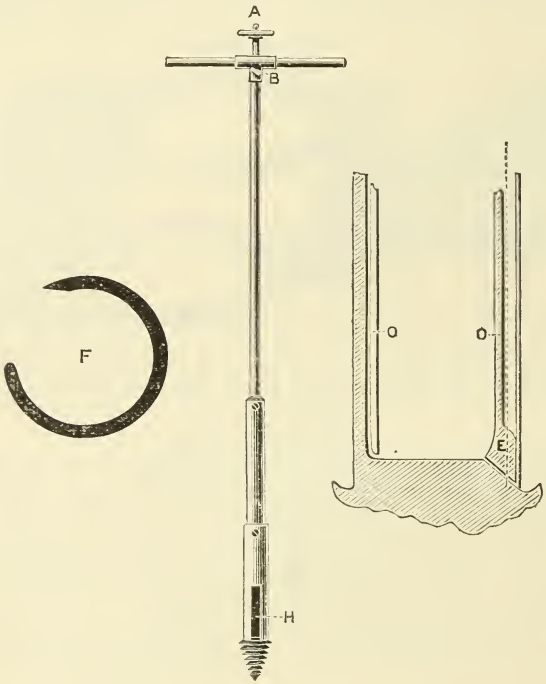
The character, utility, and excellence of the previous edition are so well known that it is almost superfluous to say that in the present volume the high standard is maintained.

Stewart's Earth-Borer.‡—The boring instrument used by Dr. J. B. Young for obtaining samples of soil is made throughout of steel tubing. The cutting section, the point of which is furnished with a strong taper

* Centralbl. f. Bakteriol. u. Parasitenk., xviii. (1895) pp. 782–3.
† Paris, 1896, 515 pp.
‡ Trans. Roy. Soc. Edinburgh, xxxvii. (1895) p. 769 (3 figs.).

screw, has in it a long cutting-slot, one edge being sharp, the other rounded off. The slot is opened or closed by means of a handle A attached to a rod passing down the interior of the bore to a hollow plunger O. When A is pulled up, O is raised and the cutting-slot H opened.

Fig. 59.



A transverse section of the cutter is shown in F. E is a projection attached to the plunger for clearing the cutting-slot of any earth got during the sinking of the borer. In using the instrument, the slot is opened by pulling up A, the boring is resumed, and when the cavity contains sufficient earth, the slot is closed by pushing down A and firmly fixing it by means of the thumb-screw B.

MICROSCOPY.

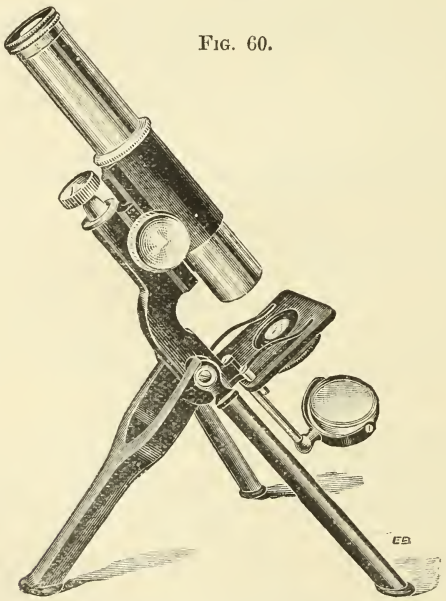
a. Instruments, Accessories, &c.*

(1) Stands.

Meyer's Microscope-Stage with Iris-Diaphragm.†—Dr. W. Behrens refers to the various contrivances which have been tried for passing from condenser illumination to diaphragm illumination, and describes the method adopted by the firm of Meyer & Co., in which an iris-diaphragm is attached to the under side of the stage.

The aperture of the stage, which is of the Zeiss type, is larger than usual (23 mm. in diameter). The short cylinder with the iris-diaphragm is fixed to the under side of the stage by a circular plate, with central aperture, which is screwed to the stage. This plate is cut away on one

Fig. 60.



side to make room for the handle of the diaphragm, which projects on the right side of the stage.

Beneath the diaphragm is the condenser system, which can be turned to one side when the stage-diaphragm is to be used.

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Zeitschr. f. wiss. Mikr., xii. (1896) pp. 292–5.

The drawback to the serviceability of the apparatus is the fact that it is fixed to the stage, and cannot therefore be easily cleaned.

New Portable Microscope.—At the meeting on May 20th Mr. E. M. Nelson read the following:—This portable Microscope (fig. 60) was made by Baker at the instance of Surgeon-Major Ross, of the Indian Army Medical Department, principally for the diagnosis of malarial fever. It only weighs 2 lbs. with lenses complete, and when folded measures $7 \times 3 \times 2\frac{3}{4}$ in. It is fitted with a rackwork coarse-adjustment and direct-acting screw fine-adjustment, a draw-tube, achromatic condenser (doublet) in sliding focusing tube, iris diaphragm, and plane and concave mirrors. It has a tripod stand with a spread of no less than $6\frac{1}{2} \times 6$ in.

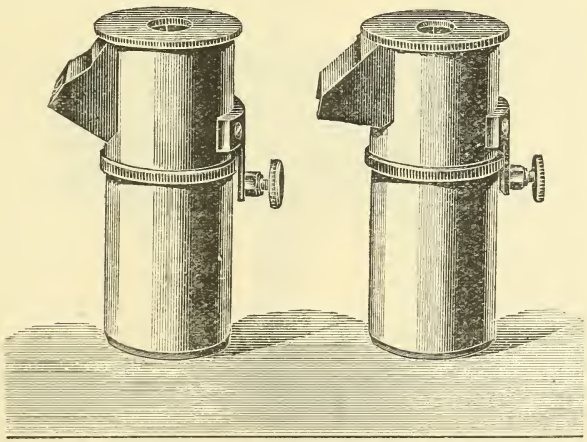
When the tube is extended the body measures 7 in.; additional length for adjustment may be obtained by drawing out the eye-piece.

In India, where long distances have to be traversed on horseback, portability and lightness are important qualities. These have been secured in this instrument without sacrificing the essential points of a good rough and ready working Microscope.

(2) Eye-pieces and Objectives.

Leitz new Drawing Eye-pieces.*—Dr. P. Schiemenz describes two new drawing eye-pieces recently brought out by the firm of Leitz. These are represented in figs. 61 and 62. The eye-piece shown in fig. 61 serves for drawing with the Microscope inclined, that shown in fig. 62 for

Fig. 61. Fig. 62.



drawing with the Microscope in the vertical position. The drawing apparatus, the prism (fig. 63 *pr*) in its metal frame, is attached to a cap (fig. 63 *c*), which is screwed over the eye-piece. In the metal frame beneath the prism is a groove in which smoked glass plates can be inserted in order to diminish the intensity of the light from the drawing

* Zeitschr. f. wiss. Mikr., xii. (1896) pp. 289–92.

surface. The whole drawing eye-piece is fixed to the body-tube of the Microscope by a clamp and screw (fig. 63 *e*). The prism has a different form in the two eye-pieces. Fig. 64 shows the form of the prism of fig. 62,

Fig. 63.

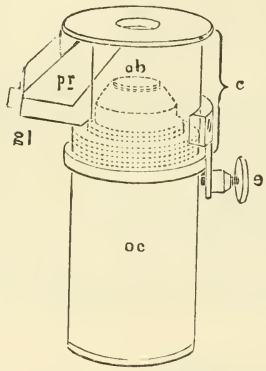


Fig. 64.

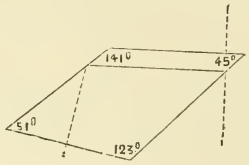
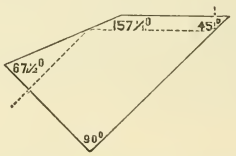
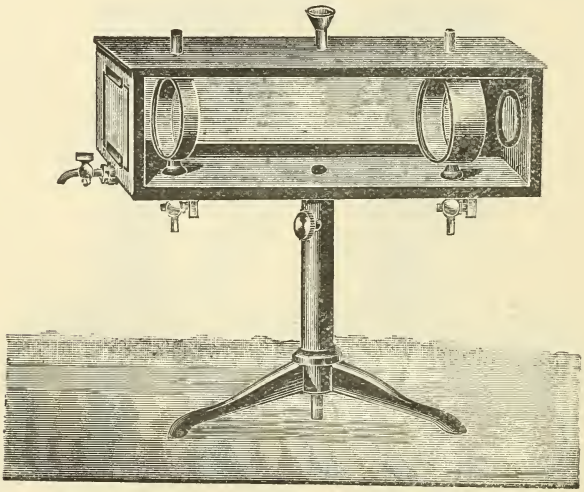


Fig. 65.



and fig. 65 that of the prism of fig. 61. The dotted lines indicate the path of the light-rays coming from the drawing surface. As seen from figs. 64 and 65, with the eye-piece fig. 62 the drawing surface must be inclined 12°, while with the eye-piece fig. 61 it must be inclined 45°,

Fig. 66.



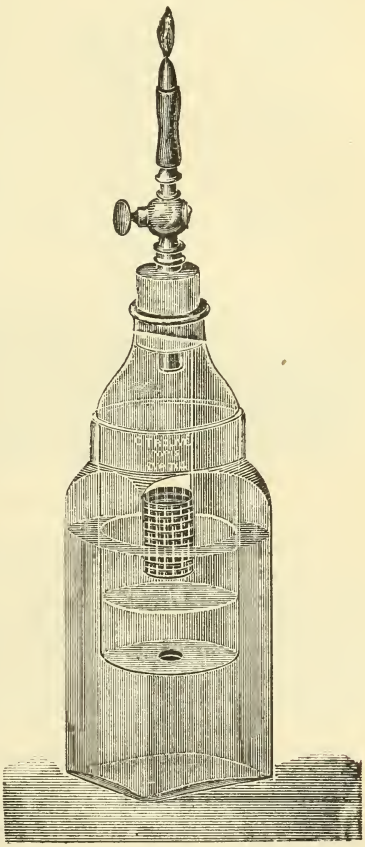
or rather the Microscope must be inclined 45°, while the table on which the instrument stands is used as a drawing-board.

The simplicity of the apparatus, and the fact that nothing about it needs adjustment, are great advantages.

(3) Illuminating and other Apparatus.

Apparatus for Demonstrating the Effect of Lenses.*—Herr K. Haas describes this apparatus, which is shown in fig. 66. On a metal tripod is supported a prismatic box, the long side-walls of which are of glass, while the ends are opaque, but provided with windows for the passage of the light. In front of the windows are grooves for the reception of adiathermic glasses. In the box are two hollow lenses, one biconvex and the other biconcave, to which tubes are attached above and below. In the upper tubes funnels for filling the lenses can be inserted, while the lower tubes serve to empty them. On the box are also a feed-pipe and an exit-tube. When the lenses are filled with a refracting liquid and the box with smoke, the biconvex lens acts as a collective lens and the biconcave as a dispersive one, but the reverse is the case when the box is filled with the liquid.

Fig. 67.



(4) Photomicrography.

Acetylene and Photomicrography.†—Dr. H. van Heurck describes the acetylene gas lamps recently constructed by M. G. Trouvé. In principle they do not differ from the Walmsley apparatus described below, but are made of glass, and have no appliance for cooling and drying the gas. The arrangement of the small apparatus is shown in fig. 67. The inner glass vessel containing the wire basket holding the calcium carbide has a hole in the bottom, and is closed at the top by a caoutchouc stopper, through which passes a tube which can be closed by a stopcock. The inner vessel slides in the outer one, which contains water. A larger apparatus with nickel mounting is also made.

The author considers that acetylene apparatus will render useful service to photomicrography.

* Zeitschr. f. Phys. u. Chem. Unterr., viii. (1895) p. 266. See Zeitschr. f. Instrumentenk., xvi. (1896) pp. 94–5.

† Bull. Soc. Belge de Micr., xxii. (1895–6) pp. 68–73.

Walmsley's "Autograph" Camera, and Walmsley, Fuller, & Co.'s Acetylene Gas Generator.* —Mr. C. F. Fox considers that the Walmsley "Autograph" camera † possesses many advantages with regard to compactness, steadiness, and general accuracy. It is applicable not only to photographing objects through the Microscope, but also to the copying of photographs and to the making of lantern slides.

The best form of illumination with the camera is the acetylene gas lamp. Walmsley's portable apparatus is a modification of the hydrogen gas generator. It consists of an outer vessel containing water, and an inner vessel open at the bottom and sliding into the outer one. The calcium carbide, which on contact with water gives off acetylene, is contained in a wire screen or basket placed in the inner vessel. As considerable heat is given off in the reaction, the gas, before being led to the burner, is cooled and dried by passing through a small chamber consisting of one metal cylinder within another, the space between the two being filled with cold water. As an illuminant, acetylene possesses many advantages: the light is pure and white, and is highly actinic; the temperature of the flame is much lower than in the case of coal-gas, and the amount of carbonic acid produced is reported to be one-sixth as much, on the basis of candle-power to candle-power.

For use with the Microscope, a lamp which consists of a pin-hole burner surrounded by a metal tube lined with plaster of Paris, and having a glass slip run into a slot on one side, is very efficient.

β. Technique.‡

(1) Collecting Objects, including Culture Processes.

Use of Centrifugal Machines in Zoological Technique.§—Dr. C. J. Cori regrets that, although in medical investigations centrifugal machines have been long used in order to quickly separate solid material from liquids, in zoological methods no general use has been found for such apparatus. The cause of this he attributes to the cumbersome and costly form of apparatus hitherto employed. This consideration led to the construction of the simple and cheap centrifugal machine shown in figs. 68 and 69. The whole arrangement consists of three parts:—(1) the centrifugal machine itself; (2) the supporting stand; and (3) a metal cover (fig. 69).

As seen in the figures, the mechanism for rotating the tubes containing the preparations is that of the ordinary drill. The rotation is always in one direction, for no rotation results from the upward movement of the nut T on the spindle *Sp*.

* Journ. New York Micr. Soc., xii. (1896) pp. 35–41.

† See *ante*, p. 126.

‡ This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

§ Zeitschr. f. wiss. Mikr., xii. (1896) pp. 303–6.

Perforated Porcelain Cylinder as Washing Apparatus.*—Mr. W. G. Fairchild describes a new washing apparatus. It consists (fig. 70) of a cylinder of white unglazed porcelain, having both sides and bottom perforated with small holes, and provided with a cork large enough to float the cylinder in the washing fluid.

Fig. 68.

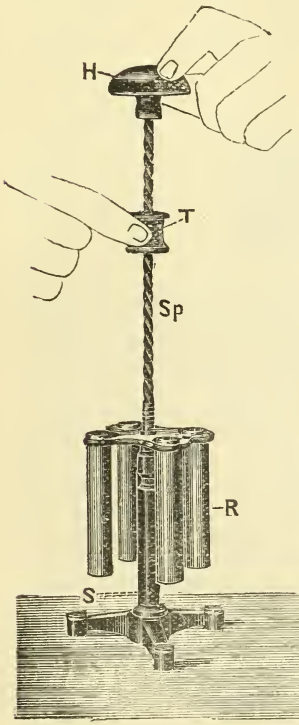
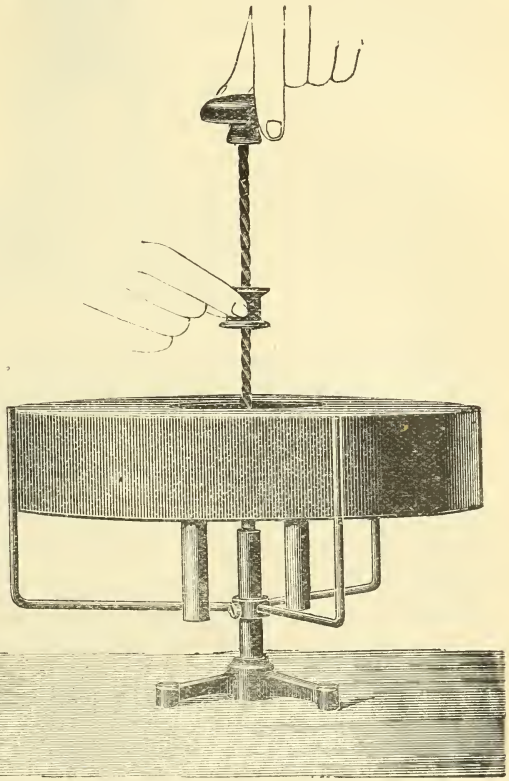


Fig. 69.



Cultivating Gonococcus.†— Dr. Hammer uses highly albuminous urine for cultivating *Gonococcus*. The urine, obtained with antiseptic precautions, is passed into sterilised vessels and, if necessary, filtered. Mixed with glycerin-agar, it makes plates on which *Gonococcus* is easily isolated, even in the presence of other organisms. This medium is said to be far more successful than blood-serum-agar.

Cultivating Spirillum Undula majus.‡—Prof. Zeltnow cultivates

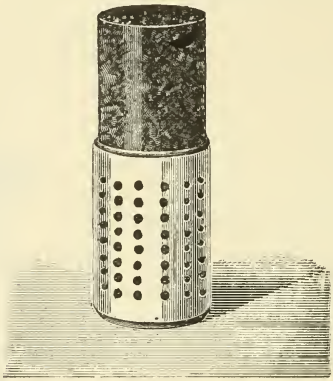
* Zeitschr. f. wiss. Mikr., xii. (1896) pp. 301–3.

† Deutsch. Med. Wochenschr., 1895, No. 51. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 239.

‡ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 393–5.

Spirillum Undula majus in a medium the basis of which is meat-agar, the adjuncts being pepton, ammonium sulphate, and potassium nitrate. The last three ingredients are added in the proportion of 0·1 per cent.

Fig. 70.



Cultivation of Amœbæ on Solid Media.*—Prof. A. Celli has found that the most suitable medium for the cultivation of Amœbæ is *Fucus crispus*, made like agar with 5 per cent. of water, with or without bouillon, and always strongly alkalinised (to 10 ccm. of the medium, 1 ccm. of a solution N/10 of caustic potash, or 4–5 ccm. of a saturated solution of sodium carbonate may be added). Hanging drops are better without the bouillon. It was found to be practically impossible to obtain Amœba colonies free from bacteria, although it was quite easy to obtain pure Amœba cultures, that is to say, isolation of the species and varieties. Isolation was effected by cultivating the Amœba material in the *Fucus* medium in Petri's capsules, and then waiting for cyst formation; cultivations were then made in hanging drops from the ripe cysts. From these it was easy to obtain a single species or variety. In cultures from intestinal contents Infusoria are often present, but are easily got rid of by 1 to 3 transfers. The apparatus required for examining Amœba is a hot stage, or, better still, a thermostat-Microscope. By the above method, which is much simpler than that of Beyerinck, pure cultivations of *Amœba guttula*, *oblonga*, *undulans*, *coli*, *spinosa*, *diaphana*, *vermicularis*, and *arborescens* were obtained, and observed throughout the course of their life-history.

Cultivating Protozoa on Solid Media.†—Dr. F. Schardinger obtained pure and bacteria-free cultures of Protozoa by incubating samples of the material in hay-infusion at 37°. Next day there were numberless swarmers on the surface, and from this surface the condensation water of an oblique hay-agar tube was infected. By the third day of incubation at 37°, bacteria, cocci, and much larger forms were observable. Fresh nutrient material was inoculated from a place where these larger

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 536–8.
† Tom. cit., pp. 538–45.

bodies (spores) were predominating, and by the dilution method pure cultures of a Mycetozoon were obtained. Great difficulty was experienced in getting rid of bacteria, but this was finally overcome by frequent transference to fresh solid and occasionally fluid media. The medium is easily prepared; 30 to 40 grm. of hay or straw were boiled with 1 litre of water, and to the filtrate 1–1½ per cent. of agar added. The mixture is then boiled until the agar is dissolved, and then Na_2CO_3 added until the reaction is alkaline. No filtration is needed, for when sterilised, precipitates are deposited and in no way hinder observations on the cultures. Of course the medium can be prepared in the usual way, if so desired. Though the author claims to have obtained bacteria-free cultures by his method, in another place it is admitted that this result is scarcely possible.

Diagnostic Medium for Coli and Typhoid Bacteria.*—Herr Elsner has found in potassium iodide a substance which imparts to nutrient media a capacity to diagnose between typhoid and coli bacteria. Gelatin is boiled with potato extract (1/2 kg. to 1 litre of water), and to 10 ccm. of the gelatin 2·5–3 ccm. of 1/10 normal soda solution are added. The liquid is then filtered and sterilised. When necessary, only 1 per cent. of potassium iodide is added. In 24 hours colonies of *B. coli* are easily distinguished from those of *B. typhosus*, in that the former are quite large and the latter tiny. The latter are further described as small, bright, watery-like, finely granular colonies, which contrast strongly with the coarsely granular brownish coli colonies.

Diagnosis of Cholera by Means of Cholera Anti-Bodies.†—Prof. R. Pfeiffer and Dr. Vagedes have devised a method for diagnosing cholera vibrios by the aid of the serum of cholera-immune animals. The serum used was of such power that 1/15 mg. sufficed to destroy 2 mg. of a living virulent cholera culture. A 1 : 50 bouillon dilution of this serum was made, and then hanging drops, inoculated with a trace of cholera-culture, examined under the Microscope. The inhibitory effect was very marked, the vibrios losing their mobility and aggregating into little heaps. Only rarely slightly mobile vibrios were observed, and after 20 minutes in an incubator the last traces of mobility were lost. Microscopical examination showed that the vibrios were morphologically unaltered. After an incubation of 24 hours, the vibrios in the hanging drops were found to have multiplied, were in lively motion, and the little clumps were barely observable, showing that the inhibitory effect of the serum had passed off. Other vibrios were not affected by cholera serum, and the authors claim that the specific inhibitory property of cholera serum is a valuable aid for diagnostic purposes. Seventy cholera cultures and twenty species of vibrios were examined by this method, which is merely an application of Pfeiffer's specific immunity reaction.

Demonstrating Capsules of Micro-Organisms.‡—Herr W. Noetzel

* Zeitschr. f. Hyg. u. Infektions., S.A. xxi. (1895). See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii. (1895) pp. 590–1.

† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 385–7.

‡ Fortschr. d. Med., xiv. No. 2. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 498.

has succeeded in demonstrating capsules not only in *Anthrax*, but in cadaver bacilli, by Johne's method,* in samples taken direct from the animal body. In preparations from artificial cultures it was found to be more difficult to stain the sheath, but by previous treatment with one per cent. caustic potash the capsule was made to swell, and a successful staining was obtained with gentian-violet and decolorising in acetic acid.

Capsules were also demonstrated in artificial cultures of various species of *Proteus* and *Staphylococci*, *Streptococcus pyogenes*, *Diplococcus lanceolatus*, and Friedlaender's pneumonia bacillus. The results with the diphtheria bacillus were unsatisfactory. The author agrees with Bütschli and Bunge that the deeply stained part corresponds to the cell-nucleus, and the pale or unstained portion between the nucleus and capsule to the cell-body.

(2) Preparing Objects.

Demonstration of the Pores of the Pulmonary Alveoli.†—Dr. D. Hansemann has demonstrated the existence of fine channels between the lung vesicles, so that it seems that adjacent pulmonary alveoli are really in free communication. The experiments were made on the lungs of rats, guinea-pigs, and rabbits. All the air was extracted from the lungs by killing the animals in an atmosphere of carbonic acid. In this way the lungs were rendered perfectly atelectatic, and were quite uninjured. They were then injected with glycerin stained with Berlin-blue at a very low pressure. By immersing the preparations in alcohol, the injection mass shrank away from the walls of the alveoli, and sections showed stellate masses connected by fine filaments. Careful focusing showed the continuity of the filaments, and therefore the existence of stomata between adjacent alveoli.

Demonstrating Structure and Composition of Cell-Nucleus.‡—Prof. A. Zimmerman fixed the material, used by him in studies of the chemical composition of the vegetable cell-nucleus, in Keiser's mixture of 10 grm. sublimate, 300 grm. water, and 3 grm. acetic acid. After twenty-four hours the material was washed in water, 50 per cent. alcohol, iodine-alcohol, alcohol and xylol, and afterwards imbedded in paraffin. The sections were stained with a mixture of 1 vol. saturated aqueous solution of fuchsin and 9 vols. of 0·1 per cent. aqueous solution of iodine-green. This staining fluid requires to be made afresh every time. The sections are immersed therein for eight to ten minutes, and then treated with a mixture of 100 ccm. absolute alcohol, 1 ccm. acetic acid, and 0·1 grm. iodine, cleared up in xylol, and mounted in balsam. Apart from differences of detail, having a greater or less scientific value, the practical result of this method is that the nucleoli stain red and the nuclear network green. The author divides the structure of the nucleus into four parts, the network, the nucleoli, the nuclear membrane, and the nuclear juice. He is of opinion that his observations indicate that the nuclear network

* See this Journal, 1895, p. 126.

† Sitzungsber. d. König. Preussisch. Akad. d. Wissensch. zu Berlin, xliv. (1895) p. 999–1001 (2 figs.).

‡ Zeitschr. f. wiss. Mikr., xii. (1896) pp. 458–76 (1 pl.).

may be composed of very different substances, just as the membrane of a cell may be. The present paper is apparently preliminary to others on the same subject.

Structure of Retina.*—Prof. A. S. Dogiel obtained very successful results by using a methylen-blue method. The retina must be laid on the slide with the nerve-fibre-layer turned towards the observer, and so that some quantity of vitreous humour remain associated with it. The methylen-blue solution must not come into direct contact with the retina. A solution of 1/10–1/16 per cent. solution, acting for 20–40 minutes, suffices to affect many nerve-cells of the inner and middle ganglionic layer. The preparation must be fixed on the slide with five to six drops of picric-acid-ammonia solution, to be followed by a mixture of glycerin and the aforesaid solution. After standing thus for 18–20 hours, the preparation may be closed up in the mixture named.

Demonstration of Leucoplasts.†—Mr. L. S. Cheney recommends the leaf-stalk of *Musa Ensete* as a favourable object for examining leucoplasts, all the stages in the development of the starch being easily followed. The leucoplasts are seated in the middle layers of the diaphragms which divide the intercellular passages of the leaf-stalk.

(3) Cutting, including Imbedding and Microtomes.

Improvement to the Reichert Microtome.‡—Dr. J. Starlinger describes an improvement which, at his instigation, the firm of Reichert have made in their microtome (fig. 71). This improvement consists in the replacement of the free-hand movement of the knife-block by a mechanical movement. This is effected by a wheel, with which is connected a toothed wheel in whose teeth the links of a chain exactly fit. The chain passes over another wheel (with no teeth) at the other end of the instrument, and both ends of the chain are attached to the block. While one wheel is fixed, the other is adjustable with a screw, so that sufficient tension can be given to the chain. The second wheel is fixed by a clamp. By these means the friction is reduced to a minimum, and the movement is very smooth.

Watch-Glass Imbedding Method.§—Mr. A. B. Lee, in reply to Rhumbler, who described a method of imbedding small objects in watch-glasses, says that the method is a very old one, having been published in 1885 by Graf Spee, and employed by the writer for years most extensively. For small objects he has found it the best process of any. It is not necessary to prepare the watch-glass with either glycerin or clove oil. After cooling, blocks can be readily cut out by means of a slightly warmed knife. Good paraffin does not break in the process.

Apparatus for Stretching Paraffin Sections.‖—Dr. J. Nowak uses an apparatus, constructed on the principle of the thermostat, for

* Arch. f. Mikr. Anat., xlvi. (1895) pp. 394–413 (1 pl.).
† Bot. Gazette, xx. (1895) p. 81.
‡ Zeitschr. f. wiss. Mikr., xii. (1896) pp. 295–9.
§ Tom. cit., pp. 457–8.
‖ Zeitschr. f. wiss. Mikr., xii. (1896) pp. 447–9 (1 fig.).

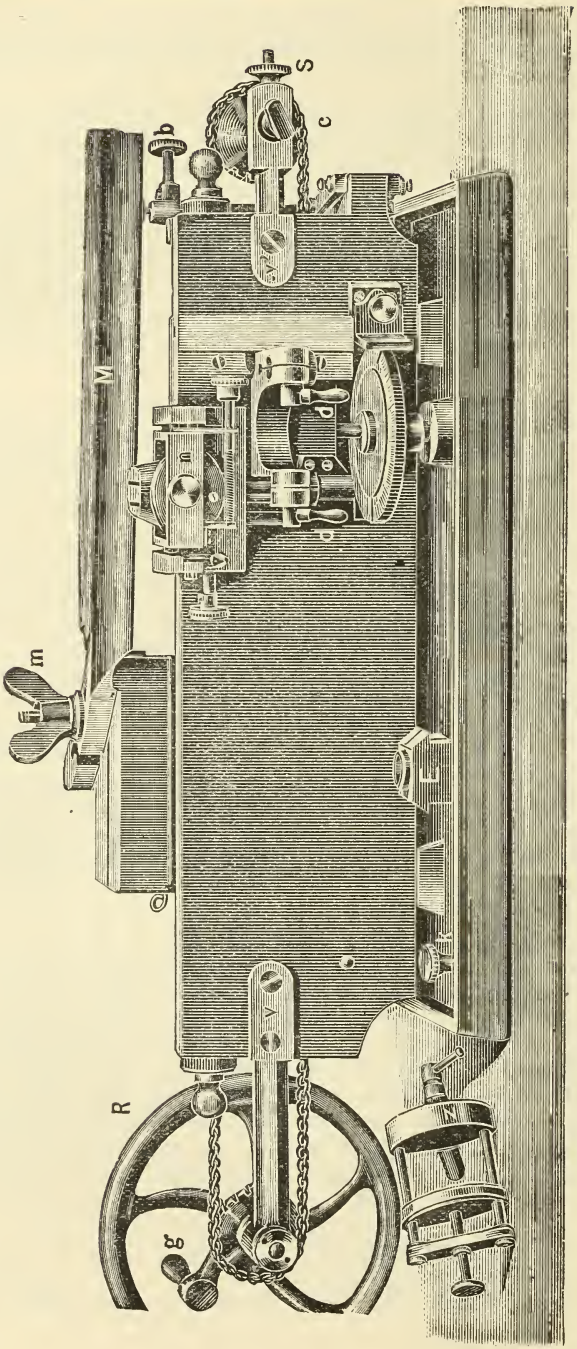
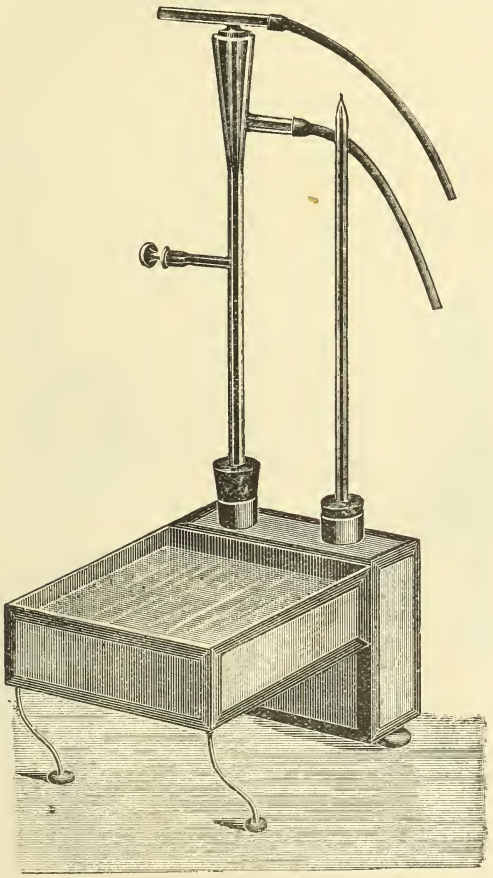


Fig. 71.

stretching paraffin sections. It (fig. 72) consists of two parts in communication, one an open pan, the other a thermostatic box. To the latter are fitted a Reichert's regulator and a thermometer. The apparatus is filled with distilled water, which is heated to a suitable temperature. Into this the sections are dropped as they are cut off by the microtome.

Fig. 72.



(4) Staining and Injecting.

Improvement in Mercury Injection Apparatus for Lymphatics.*— Dr. D. Gerota has made a considerable improvement in Sappey's apparatus for injecting lymphatics with mercury (figs. 73, 74). By bending the top of the cock at a right angle, the instrument is much more easily worked and more under control, as the tap is now moved with the thumb instead

* Anat. Anzeig., xii. (1896) pp. 35–8 (2 figs.).

of the forefinger. Another improvement consists in making the receiver of transparent celluloid instead of horn, so that the quantity of mercury can be observed. In order to adapt a glass canula to the nose-piece of the cock, the author winds round the end a thin layer of cotton-wool saturated in silicate of soda solution (soluble glass), and then screws this in and out of the nozzle of the nose-piece, thus imparting to it a screw turn. After being allowed to dry for 24 hours, wax is dropped on the screw, so that the junction is made perfectly tight.

Fig. 74.

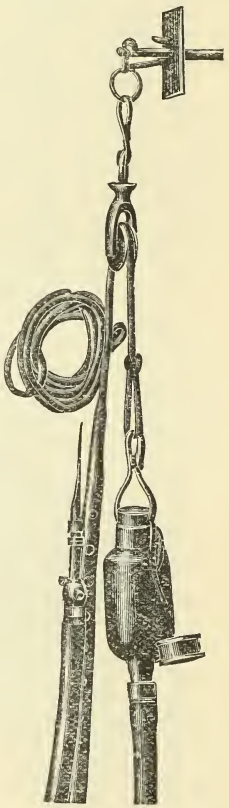
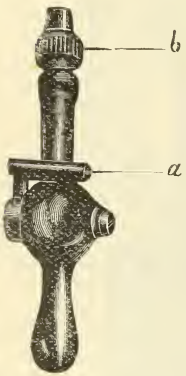


Fig. 73.



Staining by Preoccupation and Subtraction.*—Dr. P. G. Unna claims that Heidenhain's method of subtractive staining and his own, which he calls staining by preoccupation, are substantially the same.

Heidenhain's method consisted in previously saturating the affinity of the protoplasm and nucleus with Bordeaux R, and then staining the

* Zeitschr. f. wiss. Mikr., xii. (1896) pp. 454–7.

central body with iron-hæmatoxylin, any excess of the latter stain being removed by a decoloriser. Hence the term "subtractive."

The author's method has been chiefly applied to preparations from cutaneous eruptions. For obtaining a double stain the author saturates his material, say with orange or acid orcein, and then treats with methylen-blue.

(6) Miscellaneous.

New Microchemical Reaction of Chlorophyll.*—Dr. H. Molisch states that if tissues containing chlorophyll, which have not been moistened, are placed in a saturated aqueous potash-lye, the chlorophyll-grains almost immediately assume a yellow-brown colour, which again passes into green after about a quarter or half an hour. This reaction was observed in about 100 different plants, and even in material which had been kept a year in the herbarium.

Use of the Quartz-Spectograph for Vegetable Pigments.†—Herr A. Tschirch describes the use of this instrument in observing the spectra of vegetable pigments; by its means the so-called terminal absorption (of the violet and ultra-violet rays) can be resolved into bands Among the more important results which he has obtained are the following:—Xanthophyll is not an independent substance; he was able to crystallise from it a substance which he calls *xanthocarotin*, and which gives the so-called xanthophyll-bands in the absorption-spectrum of the extracts of leaves. Two distinct yellow substances are present in the yellow pigment of leaves, having entirely different spectroscopic properties. There is a very close relationship between chlorophyll and hæmoglobin; the chlorophyll of leaves is a compound of phyllocyanic acid with some hitherto unknown substance. The close resemblance of the spectra of chlorophyll and of the blood is pointed out. By means of the quartz-spectograph the terminal absorption of the spectrum of chlorophyll was resolved into a broad absorption-band (VI.), which is much the most stable in position and intensity of all the bands, and is visible in the most dilute solutions.

Demonstration and Crystallisation of Xanthophyll.‡—Dr. H. Molisch has succeeded in separating the xanthophyll (carotin) within the leaf in the following manner. Small pieces of fresh leaves were placed in 40 per cent. (by volume) alcohol, in which 20 per cent. (by weight) of calcium hydrate was dissolved, and the solution left for several days in the dark until the whole of the chlorophyll had disappeared. If the calcium hydrate is now washed out, the xanthophyll can be crystallised out in the form of orange-yellow or orange-brown tabular or needle-like crystals, with a mother-of-pearl glance. They were obtained from about 100 different species, and vary greatly in form and arrangement, even in the same leaf. The author regards the xanthophylls as forming a group of substances to which the general term carotin may be applied. The chemical reactions are distinct from those of cholesterin.

* Ber. Deutsch. Bot. Gesell, xiv. (1896) pp. 16–8.
† Tom. cit., pp. 76–94 (2 pls.). ‡ Tom. cit., pp. 18–29 (1 pl.).

Recording Apparatus for the Study of the Transpiration of Plants.*—Mr. A. F. Woods describes an apparatus which he has found useful for this purpose. It consists essentially of two parts, a balance and a register. The two parts are in an electrical circuit which is opened or closed whenever the equilibrium of the balance is disturbed. When the circuit is closed, the movement of the armature of the magnet mounted on the left arm of the balance engages a notched wheel, which turns a long screw parallel to the beam. This screw works in a half-nut attached to the carriage of the counter-weight, and is adjustable, so that the weight may be set at any point along the beam. For recording evaporation a left-hand screw is used, moving the weight from left to right. As evaporation from the plants goes on, the right arm of the scale rises, thus closing the circuit above the beam. The armature of the magnet is then attracted, and turns the screw carrying the counter-weight; at the same time the pen on the register is carried along by a similar mechanism. This is continued until the balance is brought to equilibrium, and the circuit broken. Further evaporation causes a repetition of the process.

* Bot. Gazette, xx. (1895) pp. 473–6 (1 pl. and 1 fig.).

MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

Leitz's Microscopes.†—M. E. de Wildeman describes several of the Microscopes supplied by the firm of Leitz. In many cases the same stand can be obtained either with the Continental horse-shoe base or with the English tripod.

One large model is inclinable, and has a horse-shoe base. It is provided with coarse- and fine-adjustment, and with a draw-tube with a scale indicating the total length of the tube. The circular stage is movable, and can be centered. Beneath the stage is the Abbe illuminating apparatus, with iris-diaphragm, which can be displaced laterally. There is also beneath the stage a cylinder-diaphragm, in which is another iris-diaphragm. Another model is very similar, but with tripod base, and without the cylinder iris-diaphragm.

The model II*b* is intended for institutions and for students. It is provided with both fine- and coarse-adjustment so that high-power objectives can be used. The illuminating apparatus is much simpler than in the preceding models, and consists of a cylinder carrying above a lens, and below an iris-diaphragm.

Use of Ordinary Binocular for Dissecting.‡—Dr. J. Tatham makes use of the ordinary binocular for dissecting, by the device of attaching to the rackwork substage a brass ring carrying a supplementary stage. For dissecting, the Microscope is placed in the vertical position, and the low-power objective is racked down through the aperture of the principal stage until focused upon the object lying on the supplementary stage.

(3) Illuminating and other Apparatus.

Method for the Exact Adjustment of the Nicol's Prisms.§—Dr. E. Weinschenk gives the following method for adjusting the Nicol's prisms of the Microscope:—

A doubly refracting crystal between two nicols shows no interference colours during the rotation of one of the nicols, if one of its directions of vibration is exactly parallel to the direction of vibration of the other nicol. For the application of this principle to the adjustment of the nicols a crystal is required which allows its directions of vibration to be adjusted exactly parallel to the cross-wires, and gives lively interference colours of a low order. These properties are possessed by quartz which occurs in water-clear needles 5 to 7 mm. long and 0·05 to 0·15 mm. thick. Such a needle is imbedded in Canada balsam,

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Bull. Soc. Belge de Micr., xxii. (1896) pp. 74-7.

‡ Journ. Quekett Micr. Soc., vi. (1896) pp. 206-7.

§ Zeitsch. f. Krystallogr. u. Min , xxiv. (1895) p. 581. See Zeitschr. f. Instrumentenk., xvi. (1896) p. 188.

which possesses almost the same refractive index as the quartz, and the preparation is brought under the Microscope between two nicols approximately crossed, but with directions of vibration oblique to the cross-wires. The long edge of the crystal is then adjusted parallel to the cross-wire, and the polariser is turned until the crystal cannot be distinguished from the rest of the field; the analyser is then turned to the position of darkness. If during this rotation the crystal in any position becomes again visible, the polariser must be turned until the crystal remains perfectly invisible during the rotation of the analyser through 180°. The direction of vibration of the polariser will then be parallel to the direction of vibration in the crystal, i.e. to the cross-wire. The analyser can be adjusted in a similar way.

Optical Rule.*—Mr. E. M. Nelson describes a useful optical rule. The rule, which is made of box and is 20 in. long and square in section, has on one face a scale of inches and tenths, and on the other side centimetres and millimetres. On one of the sides, at right angles to these, is a scale of dioptrics marked D, and on the opposite side a new scale of powers marked P. The author gives several examples illustrating the use of the rule.

Pulfrich Refractometer.†—This instrument in its new form as constructed by Zeiss is shown in fig. 76. It is intended as a universal apparatus for refractrometric and spectrometric investigations.

In principle the apparatus depends on the use of a rectangular prism of strongly refracting glass, of which the horizontal face is brought in contact with the object to be examined, while through the second vertical

Fig. 76.

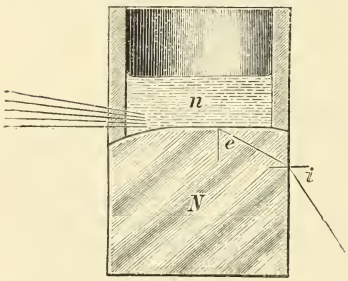
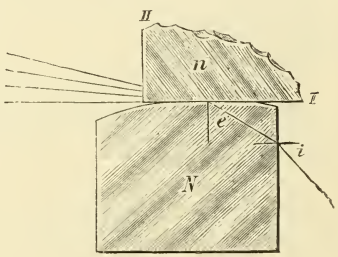


Fig. 77.



face the line of demarcation of the light falling at grazing incidence on the object is observed. From the angle i under which the limiting ray leaves the vertical face of the prism (see figs. 76 and 77), and from the known index (N) of the prism, the refractive index n of the substance examined is given by the formula $n = \sqrt{N^2 - \sin^2 i}$. A glass tube (fig. 76) cemented on to the prism serves for the reception of liquids. Solid bodies (fig. 77) are provided with two faces I and II at right angles to

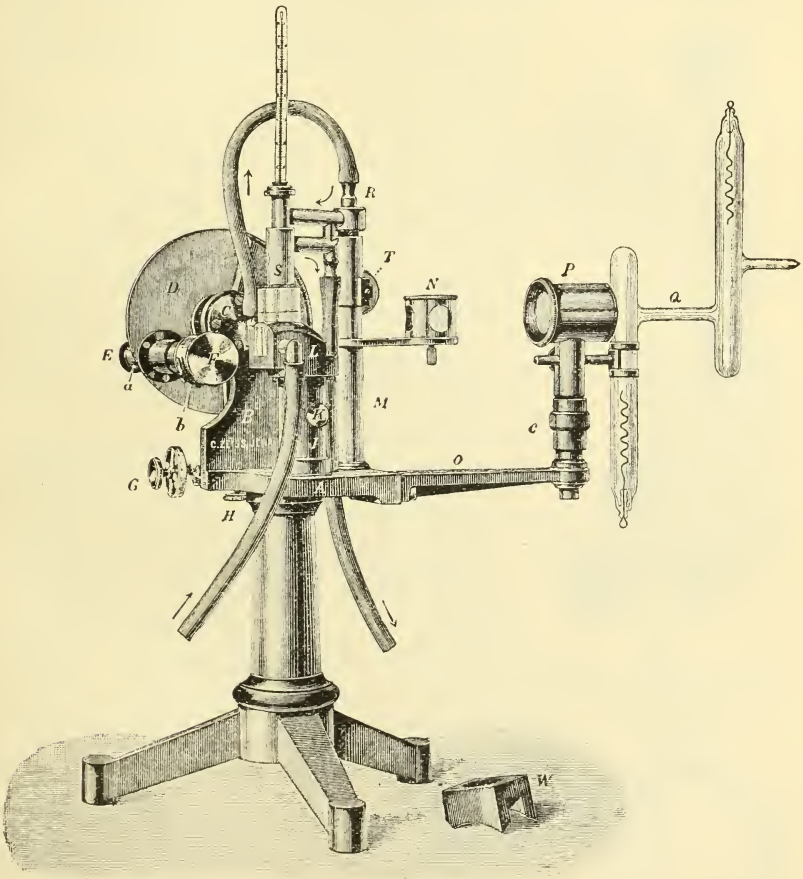
* Journ. Quekett Micr. Soc., vi. (1896) pp. 208–9.

† Jena, 1895, 8vo, 8 pp. and 4 figs.

each other, one of which, I, must be plane polished, while the face II need be only so far polished that light can enter. Between the object and prism face is a thin film of a liquid with a higher refractive index than the object.

The improvements which Dr. Pulfrich has introduced into the new instrument render it serviceable for almost all refractometric and spectrometric investigations, viz. :—

Fig. 78.



(1) For the determination of the refraction (n_D) and the dispersion (difference of the indices for the Fraunhofer lines C, D, F, and G') of transparent, liquid, and solid (single and doubly refracting) bodies.

(2) For the investigation of liquids *at high temperatures*, e.g. of bodies which only become liquid at high temperatures.

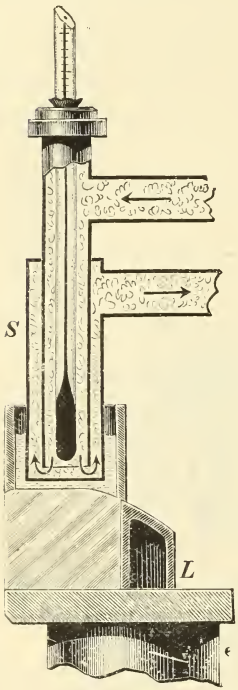
(3) For the determination of the differences of refraction and dis-

persion of solid and liquid bodies which are closely related in optical characters. (Use of the apparatus as differential-refractometer.)

The auxiliary arrangements consist (fig. 78) of—

(1) A new illuminating apparatus, by which the use of sodium light and the light of Geissler tubes (H-light), as well as a quick interchange of the two kinds of light, is possible. The illumination with sodium light is effected with the help of the reflecting prism N, that with H-light by means of the Geissler-tube Q and the condenser P, which can be adjusted in height by *c*. A micrometer arrangement for the determination of dispersion consists of the axial clamp H, and the measuring-screw G, with divided drum.

Fig. 79.



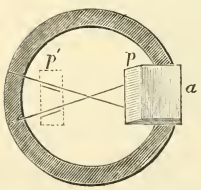
(2) A new heating arrangement, which allows of the accurate investigation of liquids up to 100° C.

The heating is effected either by a stream of hot water at a constant temperature, which traverses the apparatus as shown by the arrows (fig 78), or by the vapour of boiling water or other liquids. The prism shares in the heating. It is enclosed on three sides by a hollow casing L, through which the stream of water flows first before it reaches the upper part for the heating of the liquid.

The warming of the liquid takes place in the interior of the glass tube. For this purpose there is a silver vessel S, which is attached to the column M, and can be lowered by rack and pinion into the liquid and adjusted at any height.

The course of the hot water through the vessel S′ is seen in fig. 79. The base-plate of S can be approached to within a fraction of a millimetre of the face of the prism without injuriously affecting the observation of the limiting line, so that the temperature indicated by the thermometer represents very rigidly the temperature of the liquid. To prevent loss of heat by radiation the liquid is surrounded with a wooden case (W in fig. 78), with cylindrical boring and opening for the entrance of the light.

Fig. 80.



(3) A new vessel for liquids, as suggested by Prof. Ostwald, by which the simultaneous investigation of two liquids and the direct determination of the difference of refraction and dispersion are possible. The glass tube is divided into two compartments by a piece of black glass parallel to the divided circle. One compartment contains the normal liquid, and the other the liquid to be compared with it.

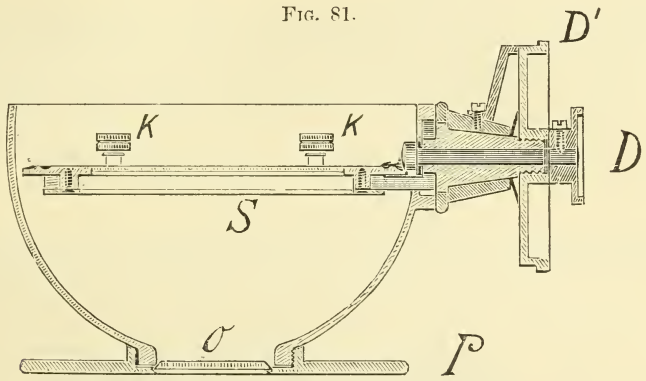
With respect to the ordinary use of the apparatus for the determination of n_D, to the new instrument two accessories have been added, viz.—

(A) A small reflecting prism (*p* in fig. 80) for quickly finding the zero-point of the telescope. This is placed between the eye-piece and cross-wires, and is illuminated by a source of light opposite the opening *u* to the right of the observer.

(B) A diaphragm with elliptic aperture placed before the objective to cut off all disturbing light from the facets of the upper face of the prism.

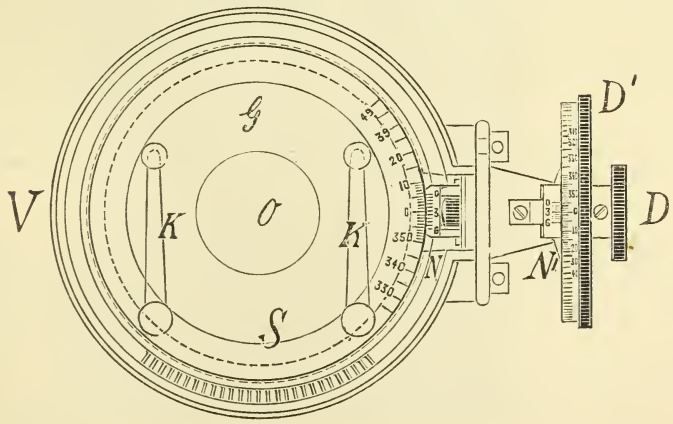
Universal Apparatus for the Investigation of Thin Slices in Liquids.*—Prof. C. Klein describes the universal apparatus which he

Fig. 81.



has devised for the optical examination of sections of minerals and rocks in liquids of high refraction.

Fig. 82.



The apparatus (figs. 81 and 82) is sufficiently large to allow of the examination of ordinary rock-sections. A rectangular metal plate P,

* SB. K. Preuss. Akad. Wiss., 1895, pp. 1151–9.

with central aperture O closed by a glass plate, supports the vessel V, 52 mm. high and 80 mm. upper diameter, which contains the liquid. The section under examination is held by the clamps K on the plate S, whose central part is of glass. Rotation of the section about a vertical axis is effected by the screw D, that about a horizontal axis by D'. Divisions and verniers N and N' allow these rotations to be read to five minutes.

The author explains the use of the apparatus in determining the position of the plane of the optic axes and the character of the double refraction in biaxial crystals.

Regulating d'Arsonval's Thermostat.*—Dr. M. Melnikow-Raswedenkow states that d'Arsonval's thermostat may be regulated to the tenth of a degree by the careful removal or addition of water from the jacket. This may be easily effected by inserting into the glass tube, which indicates the level of the water in the jacket, a siphon tube and a burette tube, the former for withdrawing, the latter for adding water. In this way the constancy of the temperature is easily maintained.

(4) Photomicrography.

Photographic Technique of Wilson's Atlas.†—Dr. E. Leaming gives the following account of the technique used in producing the photomicrographs of eggs of *Toxopneustes*. The installation used was that manufactured by Zeiss of Jena. The adjustment of focus was left entirely with Prof. Wilson, as being most familiar with the special points desired. The exposure was then made so as to slightly overtime the plate, and it was subsequently intensified. Where advisable, Strong's adjustable false stage was used, in order to bring into the same focal plane a second or third point of interest, and it was found that, notwithstanding the short working distance of a 2 mm. lens, the slide could be considerably tilted. The optical combination was an Abbe substage achromatic condenser 1 N.A., a Zeiss 2 mm. oil-immersion apochromat, and projection ocular No. 4. The luminant employed was the electric arc, specially modified for the purpose and giving an evenly lighted field. As the objects had a light blue tint by transmitted light, isochromatic plates were used with a coloured screen made by dyeing a lantern slide plate, from which the silver salts had been removed with an alcoholic solution of tropæolin.

(5) Microscopical Optics and Manipulation.

Appearances of Colour on the Boundaries of Colourless Objects under the Microscope.‡—Dr. H. Ambronn remarks that it is only when the refractive indices of a solid and a liquid are sensibly different from each other that the boundary between them is seen under the Microscope as a colourless dark line. If, on the other hand, the values for the refractive indices only vary by some units in the third decimal place, then in white light certain, often very lively, colour appearances are seen on the boundary. The author gives the following explanation of this phenomenon.

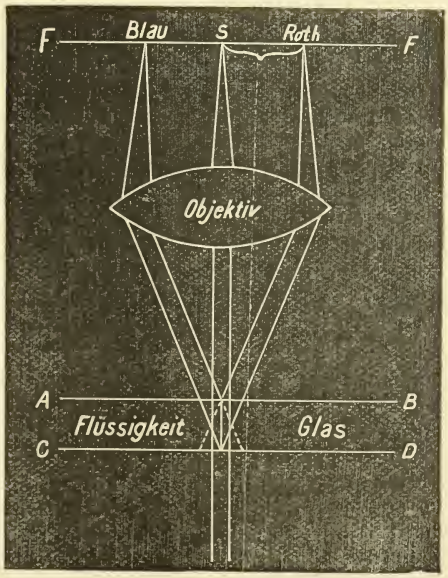
* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 709–12 (1 fig.).
† See Wilson's Atlas, *ante*, p. 394.
‡ Ber. Verh. d. K. Sächs. Gesell. d. Wiss. Leipzig, i. (1896) pp. 134–40.

A colourless liquid and a colourless solid, which have the same refractive indices for an intermediate colour of the spectrum, e.g. for the D line, show a considerable difference in the dispersion; the value of $n_F - n_C$ is greater for the liquid than for the solid. Consequently, by observation in white light, the yellow rays at grazing incidence will suffer no deviation and will give no indication of the boundary between the solid and liquid, but will form a direct image of the source of light in the hinder focal plane of the objective. The other rays, however, suffer a more or less marked deviation since slight differences in the refractive indices under these circumstances produce a considerable difference in the limiting angle of total reflection corresponding to the individual rays. Denoting the latter angle by e, the refractive indices of the liquid by n, those of the solid by n', we have for the colours at C and F of the spectrum the equations:

$$\sin e_C = \frac{n_C}{n'_C}, \quad \sin e_F = \frac{n'_F}{n_F},$$

where $n_C < n'_C$ and $n_F > n'_F$. Since the sine of the angle near 90° changes only very slowly, a considerable change of the limiting angle corresponds to a slight difference of the refractive indices.

Fig. 83.



The red rays at grazing incidence will thus be deviated towards the solid, the blue towards the liquid, as seen in fig. 83.

Accordingly, if the Microscope be adjusted on the upper plane of the preparation (A B in the fig.), the edge of the glass will appear reddish

and the edge of the liquid blueish-green, while the reverse is the case if adjustment be made on the lower plane C D.

These colour appearances are best obtained with a system of considerable focal length, e.g. with the Zeiss system a a and the weak apochromatic system of 16 mm. focal length.

The phenomenon is of practical importance for the determination of the refractive indices of Microscopic objects on which no plane faces can be cut. Out of a number of mixtures of liquids with refractive indices differing by about five units in the third decimal place, one is sought which shows the coloured edges most distinctly when the object is immersed in it. In this case the values of n_D for the solid and the liquid are not very different. Observation is then made in sodium light, and liquids of various refractive indices are tried until one is obtained in which the boundary completely disappears.

(6) Miscellaneous.

The Planktonikrit, a Centrifugal Apparatus for the Volumetric Estimation of the Food-Supply of Oysters and other Aquatic Animals.*—Dr. C. S. Dolley referring to the work of Hensen, Haeckel, and others on planktonology, explains the importance of a quantitative determination of the primitive food-supply of marine animals. Since oysters, clams, and mussels depend practically upon diatomaceous food, determinations of the bulk of diatoms for each cubic metre of regions abounding in Molluscan fauna should be made, and used as standards for estimating the value of neighbouring waters. The ostreiculturist should also have a quick and accurate method for determining the amount of plankton in the water of his parks. For this purpose the author uses a centrifugal apparatus, instead of the old method of counting the individuals. The apparatus consists of a series of geared wheels, by which an upright shaft is caused to revolve up to a speed of 8000 revolutions a minute. To the upright is attached a frame carrying two funnel-shaped receptacles of 1 litre capacity each. The main portion of each of these consists of tinned copper. To this is attached the stem of the funnel, which is formed of a heavy glass tube of 15 cm. outside diameter with a central bore of $2\frac{1}{2}$ to 5 mm. These glasses are protected by a cover.

The Microscope as a Guide in Medicine.†—Dr. C. G. Kuhlman has a remarkable article on this subject, the summary of which we would not dare to give otherwise than in his own words. This author finds that he is justified in arriving at the following conclusions:—

(1) That the Microscope is of little or no value as a guide in the study of medicine at the present date, because every known pathologic condition and change can be recognised microscopically. Pathologic conditions and changes cannot be differentiated microscopically. Owing to defects in Microscopes, defects in sights of students, unsuccessful preparation and manipulation of objects and Microscopes, modern illustrated text-books are far superior as object lessons.

* Proc. Acad. Nat. Sci. Philadelphia, 1896, pp. 276–80.

† St. Louis Medical and Surgical Journal, lxx. (1896) pp. 201–9.

(2) That the Microscope is of no value as a guide in the practice of medicine, because, aided by objective and subjective pathognomonic symptoms, and a few simple instruments and chemical tests, no scientific physician can possibly fail in diagnosing every known pathologic condition and change. The physical and chemical constitution of abnormal physiologic or pathologic animal products capable of poisoning the organism is as yet unknown, but as we have every reason to believe that they are alkaloidal in character, they, like all the known agents capable of sustaining the physiological or chemical activity of the organisms, are not visible to the Microscope. Comment is needless !

Red Blood-Corpuscles in Legal Medicine.*—Dr. M. C. White comes to the conclusion that, in favourable cases, blood-stains can be so treated that reliable measurements and credible diagnoses of their origin can be given. If error occurs on account of imperfect restoration of the form and diameter of the corpuscles, the error, if any, will be to make human blood appear like that of one of the lower animals, and will never lead to the blood of any domestic animal being mistaken for human blood. In general, when a stain has been proved to be blood it may be decided certainly whether it is or is not mammalian blood; so also a stain from the blood of the ox, pig, horse, sheep, or goat may be distinguished from human blood, thus confirming the claim of an accused person in many cases that his clothes are not stained with human blood. This negative testimony is quite as important in many cases as testimony inculpating a prisoner. Lastly, the expert can say that the average of a suitable number of corpuscles from blood-stains corresponds with the average of fresh human corpuscles, that the stain is certainly not from the blood of the ox, pig, sheep, or goat, and, in every case, he can say with great certainty that the stain is not human blood.

History of the Microscope.†—A very excellent and useful work on the history of the Microscope. from its first beginnings up to the present time. Since the last edition of Harting's treatise in 1866, which contained the most complete *résumé* of the development of the instrument up to the date of its publication, some, perhaps unavoidable, errors in facts and dates then extant have been corrected, and a good deal of supplementary information collected on the subject. Although this has, for the most part, been recorded in this Journal, it is convenient to have the information in a continuous form, as in the present work. The author lays no claim to have written an exhaustive or final history of the Microscope, but he observes that, while the modern instrument is generally fully described in microbiological literature, he finds so little or even no mention made of its evolution, that he fears it may come to be overlooked.

One other point may be mentioned in its favour: instead of the loosely stitched and paper-covered affair usually issued by Continental publishers, Dr. Petri's work is extremely neatly half bound, with marbled edges, a new departure which, it is hoped, may be generally adopted abroad.

* Medico-Legal Journal, xii. (1895) pp. 419–38 (12 pls.).

† 'Das Mikroskop, von Dr. R. J. Petri.' Berlin, 1896, 248 pp., 191 figs. and 2 facsimile portraits.

The late Mr. Slack.—We greatly regret to report the death, on the 16th June last, of one who was long actively engaged in the affairs of the Society.

Henry James Slack, who was born on October 23rd, 1818, became a Fellow in the year 1862, and as early as the succeeding year was elected into the Council. From 1867 to 1877 he acted as one of the Secretaries of the Society, and in 1878–9 he was President.

The following papers by Mr. Slack have appeared in the Society's Journals :—

Notes on the Vinegar Plant. (Trans. R. Micr. Soc., N.S. xiii. 1865, pp. 10–5.)

On a Microscopic Ferment found in Red French Wine. (Trans. R. Micr. Soc., N.S. xvi. 1868, pp. 35–9.)

The Patterns of Artificial Diatoms. (Monthly Micr. Journ., iv. 1870, pp. 181–3.)

On an Optical Illusion Slide: Cracks in Silica Films. (Monthly Micr. Journ., v. 1871, pp. 14–5.)

On the Employment of Colloid Silica in the Preparation of Crystals for the Polariscope. (Monthly Micr. Journ., v. 1871, pp. 50–2.)

On some Recent Investigations in Minute Organisms. (Monthly Micr. Journ., v. 1871, pp. 99–112.)

On Crystalline Forms modified by Colloid Silica. (Monthly Micr Journ., v. 1871, pp. 115–6, 193, pls. lxxvii., lxxviii.)

Optical Appearances of Cut Lines in Glass. (Monthly Micr. Journ., v. 1871, pp. 213–5.)

The Silicious Deposit in Pinnulariæ. (Monthly Micr. Journ., vi. 1871, pp. 71–4.)

Micro-Ruling on Glass and Steel. By J. F. Stanistreet. With illustrative remarks by H. J. Slack. (Monthly Micr. Journ., vi. 1871, pp. 151–6, pl. xcvii.)

The supposed Fungus on Coleus Leaves; and also Notes on *Podiosoma fuscum* and *P. juniperi*. (Monthly Micr. Journ., vii. 1872, pp. 217–21, pl. xviii.)

On the Structure of the Valves of *Eupodiscus Argus* and *Isthmia enervis*, &c. (Monthly Micr. Journ., viii. 1872, pp. 256–9, pl. xl.)

On Organic Bodies in Fire-Opal. (Monthly Micr. Journ., x. 1873, pp. 105–6, pl. xxvii.)

On certain Beaded Silica Films artificially formed. (Monthly Micr. Journ., xi. 1874, pp. 237–41, pls. lxiii. lxiv.)

Some Remarks on *Bucephalus polymorphus*, by J. Badcock; together with translations from papers of Von Baer, Lacaze-Duthiers, and A. Giard on *B. polymorphus* and *Haimeanus*, by H. J. Slack. (Monthly Micr. Journ., xiii. 1875, pp. 141–6, pl. xcviii.)

On Angle of Aperture in Relation to Surface Marking and Accurate Vision. (Monthly Micr. Journ., xiii. 1875, pp. 233–9.)

Perforating Proboscis Moths. (Monthly Micr. Journ., xiv. 1875, pp. 235–6.)

Bastian and Pasteur on Spontaneous Generation. (Monthly Micr. Journ., xvi. 1876, pp. 165–8.)

Microscopic Aspects of Krupp's Silicate Cotton. (Monthly Micr. Journ., xvii. 1877, pp. 236–8, pls. clxxx. and clxxxi.)

On the Visibility and Optical Aspects of Hairs viewed from a distance. (Journ. R. Micr. Soc., 1878, pp. 318–20.)

The President's Address. [Progress of Microscopy.] (Journ. R. Micr. Soc., 1879, pp. 113–21.)

On Fungoid Growths in Aqueous Solutions of Silica, and their Artificial Fossilisation. By W. C. Roberts and H. J. Slack. (Trans. R. Micr. Soc., N.S. xvi. 1868, pp. 105–8.)

Diatomaceous Earth from the Lake of Valencia, Caracas. By A. Ernst and H. J. Slack. (Monthly Micr. Journ., vi. 1871, pp. 69–70.)

An appreciative notice of our deceased Fellow appeared in the *Daily News* for June 27th.

β. Technique.*

Methods of Examining and Staining Living and Dead Cells and Tissues.†—Herr G. Marpmann has made a copious compilation of the various methods in use for examining cells and tissues. There is nothing new in the author's paper, some of the formulæ given being more than a quarter of a century old, and all may be found in works devoted to this branch of science. Nevertheless, it is a useful paper.

(1) Collecting Objects, including Culture Processes.

Cultures of Pneumococcus on Blood.‡—MM. Gilbert and Fournier have found that *Pneumococcus* thrives well on defibrinated horse-blood, and that the growth appearances are quite characteristic. After 18 to 20 hours the inoculation streak is surrounded by a brown colour, which changes to green or to brownish-yellow. The virulence and vegetative power are well maintained.

Cultivation of Amœbæ on Solid Media.§—Dr. C. Gorini has cultivated *Amœbæ* on potato with considerable success. The samples were obtained from Beyerinck's ‖ mixed cultivation of *Amœba zymophila* and *Saccharomyces apiculatus*. Transferences were made to potatoes of different kinds, of different ages, and of different reaction. All did well.

Blood-Serum-Agar Medium for Diphtheria.¶— Herr Tochtermann recommends a medium composed of 2 per cent. agar mixed with 0·3–0·5 per cent. grape sugar, 1 per cent. pepton, and 0·5 per cent. salt. To this is added sheep's serum boiled for half an hour, in the proportion of 2 or 3 to 2. The mixture is then sterilised in the usual way. The advantage of this medium is that the blood-serum need not be sterile, or be taken with aseptic precautions.

Bacteriological Examination of old Cholera Dejecta.**—Dr. Zia

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Zeitschr. f. angewandte Mikr., i. (1896) pp. 321–30, 353–67.

‡ La Médecine Moderne, 1896, p. 38. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 836.

§ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 785.

‖ See this Journal, *ante*, p. 198.

¶ Centralbl. f. Klin. Med., 1895, No. 40. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 733.

** Ann. Inst. Pasteur, x. (1896) pp. 334–6.

Bey kept 44 samples of cholera stools, and examined them after periods of 3 to 22 months. From all the cholera bacillus had been isolated. The object of the examination was to ascertain what microbes survived. Cultivations were made on 1 per cent. pepton water, and from this on gelose. Out of the 44 cases only four were sterile. The most frequent organism was the *Coli* bacillus (22), then came *Streptococcus*, while saprophytes, such as *Bacillus subtilis*, were infrequent.

Cultivation of the Diplobacillus of Conjunctivitis.*—Dr. V. Morax describes a diplobacillus which he considers to be the cause of subacute conjunctivitis, a disorder marked by a mucopurulent discharge, and lasting some six to eight weeks. In this secretion exists a diplobacillus 5–6 μ long and 1–1·5 μ broad. It is easily stained by anilin dyes, but not by Gram's method. The cultivation medium used contained 2 per cent. gelose, 2 per cent. pepton, and ascitic fluid. The reaction was neutral. The gelose-pepton solution placed in test-tubes was sterilised at 115°, and when the solution had cooled down to about 60° the ascitic fluid, obtained with antiseptic precautions, was added. The tubes were then gently shaken in order to mix their contents. The medium was allowed to set in the vertical and oblique positions, and then the tubes were incubated for 48 hours to test their sterility. The media were inoculated with some of the mucopurulent secretion and incubated at 35°. The greyish colonies became visible in 24 hours.

Another medium which gave excellent results was composed of serum, or serous fluid and bouillon, in the proportion of one-third ascitic fluid and two-thirds bouillon. The medium gets cloudy in 24 hours at 35°, a deposit falling for 8 to 10 days, after which it resumes its clearness. This diplobacillus is aerobic, is easily killed by heat (58° for 15 minutes), and while non-pathogenic to animals, pure cultivations easily reproduce the disease in man.

Bacteriological Diagnosis of Glanders.†—Dr. C. Gorini uses a modification of Chenzinsky's method for staining the bacillus of glanders, both in sections and on cover-glasses. The stain must be prepared afresh immediately before use (1 part saturated aqueous solution of methylen-blue, 1 part of ½ per cent. solution of eosin in alcohol of 70°, 2 parts of distilled water). Sections are left in this mixture for 30 to 60 minutes and cover-glasses for a few minutes. They are then washed in water and mounted in the usual way. As cultivation media the author used glycerin-gelose and potato. The latter was found to be far superior to the former, which is almost universally used for isolating the bacillus of glanders. The potato cultures, incubated at 37°, gave a positive result in 48 to 72 hours, while the growths on gelose did not appear till the fourth or fifth day, or remained sterile.

The author also records that the bacillus of glanders coagulates milk at 37° in 10 to 12 days, the reaction being neutral, and no further changes taking place in the clot.

Bacteriological Examination of Water by Parietti's Method.‡—The bacteriological examination of water by Parietti's method consists

* Ann. Inst. Pasteur, x. (1896) pp. 337–45 (1 pl. and 5 figs.).
† Ann. de Micrographie, viii. (1896) pp. 111–7. ‡ Tom. cit., pp. 89–110.

in adding a mixture of hydrochloric acid and carbolic acid to the pepton bouillon which is used as a nutrient basis for the cultivations. The principle of the procedure rests on the supposition that certain chemical substances exert an unfavourable action on certain bacteria, and the method, like many others, is chiefly intended for the detection of the bacillus of typhoid fever. M. J. Wittlin is of opinion that this method affords but little help in the isolation of *Bacillus typhosus*, yet it is of great service in finding the various species of bacteria existing normally in water, as well as pathogenic organisms such as *Streptococcus*, *Staphylococcus*, *B. coli communis*, *Proteus*, *Oidium albicans*, and others.

Urinous Substrata for Differentiating Bacillus coli communis and Bacillus typhi abdominalis.*—Dr. Piorkowski finds that the addition of urine to cultivation media facilitates the diagnosis between the bacillus of typhoid fever and *B. coli com.* Three examples are given :—(1) Urine bouillon. 0·5 grm. pepton are dissolved in 100 of urine; the solution is then filtered off into test-tubes (10 ccm. to each). These are then sterilised by heating them two days for 10–15 minutes. (2) Urine gelatin. Is made like the foregoing, save for the further addition of 10–12 per cent. gelatin. (3) Urine agar. In this medium 2 per cent. agar replaces the gelatin.

On these media the growth of *B. coli* was more rapid and luxuriant than that of *B. typh. abd.*, the development of which seemed tardy.

Simple Apparatus for Gathering Microscopic Objects.†—Mr. G. M. Hopkins describes a simple device for collecting microscopic objects. It consists of a tea or dessert spoon having a wire loop round the bowl, to which is fitted a conical bag. A piece of string is attached to the bottom of the bag on the outside and extends over the top and down to the bottom in the inside, where it is again fastened.

In use the spoon is scraped along the surface of objects submerged in water, and when sufficient material has accumulated, the bag is turned inside out by pulling the string, and is then dipped several times into water in the collecting bottle.

(2) Preparing Objects.

Preparation of Eggs of Toxopneustes variegatus.‡—Prof. Wilson took eggs carefully selected from ripe females, fertilised them artificially in sea water, and preserved them at regular intervals. After testing many different fixing agents it was found that the best results were obtained by sublimate-acetic (80 parts concentrated aqueous solution of corrosive sublimate, and 20 parts glacial acetic acid). When properly used, this reagent caused no change of form or shrinkage or distortion of the internal structures; the finest details are shown with a clearness and brilliancy which far surpasses the results of pure sublimate, or a number of fixing reagents. The eggs were preserved in alcohol, imbedded in paraffin, sectioned in the usual manner, and stained on the slide by Heidenhain's iron-hæmatoxylin. The best results were obtained with sections from 3 to 5 μ in thickness, stained 24 hours in

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 686–94.
† The Microscope, iv. (1896) pp. 53–4.
‡ See Wilson's Atlas, *ante*, p. 394.

the hæmatoxylin, and differentiated in 1 per cent. solution of iron-alum to a bright but delicate blue.

Study of Blood-Corpuscles.*—Prof. P. Owsjannikow, in his study of the blood-corpuscles of the crayfish and the fresh-water mussel, made use of some reagents which he is able to recommend. A drop of blood was placed in one or two drops of iodised serum on a slide. It was then covered with a cover-glass, which, at all four corners, was provided with a little wax foot. A drop of anilin solution is gradually introduced into the blood. The addition of glycerin will prevent the drying of the preparation. A one per cent. solution of osmic acid may have soluble stains added to it, but such stains as are not soluble in spirit must be avoided. Corpuscles were well fixed with a 1 or 2 per cent. solution of formalin. With hypermanganate of potash in a 1 per cent. solution the deposit is so finely granular that it does not affect the investigation.

Investigation of Caudina arenata.†—Mr. J. H. Gerould calls attention to the use of magnesium sulphate as a stupefying reagent. A specimen of *Caudina* having been allowed to become well expanded in a small quantity of sea-water, crystals of magnesium sulphate were added, a small teaspoonful at a time. If contraction occurs, the salt is added more slowly, or the use of it suspended entirely until the animal again expands. Perenyi's fluid gave better general results in killing than any other of the reagents which were employed. Previous to imbedding an object in paraffin, it was often found necessary to remove bubbles of carbonic acid gas which had gathered in the tissues during decalcification. This was accomplished, as suggested by Cuénot, by placing the specimen under the receiver of an air-pump, and exhausting the air. For staining on the slide nothing was found to surpass Ehrlich's hæmatoxylin followed by eosin.

The author has given what he believes to be a thorough trial to the rapid method of Golgi, but without the slightest success. However, the author thinks that the method, which is so fruitful when applied to other animals, deserves a more extended trial with echinoderm tissues than has been given it; for the Golgi method may capriciously fail when employed in the study of one animal, although it affords excellent results when applied to a closely related form.

Demonstrating Tubercle Bacilli in Sputum.‡—Prof. v. Rindfleisch moistens an ordinary camel-hair brush with water and then stirs up the sputum with it. When withdrawn it usually looks as if there were nothing on it, but if cover-glasses be smeared therewith, the film will be found to contain a relatively large number of tubercle bacilli. Of course a new brush must be used each time.

Demonstrating Tubercle Bacilli in Human Sputum.§—Herr E. Hacke says that the following procedure will be found to be very simple

* Bull. Acad. Imp. Sci. St. Petersburg, ii. (1895) pp. 367–70.

† Proc. Boston Soc. Nat. Hist., xxvii. (1896) pp. 9–10.

‡ Deutsche Med. Wochenschr., xlviii. (1895). See Zeitschr. f. angewandte Mikr., i. (1896) p. 346.

§ Zeitschr. f. angewandte Mikr., ii. (1896) pp. 1–4.

when tubercle bacilli are very scanty in the sputum. Some of the sputum is to be shaken up with water and some of the sediment spread on a slide, and if there be any small but thickish particles of mucus on the slide the layer is to be squeezed into a film by means of another slide placed thereon. The slides are best dried on an asbestos plate heated in the flame. When fixed, carbol-fuchsin is poured on the film and allowed to act for 8–10 minutes. The solution is composed of fuchsin, 1·0; alcohol, 20; acid. carbol., 5; distilled water, 100. After having been washed with water the preparation is treated for five minutes with the following acid solution:—Acid. mur. pur., 10 drops; distilled water, 20 ccm.; 90 per cent. alcohol, 100 ccm. The slide is again washed, and if not sufficiently decolorised the acid solution must be repeated. If sufficiently decolorised the preparation is contrast-stained with malachite solution, washed again with water and alcohol, and then dried.

(3) Cutting, including Imbedding and Microtomes.

Apparatus for Preserving Celloidin-Blocks on the Microtome.*—Herr G. Alexander describes an apparatus which he has found useful for preserving celloidin-blocks, especially when intended for cutting serial sections. It consists of a quadrangular block with a circular top. The square portion is fixed by the microtome-screw. The circular top has an inbevelled edge, to which a glass tube can be adapted. The tube is 3·5 cm. high, and has a cover or lid. If it be necessary at any time to suspend operations, the cylinder is put on and the junction with the bevelled edge filled up with vaselin. A jar is thus formed, at the bottom of which lies the celloidin-block. Spirit is poured in and the cover put on. By this means a celloidin-block is kept not only unimpaired but in the proper position for sectioning at some future occasion.

New Methods for Paraffin Sections.†—Dr. H. Albrecht and Dr. O. Stoerk fix paraffin sections to the slide in the following way. The section is placed on an unwarmed slide on some water and then stretched by simply breathing on it. It is then pressed on the slide with blotting paper and fixed firmly by pouring on a couple of drops of very thin celloidin solution. This method is said to be very successful, and quite avoids any crumpling of the section and also loss of time. For tissues fixed with osmic acid, however, the foregoing procedure and the albumen-glycerin method are combined. In this the water drop is placed on the albumen-glycerin layer; the section is then breathed on and pressed down on the slide with filter-paper moistened with a few drops of absolute alcohol. The following rapid method, which avoids crumpling, is also given. The pieces throughout the procedure are kept at a temperature of 55°, and first come into 95 per cent. alcohol. The thickness should not exceed 1 cm. After an hour, a piece 1/2 cm. thick is cut off and transferred to absolute alcohol. In another hour it is put into absolute alcohol for two hours, and then for three hours into alcohol kept water-free by means of copper sulphate. It is next transferred to xylol-paraffin, where it remains for three hours. Finally, it passes into paraffin with melting-point of about 52° for one hour.

* Zeitschr. f. wiss. Mikr., xiii. (1896) pp. 10–12 (2 figs.).
† Tom. cit., pp. 12–18.

Fixation of Paraffin Sections with Distilled Water.*—Prof. J. Nusbaum praises highly the method of fixing paraffin sections with distilled water, a method which for its simplicity, elegance, and satisfactory results deserves to be more widely known and practised. The slide is covered with distilled or spring water, evenly spread by means of a glass rod. The sections, even large series of sections, are then placed on the water and the slide held over a spirit-lamp until the sections are stretched out and look quite smooth, without a trace of a crease or a fold. Care of course must be taken that the paraffin does not melt. The water is now poured off, and in doing so the sections may be held by a needle and afterwards arranged if necessary. The slides are then placed in the vertical position under a bell jar for 24–36 hours to get rid of all the water. After this the paraffin is dissolved out in xylol, and the sections washed in alcohol, stained, cleared up, and imbedded. By this procedure certainty in keeping the sections fixed to the slide is attainable.

Method for Impregnating the Lacunæ and Canaliculi of Bone with Fuchsin.†—Herr M. Ruprecht has by the following method been able to confirm and extend the views of Ranvier relative to the recurrent canaliculi of bone. A piece of dry well-macerated bone is filed down to a thickness of 0·3 mm., and the sides scraped with a scalpel to remove the dust. The section is next immersed in ether for some minutes, and after removal heated quickly on a slide and plunged while hot into ether again. The section is then transferred to a boiling saturated alcoholic solution of diamond-fuchsin for five minutes. After cooling down to 34° the staining solution is evaporated to dryness at 70°. The pigment is then scraped off with a knife, and the section is ground between two glass plates with pumice-stone in vaselin-oil and benzin 1 to 10. It is next further smoothed down on an Arkansas stone with vaselin-oil and benzin. After washing off the benzin, the specimen is dried, and polished between pieces of writing-paper. Finally, it is mounted in colophonium dissolved in benzol.

New Jung Microtome.‡—Dr. L. Koch describes the new Jung microtome and gives practical hints for its use in preparing botanical sections. The instrument in its new form does not differ in principle from the microtome described in this Journal, 1893, p. 264.

(4) Staining and Injecting.

Staining Flagella.§—Dr. V. A. Moore stained the flagella of bacilli by Loeffler's method with modifications. As a mordant he used a 20 per cent. solution of tannic acid 10 ccm., a cold saturated solution of iron sulphate 5 ccm., and a saturated alcoholic solution of fuchsin 1 ccm. As a staining fluid, he used Ziehl's carbol fuchsin; 1 grm. of fuchsin is dissolved in 10 ccm. of absolute alcohol, to which 100 ccm. of a 5 per cent. solution of carbolic acid is added. In making the cover-glass preparation, a large drop of warm water was placed upon each slide by means of a sterile pipette; the point of a sterile platinum wire

* Anat. Anzeig., xii. (1896) pp. 52–4.

† Zeitschr. f. wiss. Mikr., xiii. (1896) pp. 21–31 (2 pls.).

‡ Jahrb. f. wiss. Bot., xxix. See Zeitschr. f. angewandte Mikr., i. (1896) pp. 373–5.

§ Proc. Amer. Micr. Soc., xvi. (1895) pp. 220–2.

was gently touched to the culture, and immersed in the water near to the centre of the cover-glass. A sufficient number of the bacilli were found to adhere to the wire to make from six to ten preparations. The tray containing them must next be placed in an incubator at 36°, until the water has evaporated. After the preparations had dried, they were fixed by passing them twice through the flame of a Bunsen burner, or better by heating, for from five to ten minutes, in the hot-air oven at 120° to 140°. The covers were next immersed in 3 or 4 ccm. of the mordant in a large test-tube, and this was heated until steam began to come off. If there is a greyish film on the cover after washing in water, it can generally be removed by rinsing in alcohol, and then again in water. The staining fluid should now be applied in the same way as the mordant, and allowed to act for from one to three minutes.

New Contrivance for Staining Sections.*—M. H. Coupon describes a simple and inexpensive contrivance for staining delicate sections without touching them. Its principle consists in placing pieces of bibulous filter-paper in a thin glass tube of water, and moistening the paper with the required staining solution. The sections are then placed in contact with the paper and absorb the stain from it.

(5) Mounting, including Slides, Preservative Fluids, &c.

Notes on Formalin.†—Dr. W. H. Seaman, referring to the interest taken in this fluid, publishes some particulars which he thinks are not generally known. After giving some details as to the chemical characters of the fluid, for which we must refer the reader to the original, he points out that it appears to be the intermediate substance produced by the action of the carbonic acid of the air on chlorophyll.

Mr. D. S. Kellicott ‡ appears to have had some doubts as to whether formalin was to effect all that it promised. The results of his experience were essentially in accord with the results already published. He has used it as a preservative for a variety of objects, and also in preserving animals for dissection. Its advantages appear to be that it is cheaper than any other method that gives good results. It gives results in much less time, the colours are better preserved, and there is less change of form by shrinkage or by swelling. Its penetrating power is excellent, so that objects preserved in it are fit for work on the internal organs, but it has its disadvantages, It is extremely volatile, and the jars have to be sealed with care, but the author has not had it in use long enough to decide how great an obstacle this will prove in a museum. Again, the watery solution will freeze, and not all museums are at all times above freezing point. Dr. Seaman has a high opinion of the fluid for fixing animal tissues.

Formol.§—Dr. F. Blum, who along with his father introduced formaldehyde as a preservative medium, points out that its virtues depend on its forming a methyl-combination with albuminoids. He has many interesting notes on its use, and gives a bibliography of the subject.

* Rev. Gén. de Bot. (Bonnier), viii. (1896) pp. 70–3 (2 figs.).
† Proc. Amer. Micr. Soc., xvi. pp. 238–41.
‡ The Microscope, iv. (1896) pp. 69–74.
§ Anat. Anzeig., xi. (1896) pp. 718-27.

Herr Fr. Kopsch * gives the results of his use of formaldehyde antecedent to chrome-silver impregnation. It works well and surely even for difficult objects, such as the retina, and the impregnation succeeds on material 24 hours or even 48 hours old.

Retention of the Blood-Colour in Anatomical Preparations by means of Formalin.†—Herr L. Jores uses saline solutions instead of water for diluting formalin. This mixture not only keeps the blood-colour better, but the preparations are also more suited for histological investigation. The solution recommended for the mixture is:—common salt 1 part, magnesium sulphate 2 parts, sodium sulphate 2 parts, water 100 parts. In this solution the organs lose their colour and assume a dirty blue-grey hue. On pouring off the formalin and replacing it by 95 per cent. alcohol, the natural colour slowly returns. The objects are then placed in an indifferent preservative fluid, i.e. a mixture of glycerin and water.

Disinfecting Power of Formalin.‡—Dr. H. Strehl found that formalin vapour is not an effective disinfectant when used against a dry virus (anthrax, staphylococcus). But when formalin spray is used the test objects are killed, and the same result is arrived at even with the vapour, if the objects be moistened first.

Herr Schepilewsky § states that the effect of solutions of formalin tested on anthrax is about equal to that of carbolic acid, and about fourteen times weaker than sublimate. In the gaseous form the influence of formic aldehyde is much stronger than in solution. As a disinfectant for articles of furniture, clothing, furs, and those made of metal, it is very satisfactory, inasmuch as it does not damage or tarnish them. The author's results are quite in agreement with those of other observers, viz. that while formalin is a valuable and effective disinfectant, its action may be inoperative on dry material, or where the material is placed in a position difficult of access, as between the leaves of books.

Disinfection with Formic Aldehyde.‖—Experiments as to the disinfecting properties of the vapour of formic aldehyde have been made under practical conditions by MM. G. Roux and A. Trillatt. The vapour was generated in an autoclave, in which commercial formaldehyde was heated in presence of a neutral salt. Bardet's apparatus, by which the vapour is produced by the oxidisation of methyl-alcohol, was also used. The size of the rooms exposed to the influence of the vapour varied from 70 to 1400 cubic metres. The destruction of germs was found to be complete. Though the vapour is extremely irritating, there is no fear of poisoning from carbonic oxide.

Dr. F. J. Bosc ¶ has tested the value of formaldehyde vapour for disinfecting the wards of hospitals for contagious diseases. Trillat's apparatus was used for generating the vapour. A five hours' exposure was

* Tom. cit., pp. 727–9.

† Centralbl. f. allg. Pathol. u. Pathol. Anat., vii. (1896) No. 4. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 629.

‡ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 785–7.

§ Diss., Petersburg, 1895. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 794–6.

‖ Ann. Inst. Pasteur, x. (1896) pp. 283–96. ¶ Tom. cit., pp. 297–308.

found to be sufficient for destroying pathogenic germs, provided the vapour had free access, even though the space was large (737 cubic metres). If too much covered, as by heaping up of cloths, or by concealment in pockets of dresses, &c., the action of the vapour was less successful. The bacillus of tubercle, either in the wet or dry condition, were easily killed. No damage was done to any of the articles in the places disinfected.

Media for Preserving Algæ.*—Prof. W. A. Setchell and Mr. W. J. V. Osterhout give the results of their experience in the use of the following media for preserving algæ for class-material:—chrome-alum, formalin, and camphor-water. The Cyanophyceæ are best prepared with a solution containing 1 per cent. chrome-alum and 1 per cent. formalin; this solution renders the gelatinous sheath and matrix firm, and retains in most cases the colours in their ordinary tints. The Chlorophyceæ are very satisfactorily preserved in any of these media; chrome-alum is to be preferred in most cases, but some species, such as *Ulva Lactuca*, are rendered very brittle. Such forms are better preserved in formalin. The Phæophyceæ do well if placed immediately in 1 per cent. formalin in sea-water; the larger forms are better fixed in the 1 per cent. chrome-alum for a few hours, and then preserved in 2 per cent. formalin solution or camphor-water. The coarser forms of the Florideæ may be put into any one of the three solutions, and will be found in very excellent condition; chrome-alum preserves the colour better than formalin or camphor-water. Very delicate species, like *Griffithsia Bornetiana*, may be placed in 2 per cent. formalin in sea-water, when the cells keep their shape, and the whole plant preserves a life-like appearance, though the colour disappears.

Preserving and Mounting Fluids for Algæ and Mosses.†—M. J. Amann recommends the following fluids for preserving and imbedding mosses, Chloro-, and Cyanophyceæ:

(1) Lactophenol. Crystal. carbolic acid, 20 grm.; lactic acid sp. gr. 1·21, 20 grm.; glycerin sp. gr. 1·25, 40 grm.; distilled water, 20 grm.

(2) Lactophenol-copper solution. Crystal. copper chloride $CuCl_2$, 0·2 grm.; copper acetate $CuC_4H_6O_4$, 0·2 grm. Dissolved in lactophenol, 5 grm.; distilled water, 95 grm.

(3) The foregoing solution concentrated ten times is very useful for excursion work. The water containing the algæ is merely diluted with 5–10 per cent. of the strong solution, the formula for which is copper chloride, 2 grm.; copper acetate, 2 grm.; lactophenol, 96 grm.

(4) Glycerin-gelatin, with lactophenol. White gelatin, 8 grm.; distilled water, 44 grm. After the gelatin has been thoroughly soaked, glycerin sp. gr. 1·25, 30 grm. are added, and the whole boiled in a water bath; after filtration 10 grm. of lactophenol are added. This medium is a better substitute for Canada balsam than the ordinary phenol-glycerin-gelatin.

(5) Glycerin-gelatin, with copper solution, is prepared like No. 4, but instead of the lactophenol, 10 per cent. lactophenol-copper solution (No. 3) is substituted.

* Bot. Gazette, xxi. (1896) pp. 140–5.
† Zeitschr. f. wiss. Mikr., xiii. (1896) pp. 18–21.

(6) Lactophenol gum. 38 grm. of white gum-arabic are first washed and then dissolved in 50 grm. distilled water. The solution is mixed with 5 grm. glucose and 6 grm. lactophenol, and the whole filtered through glass-wool.

(7) Potassium iodide-mercury-glycerin. Potassium iodide-mercury ($KI + HgI_2$) is dissolved in hot pure glycerin. The solution, which should be very thick, has a high refractive exponent ($n_D = 1{\cdot}78–1{\cdot}80$) and is more convenient to use than the thin watery solution; moreover, specimens, notably diatoms, mounted therein keep much better. For closing the preparations the amber-lac advocated by Behrens, or damar-lac diluted with 2 per cent. boiled linseed oil is recommended.

Antiseptic Value of Sublimate Spray.*—M. P. Chavigny finds from experiments made with one per thousand sublimate solution used in the form of spray, that even when continued for periods longer than those adopted in practice this disinfectant fails to destroy microbic germs or to diminish their virulence. The author conceives the preventive action of sublimate to be due to the deposit of a thin layer of the antiseptic on the surface of the germ, which by cutting off the communication with the surrounding nutritive medium suspends the vital activity and development of the germ. Hence, if the ambient layer be removed the antiseptic property is lost, and the germ becomes free to develope. The author's method was to contaminate plaster plates with infected dust, anthrax, *St. py. aureus*, potato bacillus, and then spray them with a freshly-made one per thousand solution of sublimate, to which was added 1 grm. of sea-salt and 5 ccm. of hydrochloric acid per litre. The spray was made with the small Geneste and Herscher apparatus at a distance of 1·5 m. and maintained for 1–10 minutes. The plates were then covered with sterilised paper and allowed to dry. When dry the surface was scraped in places to get some dust, while on other parts a few drops of sulphate of ammonia solution were poured before the dust was removed. Cultivations made from the dust and examined at 24 and 48 hours indicated that sprayings of a one per thousand solution of sublimate confer merely a temporary protection, and this is likely to fail if the antiseptic layer be removed or become imperfect, so that a communication between the germ and the medium becomes established.

Allusion is also made as to the effect of the spray on thin dry layers of tuberculous sputum. Guinea-pigs inoculated with this sprayed sputum died of tuberculosis in six weeks to two months.

Mounting in Phosphorus.†—Dr. A. M. Edwards uses the following method for mounting objects in phosphorus. Some pure phosphorus is melted under water and then violently shaken while cold water is added, until it breaks up into a fine sand. A few grains of this sand are heated with oil of cinnamon and then added to a solution of gum Thus in alcohol.

(6) Miscellaneous.

Simple Apparatus for Generating Gaseous Formic Aldehyde.‡—Herr A. Dieudonné employed a soldering lamp filled with aceton-free

* Ann. Inst. Pasteur, x. (1896) pp. 351–7.

† The Microscope, iv. (1896) pp. 55–6.

‡ Arb. a. d. Kaiserl. Gesundheitsamte, xi. (1895) pp. 534–43 (1 fig.). See Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., i. (1895) pp. 898–9.

methyl-alcohol for the production of gaseous formic aldehyde. The horizontal chimney is in two parts; the vaporising portion, which contains a Krell's platinum wire core, being placed on top of the wick-tube. The wick-tube is heated until the escaping alcohol vapour ignites, and then the platinum core is inserted into the vaporising tube. Incomplete combustion of the methyl-alcohol now ensues, and in consequence gaseous formic aldehyde is copiously developed, the vapour being discharged at a high pressure. The apparatus is said to work very efficiently, and to be superior to Tollens' lamp, as the amount of air is easily regulated, and the stream of gas can be directed with ease against any particular point. The apparatus was used for disinfecting small infected articles and large spaces.

Cocain in the Study of Pond-Life.* — Mr. H. N. Conser calls attention to the special value of hydrochlorate of cocain as a narcotic in the study of Bryozoa and the encased Rotifera. Quick-killing methods cannot be used where the contractile organs are so well protected as in these forms, neither can the narcotics that kill, for they allow disorganisation of the tentacles before other parts of the organisation are sufficiently benumbed. The method the author has found most satisfactory and certain is as follows :—Several colonies of Bryozoa are placed in a solid watch-glass with 5 ccm. of water, and as soon as the animals have expanded, one or two centigrams of cocain are dropped on the edge of the water at two or three distant points; in 15 minutes the narcotic influence is sufficient, as can be tested by touching the tentacles with a needle. One per cent. chromic acid is now poured in to fill the watch-glass, and left to act for half an hour or more, when it is nearly all withdrawn, and water substituted. This process is repeated in half an hour, and alcohol to form about 25 per cent. added to the water. The strength of the alcohol must be increased until 80 per cent. is reached. By this means the chromic acid is washed out, and the hardening accomplished so gradually that no distortions occur. Swimming Rotifers readily succumb to the influence of cocain, but the Melicertidæ hold out for a long time against it. The method for these is like that for the Bryozoa, with the exception that only sufficient water to cover the colony well need be used. The quantity of cocain must be relatively large, and, when all movements cease, killing may be done with 20 per cent. formalin, for chromic acid precipitates cocain when present in any considerable quantity.

Separation of Vegetable Acids.†—M. L. Lindet recommends the use of methyl-alcohol for the separation of citric and malic acids in plants, after treating with quinine. In the cold, methyl-alcohol of 95° per cent. dissolves 8·2 per cent. of the acid malate of quinine, but only 0·3 per cent. of the acid citrate of quinine.

Microscopical Examination of Cosmetics.‡—Herr G. Marpmann gives an instance of the value of microscopical examination. Two samples of almond paste were submitted to him. One was found to contain two-thirds of fine siliceous earth, the other one-third of an

* Amer. Mon. Micr. Journ., xvii. (1896) pp. 95–6.
† Comptes Rendus, cxxii. (1896) pp. 1135–7.
‡ Zeitschr. f. angewandte Mikr., ii. (1896) pp. 10–11.

infusorial earth. The first ingredient, owing to its method of preparation, is harmless to the most delicate skin, while the latter is most deleterious.

Microscopical Examination of Samples of Meal.* — Dr. Lange recommends the following method for the determination of the amount of silica in meals. Instead of by burning, the organic matter is destroyed by digesting the meal in concentrated sulphuric acid containing some anhydrous copper sulphate. A teaspoonful of the meal is boiled in a flask with about 20 ccm. of strong sulphuric acid and a teaspoonful of anhydrous copper sulphate until the liquid becomes colourless. The liquid is then slowly added to 250 ccm. of water, and the sediment containing the silica allowed to settle. The latter is then examined under the Microscope. The method is particularly useful for the detection of barley meal in other meals.

Estimation of Lecithin in Plants.†—Herr Béla v. Bittó has made a number of measurements as to the quantity of lethicin in various seeds. He notes as to methods, that if a vegetable substance be extracted with ether and then twice with alcohol, with each for an hour, only part of the lecithin passes into solution. For quantitative measurements the substance must be boiled at least 30 times with ethyl-, or 20 times with methyl-alcohol, and each boiling must last 8–10 minutes, but not above a quarter of an hour. Simplification can hardly admit of less than 20 boilings with methyl-alcohol.

* Zeitschr. f. angewandte Micr., i. (1896) pp. 369–70.
† Math. Nat. Ber. Ungarn, xii (1895) pp. 36–46.

MICROSCOPY.

a. Instruments, Accessories, &c.*

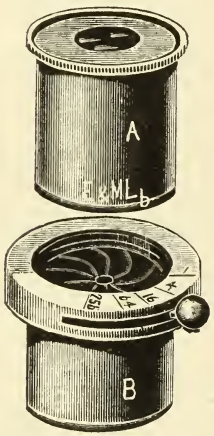
(1) Stands.

New Microscope.†—The firm of Richards & Co. offer for sale a new Microscope, the stand of which is made entirely of brass. The stage is extra large, 9·5 by 8·5 cm., and consists of vulcanised rubber bolted to heavy brass stage-bed 5 mm. thick. The condenser is of the double-lens system, and is fitted with an iris-diaphragm, beneath which is a ring for the reception of blue or ground glass, &c. The eye-pieces and objectives furnished with this stand are Reichert's standard quality.

(2) Eye-pieces and Objectives.

Eye-Piece with Graduated Iris-Diaphragm.‡—Dr. W. Cowl describes and explains the advantages of an eye-piece provided with an iris-diaphragm. As seen in the figure, the iris-diaphragm takes the place in the Huyghens' eye-piece of the usual fixed diaphragm. It is provided on its edge with a scale, each division of which corresponds to a doubling of the diameter of the aperture, beginning with 1 mm. The numbers on the scale correspond to the area of the field of view.

Fig. 84.



Amongst the advantages of the apparatus are —a more acute perception of details in the field of view, owing to the exclusion of neighbouring parts of the preparation; the exclusion of unnecessary light; the possibility of varying the magnification by changing the eye-piece without the necessity of adjusting the Microscope anew, since the iris-diaphragm only slides in the body-tube up to the diaphragm, i.e. up to the plane of the image formed by the objective.

Goerz's New Double Objective.§—The removal of the error of astigmatism in a photographic objective requires a crown-glass of higher refractive power than that of the flint-glass connected with it, whereas the condition for the compensation of the spherical aberration is that the refractive power of the crown-glass must be less than that of the flint-glass. The Goerz double objective is the result of a successful attempt to meet these seemingly incompatible conditions.

Each of the two halves of this double objective consists of three lenses. Theoretically, these could be either a negative flint-glass *b* enclosed between two positive crown-glasses *a* and *a'* (fig. 85), of which *a* has a higher, and *a'* a lower refractive index than *b*; or a crown-glass *a*

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Amer. Mon. Micr. Journ., xvii. (1896) pp. 217–8.

‡ Anat. Anzeig, xii. (1896) pp. 178–80.

§ Central-Ztg. f. Optik u. Mech., xvii. (1896) pp. 131–2.

(fig. 86) enclosed between two flint-glasses $b\,b'$, of which b has a higher, and b' a lower refractive index than a. Practically, however, the first combination, flint between crowns, is found to be most suitable.

Fig. 85.

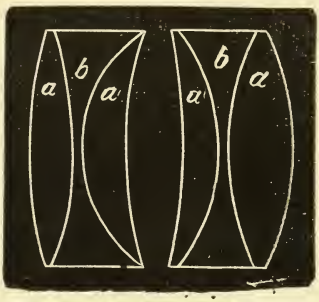


Fig. 86.

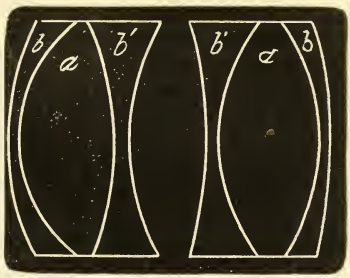
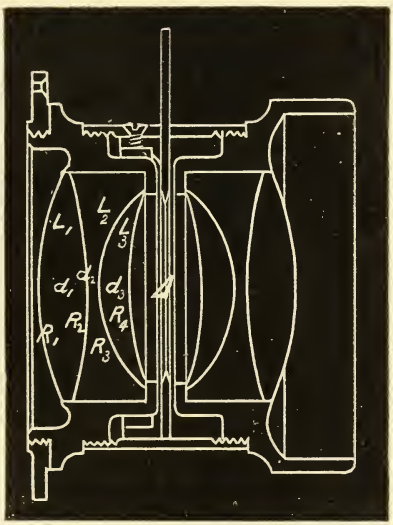


Fig. 87.



As an example, fig. 87 shows in natural size an objective of this kind, of 240 mm. focal length, and 30 mm. greatest effective aperture.

For the production of this objective the necessary constants are as follows:—

Radii of Curvature.	Glass-Thickness.
$R_1 = -R_8 = 45{\cdot}835$	$d_1 = d_6 = 7{\cdot}343$
$R_2 = -R_7 = 54{\cdot}324$	$d_2 = d_5 = 1{\cdot}833$
$R_3 = -R_6 = 19{\cdot}853$	$d_3 = d_4 = 4{\cdot}584$
$R_4 = -R_5 = 49{\cdot}088$	$\Delta = 11{\cdot}00$ air-distance.

Kinds of Glass.

	n D.	n G.
$L_1 = L_6$	1·61310	1·62683
$L_2 = L_5$	1·56804	1·58182
$L_3 = L_4$	1·51497	1·52663

The radii, &c. are expressed in mm. The kinds of glass are determined by the refractive indices for the line D (^{n}D) of the solar spectrum, and for the line of the hydrogen spectrum ($^{H}8[^{n}G^{1}]$). The focal distances for rays parallel to the axis in different zones are:—

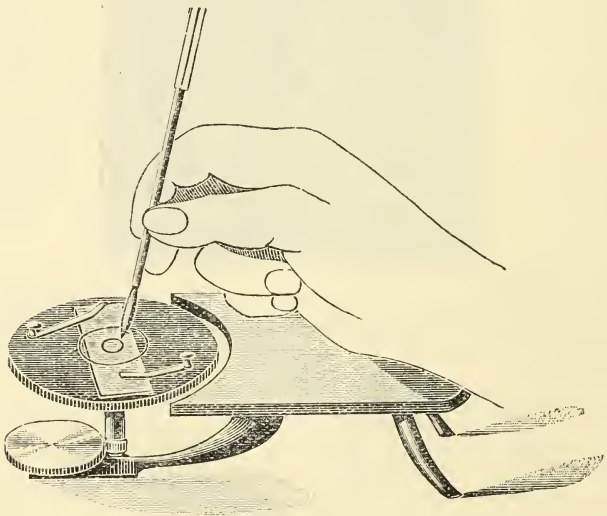
For central rays	$\left\{\begin{matrix} F\,G_1' = 223{\cdot}065 \\ F\,D = 223{\cdot}275 \end{matrix}\right\}$	$\Delta = -0{\cdot}210$
For middle zone, F : 12	$\left\{\begin{matrix} F\,G_1 = 221{\cdot}400 \\ F\,D = 221{\cdot}360 \end{matrix}\right\}$	$\Delta = +0{\cdot}040$
For marginal zone, F : 8	$\left\{\begin{matrix} F\,G_1 = 223{\cdot}495 \\ F\,D = 223{\cdot}442 \end{matrix}\right\}$	$\Delta = +0{\cdot}053$

(3) Illuminating and other Apparatus.

New Thermometer for Regulating the Temperature of Paraffin Baths, &c.*—Most instruments for obtaining a constant temperature are liable to get out of order, so that it is advisable to use with them an apparatus which shall give warning when the temperature has risen above the desired degree. Such an apparatus is the contact-thermometer, which consists of an ordinary glass thermometer armed with two platinum wires. One of these wires is in contact with the mercury in the reservoir, while the other is fused in the tube at the point 50° C., so that the mercury touches the wire when it rises to this point. When this happens, an electric circuit containing a bell is closed, and the bell will continue ringing until, by regulating the flame, the temperature again falls.

New Rotating Disc for the Preparation of Lacquer Rings.†—Mr. C. F. Betting has devised a new form of apparatus for making

Fig. 88.



lacquer rings. As seen in fig. 88, it consists of a rotating disc which is set in motion by a toothed wheel engaging in a pinion on the axis of

* Zeitschr. f. ang. Mikr., ii. (1896) pp. 35-6. † Tom. cit., pp. 33-4.

the disc. The whole apparatus is strongly constructed of iron and brass.

Box for Colouring-Reagents.*—This box has room for ten stoppered bottles for the usual colouring-liquids, imbedding material, &c. The pipette bottles are for methylen-blue, fuchsin, eosin, alcohol, and xylol. There is also a glass for Canada balsam. A space is also left for platinum wire, needles, knife, pipettes and other instruments.

Simple Thermostat for Microscopes of different Construction.†—This apparatus is so constructed that the Microscope can be placed in the heating chamber from behind. The box is large enough to take all ordinary stands.

(4) Photomicrography.

Optical Works of C. P. Goerz in Schöneberg, Berlin.‡—Herr J. Goedicke describes a visit to these works, in which the well-known photographic objectives, the double anastigmatics, are produced. The firm now employs 250 workers. The manufactory consists of a large square building of six stories. In the basement, the first process consists in cutting up the blocks of optical glass into plates of exactly determined thickness. From these plates square pieces are cut out, to which an approximately circular form is given by cutting down the edges. Then follows the grinding down with sand on rotating brass forms, which have a special curvature for each lens. The rough lens thus formed is some tenths of a millimetre thicker than it must be in its completed state. This rough lens is then submitted to fine grinding and polishing with gradually finer emery. For each curvature a very exact pattern glass is produced, which must be exactly filled by a correctly ground lens. From time to time during the grinding the lens is fitted into the pattern until at last no Newton's rings are observed in any position. For the double anastigmatic six lenses are required. These are cemented together with Canada balsam so as to form two symmetrical glasses. They then pass from the hands of the optician to those of the mechanic, to be fitted into the frames. Finally, they are submitted to rigorous optical tests, and if found faultless are engraved with a number and the name of the firm.

Practical Photomicrography.§—Dr. W. C. Borden gives a detailed account of the apparatus and method which, after much experience, he has adopted in photomicrographical work. The Microscope is used in the upright position, while the camera is hung on a rackwork attached to an upright placed on the right of the Microscope. Both the upper and lower ends of the camera are movable on the rackwork. As illuminant the acetylene burner is recommended as "the best artificial light now obtainable for use in photomicrography." A good filter for this light is a solution of 10 grm. of potassium bichromate in 200 ccm. of water contained in a trough 3 cm. wide. The author gives elaborate instructions for the adjustment of the apparatus, &c. He recommends

* Zeitschr. f. ang. Mikr., ii. (1896) pp. 34–5.

† Centralbl. f. Bakteriol. u. Parasitenk., xviii. 1te Abt., No. 11. See Zeitschr. f. ang. Mikr., ii. (1896) p. 108.

‡ Central-Ztg. f. Optik u. Mech., xvii. (1896) pp. 151–3.

§ Amer. Mon. Micr. Journ., xvii. (1896) p. 193–208.

the Cramer "isochromatic" plates. For developing, the following solutions (using equal parts of each) have given him clear negatives of sufficient contrast and graduation:—No. 1. Water 300; sodium sulphite 25; potassium bromide 0·5; hydrochinone 1·5; methol 1·5. No. 2. Water 15; sodium carbonate 300.

(6) Miscellaneous.

Arc-Light Dust as an effective Abrasive Material.* — Mr. K. M. Cunningham has discovered, by microscopic examination, that the black dust which accumulates in the globes of arc lights consists to a large extent of opaque and translucent spherules, hard enough to polish carborundum. He finds that this material is capable of abrading and polishing the hardest rocks.

Presidential Address.†—Mr. E. Davis, in his annual address to the Liverpool Microscopical Society, first dealt with the suggestion that there is no need for a Microscopical Society at all as a separate organisation. Mr. Davis himself, as may be supposed, does not hold this view, and he points out in how many various directions a Microscope gives a means of increasing our knowledge, and affording employment and delight for our leisure hours. First to be named, as they constitute a number of the members of a Microscopical Society, are those who possess a Microscope, who have neither time nor desire to make a systematic use of it. In the Liverpool Society an arrangement has been made by which experienced members give the benefit of their knowledge to those who wish to know how to use the Microscope. Secondly, there are those who endeavour to ascertain the true nature of the markings of a diatom or the structure of a podura scale. It is for such as these that opticians have continually striven to perfect lenses, and to provide improved illumination, and all the world of microscopy have profited thereby. Thirdly, there are users of the instrument who find it useful in their business; while the fourth class of observers are those who use the Microscope for investigating the life-history or minute structure of vegetable or animal organisms. To them is not offered the prize of pecuniary recompense—their reward is the discovery of the mysteries of nature. Of late years a fifth class of microscopic workers has brought to light a class of organisms of whose importance we have as yet only an imperfect idea. In connection with these the President devoted the remainder of his discourse to an account of the life-work of Pasteur.

β. Technique.‡

Microtomist's Vade-mecum.§—Just as we are going to press we receive the fourth edition of Mr. Arthur Bolles Lee's now well-known work. The fact that another edition is called for three years after the appearance of the third edition is of itself sufficient evidence that Mr. Lee's work supplies a want, but it is needless to say anything in

* Journ. New York Micr. Soc., xii. (1896) pp. 78–83.

† 27th Annual Report of the Liverpool Microscopical Society, 1893, pp. 10–20.

‡ This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

§ London, 4th edition, 1896, xii. and 536 pp.

praise of it to an audience of microtomists. We learn from the preface that the author has most thoroughly revised his book—so thoroughly, indeed, as in many parts to have completely rewritten it.

He has thought it well to enter more fully than was hitherto done into the details of the more important processes, to explain more fully the principles on which they are founded, and to add in many cases an estimate of their value. In consequence of this the bulk of the work is considerably increased, though the number of new processes described is smaller than in any edition since the first. The classification of the various methods has been in many cases greatly simplified, and a number of superfluous methods have been rejected. In dealing with the chapters on staining, the author has had the great advantage of the assistance of Dr. Paul Mayer. In the three chapters entitled Neurological Methods the contents have been entirely rearranged by the advice of Prof. Van Gehuchten. The author thinks that the new arrangement may fairly claim to be natural, logical, and easily comprehensible. Perhaps the best statement as to the differences between this and earlier editions of the work will be found in a quotation from Mr. Lee's preface:—"On the one hand the book has been lightened by the jettison of much useless matter, and on the other hand there has been accorded to the matter that has been retained a far ampler share than before of explanation and detail. To such an extent, indeed, have the instructions to students and other explanatory matter been amplified, that I am not acquainted with any modern work on the subject that contains anything like so complete an account of the various fundamental operations of histological technique."

(1) Collecting Objects, including Culture Processes.

Apparatus for Cultivating Anaerobes.*—Herr Migula describes a very simple and practical apparatus for cultivating anaerobes. A closed chamber is made with two glass capsules, and in this, resting on glass blocks, is placed the culture vessel filled with inoculated agar or gelatin. The cover rises in the middle, in order to prevent the condensation water from dropping on the culture. In the middle is an aperture fitted with a caoutchouc plug and glass tube. Into the outer vessel so much liquid paraffin is poured as to form a layer about 1 cm. deep, and then, after having been sterilised, hydrogen is passed through the apparatus. The air is driven out in bubbles through the paraffin.

Agar Media for Bacteriological Cultures.†—According to Herr Marpmann, algæ belonging to the group Florideæ may be used for making agar. Freshly collected algæ are boiled and strained. Among the kinds suitable for the purpose are *Fucus amylaceus*, *Fucus lichenoides*, *Eucheuma spec.*, and *Sphærococci* from the Mediterranean. *Sphærococcus confervoides* gives a fine jelly when prepared as follows:—30 parts of *S. confervoides* are macerated in 2 parts hydrochloric acid and 1 litre of water, and afterwards washed with water until litmus paper is no longer reddened. The residue is squeezed and to it added 700 parts of water, 40 parts of glycerin, 20 parts of liquid pepton (Koch), and

* Deutsche Tierärztliche Wochenschr., 1895, No. 52. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) p. 894.

† Zeitschr. f. ang. Mikr., ii. (1896) pp. 79–80.

the whites of two eggs. The mixture is steamed for 20 minutes, and then strained through a neutralised syrup-filter.

Relation of Pure Cultures to the Acid, Flavour, and Aroma of Butter.*—During the past year Prof. H. W. Conn has carried out experiments in butter-making with 55 different species or varieties of bacteria. The experiments were performed as follows. A lot of milk was passed through a separator and the cream divided into four equal parts. These were placed in separate vessels and at once pasteurised at from 69°–70° for 10 to 15 minutes. After cooling, three of them were inoculated with a culture of bacteria, each being inoculated with a different species. The fourth lot was left as a control. The cultures used were two days old milk cultures, and were added to the cream in the proportion of about 1 to 15. The four lots of cream were kept under similar conditions, and the butter made from the four lots compared. The general conclusions arrived at were that the inoculation of cream with a large culture of one kind of bacteria has a checking influence upon others present, even though the cream be impregnated with other bacteria at the start. A pure culture starter of this sort may therefore be of decided value, not only in developing its own flavour, but in preventing the growth of injurious flavours. The flavour, acid, and aroma appear to be independent of each other; each is a product of bacterial growth, but no one kind of dairy bacteria produces all the three. Flavour is more likely to be found as a product of the growth of acid organisms than those which produce an alkaline reaction in milk, but good flavours may be found in cream ripened with bacteria which produce no acid. Aroma is entirely independent of flavour. The acid-producing organisms do not appear to produce the butter aroma. These aromas are, however, produced by the bacteria which peptonise milk, and the aroma is, therefore, probably due to volatile products of albuminous decomposition.

Influence of Glucose on Staphylococcus pyogenes aureus.†—When making experiments relative to the influence of glucose on *Staphylococcus pyogenes aureus*, M. J. Nicholas used a pure culture from a case of osteomyelitis. Saturated solutions of grape-sugar were injected subcutaneously or intravenously into rabbits at the same time as the inoculation, or the cocci and the sugar solution were injected both together into the veins, or the subcutaneous inoculation was preceded and followed by intravenous injection of *St. aureus*. No definite result was arrived at as to the relation between increased suppurative power and diminished virulence. A tendency to sloughing was noticed about the inoculation sites, in the case of intravenous injection and subcutaneous inoculation. It was also remarked that an animal which was injected intravenously for twenty consecutive days with 5 ccm. of a glucose solution did not pass sugar in the urine.

Diagnosis of Typhoid Bacilli by means of Serum of Animals Immunised to Typhoid.‡—Herren R. Pfeiffer and Kolle have found that

* Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., ii. (1896) pp. 409–15.

† Arch. de Méd. Exp. et d'Anat. Pathol., 1896, No. 3. See Centralbl. f Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 1016–7.

‡ Deutsche Med. Wochenschr., 1896, No. 12. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 957-8.

typhoid serum even *in vitro* gives a characteristic reaction with typhoid bacilli. 2 mgrm. of serum obtained from the goat, which serum is ten times stronger than that of the typhoid fever patient, is mixed with bouillon in the proportion of 1–40. When typhoid bacilli were added (2 mgrm.) to the culture medium and the latter incubated, fine whitish flakes were thrown down, and only after twenty-four hours was there a general turbidity. In this the authors see a means for diagnosing the typhoid bacillus, since the same medium when infected with other organisms, such as cholera, became turbid almost directly.

Method for Rapid Recognition of the Cholera Vibrio and the Typhoid Bacillus.*—The method devised by Herren M. Gruber and H. E. Durham is based on the observation of the first-mentioned that the blood-serum of animals immunised to cholera or typhoid exerts *in vitro* a strikingly specific action on these bacteria. If a scraping from an agar culture be mixed with the protective serum, the bacteria aggregate into balls and their movements cease. Even with the naked eye the massing together of the bacteria can be recognised; for the uniform turbidity of the medium first becomes flaky, the flakes becoming clumps of bacteria, which, as they increase in size, fall to the bottom, leaving the fluid clear. No such result obtains if other bacteria be used. The reaction can be carried out in a test-tube by mixing a loopful of a young agar culture in 1/2 ccm. bouillon, and this with 10 mgrm. of the serum in 1/2 ccm. bouillon; or a drop of the serum may be poured on a cover-glass with a similar sized drop of a bacterial suspension, and, after mixing the two drops, inverting the cover-glass over a hollow-ground slide. If the bacteria be true cholera or typhoid, as the case may be, movement will be found to be extinguished within a minute, and complete balling set up.

Tochtermann's Medium for Diagnosis of Diphtheria.†—Herr W. Kempner made a series of test experiments with four cultivation media for diphtheria bacilli. These were Loeffler's blood-serum, Tochtermann's blood-serum agar and Deycke's alkali albuminat agar and glycerin agar. The last two media failed to come up to the high standard of the first two, and though Loeffler's medium took the first place, as far as numerical success is concerned, yet Tochtermann's substratum is really awarded the palm, on the ground of easier manipulation and more rapid diagnosis.

Tochtermann's medium is made by adding 1 per cent. pepton, 1/2 per cent. common salt, 0·3–0·5 per cent. grape-sugar to a 2 per cent. aqueous solution of agar; this, after filtration, is boiled for 1/4–1/2 an hour with an equal bulk of unsterilised sheep's blood-serum, or in the proportion of 2 to 3. The mass is filtered into test-tubes and sterilised, but should not be heated too long, as its efficiency as a cultivation medium is thereby damaged.

Presence of Influenza Bacilli in the Central Nervous System.‡—Drs. A. Pfuhl and Walter made a bacteriological examination of the

* Münchener Med. Wochenschr., 1896, No. 13. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 895-6.

† Hyg. Rundschau, 1896, p. 409. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 1013-4.

‡ Deutsche Med. Wochenschr., 1896, Nos. 6 and 7. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 1004-5.

blood and exudation in two cases of influenza which died of cerebro-spinal meningitis. The influenza bacillus was demonstrated in cover-glass preparations of the blood and from the meningeal pus. Characteristic colonies of the influenza bacillus were obtained in blood-agar, and histological investigation of the cord and brain confirmed the presence of suppurative cerebro-spinal meningitis, and the existence of the influenza bacilli. As the demonstration of the micro-organism in the tissues has been rarely successful the author's results must be regarded as important, for they show that the nervous phenomena are dependent on the immediate presence of the bacilli, and there is no need to suppose the symptoms and morbid appearances are provoked by absorption of toxins raised at a distance.

The authors advise plate cultures in capsules, in preference to oblique agar tubes. The agar should be filtered, and after having been incubated for several days the condensation water should be removed. The blood should be brushed on shortly before the medium is inoculated with the material to be examined. The most convenient and suitable blood for the purpose is pigeon's. After wringing the bird's neck the thorax is opened, and after the large vessels are tied, the heart is cut out. It is next washed with sterile water, and then one of the cavities having been opened, the blood is allowed to drop on the agar surface.

Relations between Chimiotaxis and Leucocytosis.*—Dr. O. Kowalevsky has made experiments relative to the chimiotactic properties of certain antiseptics, and their action on the number of leucocytes in the blood after intravenous injection of these substances. The animals used were rabbits. The authoress found that iodine, iodide of potassium, tri- and monochlorides of iodine, biniodide of mercury, sublimate, the chloride and sulphate of zinc excite a greater or less amount of chimiotaxis, and when injected into the blood circulation produce a leucocytosis marked by augmentation of the granulations. The degree of leucocytosis usually corresponds to that of the chimiotaxis, and is of a purely chimiotactic nature. The authoress considers it very probable that disinfectants exert a favourable action, not only on account of their bactericidal power, but also in virtue of possessing positive chimiotactic properties.

The methods adopted for bringing about and estimating the amount of chimiotaxis and leucocytosis were simple. For the former, capillary tubes filled with the fluid to be examined were inserted beneath the skin, and after removal inspected. Leucocytosis was effected by injecting in the vein of the ear about 2 ccm. of the fluid. The number of leucocytes was counted in the usual way.

Bifurcated Double-Ended Crystal from Asthmatic Sputum.†—Dr. E. Cutter describes a peculiar bifurcated crystal found in asthmatic sputum, and shows how the presence of such crystals in sputum throws light on the diagnosis of asthma.

New Analytical Process for the Study of Diatomaceous and other Clayey Deposits.‡—Mr. K. M. Cunningham describes the method he

* Ann. de Microg., viii. (1896) pp. 185-226.
† Amer. Mon. Micr. Journ., xvii. (1896) pp. 242-4. ‡ Tom. cit., pp. 228-40.

employs in eliminating the clay from the organisms in diatomaceous earths, &c. It consists in triturating and rubbing them down on a sheet of rubber. The preliminary step in the cleaning is the breaking down of the clay in a soap-bowl containing water, which is several times poured off and renewed. The pellet of heavier sediment resulting from this treatment is then spread out and triturated on the rubber sheet. Finally the material is again transferred to the soap-bowl, and the washing with water continued until all the clay has been eliminated and the diatoms left, only mixed with sand-grains. To remove the diatoms from the sand, the customary concentration method may be used. In the case of marine clays, by the concentration method, the diatoms are left mixed with a large amount of vegetable débris difficult to reduce in the boiling acids. For such clays the author uses the following method :—The diatomaceous material, as roughly concentrated, is transferred to a wooden butter-holder, or hemispherical rubber cup, which is made to spin round rapidly by a smart flip of the finger. The contained liquid will rise up and spread round the sides, and the heavier sand and vegetable débris will settle back at once, leaving a cloud of diatoms in suspension. The bowl is then tilted to throw the diatoms to one side, and several pipettes full of liquid are quickly removed. The diatoms which settle from the liquid thus removed may be dried at once and mounted without treating with acid.

Long Lines as Zoological Collecting Apparatus.*—Prof. Ijima gives an account of the use of long fishing lines as a means for collecting zoological specimens. It may be safely asserted that almost all the hexactinellid sponges hitherto known to inhabit Sagami Bay were brought to light through the medium of "dabo" lines. There are in the Zoological Institute of the College at Tokio many still new to zoologists, some of which are of such exquisite beauty as to fascinate every eye, while others are of truly handsome dimensions. One is no less than 875 mm. long and 270 mm. broad at the middle. Other kinds of sponges obtained by the same method are likewise rich in both individuals and species. A valuable collection of various forms of Hydrozoa and Anthozoa has been made for the Science College Museum since the Japanese fishermen have taken to dabo lines. Among Echinoderms, brittle-stars are the most frequently caught, but such rare and peculiar genera as *Asthenosoma* and *Pourtalesia* have also been dredged. Most interesting holothurians and crinoids have also been taken. Many crustaceans have been taken, and for the famous giant crab, dabo lines appear to be the only apparatus that brings it up from the abyss. Both simple and compound Tunicates, as well as Brachiopoda, are also fairly well represented among the trophies of the dabo lines. As may be supposed, worms and molluscs are the least favourable for dabo lines to catch hold of, although rare and remarkable specimens have thus been taken.

Although we have not said as much as Prof. Ijima, yet we have said enough to show that the dabo lines can be of immense service to zoologists. The process is comparatively simple and inexpensive; it enables the dredger to reach a tolerably great depth where dredging and trawling can only be managed by steam power, and where, if the bottom

* Zool. Mag., viii. (1896) pp. 13-17, 19-23, 39-46.

be rocky, it is hardly possible at all. No doubt, when the method comes to be more largely used, improvements and alterations will be made in it.

New Steriliser.*—In this apparatus a double-walled steam cylinder effects a constant temperature of the interior. The heating is accelerated by the bottom of the apparatus being bent inwards, so that the water above the flame is only a few centimetres in depth. The main mass of the water is in a ring-shaped enlargement of the lower part.

Formic Aldehyde Lamp for Disinfecting Purposes.†—The firm of G. Barthel, Dresden, have brought out a new formic aldehyde lamp. In the lamp methyl-alcohol is drawn up into a tube by a wick, is evaporated, and burnt with a limited supply of air.

(2) Preparing Objects.

Method of Preparing Molluscan Eggs.‡—Mr. J. Fujita, in his experiments on Molluscan eggs, studied the normal methods of development, thus:—The eggs were stained *in toto*, and passed through ascending grades of alcohol as usual; on a prick being made through the chorion, the eggs were set free into the alcohol. The latter was then immediately replaced with clearing fluids, and the eggs were afterwards mounted in balsam. This method is quite sufficient for tracing all the history up to the formation of the mesoderm. For the purpose of experiments the method employed resembled generally that adopted by Crampton. The eggs were first examined with a low power to determine the stage to which they had developed. The separation of the blastomeres was at first attempted by the use of very fine needles, but, as the blastomeres are minute in size, the author failed in almost every case, and, even when successful, the rough treatment resulted in death. At last the difficulty was got over by trusting to the accidental separation of the blastomeres in the breaking and piercing of the gelatinous envelope and the chorion; the egg fragments thus obtained were transferred to watch-glasses by a jet of steam, and were then ready for observation.

Examination of Polar Rings of Earthworms.§—Miss K. Foot, after trying various reagents and stains, made use of lithium-carmine and Lyons' blue. The method that has proved most satisfactory for eggs of *Allolobophora fœtida* is to stain the sections from one to twenty-four hours in lithium-carmine, wash in acidulated alcohol for a few seconds, and double stain with a very dilute solution of Lyons' blue. The process must be carefully watched under the Microscope. If the staining be properly modified to suit the special fixative, all the fixatives tested give results more or less satisfactory, but the corrosive sublimate, with or without acetic acid, gives the most brilliant and satisfactory reaction. However, Miss Foot thinks that the most reliable fixative is chromo-acetic, for it so fixes the eggs that the subsequent treatment with alcohols produces scarcely perceptible shrinkage; with its use all the structures of the cell may be constantly and sharply defined. The

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xviii., No. 25. See Zeitschr. f. ang. Mikr., ii. (1896) p. 108. † Zeitschr. f. ang. Mikr., ii. (1896) p. 109.
‡ Zool. Mag., viii. (1896) p. 49. § Journ. of Morphol., xii. (1896) pp. 3–8.

structures that are distorted or obliterated by many other fixatives may be constantly and distinctly defined with chromo-acetic.

Preparation of Specimens of Spermatobium.*—Mr. G. Eisen, after trying a dozen or more stains, found the following method to be superior to any other, and to give by far the finest nuclear images:—(1) Staining of the hosts *in toto*—in very weak Delafield's hæmatoxylin, or in Ehrlich's ammonia-hæmatoxylin; (2) hardening and sectioning in paraffin; (3) the slide fixing consisted simply of distilled water, or of formalin and gelatin (one-half per cent. in water). This fixing is used as follows:—(1) Cover the space of the cover-glass on the slide with several drops of the fixing so that the sections will float; (2) warm gently over a plate until the paraffin becomes slightly transparent, but not so long that it begins to melt; (3) let the fixing harden in the air during at least four hours, or better, during the night. Sections treated in this way never loosen, and are always straight. They should never be melted, but the paraffin dissolved in pure turpentine or xylol. When the latter is at last removed, the slides are stained by a saturated solution of orange G in 33 per cent. alcohol. The stain should be left on only a few seconds, and then immediately washed off in 94 per cent. alcohol. If it is found that the nuclei of the hosts are not sufficiently brightly or too darkly stained by the hæmatoxylin, the slide may be again stained by a weak solution of Ehrlich's ammonia-hæmatoxylin under the Microscope. Then clear with oil of bergamot and mount in gum Thus; in xylol such sections give exceedingly good images. The author calls attention to the very great advantages of gum Thus in xylol as a mounting medium, for it gives images far superior to those obtained with Canada balsam or dammar.

Preparation of Nervous System of Cestodes.†—Mr. W. L. Tower found in his study of the nervous system of Cestodes that the Golgi and methylen-blue methods proved of very little value. He has, however, been more successful in the use of Vom Rath's killing fluid. The Cestodes examined were taken from the small intestine of the sheep twenty minutes after the sheep was killed, and placed in warm normal salt solution, in which they remained for 30 minutes. They were then put into the following mixture:—500 ccm. sat. aq. sol. picric acid, filtered; 3 ccm. glacial acetic acid; 5 grm. platinic chloride in 5 ccm. dist. water; 2 grm. osmic acid crystals. After being in this mixture for ten hours the worms were removed, and cut into pieces from 1 to 3 cm. long. They were then put into fresh crude pyroligneous acid for 6–10 hours, and then into 70 per cent. alcohol for a day. After dehydration the pieces were soaked in xylol for 24 hours, and then imbedded in paraffin. By this treatment nerve-tissue is differentiated from muscular and connective tissue, the nerves being coloured greyish-blue, whereas the more highly refractive muscles become brownish, and the connective tissue remains paler than either of the two other tissues.

Method for Demonstrating Axis-Cylinders of Nerve-Fibres.‡—Dr. R. Marchesini recommends the following procedure for demonstrating axis-cylinders. The freshly removed sciatic nerve of a dog is placed at

* Proc. California Acad. Sci., v. pp. 3–5. † Zool. Anzeig., xix. pp. 323–4.
‡ Anat. Anzeig., xii. (1896) pp. 211–5 (2 figs.).

once in Müller's fluid, wherein it remains for five months. The fluid is to be constantly renewed. A piece of the nerve is then cut off, and cleaned of superfluous connective tissue. After having been carefully washed in water, the piece is immersed in 1 per cent. corrosive sublimate for 24 hours. After removal from the sublimate, the piece is dried on blotting-paper and transferred to a 1 per cent. solution of sulphate of potash for at least 12 hours. The piece of nerve is then dried on blotting-paper and immersed in 0·5 per cent. osmic acid for 12 hours. Should the tissue be too dark, the excess of colour can be removed with permanganate of potash solution. Examinations of the specimens may be made from preparations teased out in glycerin, or from mounted celloidin sections cleared up with creosote.

Specimens prepared by this method show striations parallel to the short axis of the cylinder, but not equidistant. In some, the appearances are serpentine, or rather like the worm of a corkscrew. From the appearances observed by this method of preparation, it would seem that the axis cylinders of nerves have a spiral course.

Preparation of Nerve-Cells.*—Miss M. Lewis found that her best and clearest preparations of the nerve cells of a Polychæte were obtained from material prepared by one of vom Rath's osmic mixtures. This experience is not in accordance with that of v. Lenhossek and Dehler, and Miss Lewis therefore took pains to confirm her results by using the methods of the former, namely, the use of corrosive sublimate, followed by iron hæmatoxylin. The conditions obtained by this method furnished an excellent confirmation of the preparations made with the vom Rath mixture, but were in no respect better. In the first method employed, the material was allowed to remain in the vom Rath mixture (picric + osmic + acetic + platinic chloride) 8 days. It was then washed for a short time in methyl-alcohol, followed by pyroligneous acid for 48 hours. Then it was transferred to absolute alcohol, where it was allowed to remain for several days, with frequent changes of alcohol. Further staining was unnecessary. The sections were cut 3·3 μ thick, were mounted in Canada balsam, and gave most satisfactory results. Material prepared by the sublimate method sometimes showed shrinkage of the protoplasm.

(3) Cutting, including Imbedding and Microtomes.

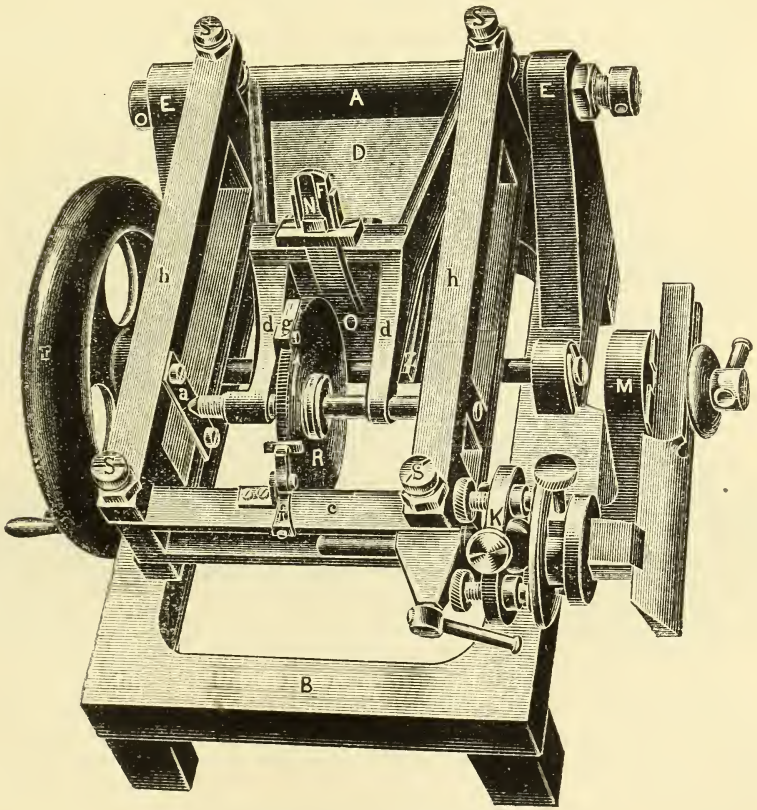
New Simple Microtome.—Herr G. Marpmann † describes a microtome the general aspect of which resembles the Cathcart. A claim to consideration is raised for the preparation clamp, which is stated to be "very practical and apparently new." This claim is founded on the use of the ball-and-socket joint. In neither of the illustrations is the novel arrangement clearly shown. The screw for raising the preparation has a thread rising 1 mm.

New Fromme Microtomes.‡—Prof. J. Schaffer describes the microtomes recently brought out by the firm of Fromme, of Vienna.

* Anat. Anzeig., xii. (1896) pp. 292–3.
† Zeitschr. f. ang. Mikr., ii. (1896) pp. 65–8 (2 figs.).
‡ Zeitsch. f. wiss. Mikr., xiii. (1896) pp. 1–9.

The microtome for paraffin series is shown in fig. 89. A heavy cast-iron frame B, supported on four feet, carries between its projecting ends E E a massive axis A, which is rigidly connected with a horizontal broad arm D. The parallelogram piece has its arms *h h* at *s' s'* attached to the axis A, and at *s s* to a cross-piece *c* parallel to the axis A. This cross-piece *c* has on the left a screw for fixing the clamp K for the preparation. The arm D carries on its free end two vertical cheeks *d d*, between which is the toothed wheel R. The axis of the toothed wheel

Fig. 89.

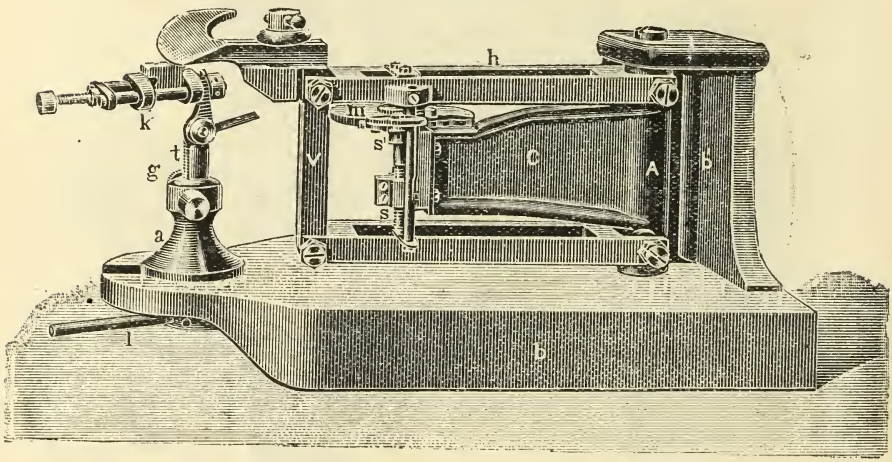


is a micrometer screw, which engages in a nut of the arm *d*. The conical ends of the micrometer screw, one of which is visible at *a*, abut against two pieces screwed to the arms *h h* of the parallelogram. Since the nut of the micrometer-screw is fixed, a turn of the toothed-wheel will result in a displacement to right or left of the parallelogram and of the clamp for the preparation attached to it. The whole apparatus, supported by the axis A, can be raised and lowered about this axis. This movement is effected by means of an excentric, which is attached to the

axis of the wheel r and runs on a steel tongue Z of the arm D. The knife is screwed to a massive arm M projecting from the left side of the base-frame B.

The graduated displacement of the object-clamp is effected by means of the abutting edge N and the two pawls g and f. The pawl g is hinged to the upper end of the vertical arm of a bent lever, which turns about the axis of the wheel and has a horizontal arm projecting beyond. Here the projecting arm carries a nickel block, which on raising the wheel strikes against the abutting edge N. The position of the latter can be adjusted in the piece F, which projects from the base-frame B and carries a division. When by the action of the excentric the parallelogram and toothed-wheel are raised against the abutting edge, the pawl engages in the teeth of the wheel so that the latter is moved in the direction of the arrow, and the parallelogram and clamp connected with it are displaced towards the knife. At the beginning of the back move-

Fig. 90.



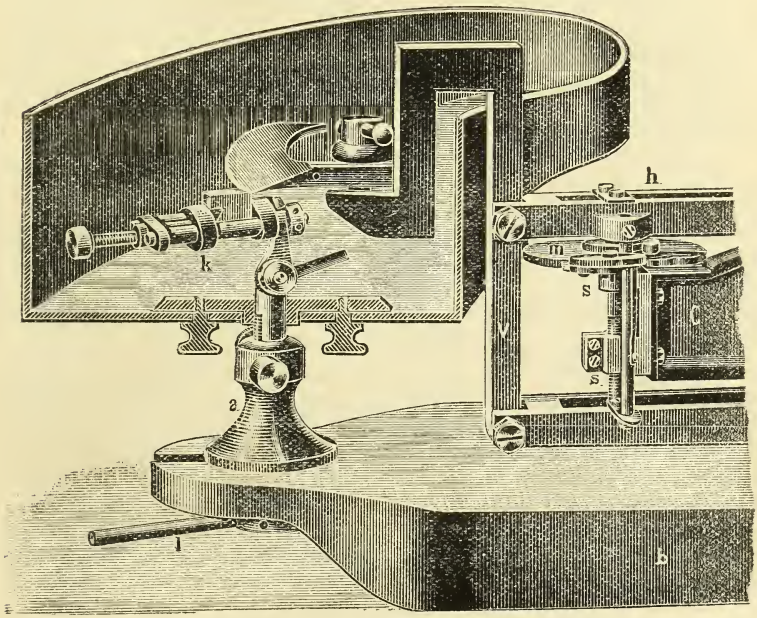
ment the pawl f prevents the wheel from turning back, while the pawl g is raised above the teeth owing to the nickel block of the lever resting on the cross-piece O. The extent of the movement is determined by the adjustment of the abutting edge N in the piece F; each division of the scale corresponds to $2{\cdot}5\ \mu$. In order to render the movement as smooth as possible, a strong spring is brought between the base-frame and the arm D to counteract the weight of the upper part of the instrument.

The new celloidin microtome is represented in figs. 90 and 91. Through a slit in the heavy cast-iron base-plate b, a stand a, carrying the clamp for the preparation, can be inserted, and fixed in the desired position by means of the lever l. The preparation clamp is adjustable by two joints, and can be raised to the desired cutting plane by means of the rack t, where it is fixed by the screw g.

The arrangement for the movement and gradual lowering of the

knife are precisely similar to those for the movement of the object in the instrument for series just described. In the present instrument the turning axis is vertical. With the heavy cast-iron base-plate *b* is rigidly connected the fluted upright support *b'*, between the cover of which and the base-plate moves the axis A and with it the plate C and the parallelogram *h*. The end-piece V of the latter serves for the fastening of the knife. The plate C carries on its end the double nut S and S', in which moves the micrometer screw connected with the toothed wheel *m*. The arrangement for regulating the thickness of the sections is similar to that in the preceding instrument.

Fig. 91.



For cutting under liquids a crescent-shaped vessel (fig. 91) is brought round the stand. In this case the form of the end-piece V of the parallelogram is modified as seen in the figure.

(4) Staining and Injecting.

Injection Masses for Lymphatics.*—Dr. Gerota used the following coloured fluids for injecting lymphatic vessels. The one most recommended is made with Prussian blue. To 2 grm. of this pigment are added 3 grm. of pure turpentine oil, and the mass carefully rubbed up in a porcelain mortar. After this 15 grm. of sulphuric ether are added and the mixture strained through a double layer of linen. The mass is

* Anat. Anzeig., xii. (1896) pp. 216–24 (4 figs.).

preserved in bottles with ground glass stoppers, and the author uses it chiefly for mucosæ and embryonic tissues. Number 2 is made with Extractum alkannæ (Orcanette). 1 grm. of this is dissolved in 3 grm. of turpentine oil, and after filtration through linen 10 grm. of sulphuric ether are added. One objection to this mixture is its liability to pass through the walls of lymphatics and stain the fat. The basis of Number 3 is known commercially as absolute black. Of this 5 grm. are rubbed up for 10 minutes with 5 grm. of unboiled linseed oil in a porcelain mortar, and then 10 grm. of turpentine essence and 10–15 grm. of sulphuric ether are added. The mixture is filtered and preserved in glass-stoppered bottles; it must be well shaken each time before being used. Number 4 has a red colour, and is more difficult to make and to preserve. 5 grm. of very finely powdered cinnabar are rubbed up with 15–20 drops of unboiled linseed oil in a warmed porcelain mortar until a thin paste is formed (10–15 minutes). This is then mixed with 3 grm. of turpentine oil and 5 grm. of chloroform, after which it is filtered and preserved as before. This injection should always be prepared in small quantity, and used while quite fresh.

In injecting these coloured fluids special attention is paid to the syringe, which should be cleaned from time to time with turpentine and ether, since the leather plug is apt to give off a little dust. The syringe used by the author is much like an ordinary syringe used for injecting therapeutic remedies, but is easily taken to pieces, and therefore easily cleaned.. The only material difference is that the needle is made of glass drawn out to a fine point. Many of these glass needles are necessary for working the syringe quickly.

Staining Mucus.*—Dr. Paul Mayer discusses the various reagents used for staining mucus. He begins with "the so-called hæmatoxylins." Hæmatoxylin alone does not stain nuclei or mucus; the presence of an inorganic salt is necessary, and then it is not unchanged hæmatoxylin but its oxidation stage—hæmatein—which forms the stain. It is, therefore, more exact to speak of "hæmatein-Thonerde," "hæmalum," "hæmacalcium," &c. The indispensable "ripening" of hæmatoxylin solutions depends not merely on an oxidation to hæmatein, but also on a gradual weakening of the originally acid reaction of the alum. For rapid and intense mucus staining, Mayer recommends "muchæmatein," with the following composition :—hæmatein ·2 grm., aluminium chloride ·1 grm., glycerin 40 ccm., distilled water 60 ccm., or leaving out the glycerin and water, an alcoholic solution may be made with 100 ccm. of 70 per cent. alcohol and 1–2 drops of nitric acid.

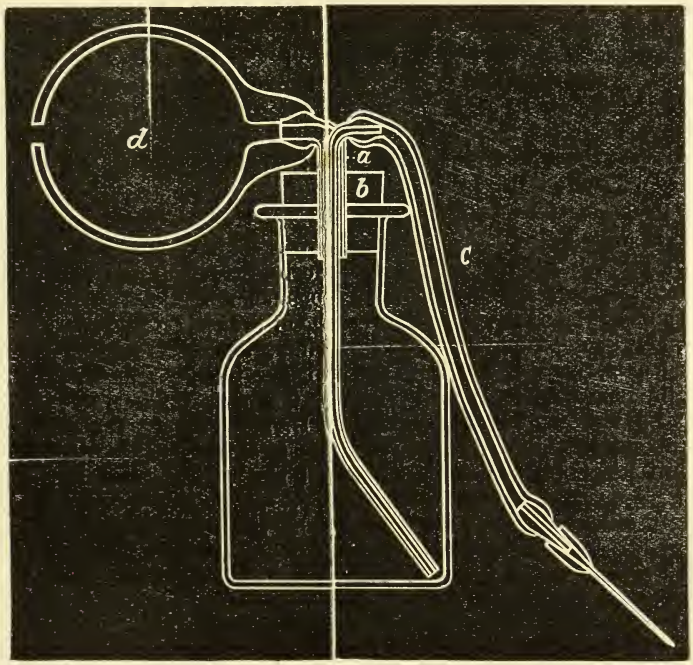
The author goes on to discuss methyl-green, iodine-green, methylen-blue, methyl-violet, thionin- and toluidin-blue, bismarck-brown, and safranin. Thionin is equalled or surpassed by mucicarmin, the receipt for which is as follows :—Carmine 1 grm., aluminium chloride ·5 grm., distilled water 2 ccm., heated over a small flame for about two minutes until the mixture is quite dark. Then 100 ccm. of 50 per cent. alcohol are added. For most cases, to stain the mucus only, the solution should be diluted to 1/5 to 1/10 with alcohol, or to 1/10 with water. Instead of fixing the paraffin sections on the slide through a medium of water

* MT. Zool. Stat Neapel, xii. (1896) pp. 303–30.

or weak alcohol, Mayer sometimes used the staining fluid itself, which acted with unusual rapidity and intensity when the sections were brought for stretching purposes into warmth. Finally the general theory of mucus staining is discussed.

Serum-Injection Syringe.*—Dr. Gabritschewsky has devised a syringe for injecting diphtheria-serum, and one of its chief advantages is that it can be directly applied to the bottles containing the serum. Its construction is easily understood from the illustration : *a* is a metal

Fig. 92.



tube passing through a rubber plug *b*, and *c* a rubber tube connecting with the needle. After these parts have been disinfected in boiling water, the plug is inserted into the serum bottle, and the rubber ball *d* put on. The syringe is then ready for injecting. Entrance of air under the skin is easily prevented by pinching the rubber tube as soon as the last drops of serum are emptied from the bottle.

(5) Mounting, including Slides, Preservative Fluids, &c.

Use of Formalin in Neurology.†—Dr. P. A. Fish reviews the various means which have been recommended for preserving nerve pre-

* Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xix. (1896) pp. 551-2 (1 fig.).
† Proc. Amer. Micr. Soc., xvii. (1895) pp. 319-39.

parations and others in formalin. The combination of formalin with other hardening reagents has not as yet apparently received much attention. Dr. Fish thinks that its use in this connection will undoubtedly be of great value in macroscopic as well as microscopic methods. Good results may be obtained with nerve-tissues when the following mixture is employed:—Water, 2000 ccm.; formalin, 50 ccm.; sodium chloride, 100 grm.; zinc chloride, 15 grm. The specific gravity should be about 1·05; in practice the specimen is left in this mixture for a week or ten days—it may then be transferred to a mixture of water 2000 ccm. and formalin 50 ccm., and it may remain in this solution indefinitely, if the jar be kept tightly covered. To prevent the freezing of formalin solution, it is suggested that alcohol might be mixed with it, say equal parts of 95 per cent. alcohol and 2½ per cent. formalin. Material treated in the way described has yielded most satisfactory results histologically. Formalin may replace osmic acid in the Golgi-Cajal method. A mixture which was used with very great success was the following:—Müller's fluid, 100 ccm.; formalin 10 per cent., 2 ccm.; osmic acid 1 per cent., 2 ccm.

Method of Preserving Nervous Tissue.*—Dr. G. R. Elliott has some notes on the various methods of preserving nervous tissue. They seem on the whole to be addressed to the beginner, but there are one or two points of special interest. He recommends Müller's fluid, when it is especially desired to prevent shrinkage of the specimen, to trace nerve tracks, or when cheapness is a matter of importance. The time necessary to harden is considerably reduced by using the fluid hot, say at 75°. Formalin is looked upon as, perhaps, the most valuable method for preserving tissues which we possess. If, says Dr. Elliott, you once prepare your specimen in this, and forget to change it for three months, you will probably find it preserved all right. The best method for making dry specimens of the brain appears to be that of Giacomini. Among the staining methods to which he refers, he finds that one of the very best of the more recent stains is that of Nissl. Small pieces of fresh tissue are placed at once in absolute alcohol and left from two to six days. After imbedding in celloidin or in paraffin, the specimen is best stained by placing the sections in a watch-glass which can be heated over a flame to a temperature of 70°. The author has succeeded in getting excellent results by allowing the sections to remain overnight in a 25 per cent. solution of methyl-blue. This gave beautiful staining results of cell-processes together with nerve-fibres. The cells are apt to be overstained unless a very weak solution is used. As may be supposed, the Golgi stain is recommended for studying cell structure, as it brings out magnificently the processes of the cell. A neuroglia stain which can be recommended, is one modified by Dr. Mallory of Boston, from one of Weigert's; by this method, small bits of tissue are kept from four to seven days in a solution of formalin 10 c.c. and 90 c.c. of a saturated solution of picric acid; transfer to a 2 per cent. solution of bichromate of ammonia, and leave from one to two weeks, wash in water, and place in alcohol for 24 hours. Mount in celloidin, and stain lightly with carmine; the sections are now to be further stained thus:—Anilin-gentian for from 5 to 20 minutes, decolorise in a solution of one part

* 'The Post Graduate,' xi. (1896) pp. 336-48.

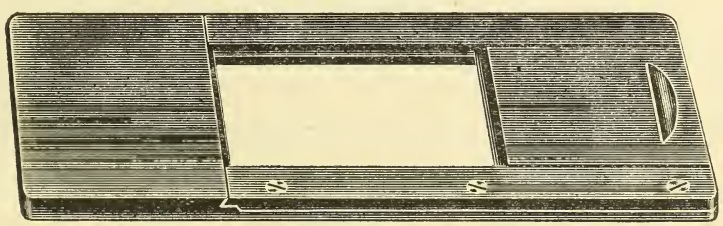
iodine, two parts iodide of potassium, and a hundred parts water; dry with blotting-paper, and further decolorise in a mixture of anilin oil two parts with xylol one part. When sections are sufficiently decolorised, they should be washed two or three times and mounted in xylol-balsam.

The Marchi method is recommended for discovering whether or no a process of degeneration is going on in the nerve-cell.

Preservation of Marine Animals.*—Mr. E. T. Browne remarks that the introduction of formaldehyde as a preserving fluid, instead of alcohol, is of great importance to the marine naturalist, especially when working in localities where it is difficult to obtain a supply of good spirit. He first tried formaldehyde for preserving marine animals at Valentia last year. The results, both for hydroids and medusæ, were far superior to those obtained by means of alcohol. The colouring, however, is not permanently preserved. The best results with hydroids and medusæ have been obtained when the specimen has been killed by a fixing reagent, and then placed first into a 2·5 per cent. solution and finally into a 5 per cent. solution.

Object-Holder for the Observation of Objects enclosed between Two Cover-Glasses.†—Dr. C. J. Cori uses an object-holder, such as is represented in fig. 93, when it is necessary to examine small objects mounted between two cover-glasses on both sides. It consists of an

Fig. 93.



oblong brass plate, 9 cm. long and 4 cm. broad, with a rectangular aperture of dimensions 30 by 35 mm. This aperture can be diminished at will by a sliding panel which serves to firmly clamp the cover-glasses containing the objects to be examined, which are supported in grooves on the sides of the aperture.

Preserving Yeast in Saccharose Solution.‡—Herr J. C. Holm mentions two modifications of Hansen's flasks which are used in Jörgensen's laboratory for keeping yeasts. In these flasks the culture remains unimpaired for many months, and the medium does not deteriorate from evaporation or contamination. From the verbal description, a bent tube connected with the cup of the flask is the essential part of the apparatus. No illustration is given.

* Proc. Zool. Soc. Lond., 1896, pp. 460 and 1.
† Zeitschr. f. wiss. Mikr., xii. (1896) pp. 300–1.
‡ Centralbl. f. Bakteriol. u. Parasitenk., 2te Abt., ii. (1896) pp. 313–6.

New Method for Preserving Succulent Fruit, Fungi, &c.*—Herr H. Behrens recommends the following process for preserving botanical specimens so that they shall retain their natural form and colour, &c. The plants are air-dried, and dipped in a warm 5 per cent. gelatin solution. In case the gelatin should not adhere, the object is first immersed in 70 per cent. alcohol, and then in the gelatin solution. After the layer of gelatin has cooled, the object is dipped into a mixture of 20 parts of the 40 per cent. commercial formic aldehyde and 90 parts of water. By this means an insoluble layer of gelatin is obtained, and at the same time all fermenting organisms, bacteria, &c., are destroyed, and the plants (fungi and fruit) are preserved in their natural form and colour.

* Zeitschr. f. ang. Mikr., ii. (1896) pp. 36–7.

MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

Horizontal Microscope.†—Mr. C. R. Barnes describes a horizontal Microscope for the measurement of the vertical growth of plants, &c. The arrangement is, on the whole, similar to that illustrated in Pfeffer's 'Physiologie,' ii. p. 85, fig. 8, which is the form used in the Leipzig laboratory. For the present instrument, however, the author claims several points of superiority. The base is a large lead-filled brass tripod with levelling screws. From this rises a tube 3 cm. in external diameter, sawed at the top, where it is pinched by a screw collar. A nickel draw-tube, 22 cm. long, slides in the outer tube, and can be adjusted in height by means of the screw collar. At the upper end of the draw-tube is a pinion which engages a rack on a triangular slide. This rack and pinion serve to accurately adjust the Microscope after it has been roughly brought to the required height by means of the draw-tube.

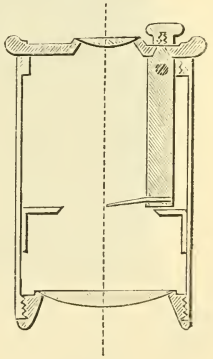
At right angles to the triangular slide is a tube in which the body-tube for focusing slides by means of a rack and pinion. Above the pinion is a spirit-level accurately parallel to the body-tube, so that the latter can be set horizontal by means of the levelling screws.

The optical parts consist of a 2-in. eye-piece, 1-in. and 3-in. objectives. A micrometer divided into tenths of a millimetre is fixed in the focus of the ocular lens of the eye-piece.

(2) Eye-pieces and Objectives.

Demonstration Eye-piece.‡—Dr. M. Kuznitzky describes a modified form of the eye-piece devised by Prof. Pfitzner, in which the end of a pointer can be brought into the centre of the field in order, for demonstration purposes, to mark a certain spot in the preparation. In Prof. Pfitzner's apparatus the movement of the pointer was effected by a lever actuated by a knob on the side of the eye-piece. In the modified apparatus, as seen in fig. 94, the side knob and lever are replaced by a vertical rod, at the lower end of which is the pointer projecting horizontally as far as the centre of the field of view. The upper end of the rod passes through the upper plate of the eye-piece and carries a knob, by turning which the pointer can be brought at will into the field of view or beneath the diaphragm. The knob projects so little above the eye-piece as not to interfere with observation through the Microscope. Many English workers will here recognise an old friend.

Fig. 94.



* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Bot. Gaz, xxii. (1896) pp. 55–6.

‡ Zeitschr. f. wiss. Mikr., xiii. (1896) pp. 145–6.

(3) Illuminating and other Apparatus.

New Thermostat heated without the use of Gas.*—Dr. W. Karawaiew gives a detailed description of the thermostat which he has found very serviceable for histological purposes. The regulator for the thermostat depends in its construction upon a new principle, viz. the cutting off from the thermostat of the heat of the flame by means of a rotating metal plate. In fig. 95, A B C D represents the section of the thermostat and E F G that of the plate, at right angles to the axis of rotation which passes through F and is parallel to the edge of the thermostat from front to back through C. At first the position of the plate is such (E F G) that the heat of the flame F*l* acts without hindrance on the bottom of the thermostat C D. This will be the case until the temperature of the thermostat rises above a certain point, when the plate, by an automatic arrangement to be explained later, moves into the position K F L, and the heat of the flame is cut off from the thermostat.

Fig. 95.

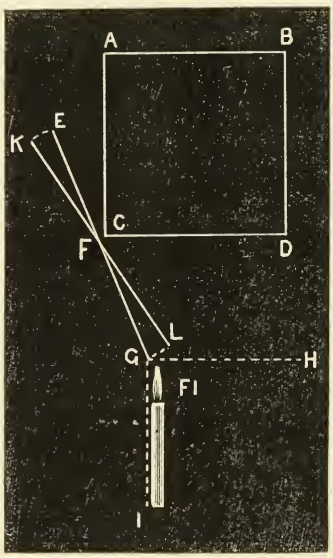
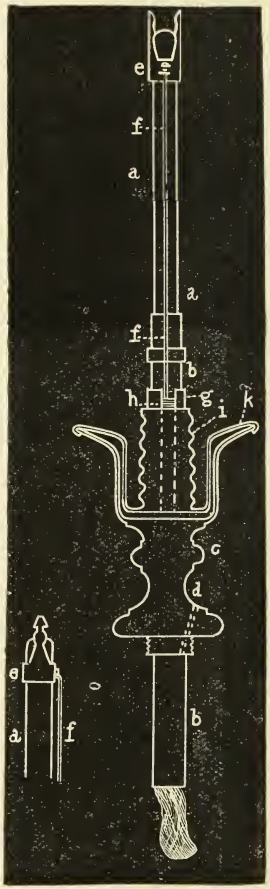


Fig. 96.

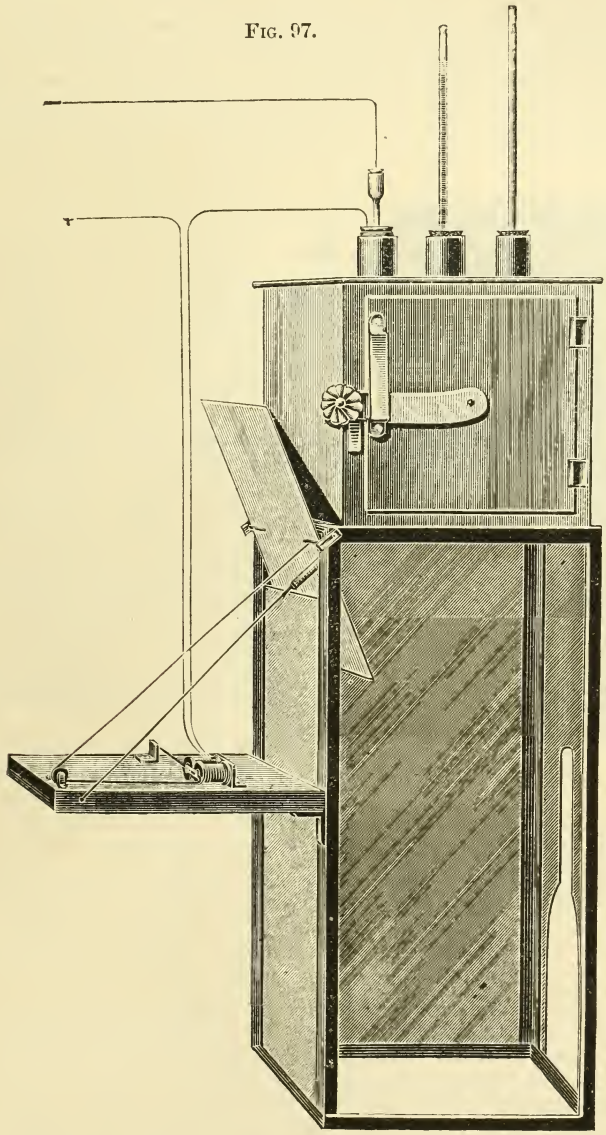


The thermostat consists of a cubical copper box with double walls, the interval between which is filled with water. As source of heat the author uses the benzine lamp of Puschkareff. The internal construction of this lamp is seen in half natural size in fig. 96. The brass tube of the lamp has a length of 21 cm. Its upper part *a* is

* Zeitschr. f. wiss. Mikr., xiii. (1896) pp. 172-83.

thin and of diameter 6·5 mm., the lower part *b* is thicker and is soldered into the massive fastening *c*, which screws into the benzine reservoir. The lower part of the fastening is provided with a fine

Fig. 97.



passage *d* for the admission of air to the reservoir. In the interior of the tube is a wick extending from the top down into the reservoir. The upper end of the tube is provided with two extremely small holes *x x*, and is surrounded by a second short tube *e*, which carries two projecting

pieces. By means of the wire *f*, the tube *e* is connected with a screw arrangement at the base of the tube, so that by turning the milled rim K the tube *e*, with its projecting pieces, can be adjusted in height above the end of the tube *a*. The two projecting pieces serve to conduct the heat of the flame, when the lamp is lit, to the tube *a*, and thence to the benzine, so that by adjusting the height of these the heat of the flame is regulated. The advantages of the lamp are :—(1) It needs no chimney, so that only a very slight movement of the plate of the regulator is required ; (2) it gives no soot; (3) the size of the flame can be easily regulated ; (4) the size of the flame once regulated remains the same.

Fig. 98.

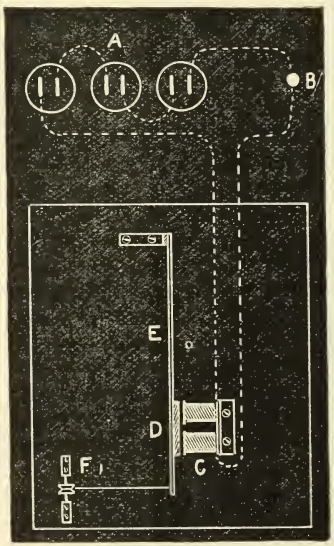


Fig. 99.

In fig. 97 is shown the arrangement of the whole thermostat. The movable plate, 13 × 22 cm., rotates about a horizontal axis through its centre of gravity. The frame on which the thermostat rests is supported on four iron feet, 38 cm. long. The front side of the stand is of glass, the three others of iron. A space at the top of the left side is left for the plate, and the right side is cut away below for the insertion of the lamp. On the left side, at a height of 22 cm., is a horizontal platform for the electromagnet which serves to regulate the position of the rotating plate. The electromagnet C, with its connections with the battery A and current transmitter B, is seen in fig. 98. When the current passes the armature D, which is attached to a very flexible spring E, is attracted to the magnet. To the free end of the spring is attached a thread which passes round a small pulley F, and is fastened to the movable plate of the thermostat (fig. 97), above the axis of rotation. When the armature is drawn towards the magnet, the thread pulls the plate so that its lower half covers the flame of the lamp. The temperature of the thermostat then falls, the current is again broken by the automatic regulator B, and the plate is brought back to its original position by means of the weak spiral spring beneath the axis (fig. 97).

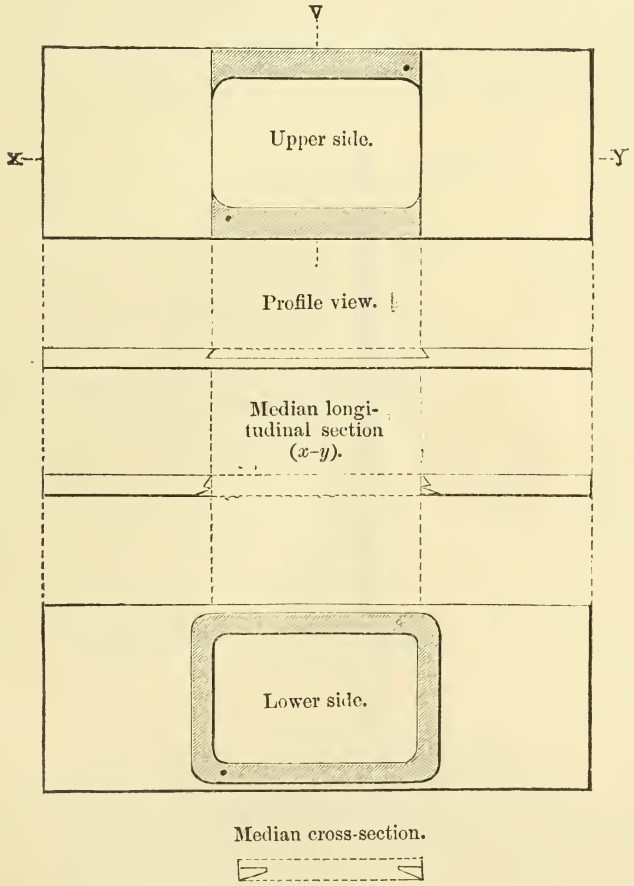
The automatic current transmitter is shown in fig. 99. It consists of a test-tube containing some mercury, and closed by a good cork, through which passes a small tube. The small tube passes down to the bottom of the test-tube, and is enlarged at the upper end, where it is closed (but not air-tight) by a cork. Through this cork the + wire from the battery passes down to a certain point of the small tube, while the − wire goes through the cork of the test-tube down to the mercury at the bottom.

As the temperature rises the air inside the test-tube expands and presses the mercury up the small tube until it makes contact with the + wire, and the current passes. The position of this current regulator in the thermostat is seen in fig. 98.

For the battery, four or five Meidinger elements are sufficient.

In using the thermostat the flame of the lamp is gradually raised until the desired temperature is reached, when the platinum wire of the current regulator must be brought just into contact with the mercury. According to the author, the variations of temperature do not then exceed 0·25° during twelve hours' work.

Fig. 100.



Object-Holder of Aluminium for observation of Objects on both sides.*—Dr. M. Heidenhain describes a new object-holder of aluminium,

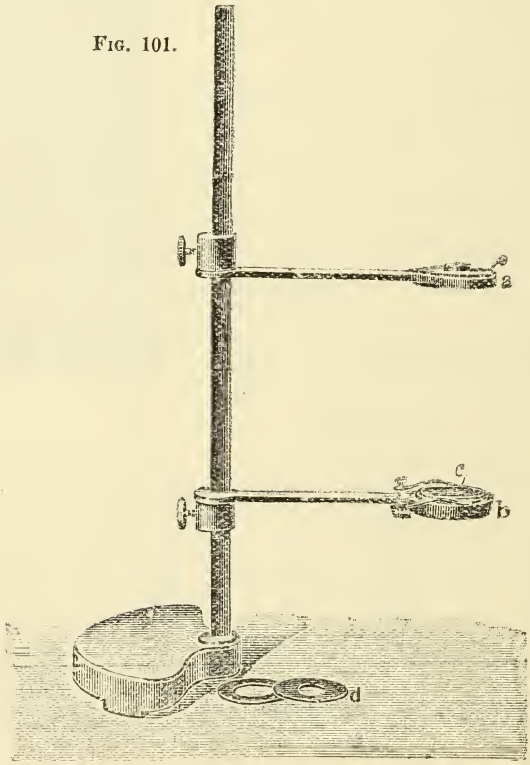
* Zeitschr. f. wiss. Mikr., xiii. (1896) pp. 166–72.

which in some respects is similar to the slide devised by Dr. C. J. Cori, and figured in the last number of this Journal (p. 579). The advantage of an aluminium slide over the brass one of Cori is that it can be used in staining sections on the object-holder.

The slide, seen in fig. 100, is of the English shape, and in its thickest part is not more than 3 mm. thick. The aperture in the centre is sufficiently large to take a cover-glass of 20 × 30 mm. The object-plate is slid in from the side along grooves in the sides of the aperture, and can be fixed in position by inserting small pegs in two holes on opposite sides of the aperture.

New Cover-Glass Clip.*—Herr D. C. Wessel uses a new form of clip for picking up cover-glasses in blood investigations. It consists of a crosswise spring clip, the two ends of which are provided with small plates 12 mm. long and 2 mm. broad. The lower plate is quite thin so that it can be easily pushed under the glass, while it has a raised piece 1·5 mm. from the edge against which the cover-glass stops.

Fig. 101.



Simple Arrangement for Drawing Microscopic Preparations under very low Magnifications.†—Dr. O. Kaiser describes a simple

* Zeitschr. f. wiss. Mikr., xiii. (1896) pp. 184–5. † Tom. cit., pp. 163–6.

apparatus by which it is possible to draw microscopic preparations quickly, and without the need of any complicated mechanism. The principle of the apparatus depends on the fact that most microscopic preparations are transparent, and that a bright white drawing paper can serve as source of light with low magnifications.

On a simple stand, an eye-piece diaphragm *a* (fig. 101) and an object-stage *b* can be adjusted in height one above the other. Under this, on the table, is the drawing paper. The effect of the fine opening in the eye-piece diaphragm is that object and drawing appear to the eye always exactly in the same position above one another. In this diaphragm a lens can be placed. Lenses (*c*) as well as diaphragms (*d*) can also be inserted in the object-stage. As lenses, the author has used spectacle glasses +5, +10, −5, −10, −20 D, &c.

Without lenses and with the distance between *a* and the drawing paper (e.g. 30 cm.) double the distance between *a* and *b*, a double magnification of the drawing is obtained. For higher magnification, the object-stage must be brought nearer to the eye-piece, or the drawing paper removed further. Both can be effected by the use of lenses; the apparent separation of the drawing plane is produced by placing concave lenses in the object-stage, while the object itself can be magnified and brought nearer to the eye by placing convex lenses in the eye-piece diaphragm. In the latter case, a concave lens in the object-stage, at least double as strong as the convex lens in the eye-piece, is indispensable.

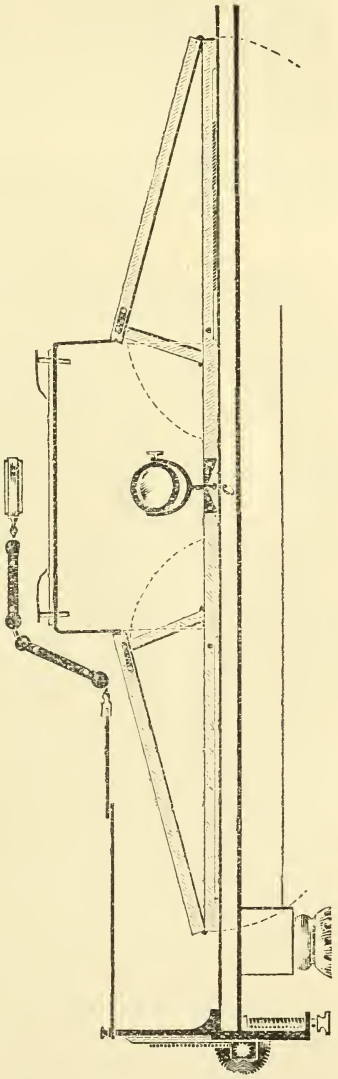


Fig. 102.

New Form of Dissecting-Stand and Lens-Carrier.—Lt.-Col. H. G. F. Siddons, at the October meeting of the Society, exhibited and described a portable dissecting-stand and lens-carrier. When opened out, a bent metal plate with large aperture bridged the space between the (folding) hand-rests, and upon this, either a transparent or a blackened plate could be clamped by four spring clips, while a mirror was erected below,

(fig. 102). The ends of the stand fold downwards on the central joint *c*.

The whole of the above was contained (with the stand) in a compass of $7 \times 4 \times 1\frac{3}{4}$ in.

For use with this apparatus the lens-carrier of Baker's Tank Microscope was well adapted, as it can be clamped to a table edge, has rack-and-pinion adjustment, and a long jointed arm, which is here partly replaced by a ball-jointed arrangement.

The position of the lens-carrier should be at right angles to the dissecting-stand, and not as in the figure, where it is shown for convenience in illustration.

For dissecting with higher powers, a small Microscope can be placed between the hand-rests, for which purpose the base of the apparatus has been recessed to receive the feet of such an instrument.

(4) Photomicrography.

New Photomicrographic Apparatus.*—Dr. E. Czaplewski has sought to combine in this apparatus great stability with ease of adjustment and convenience of regulation of the illumination. A feature of the apparatus is that the Microscope is enclosed in a box so as to be protected from all extraneous light.

A heavy wooden plate, weighted with lead and supported on four feet, serves as base-plate. On this rise two side walls, 47 cm. high, 4 cm. thick, 28 cm. wide and 28 cm. apart, between which the Microscope stands. On the inside of these side-walls and projecting above them are two iron plates, 60 cm. long, 6 cm. broad, and 7 mm. thick, which serve to support the upper part of the apparatus.

In front, the two side walls are connected together by a wooden plate in which is an aperture 6 cm. in diameter, for the admission of light. This can be closed by a side shutter, sliding in a frame and having a large round opening of 7 cm. The frame carries a horseshoe groove, in which ground or coloured glasses can be placed. In one position of the shutter, all light is cut off from the Microscope. The apparatus is closed behind by a door. In the base-plate, holes are cut for the feet of the Microscope, so that the latter may always occupy the same position. The photographic part of the apparatus is made as light as possible. The camera-bag is 22 cm. in length when drawn out; its upper aperture is about 10 cm., while underneath, it carries a brass socket of 3·2 cm. aperture, which fits over the eye-piece of the Microscope. The camera-bag fits into a corresponding opening in a plate, 36 cm. × 28 cm., which forms a cover for the box enclosing the Microscope. This cover-plate slides in the iron plates attached to the side walls, and can be adjusted in height and fixed by a clamping screw.

In order that the body-tube of the Microscope shall not be pressed by the weight of the camera-bag, the latter is supported by two bars attached to the cover-plate, and has grooves in which slide two projecting pieces from the lower plate of the camera-bag. By means of a screw, the lower plate can be fixed in any position on the bars. The arrangements for the light-proof connection of Microscope and camera-bag consist of a double socket similar to that in Zeiss' apparatus.

* Zeitschr. f. wiss. Mikr., xiii. (1896) pp. 147–56.

The cover-plate, to which the camera-bag is glued, has a depression in its upper surface, 18 × 18 cm. and 2 mm. deep, in which fits (not slides) the slide-holder. The slide-holder consists of a wooden plate with a thin brass plate on its upper surface. The wooden plate has a central round aperture of 7 cm., the brass plate on which rests the photographic plate, one of 6 cm. In the wooden plate is a shutter 15 cm. long and 8 cm. broad. The photographic plate is held in a frame on the slide-holder, and is protected above by a light-proof cover carrying a spring which presses it down upon the metal plate of the holder.

The author describes in detail the process of taking a photograph with the apparatus. As source of light he prefers the Auer incandescent gas-flame.

(5) Microscopical Optics and Manipulation.

Tests for Microscope Objectives.*—Mr. E. M. Nelson enumerates for "Beginner" some useful test-objects for microscopic objectives. With a 3/4 axial cone a "spread slide" of *P. angulatum*, dry on cover, is a good test for lenses from 1/2 in. upwards. One of the best diatoms for higher powers is the large *N. rhomboides* found in "Sozodont" tooth-powder. The best test for low-power lenses is a balsam-mounted diatom with dark-ground illumination by Abbe condenser and central stop.

"The golden rule for the resolving power of any objective with a 3/4 axial cone of illumination, is that they should show a fineness of structure equal to 70,000 multiplied by their N. A."

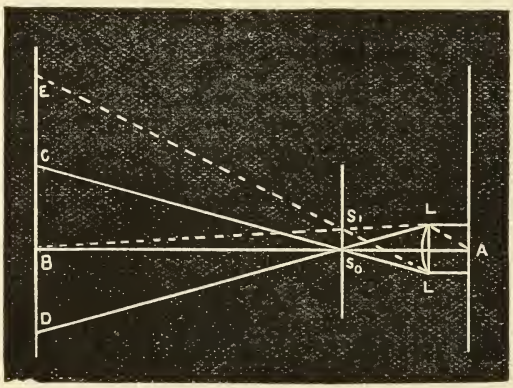
On the Theory of Optical Images with special reference to the Microscope.†—Lord Rayleigh remarks that the theory of optical images has been treated from two distinct points of view. The method adopted by Helmholtz consists in tracing the image representative of a mathematical point in the object, the point being regarded as self-luminous; while in the method of Abbe the typical object is not a luminous *point*, but a *grating* illuminated by plane waves. In the latter method, it is argued that the complete representation of the object requires the co-operation of all the spectra which are focused in the principal focal plane of the objective; when only a few are present, the representation is imperfect, and wholly fails when there is only one. From these considerations the resolving power can be deduced as follows:—In fig. 103, A B represents the axis, A being in the plane of the object (grating) and B in the plane of the image. S_0 S_1, &c. represent the diffraction spectra. From the central one S_0 the rays diverge and illuminate a circle C D in the plane of the image. The first lateral spectrum S_1 is due to rays diffracted from the grating at a certain angle; and in the critical case the region of the image illuminated by rays from S_1 just includes B. Since the extreme ray S_1 B proceeds from A, the condition that S_1 shall co-operate at B is that the angle of diffraction do not exceed the semi-angular aperture α. But the sine of the angle of diffraction is λ / ϵ, where λ denotes the wave-length and ϵ the smallest resolvable distance. The above condition then requires that ϵ exceed $\lambda / \sin \alpha$. With oblique incidence the limit becomes $\frac{1}{2} \lambda / \sin \alpha$.

* English Mechanic, lxiv. (1896) p. 187.

† Phil. Mag., xlii. (1896) pp. 167–95 (4 figs.).

In criticising the Abbe spectrum theory the author observes that, although the image ultimately formed may be considered to be due to the spectra focused at S_0, S_1 . . ., the degree of conformity of the image to the object is another question. Consideration of the case of a very fine grating, which might afford no lateral spectra at all, shows the incorrectness of the usually accepted idea that if all the spectra are utilised the image will be complete. The author considers that the theory needs a good deal of supplementing. It is also inapplicable when the incident light is not parallel and when the object is, for

Fig. 103.



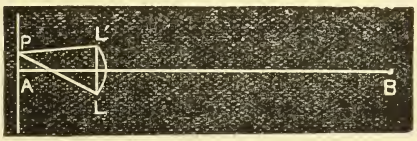
example, a double point and not a grating. Even in the case of a grating, the spectrum theory is inapplicable if the grating is self-luminous; for in this case no spectra can be formed since the radiations from the different elements of the grating have no permanent phase-relations. For these reasons the author thinks it a desideratum that the matter should be reconsidered from the older point of view according to which the typical object is a point and not a grating. Such a treatment shows that the theory of resolving power is essentially the same for all instruments. The peculiarities of the Microscope, arising from the divergence-angles not being limited to be small, and from the different character of the illumination, are theoretically only differences of detail. The investigation can be extended to gratings, and the results so obtained confirm for the most part the conclusions of the spectrum theory.

The author commences the discussion by a simple investigation of the resolving power for a self-luminous double point. In fig. 104, as before, A B represents the axis, A being a point in the object and B a point in the image formed by the object-glass L L^1. The limit to definition depends upon the fact that owing to diffraction the image thrown even by a perfect lens is not confined to a point, but distends itself over a disc of light, and that two points in the object can only appear fully separated when the representative discs are nearly clear of one another.

In fig. 104, B is the centre of the diffraction disc representative of A.

At this point all the secondary waves from A agree in phase, but the waves from a neighbouring point P will arrive at B with discrepancy of phase. For a very small interval A P this discrepancy produces no practical effect, and A and P will not be separated in the image. The question is, to what amount must A P be increased in order that the

Fig. 104.



difference of situation may make itself felt in the image? Simple calculation shows that the illumination at B due to P becomes practically evanescent when the relative retardation of the extreme rays P L and P L′ amounts to a wave-length on their arrival at B. The limit of resolution, then, is reached when $PL - PL' = \lambda$. But since A P is very small, A L′ − P L′ and P L − A L are each equal to A P sin α where α is the semi-angular aperture L′ A B. Therefore

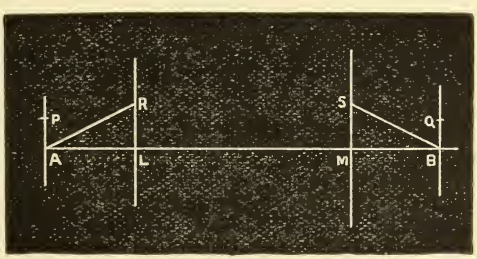
$$\lambda = PL - PL' = 2AP.\sin\ \alpha,$$

and the condition of resolution is that A P or ϵ should exceed $\frac{1}{2}\lambda / \sin\alpha$.

In the above discussion the points to be discriminated are supposed to be self-luminous. The author considers that the function of the condenser in microscopic practice in throwing upon the object the image of the lamp-flame "is to cause the object to behave, at any rate in some degree, as if it were self-luminous, and thus to obviate the sharply marked interference-bands which arise when permanent and definite phase-relations are permitted to exist between the radiations which issue from various points of the object."

Preparatory to the actual mathematical calculation of the images in the various cases, the author gives the following instantaneous proof of

Fig. 105.



Lagrange's theorem, which is similar to the one given many years ago by Hockin.* In fig. 105, A and B are conjugate points on the axis A B; P is a point near A in the plane through A perpendicular to the axis; and

* This Journal, 1884, p. 337.

Q is its image. The optical distance between the conjugate points A and B is the same for all paths—e.g. for A R S B and A L M B, and the optical distance from P to Q is the same as from A to B. Consequently, the optical distance P R S Q is the same as A R S B, i e. μ . A P . $\sin\alpha = \mu'$. B Q . $\sin\beta$, where μ, μ' are the refractive indices near A and B respectively, α and β the divergence angles R A L, S B M for a given ray, and A P, B Q denote the corresponding linear magnitudes of the two images.

The author then proceeds to the actual calculation of the images to be expected upon Fresnel's principles in the various cases. The origin of co-ordinates ($\xi = 0, \eta = 0$) is the geometrical image of the radiant point. Representing the vibration incident upon the lens by $\cos(2\pi \mathrm{V}t/\lambda)$, where V is the velocity of light, the vibration at any point ξ, η in the focal plane is

$$-\frac{1}{\lambda f}\int\int \sin\frac{2\pi}{\lambda}\left\{\mathrm{V}t - f + \frac{x\xi + y\eta}{f}\right\} dx\,dy,$$

in which f denotes the focal length, and the integration for x and y is to be extended over the aperture of the lens.

In the case of a rectangular aperture of width a, b parallel to x and y respectively, the expression giving the diffraction pattern along the axis ξ can be simplified to the form $\frac{\sin u}{u}$, where u is equated to $\pi\xi a/\lambda f$. Values of the amplitude $\frac{\sin u}{u}$ and the intensity $\frac{\sin^2 u}{u^2}$ for different values of $\frac{4u}{\pi}$ are given in a table. The illumination first vanishes when $u = \pi$, i.e. when $\xi = \lambda/af$.

The author has shown, in a previous paper,* that a self-luminous point or line at $u = -\pi$ is barely separated from one at $u = 0$. He now considers the case under three different conditions as to phase:—(i.) when the phases are the same; (ii.) when the phases are opposite; and (iii.) when the phase-difference is a quarter-period. In the first case the resultant amplitude is represented by

$$\frac{\sin u}{u} + \frac{\sin(u+\pi)}{u+\pi};$$

in (ii.) by

$$\frac{\sin u}{u} - \frac{\sin(u+\pi)}{u+\pi};$$

and in (iii.) by

$$\sqrt{\left\{\frac{\sin^2 u}{u^2} + \frac{\sin^2(u+\pi)}{(u+\pi)^2}\right\}}.$$

A table gives the values of these three functions for different values of $\frac{4u}{\pi}$. The graphs of the three functions in fig. 106 show that in i.

* Phil. Mag., viii. p. 266.

there is no duplicity, and in iii. only an attempt, while in ii. the separation may be regarded as complete. For case ii. the same result follows, even when the points or lines are twice as close as before, for in this case the resultant amplitude is

$$\frac{\sin u}{u} - \frac{\sin\left(u + \frac{1}{2}\pi\right)}{u + \frac{1}{2}\pi},$$

and this vanishes when $u = -\frac{1}{4}\pi$. The maximum value of the resultant amplitude which takes place at a point near $u = \frac{1}{2}\pi$ is much less than before. The image, in fact, very incompletely represents the object; "but if the formation of a black line in the centre of the pattern be supposed to constitute resolution, then resolution occurs at all degrees of closeness." The author has illustrated these results experimentally by the observation through a telescope of two parallel slits in films of tinfoil or silver. The distance is chosen so that when backed by a neighbouring flame the double part of the slit is just manifested by a faint shadow. On replacing the flame by sunlight through a distant vertical slit, when everything is in line no sign of resolution of the double part of the slit is observed. A slight sideways movement of the telescope then suffices to bring in the half-period retardation, and a black bar down the centre is at once seen. In accordance with theory, this black bar is still seen when the distance is increased much beyond that at which duplicity disappears under flame illumination.

The calculations for a circular instead of a rectangular aperture in the case of a double point lead to similar results in the three cases i., ii., iii., as before, except that the partial separation, indicated by the central depression in curve iii. (fig. 106) is here lost.

The author then extends the calculation from the consideration of a double point or line to the case where the series of points or lines is infinite, constituting a *row* of points or a *grating*. First taking the case where the various centres radiate independently, as if self-luminous, if the geometrical images are situated at $u = 0$, $u = \pm v$, $u = \pm 2v$, &c., by the preceding the expressions for the intensity at any point u may be written as an infinite series,

$$\mathrm{I}(u) = \frac{\sin^2 u}{u^2} + \frac{\sin^2(u+v)}{(u+v)^2} + \frac{\sin^2(u-v)}{(u-v)^2} + \frac{\sin^2(u+2v)}{(u+2v)^2} + \frac{\sin^2(u-2v)}{(u-2v)^2} + \ldots.$$

which may be expanded by Fourier's theorem in a series of cosines.

Thus

$$\mathrm{I}(u) = \mathrm{I}_0 + \mathrm{I}_1 \cos\frac{2\pi u}{v} + \ldots. + \mathrm{I}_r \cos\frac{2\pi r u}{v} + \ldots.$$

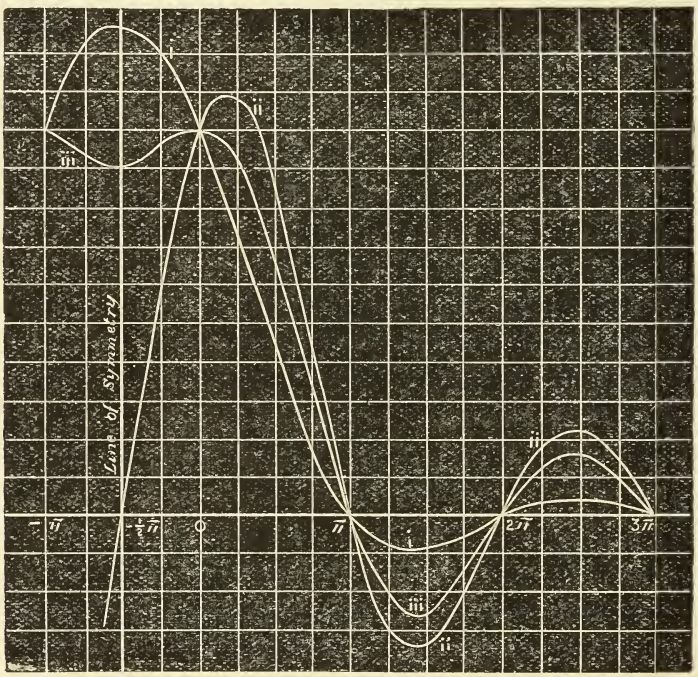
in which, as shown by calculation,

$$\mathrm{I} = \frac{2\pi}{v}\left(1 - \frac{\pi r}{v}\right), \text{ or } 0,$$

according as v exceeds or falls short of $r\pi$.

This expression for I_r shows that when v is large, a considerable number of the terms in the Fourier expansion are important, so that the discontinuous character of the luminous grating or row of points is fairly well represented in the image; but as v diminishes, the higher terms drop out in succession until v is equal to 2π, in which case I_2 is zero, and only I_0 and I_1 remain. When v drops below π, I_1 also disappears. The field is then uniformly illuminated, and shows no trace of the original structure. This is the case of fig. 106, and curve iii. shows that when an infinite series shows no structure, a *pair* of luminous points or lines of the same closeness are still in some degree separated.

Fig. 106.



The case of a grating or row of points perforated in an opaque screen and illuminated by plane waves of light incident perpendicularly is next considered. In this case amplitudes and not intensities have to be superposed. If A be the resultant amplitude,

$$A(u) = \frac{\sin u}{u} + \frac{\sin(u+v)}{u+v} + \frac{\sin(u-v)}{u-v} + \ldots .$$

which, by calculation, becomes equal to

$$\frac{\pi}{v}\left\{1 + 2\cos\frac{2\pi u}{v} + 2\cos\frac{4\pi u}{v} + \ldots .\right\},$$

the series being continued so long as $2\pi r < v$.

As before, the image will correspond accurately with the object when v is very great, so that the series includes a large number of terms. As v diminishes the higher terms fall out, until when v is less than 2π the series is reduced to its constant term, and the field becomes uniform. The resolving power in this case is therefore only half as great as when the object is self-luminous.

These conclusions accord with Abbe's theory. The first term of the series represents the central image, the second term the *two* spectra of the first order, and so on. Resolution fails when the spectra of the first order cease to co-operate.

The more complex case when the incident plane waves are inclined to the grating is next taken. Calculation shows that the image of the grating or row of points can be represented by the sum of terms

$$\pi / v \{e^{imu} + e^{i(m+s_1)u} + e^{i(m-s_1)u} + e^{i(m+s_2)u} + \ldots\},$$

where $s_1 = 2\pi / v$, $s_2 = 4\pi / v$, &c.

Each of these terms corresponds to a spectrum of Abbe's theory.

With this the author concludes the discussion of the theory of a rectangular aperture. The consideration of a circular aperture for the case of parallel waves and perpendicular incidence leads to results similar to those obtained in the case of a rectangular aperture, with one important difference. In this last case the spectra do not enter suddenly and with their full effect, as in the case of a rectangular aperture, but the effect of a spectrum which has just entered is infinitely small.

The author concludes with a general method of investigation, in which the form of the aperture is supposed to remain symmetrical with respect to both axes, but is otherwise kept open, the integration with respect to x being postponed. In the case where the illumination is such that each point of the row or of the grating radiates independently, the limit to resolution is shown to depend only on the width of the aperture, and thus to be the same for all forms of aperture as for the case of the rectangular aperture previously considered.

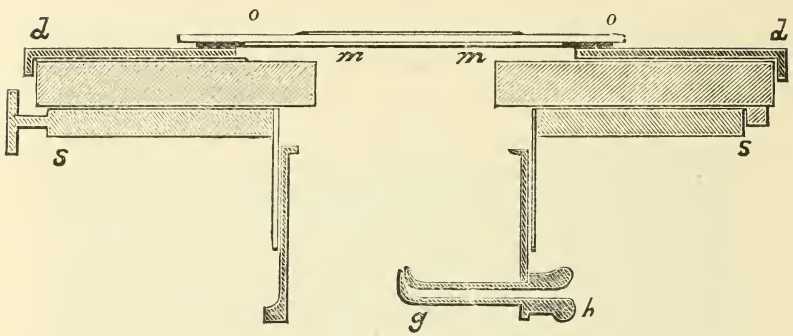
(6) Miscellaneous.

Microchemical Reaction for Nitric Acid.*—Prof. R. Brauns recommends the use of barium chloride as a microchemical test for nitric acid, since barium nitrate is soluble with difficulty. A drop of barium chloride is added to a drop of the solution to be tested, and warmed over the water-bath. On cooling, sharp colourless octahedra of barium nitrate separate out of a solution which contains a nitrate.

Sublimation and the Determination of Melting-Points in Microchemical Investigations.†—Prof. H. Behrens, in his introduction to the microchemical analysis of the most important organic compounds, describes a simple heating arrangement for experiments on sublimation and the determination of melting-points under the Microscope. In fig. 107 the apparatus is seen in natural size. Beneath the Microscope

* Zeitschr. f. wiss. Mikr., xii. (1896) pp. 207-8.
† Zeitschr. f. ang. Mikr., ii. (1896) pp. 161-4.

stage, in the place of the Abbe condenser or nicol, is inserted a socket with the small burner *gh*. The mouth of the burner is so small that the height of the flame never exceeds 15 mm. Two millimetres above the stage, a mica plate *m–m*, 0·3 mm. thick, is supported by strips of



cardboard *d–d*. The object-holder *o–o* is separated from the mica plate by a layer of air, the thickness of which can be determined by paper strips.

The late Mr. F. C. S. Roper.—We greatly regret to record the death of Mr. Freeman C. S. Roper, F.L.S., &c., a Fellow of this Society since 1852, which occurred at Eastbourne in July last. Mr. Roper in former years was a recognised authority on the Diatomaceæ, and contributed several valuable papers on this subject in the Trans. Mic. Soc. of London and the Q. J. Micr. Sci. He was also an ardent botanist and published in 1875 a 'Flora of Eastbourne and the Cuckmere district of East Sussex,' which the late H. C. Watson, a severe critic in such matters, pronounced a model of what a local Flora should be. Mr. Roper was the possessor of an extensive library, mainly botanical and of works on the Microscope. Of the latter, he printed a list for private circulation in 1865.

Besides this and the Flora, his chief papers are:—

Some observations on the Diatoms of the Thames. T.M.S., ii. (1854) p. 67.

On three new species of Diatomaceæ. Q.J.M.S., ii. (1854) p. 283.

Notes on new species and varieties, Brit. Mar. Diatomaceæ. Q.J.M.S., vi. (1858) p. 17.

On the genus Biddulphia and its affinities. T.M.S., vii. (1859).

Notes on Actinocyclus and Eupodiscus. Q.J.M.S., vi. (1859).

On Triceratium arcticum. T.M.S., viii. (1860).

On the genus Licmophora. T.M.S., xi. (1863).

Notes on the Flora of East Surrey. Jour. of Bot., 1881.

Note on Ranunculus lingua. Jour. of Bot., xxi.

He was Secretary of this Society from 1861–6; his collection of diatoms (some 4000 specimens) has passed to the Botanical Department of the British Museum, and his herbarium to the Brighton Museum.

β. Technique.*

Hints on Bacteriological Technique.†—Dr. Czaplewski gives a few practical hints on certain points often occurring in bacteriological work. Pipettes for obtaining samples of pus or other juices free from contamination with blood, fæces, &c., are often required. They may be made out of a piece of glass tubing a little longer than the ordinary test-tube, and from 3 to 4 mm. thick. One end is drawn out to a fine open point and then stopped with cotton-wool. The pipette wrapped round with cotton-wool is placed in a test-tube, and then dry or steam sterilised.

Pieces of tissue should first be washed with water and then with 1 : 1000 sublimate for about one minute, after which they are plunged in spirit for about half a minute. The alcohol is then burnt off so that superficial impurities are removed and the internal portions opened up by tearing or cutting for examination.

Knives and syringes are freed from contamination by immersing them in caustic potash solution to soften the albuminous matters. These are then wiped off, the instrument dipped in spirit and the spirit burnt off. Gelatin should be boiled in a porcelain lined vessel, and this placed inside another saucepan filled with water, care being taken to prevent the gelatin pan from wobbling.

Before inoculating birds their feathers should be wetted with spirit dabbed on with cotton-wool.

Infectious material and apparatus used in bacteriological work should be disinfected by boiling them for a good hour in a closed vessel, say a Papin's digester, about half filled with water. This procedure is more trustworthy than the use of chemicals.

Platinum loops should be of a definite size or sizes. These can be made by winding thin platinum wire round "standard" (1/2–5 mm.) wires of definite thickness. In this way, not only is the loop circular, but holds a definite quantity.

For inoculating eggs, the egg-borer used for blowing birds' eggs is very convenient. To obtain samples of blood for bacteriological examination, the skin should first be wiped over with strong caustic potash solution, and then washed with spirit. After this it is further disinfected with sublimate, followed by alcohol and ether; after the evaporation of the latter the skin may be pricked.

For imbedding small pieces for sectioning on a freezing microtome, cacao-butter is convenient as its setting point is 20°, while it is quite fluid at 37°. After removing the piece from alcohol it is placed in a mixture of cacao-butter and chloroform, which contains so much of the latter that it is fluid at room temperature. In this it remains for 1–24 hours, according to the size of the piece; it is then transferred to liquefied cacao-butter (37°), and after a few to 24 hours sectioned. The cacao-butter is removed with turpentine, after which the sections are placed in alcohol.

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xx. (1896) pp. 307–13.

Small pieces of tissue, secretions, or deposits may be conveniently transported between two watch-glasses placed one on top of the other, and held together by a rubber band or by adhesive plaster.

Certain fluid nutritive media may be conveniently preserved in hermetically sealed glass tubes, such as pepton and pepton-glucose blood-serum. These sealed tubes are obtainable from the usual agents.

Microtechnique of Animal Morphology.*—Prof. S. Apáthy has just brought out the first half of an exhaustive treatise on the microtechnique of animal morphology. The subject is dealt with, not only from a practical but a critical standpoint, and the keynote may be gathered from a quotation in the introduction :—" We heartily agree with Lionel Beale, who said that no man ever did perform real work until he had himself mastered minute practical details." The work is divided into a general and special part, and these into sections. The first section is devoted to preliminary considerations, such as the reasons and objects of preparatory treatment of the specimen to render it capable of being examined microscopically, the inherent difficulties that have to be overcome, and so on, and finally fixation, imbedding, staining, and mounting.

The second section treats microtechnique from a historical aspect. The third section gives advice as to the choice of methods, how to observe the preparation, and so on. The fourth section, which is the first of the special part, is concerned with the treatment of animal organisms without the aid of chemical substances. Not the least useful and interesting is a chronological review of the literature and advances made in the last 50-60 years in microtechnique.

Prof. Apáthy has produced a work on quite original lines, and one which is a very valuable contribution to the now difficult subject of microscopical technique. It is, however, not a text-book in the narrow sense of the word, though at the same time it is quite suitable for the use of the student, and is especially adapted for the wants of the zoologist, histologist, and embryologist.

The second half is to be published in the course of the next twelve months.

(1) Collecting Objects including Culture Processes.

Proper Reaction of Nutrient Media for Bacterial Cultivation.†—In a synoptical commentary on the reaction of nutritive media, Mr. G. Fuller points out that the terms alkaline and acid have only a relative signification. He found that the reaction was most accurately determined by titration, and that of the different aromatics in use, the safest results were obtained from phenolphthalein. Caustic soda was used for alkalinising, and the media were alkalinised while hot, in order to prevent the absorption of carbonic acid from the air. With regard to other indicators, litmus paper proved more satisfactory than litmus tincture, though the reaction with the papers was found to vary, both with their age and method of preparation.

Comparative experiments on alkaline media showed that water

* Braunschweig und London, 8vo, 1896, 320 pp. and 10 figs.

† Journ. Amer. Public Health Assoc., x. 1895. See Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xx. (1896) p. 333.

bacteria throve best on those which contained 15–20 ccm normal alkali per litre.

Influence of Glycerin in Culture Media on Diphtheria Bacillus.*—Dr. A. M. Gossage finds that the addition of 9 per cent. glycerin to the culture medium gives very favourable results for the cultivation and staining of the diphtheria bacillus. Glycerin-serum is preferable to glycerin-agar, as the growth is usually greater, and the appearance of the bacilli more characteristic. Cultivated on glycerinised media diphtheria bacilli exhibit an increased affinity for alkaline methylen-blue, and also a specific metachromatism. On these media each bacillus shows a deep violet dot at each pole, with frequently one or more dots between them, whilst the remainder of the bacillus is colourless or deep blue. Other bacteria in the same culture stain blue.

Dr. A. A. Kanthack† states that metachromatism with alkaline methylen-blue is not dependent on the presence of glycerin in the cultivation medium, and that as a staining phenomenon it is not only well known, but common to numerous bacilli.

(2) Preparing Objects.

Preparation of Embryos of Limulus Polyphemus.‡—Prof. W. Patten found that surface views of opaque embryos were useful for some purposes. In order to make out many important details it was, however, absolutely essential to stain the egg, and clear in clove-oil, balsam, or oil of cedar. The last often gave the best pictures, and the eggs could be kept longer in this fluid without discolouring the yolk. To obtain the best surface view the embryos should be stained and mounted as soon as possible after hardening, or preserved in perfectly clean alcohol in glass-stoppered bottles. The use of glass stoppers is necessary as the tannin or other substances in cork stoppers are dissolved out by alcohol and discolour the yolk. Either picronitric or undiluted picrosulphuric acid, or Perenyi's fluid may be used for hardening. The eggs should be immersed in the cold solution from 10–24 hours. After the eggs are shelled they are rinsed in the hardening fluids, and transferred to a large quantity of alcohol of about 94 per cent., which is changed frequently the first few days. The most beautiful surface views are obtained by staining the whole egg in borax-carmine or almost any hæmatoxylin for a very short time, and then wash in acid alcohol. This method gives very sharp and luminous contours. If the eggs are to be mounted after clearing in oil of cloves they should be split in halves with a sharp knife, made by grinding the end of a needle down to a very thin blade.

Examination of the Sense-Organs of Lumbricus.§—As Miss F. E. Langdon has discovered sense-organs in the epidermis of the earthworm, which have been so often overlooked by competent observers, she thinks it well to give an account of the methods employed by herself, although the account contains little that is new. To ensure successful cutting of sections, it was found best to feed the worm on wood-pulp, in the preparation of which no chemicals had been used. In killing, great care

* Lancet, 1896, ii. pp. 458–9.
† Tom. cit., pp. 531–2.
‡ Journ. Morphol., xii. (1896) pp. 23–7.
§ Op. cit. xi. (1896) pp. 194–6.

must be taken to avoid contortion, or an excessive discharge of mucus from the gland-cells of the epidermis. Seventy per cent. alcohol was used, and it was made to drop on the filter-paper at the rate of sixty drops a minute. This is a modification of the method suggested in 1890 by Cerfontaine. In about an hour the worms are so stupefied by this method that all the paper may be removed except the small piece on which the alcohol drops, and the alcohol may be made to drop more rapidly. At the end of two hours the worms were placed in 50 per cent. alcohol for an hour, in 70 per cent. alcohol for 24 hours, in 96 per cent. alcohol for the same time, and they were then preserved in fresh alcohol of the same strength. Parts of worms chosen for study were run through absolute alcohol, cedar oil, soft paraffin, one half hard and one half soft paraffin, and finally imbedded in the last. Each change from one reagent to another must be made gradually, and the temperature of the paraffin bath must not rise above 54°. The minute structure of the sense-organ did not show well in sections more than 10 μ thick. Dr. Huber suggested to the writer two changes in the published method of using silver nitrate. The first was to leave the turpentine for 15 minutes instead of five, and the second was to use pure balsam instead of turpentine balsam.

Examination of the Spermatozoa of Echinoderms.*—Prof. G. W. Field very rightly thinks that, owing to the extreme delicacy of the cells involved, and the extraordinary distortion caused by most killing fluids in common use for other tissues, he should report with great care the methods which he found best adapted for his examination of the spermatozoa of Echinoderms. Dealing first with fresh material on the slide, he describes the use of neutral dahlia and methyl-green. To a watchglassful of sea-water add a small quantity of concentrated aqueous solution of dahlia, filter very carefully several times. Place the living spermatozoa in a drop of this liquid on the slide. After three minutes, add a drop of a dilute solution of methyl-green prepared in the same way. This method gives a minimum distortion, but unfortunately the results are very transitory. The value of this method lies in its delicacy, and for that reason very clean and very dilute, as well as freshly prepared, stains are necessary. A very weak solution of tincture of iodine in sea-water, very carefully filtered, preserves the shape and size very well. The author found that a method which was remarkably good for use in studying the mode of formation of the tail of the spermatozoa, was to take a 10 per cent. solution of chloride of manganese, and add to it a concentrated aqueous solution of dahlia; acetic acid combined with dahlia and methyl-green gave fair results. Osmic acid was found very useful for demonstrating the centrosome.

Prolonged fixation was found to be valuable for studying the details of the development of the spermatozoa. A piece of the testis was teased in a small quantity of water, fixed in Flemming's chrom-osm-acetic for 24 hours, then washed for 24 hours or more in distilled water, frequently changed and shaken. After, treat with some aqueous stain; the mounting may be made in dilute glycerin or in dammar. The cells become separated by tapping the cover-glass gently with the point of a needle.

* Journ. Morphol., xi. (1895) pp. 238–41.

Other methods are given, for which we must refer the student to the original.

Spermatogenesis.*—In investigating the part which central corpuscle and sphere play in forming the spermatozoon, Herr C. Messing got best results with Hermann's platinum chloride-osmio-acetic acid mixture, and similar mixtures used by G. Messing, e.g. 25 parts 10 per cent. platinum chloride, 20 parts 2 per cent. osmic solution, 5 parts glacial acetic acid, and 50 parts distilled water or concentrated aqueous solution of corrosive sublimate.

Dilute Sulphuric Acid in Preparing Fish Skeletons.†—Dr. O. Thilo recommends the following procedure for preparing fish skeletons. Wash the fish thoroughly with soap and brush, leave for a day in water, immerse in a cooled mixture of English sulphuric acid and water (1 : 10), and leave for 8–10 days. Then cleaning is easy. To remove the sulphuric acid, place in water (once changed) for 12 hours, then in soda solution (1 : 20) or in saturated baryta hydrate. The cartilage becomes a beautiful white colour. In 4–5 weeks the branchial skeleton falls apart. If this is to be avoided, 8 days in the baryta solution will suffice. A skull, like that of the sturgeon, should remain about three weeks in the sulphuric acid solution. To avoid any softening of the skeleton, 70 to 80 per cent. alcohol may be used instead of water. The cleaned cartilages may be placed in 30–50 per cent. alcohol, or in Wickersheimer's solution, for a couple of weeks, and then kept dry in securely closed glass vessels.

Demonstrating the Structure of the Human Neuroglia.‡—Prof. C. Weigert devotes no inconsiderable portion of an elaborate monograph on the normal human neuroglia to the methods necessary for demonstrating its structure. The general course of procedure was to take small pieces of central nervous system, which should be quite fresh and of "good consistence," and immerse them for eight days in a fluid having mordant and fixative properties. This was composed of formalin, neutral acetate of copper, and chrome-alum. The pieces were then got ready for section by the celloidin method. The sections were then treated with reducing agents, i.e. permanganate of potash, chromogen, and sulphurous acid solutions. The next step was to increase the staining affinity of the neuroglia by means of an aqueous solution of chromogen. The sections were stained by the fibrin method.

The mordant-fixative is composed of 5 per cent. neutral acetate of copper, 5 per cent. acetic acid, and 2·5 per cent. chrom-alum in water. To make this solution, it is necessary first to dissolve the chrom-alum in boiling water, then add the acetic acid, and lastly the finely powdered copper salt. If made in any other way there is a copious green precipitate.

Reduction is effected by immersing the sections for about 10 minutes in ·33 per cent. solution of permanganate of potash; they are now carefully washed in water, and then, the water having been poured away, the reducing solution is poured in. This fluid is made by dissolving 5 per cent. chromogen and 5 per cent. formic acid in water and filtering. To 90 ccm. of this solution 10 ccm. of a 10 per cent. solution of ordinary

* Arch. Mikr. Anat., xlviii. (1896) pp. 111–42 (2 pls.).
† Anat. Anzeig., xii. (1896) pp. 244–7.
‡ Abhandl. d. Senckenb. Ges., xix (1895) pp. 65–213 (13 pls.).

sodium hyposulphite are added. The sections are decolorised in a few minutes, but the solution may be allowed to act for 2–4 hours.

The sections are next washed once or twice in water, and then immersed in a saturated aqueous solution of chromogen (chromogen is a naphthalin derivative, the acid sodium salt of 3–6 disulphoacid of 1–8 dioxynaphthalin). In this solution, which is prepared by filtering a 5 per cent. solution of chromogen, the sections remain all night or longer. After washing once or twice in water the sections are ready to be stained. If the staining cannot be carried out at once, the sections must be kept in acid-alcohol (90 ccm. of 80 per cent. C_2H_6O plus 10 ccm. of 5 per cent. oxalic acid).

The rest of the procedure must be carried out on the slide. The staining solution is dropped on, this is immediately followed by iodine solution. The section is at once washed and then treated for 15–30 or more minutes with anilin-oil-xylol. The last fluid is carefully removed by means of xylol before mounting in xylol-balsam.

The staining solution is composed of 100 ccm. of an alcoholic solution of methyl-violet and 5 ccm. of a 5 per cent. aqueous solution of oxalic acid. The iodine solution is made of a saturated solution of iodine in 5 per cent. iodide of potassium solution. The anilin oil solution is composed of two parts of anilin oil to one part of xylol.

Prepared and stained by this method the neuroglia fibres are blue, while the connective-tissue elements are colourless. The plasma of the nerve-cells is brownish-yellow.

Rapid and Convenient Method of Preparing Malarial Blood-Films.* —Dr. P. Manson has devised the following elegant method for preparing blood-films. Well-cleaned slides are placed in rows on a table near the patient. Three or four oblong slips of fine tissue-paper 1½ by 5/8 in. are also prepared. The droplet of blood, about 1/16 in. in diameter, is then taken up by touching it with one of the papers about 1/2 in. from the end of the paper. The charged surface is then placed upon a slide rather towards one end. When the blood has run out into a film, but not before, the paper is drawn along the surface of the glass. The same paper is usually sufficient for several glasses, and when exhausted should be recharged. In this way 50–60 films may be prepared in 5 or 6 minutes. Labels may then be attached and the slides stored away. Before proceeding to stain, the blood is fixed by dropping a little absolute alcohol on the films. After drying they are stained with borax 5 per cent., methylen-blue 1/2 per cent., for about half a minute. They are then washed and dried, and mounted in balsam.

Examination of Sputum in Sections.† — According to Herr A. Schmidt, sputum is best examined in sections. Lumps of sputum are fixed in sublimate and further hardened in alcohol of increasing strength. The material may then be imbedded in paraffin or celloidin. Staining is best performed on the slide.

Curschmann's spirals are easily found and studied by this method. In the sputum of asthmatics eosinophilous cells are frequently met with, while in the expectoration of pneumonia their occurrence is rare.

* Brit. Med. Journ., 1896, ii. p. 122.

† D. A. Ztg. See Zeitschr. f. ang. Mikr., ii. (1896) p. 115.

Plasma-cells are occasionally found in asthmatic sputum, and giant-cells in tubercular.

By this method microbes of all sorts may be demonstrated and enumerated.

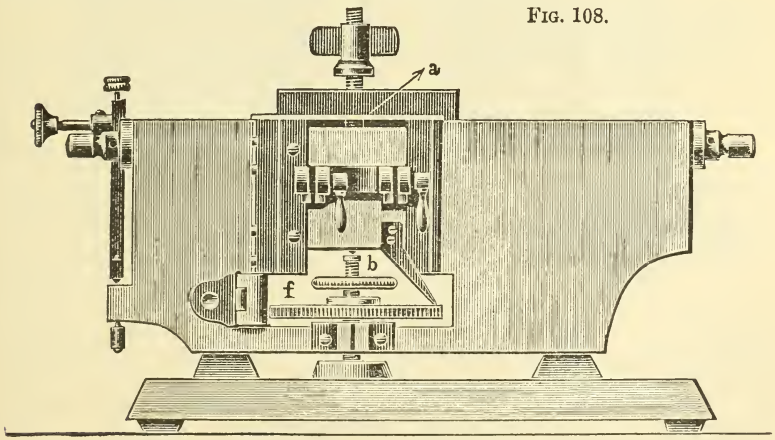
Negative Test for Blood-Spots.*—It is well known, says Herr F. Gantter, that it is not always possible to obtain hæmin crystals from old blood-spots on rusty iron. It is, however, possible to prove the absence of blood. The action of peroxide of hydrogen on the merest traces of blood produces a scum of bubbles of oxygen. This reaction may be observed under the Microscope by placing on a slide a scraping of the suspected substance, and, after softening it by the application of weak alkaline water, adding some peroxide of hydrogen solution. If no gas-bubbles appear after the lapse of a short time, it is distinct evidence that there is no blood. The appearance of gas-bubbles, however, is not to be taken as a proof of the presence of blood, as other animal fluids, such as pus, give the same reaction.

(3) Cutting, including Imbedding and Microtomes.

Handbook of Histology.†—Dr. W. S. Colman has issued a second edition of his work, which is intended as a practical introduction to histological methods for students and practitioners. This edition is enlarged, and has been in great part rewritten. The author says that he has selected for description those methods which have been found to work well in practice, and he has thought it better to describe a few in detail rather than give a short account of many similar methods.

Those who have already found this book useful will no doubt be glad to have this new edition of the author's work.

Fig. 108.



Microtome with new Device for Raising and Lowering the Object.‡—Dr. J. Nowak has sought to obviate the troublesome and

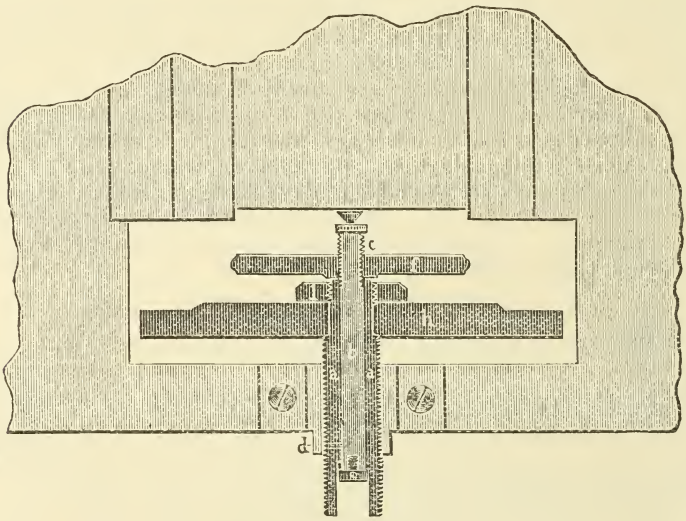
* Zeitschr. f. analyt. Chemie, ii. (1895) p. 159. See Zeitschr. f. ang. Mikr., ii. (1896) pp. 111-2.

† 'Section Cutting and Staining,' 2nd edition, London, 1896, 8vo, viii. and 160 pp. and 8 figs.

‡ Zeitschr. f. wiss. Mikr., xiii. (1896) pp. 157-60.

tedious process involved in regulating the position of the object in ordinary microtomes. With this object he has devised the mechanism shown in figs. 108–10. In the micrometer-screw there is a second

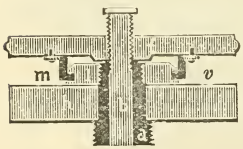
Fig. 109.



screw which can be raised or lowered, and with it the object-clamp, independently of the micrometer-screw.

In fig. 109 the second screw *b* is seen inside the spindle *a* of the micrometer-screw. In this it slides smoothly, and is prevented from being drawn out too far by the little screw *e*. The milled head *f* has a nucleus of steel and serves as nut to the screw-thread *c* on *b*, so that on turning it to and fro the screw *b*, and with it the object-clamp, can be adjusted in height.

Fig. 110.



In the Reichert microtome the slide of the object-clamp is pressed downwards by a spring (*a*, fig. 108). In this case the milled head *f* need simply rest upon the spindle *b*. In other microtomes, however, which do not possess such a spring, *f* must be attached to a plate *l* on the toothed wheel *h*, in such a way that it can turn, but cannot rise or sink on the spindle *b*.

Fig. 110 shows how this is effected by two hooks *m v* from the nut *f* engaging in a groove on the edge of the plate *l*.

Section-Stretcher for Paraffin Sections with the Cathcart Improved Microtome.*—Dr. K. Kornauth remarks that with the Cathcart microtome, in the case of objects imbedded in paraffin, there is such a tendency for the sections to roll up together, that the production of a

* Zeitschr. f. wiss. Mikr., xiii. (1896) pp. 160–3.

series is almost impossible. For his work on *Psilura monacha* L., in order not to have to give up the use of the convenient Cathcart micro-

Fig. 111.

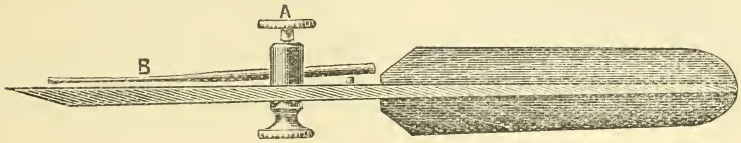


Fig. 112.

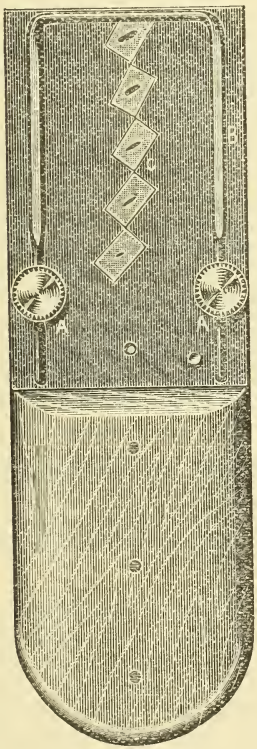


Fig. 114.

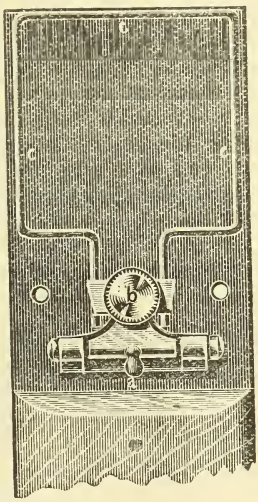
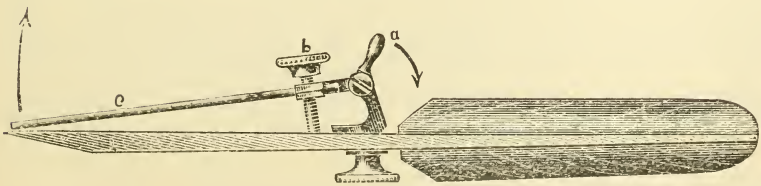


Fig. 113.



tome, he has devised two section-stretchers which have been made by the firm of Reichert and have proved very serviceable.

In the first and simple form shown in figs. 111 and 112 the cutting blade is provided with two holes A A, in which are screwed two double clamps serving to fasten the brass wire B. By bending the wire and altering its position in the clamping screws, the distance between wire and blade can be regulated.

In the more complicated form shown in figs. 113 and 114 the raising or lowering of the stretcher *c* is regulated by the screw *b*, while the small handle *a* allows the wire to be raised so as to remove the sections from the knife.

(4) Staining and Injecting.

Application of Anilin Mixtures for the Tinctorial Isolation of Tissue-Elements.*—Dr. P. G. Unna recommends Weigert's method for staining fibrin and bacteria as being specially suitable for dermatological specimens. While in this method the decolorising effect of the anilin was modified by the presence of xylol, and thus certain tissue-elements were preserved from altogether losing their colour, the author has employed the decolorising effect in a new direction. The pigments used were gentian-violet, methylen-blue, and polychrome methylen-blue; and for decolorising, six groups of anilin mixtures were employed:—(1) mixtures of anilin with acids; (2) with salts and double salts; (3) with acid pigments; (4) with acid pigments and acids; (5) with iodine; and (6) with carbolic acid. The effect of these mixtures as regards their staining or decolorising action on the various normal and pathological tissues, and also on agar and blood-serum, are fully discussed. The more important formulæ for staining Hyphomycetes and Schizomycetes, and sections of normal and pathological cutaneous tissues, are also given.

Retina of Selachians.†—Herr L. Neumayer has followed Ramon y Cajal's example in trying methylen-blue coloration as well as chrom-osmic-silver impregnation in his study of the retina in Selachians. But after some entirely negative results with the former method, he adhered to metallic impregnation.

Staining of Sexual Nuclei.‡—Miss E. Sargant has adopted with success the following methods (*Lilium Martagon*). For fixing: Flemming's solution, viz.:—3 ccm. of 10 per cent. chromic acid in water, 8 ccm. of 1 per cent. osmic acid, 2 ccm. glacial acetic acid, 27 ccm. absolute alcohol. The ovaries were then placed in 0·5 per cent. aqueous solution of chromic acid for 18–24 hours; then washed and placed successively in 30 per cent., 50 per cent., and 70 per cent. alcohol, at intervals of 24 hours, and finally removed to methylated spirit. For imbedding and cutting, bergamot oil was used as a penetrating agent (Heidenhain's process). For staining:—(1) Flemming's orange method for material fixed in Flemming's solution. The sections were left about 30 hours in 1 per cent. solution of safranin in absolute alcohol diluted with its own bulk of water; then washed out in 50 per cent. alcohol,

* S.A. aus Monatshefte f. prakt. Dermatologie, xxi. (1895). See Centralbl. f. Bakteriol. u. Parasitenk., xx. (1896) p. 406.

† Arch. f. Mikr. Anat., xlviii. (1896) pp. 83–111 (25 figs.).

‡ Ann. Bot., x. (1896) pp. 473–5.

slightly acid, then in neutral 30 per cent. alcohol, and transferred to distilled water. They were then transferred to 0·25 per cent. solution of gentian-violet in water for 2–4 hours; then washed out successively in 2 per cent. aqueous solution of Grübler's orange G, 1 per cent. solution of orange G in 50 per cent. alcohol, and methylated spirit; dehydrated, and cleared in clove oil. (2) Renaut's hæmatoxylic eosin for alcohol material. The sections were left all night in a solution of 2–3 drops orseillin extract diluted with 100 ccm. of water; then rinsed, and placed in a very dilute solution of Renaut's hæmatoxylic eosin in 0·1 per cent. aqueous solution of potash-alum, washed with tap-water (to keep them alkaline), and the orseillin stain washed out slowly by dilute alcohol.

Staining of Fungi.*—Mr. H. Wager recommends the following methods, especially for observing the sexual organs (*Cystopus*). The most useful fixing and hardening reagent is corrosive sublimate. The pieces of tissue are then well washed in water, transferred to 30 per cent. spirit, 50 per cent. spirit, and 70 per cent. spirit, and finally to 90 per cent. spirit, about 2 or 3 hours in each. They may now be saturated *en bloc* and imbedded in paraffin, or they may be first imbedded in paraffin and the sections stained on the slide (the latter preferable). For imbedding previously to staining they are transferred to absolute alcohol for half an hour, then to a mixture of alcohol and xylol, and are finally placed in melted paraffin. The staining solutions used are as follows:—(1) 50 per cent. spirit, 4 vols.; glacial acetic acid, 1 vol.; (2) to solution (1) enough nigrosin is added to make it opaque in the bottle and transparent in a half-in. layer; (3) to solution (1) enough nigrosin is added to make it blue, but transparent, in a layer 2 in. thick; (4) 50 per cent. spirit, to which a small quantity of (2) is added to make it quite light blue; (5) Mayer's alcoholic solution of carmine. The sections are placed for 5 or 10 minutes in the mordanting solution (4). They are then placed in Mayer's carmine for a few minutes until they become stained distinctly red, then washed in 30 per cent. spirit in solution (3). If a deep stain is required, use solution (2).

(5) Mounting, including Slides, Preservative Fluids, &c.

Preserving Embryological Material.†—Prof. A. A. W. Hubrecht adopted the following method for collecting and despatching embryological material from the Dutch East Indies to Utrecht. The animals were killed with chloroform and then cut up. The uterus was removed and placed in picrosulphuric acid, prepared according to the following formula: 100 volumes of saturated aqueous picric acid were mixed with 2 volumes of sulphuric acid. The solution was filtered and mixed with water in the proportion of 1 part of the solution to 3 parts of water. In this mixture the parts cut out were placed; after 10 to 15 minutes, the fluid having become cloudy, fresh acid solution was used. In this the preparations remained not less than 8 and not more than 24 hours. They were then transferred to 70 per cent. alcohol, and after 1 or 2 days to 90 per cent. alcohol.

* Ann. Bot., x. (1896) pp. 312-4.

† Naturk. Tijdschrift voor Nederl.-Indië, Deel 54, p. 90. See Zeitschr. f. ang. Mikr., ii (1896) p. 111.

Preservation of Urinary Deposits.*—Dr. Gumprecht first obtains a deposit with a centrifuge. This deposit is then placed in a saturated solution of sublimate and centrifuged again. It is then washed and preserved in a solution of formol (2 to 10 per cent.) If no red blood-corpuscles be present the sublimate stage may be omitted. If there be much albumen the deposit should be washed with normal saline solution. If there be urates the deposit should be washed with warm water or saturated solution of boric acid. If permanent preparations of the deposit be desired it is well to wash off the formol. Preserved in this way, the deposit can hardly be told from those of fresh specimens.

Preserving Museum Specimens.†—Dr. C. Kaiserling describes a process for preserving, and at the same time retaining the colour of museum specimens. The organ is placed for 24–36–48 hours in the following solution:—Formalin 750 ccm., distilled water 1000 ccm., nitrate of potash 10 grm., acetate of potash 30 grm. The specimen is then transferred to 80 per cent. alcohol for 12 hours, then for 2 hours to 95 per cent. alcohol, and is subsequently preserved in a mixture composed of equal parts of water and glycerin with the addition of 30 parts of acetate of potash.

Delicate tissues, such as intestine, are best kept in equal quantities of glycerin and water with the addition of 1 part of absolute alcohol to 10 of the mixture.

Disinfection with Formalin Vapour.‡—M. M. L. Vaillard and G. H. Lemoine found that formic aldehyde is a far superior disinfectant to atomised sublimate. It is extremely effective on all bacteria, but its action on spores is inconstant. For obtaining a quite certain effect, the vapour must be disengaged not only rapidly, but in large quantity. Owing to the fact that it polymerises rapidly, becoming converted into an inert body, formol must be considered as a surface disinfectant; from experiments this was found to be the case, for with infected articles lightly covered by it the deeper layers of dust were found to be unaffected by the antiseptic, even after prolonged exposure to its action. With this reservation, the authors think that as a disinfectant formol is of incontestable utility and certainly superior to sublimate spray.

Experiments with Porcosan.§—Dr. Deupser has made experiments with porcosan, a preparation which is advertised as being an infallible preventive of swine-fever. The fluid was tested in the usual way, the animals used for the purpose being mice, rabbits, and pigeons. As a preventive against swine-fever, porcosan was a complete failure.

(6) Miscellaneous.

Microscopical Examination of Meal.‖—It is possible, says Dr. Lange, to distinguish barley-meal from the flour of rye and wheat, owing to the fact that the first contains 2 to 4 per cent. of silica, while the two latter contain only small quantities. And as the silicated plant-

* Centralbl. f. inn. Med., July 25, 1896. See Brit. Med. Journ., Epit., i. (1896) p. 48. † Berliner Klin. Wochenschr., xxxiii. (1896) pp. 775-7.
‡ Ann. Inst. Pasteur, x. (1896) pp. 481-7.
§ Centralbl. f. Bakteriol. u. Parasitenk., 1te Abt., xx. (1896) pp. 421-8.
‖ Zeitschr. f. ang. Mikr, i. (1896) pp. 369-70.

cells, such as the husk of seeds, epidermis, and even hairs retain their appearance after combustion and treatment with mineral acids, it is possible to detect their presence even under low powers. The author's method is to put a teaspoonful of the meal to be examined in a flask of hard glass, together with 20 ccm. of strong sulphuric acid, and a teaspoonful of anhydrous copper sulphate. Energetic oxidation takes place on boiling, and after complete reduction, a colourless fluid is obtained. The fluid is poured slowly into 250 ccm. of water in a conical glass, and after having been stirred with a glass rod, is allowed to stand for some hours. Some of the sediment may then be pipetted off and examined under the Microscope. This method is said to be quite certain for the detection of barley-meal when mixed with flour and other meals. Of course it can be used for baked articles.

Detection of Starch in Meat Preparations.*—For determining the presence and amount of starch in sausages, Herr J. Mayrhofer follows the method devised by Dragendorff who treated the material with alcoholic solution of potash, in which sugar, albumen, fat, &c., are soluble, the starch being left as residuum on the filter. Finely minced sausage is digested in 8 per cent. alcoholic solution of caustic potash in a water-bath until the meat is quite dissolved. The insoluble residue, placed in a paper or asbestos filter, is then treated with hot alcohol and washed therewith until the reaction is no longer alkaline. The residuum is then dissolved in aqueous solution of caustic potash, and the starch afterwards precipitated by the addition of alcohol. The precipitate is separated by filtration and then washed in turn with alcohol and ether.

The starch thus obtained is nearly always mixed with a greater or less amount of carbonate of potash, to get rid of which it is necessary to treat the mass with dilute acetic acid, for acetate of potash is easily soluble in alcohol. Though the method is satisfactory as far as ascertaining the quantity of starch in the sample used, it gives no idea of the total quantity of meal in the sausage from which it was taken, as the distribution of the meal in the sausage is very irregular.

Microscopical Examination of Jams.†—Herr G. Marpmann contributes some practical though lengthy observations on the adulterations of jams and the means of detecting them partly by chemical and partly by microscopical investigation. It seems that conserves manufactured in Germany are adulterated with gelatin, agar, algæ, arabinose, &c., coloured with anilin pigments and preserved by means of salicylic acid, boric acid, &c. Instead of cane-sugar, starch-sugar is used, saccharin or dulcin being employed to impart the wanting sweetness.

* Forschungs-Berichte, 1896, p. 141. See Zeitschr. f. ang. Mikr., ii. (1896) pp. 112–3. See Zeitschr. f. ang. Mikr., ii. (1896) pp. 112–3.

† Zeitschr. f. ang. Mikr., ii. (1896) pp. 97–107 (11 figs.).