JOURNAL

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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.

Leitz's Microscope.†—The large Microscope of Leitz, No. I*a*, shown in fig. 1 on the next page, can be inclined at any angle; the coarse-adjustment is by rack and pinion, the fine by micrometer screw with divided head; the draw-tube is provided with a millimetre scale; the Abbe condenser, with iris diaphragm, can be raised and lowered by rack and pinion. The ordinary cylinder diaphragm is readily adjusted by simply turning aside the iris diaphragm and slipping out the condenser. The instrument is provided with a triple nose-piece.

Leitz's New Microscope Stand.‡—Mr. E. M. Nelson points out that Leitz's new stand is a nearer approach to the "English" model than any Continental instrument hitherto constructed. Instead of the heavy horse-shoe foot, there is a bent claw with a spread of 5 by 6 inches. Mr. Nelson's horse-shoe stage has been adopted, but the spring clips on the sliding bar ought to be removed.

An altogether novel procedure in Microscope construction is to be found in the substage rackwork; the rack is not in the groove, but on one side of it; there is no U-shaped groove at all, but a flat piece of steel which is pressed downwards by a spring; this is tightened up by a screw. Experience alone can decide whether, as seems probable, we have here a very simple and smooth form of slide.

Microscope for Measurement of Growth of Plants.§—Herr J. Wiesner describes the apparatus, constructed for him by C. Reichert of Vienna, which he made use of in his experiments on the influence of light on the increase in length of the organs of plants.

The instrument consists of two separable parts, the stand and the body-tube of the Microscope. The stand is composed of a horse-shoe base and a vertical column, which serves to support the body-tube of the Microscope in the horizontal position.

The column has a height of about 119 mm. and can be lengthened by 70 mm. At the back of the movable part of the column is a divided scale, 60 mm. long, which is read off against the vernier attached to the fixed part of the column. The raising of the column, and with it the Microscope, is effected in the usual way by rack and pinion.

The Microscope is connected with the stand by a pin, and is fixed by a screw. The body-tube can be displaced in the horizontal direction by rack and pinion for the purpose of adjusting the object. The whole Microscope can also turn in the horizontal plane about the pin, mentioned above, on the loosening of a screw.

As objective the Reichert system I*a* was used. With a tube-length

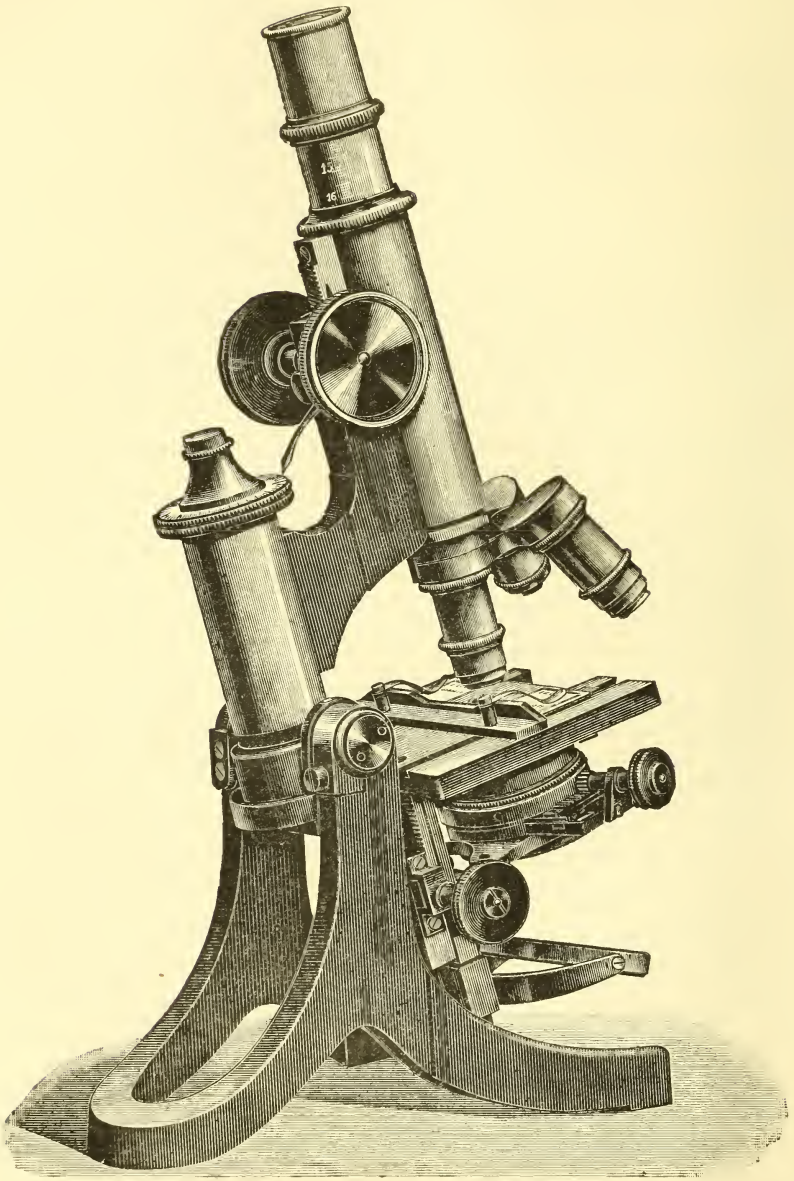
* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Catalogue No. 34 of Microscopes and Accessory Apparatus. Ernst Leitz, Wetzlar, 1892, p. 19.

‡ Journ. Quekett Micr. Club, v. (1893) pp. 309–11 (3 figs.).

§ Zeitschr. f. wiss. Mikr., x. (1893) pp. 145–8 (1 fig.).

FIG. 1.



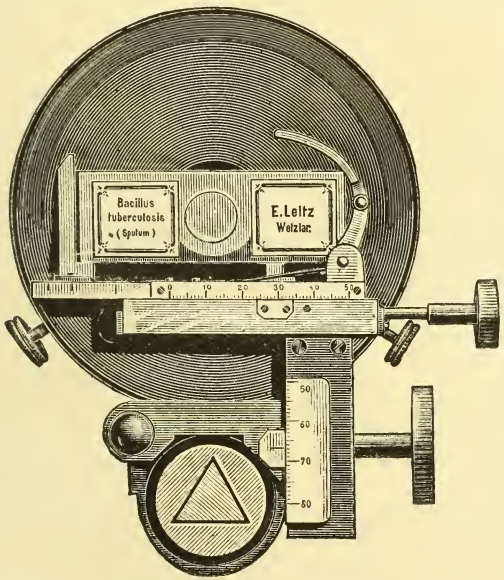
LEITZ'S MICROSCOPE.

of 160 mm. a magnification of twenty times was obtained, for a focal distance of more than 30 mm.

The difference in height of the growing plant can be determined with this instrument in two ways. One method consists in adjusting on a determined fixed point in the Microscope at the beginning and end of the experiment, each time taking the reading on the vernier. This determination is, however, only exact to about 0·1 mm. The more precise method is to take a reading on the micrometer at the beginning and end of the experiment. A difference in height of 0·06 mm. can then be directly determined, and a difference of 0·03 mm. can be conveniently estimated.

Leitz's Mechanical Stage.* — This stage, shown in fig. 2, is adapted to the Leitz stands I., I *a*, and II. The movement from front to back is effected by two racks and pinions, that from right to left by means of a screw. The movements are measured by two millimetre

Fig. 2.



scales. To fit the stage to the Microscope the screw on the right is loosened so that the arc lever can turn about the axis. The stage is then placed on the ordinary Microscope stage, so that the angle-pieces opposite the lever are in contact with the column ; the lever is then put in its place and the screw fastened. Lastly, the stage is fixed to the column by means of the other screw.

* Catalogue No. 34 of Microscopes and Accessory Apparatus. Ernst Leitz, Wetzlar, 1892, p. 45.

A Farmer's Microscope.—Mr. E. M. Nelson writes:—"Two or three months ago a scientific farmer asked me if Watson's histological Microscope was suitable for a certain kind of investigation, which he described. To this I replied that in its present condition it was not suitable, but with a few alterations it could be made serviceable for the purposes he had named. He desired me to have these alterations carried out, and, as he gave me a free hand with regard to all the details, the result is the Microscope before you.

Two features are noticeable at once:—(1) There is no fine-adjustment; (2) The main stage is very large for the size of the instrument, viz. 4 by 4 in. The body and the foot are of the usual form, but the principal alterations will be found in the stage.

Fig. 3.

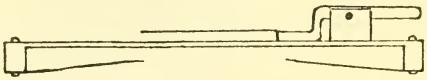
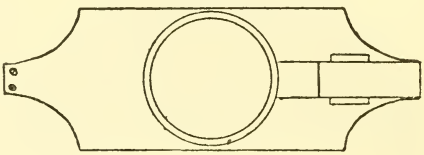


Fig. 4.



The hole in the stage is 1 in. in diameter, and it can be closed by a sliding plate underneath. When it is closed it forms a dark well for the observation of seeds and similar objects under a low power. The stage has two carriers, one of the ordinary sliding type which need not be described. The other, which is much larger, viz. $6\frac{1}{2}$ by $2\frac{1}{4}$, has no aperture in it, but has a ring compressor 2 in. in diameter, which is worked by a lever and spring, precisely like a letter-clip (see figs. 3 and 4, drawn one-third scale). This is for the purpose of holding leaves and similar objects.

The mirror is a silvered equiconvex lens, an invention dating from the last century.

The instrument has, however, another mirror on the same principle for superstage opaque illumination. At the right-hand side underneath the stage is a rotating bar to hold this mirror, which is mounted on a rod. The focus of the mirror is made equal to the distance of the dark well, and in practice its performance will be found most satisfactory. It is $1\frac{3}{4}$ in. in diam., and concentrates a powerful beam on the object. We have here a cheap and thoroughly practical piece of apparatus, which might with benefit be applied to other instruments. This will be found preferable to the old plan of a bull's-eye placed in front of the stage, where it is always in the way. The mirror being at the back of the stage interferes with stage manipulations no more than the limb of the Microscope.

The lenses selected for use with this instrument also demand notice.

The highest power is a No. 4 Leitz; this has been chosen, not only on account of its being of the power that was required, but also because it makes a very fair low-power lens when the front lenses are removed. The complete lens gives a power of 100 diameters with the tube extended, and 66 with the tube closed; when the front lenses are removed and the tube extended, a power of 32 is obtained. We have, therefore, a range of power from 30 to 100 diameters with the one objective.

The other lens, which Messrs. Watson have constructed at my suggestion, is somewhat of a novelty. It is made on the plan of the Zeiss a* with a concave front, but it differs from those lenses in as much as its aperture is greater and its mount is a rigid one. The range of power in this lens is more than twice as great as in the case of Zeiss a*. For example, on this instrument my Zeiss a* gives a range of power from 6 to 10 diameters, while the new lens on the same instrument gives from 5 to 20 diameters. This lens will be valuable for all kinds of low-power work, as it will do the work which now falls to the 3-, 4-, and 5-in. lenses.

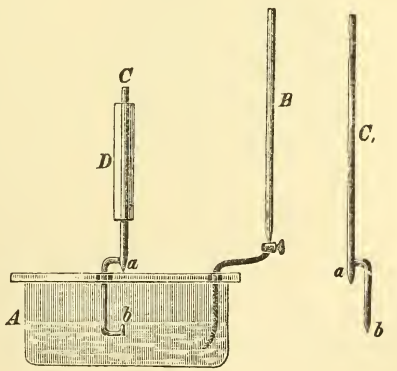
In bringing forward this instrument let me express a hope that it will open a wider field for research and extend the ever-growing popularity of the Microscope."

(3) Illuminating and other Apparatus.

New Exact and Easily Constructed Spherometer.* — Signor G. Guglielmo has devised a new form of spherometer which can be easily constructed out of ordinary laboratory apparatus without the use of a micrometer screw.

The apparatus is represented in fig. 5. A is a cylindrical or prismatic vessel covered with a glass plate in which two holes are bored. Through one of these holes there passes nearly to the bottom of the vessel the glass or indiarubber tube which is connected with the burette B. Through the other opening projects a glass or metal rod (C or C_1 in the figure) which possesses two points *a* and *b* and slides in the holder D. In order to work the apparatus, a liquid is poured into the cylindrical vessel and into the burette, and the level in A adjusted exactly to the point *b*. The plate, of which the thickness is to be measured, is then placed on the glass plate beneath the point *a*. This will have the effect of raising *b* above the surface of the liquid. More liquid is then introduced from the burette until the level in the vessel is again flush with *b*. The

Fig. 5.



* Atti d. R. Acc. d. Lincei. Rndct. (1893) I. 4. See Zeitschr. f. Instrumentenk., xiii. (1893) p. 393.

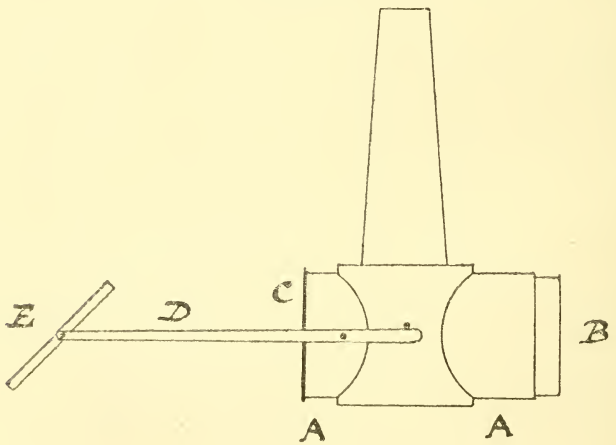
quotient of the liquid used (as measured by the burette) by the area of the cylindrical vessel gives the thickness required. If an arrangement be attached to the burette by which the liquid can be drawn back into it, a great number of adjustments may be made for the same determination. Mercury is the best liquid to use, and in this case a rod of the form C_1 is employed, but in the case of water, one of the form C. The exactness of the determination naturally depends on the correct adjustment of this rod; it must stand vertically and must not rotate during a determination; the glass plate also on which the point *a* rests must be exactly plane and horizontal. According to the author, when these conditions are fulfilled the new spherometer is in no way inferior in exactness to the ordinary instrument with micrometer screw. By a number of adjustments of the same level an exactness up to 0·001 mm. was effected.

Chimney for a Microscope Lamp.—Mr. Nelson writes:—"This chimney, which Messrs. Watson have made from my designs, would at first sight appear to be an elaboration of the existing illuminating apparatus for a Microscope, whereas it is an attempt at simplification.

While working with the superstage illuminator of the "Farmer's" Microscope, it occurred to me that an equiconvex lens silvered mirror would form an excellent parallelizer for a Microscope lamp.

A reflector to parallelize a wide-angled beam can be constructed on that principle with shallow curves, it is therefore apparent that the aberrations will be less than that of a single plano-convex lens,* whose ratio of aperture to focus is the same.

Fig. 6.



The adaptation of such a mirror to the chimney itself was only one step further. The chimney, fig. 6, is the same as my ordinary one with a horizontal tube A A inserted, which is of course cut away inside the

* Calculation shows that it is less than a half.

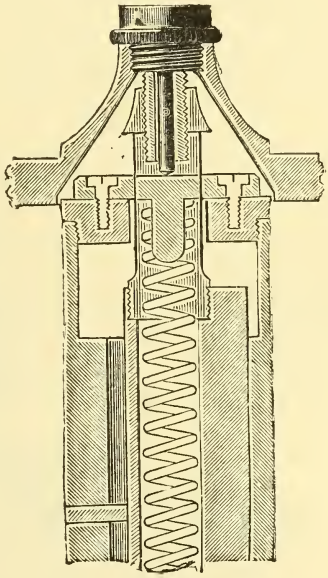
flame chamber; at the back another short tube B slides easily, one end of this inner tube carries the equiconvex lens mirror, while the other is closed and made dead black.

When parallel rays are wanted the mirror is inserted, and the tube pushed home, as in fig. 6, as far as it will go, it will then be found to be centered and focused to the flame. This plan saves all trouble of adjustment.

The front C is a circular piece of plane glass, fitted to a small piece of tube, which slides into A. Fastened to each side of the lamp are two aluminium arms D, which carry at their extremities a plane mirror E. This will be found convenient, not only for the illumination of small Microscopes when used in an inclined position, because the light can be reflected downwards on to the mirror of the Microscope, but also for dissection, opaque illumination, &c.

When divergent rays from the edge of the flame are required for direct illumination in the ordinary manner, the arms D with the attached mirror E are turned upwards, the tube B is withdrawn, and replaced with the dead black surface inwards, the mirror being then outside. The sliding-tube C with the plane glass can be withdrawn, and a plate having the usual 1½ by 3/4 rectangular opening, closed by a 3 by 1 slip, inserted in its place; some observers preferring all extraneous light cut out."

Fig. 7.



Leitz's Micrometer Screw Adjustment.*—This micrometer screw, which is shown in section in fig. 7, is constructed with particular attention to the elimination of all lateral motion. The spindle is hollow and contains a freely movable steel cylinder, the point of which transmits the pressure to the spring. The micrometer thread is carefully cut so that the screw works freely in either direction, and stops in any position without slipping.

(4) Photomicrography.

Leitz's Photomicrographic Apparatus.†—In this instrument, represented in fig. 8, the camera is supported by a metal column which rises from a broad iron base on which the Microscope stands. This column is adjustable in height and can be fixed in any position by thumb-screws, so that the apparatus can be used with Microscopes of various sizes. The neck of the camera admits diaphragms of various

* Catalogue No. 34 of Microscopes and Accessory Apparatus. Ernst Leitz, Wetzlar, 1892, p. 12.

† Op. cit., p. 44.

sizes, by which the size of the picture may be regulated. Accurate focusing is effected by means of a simple lens which moves over the

Fig. 8.

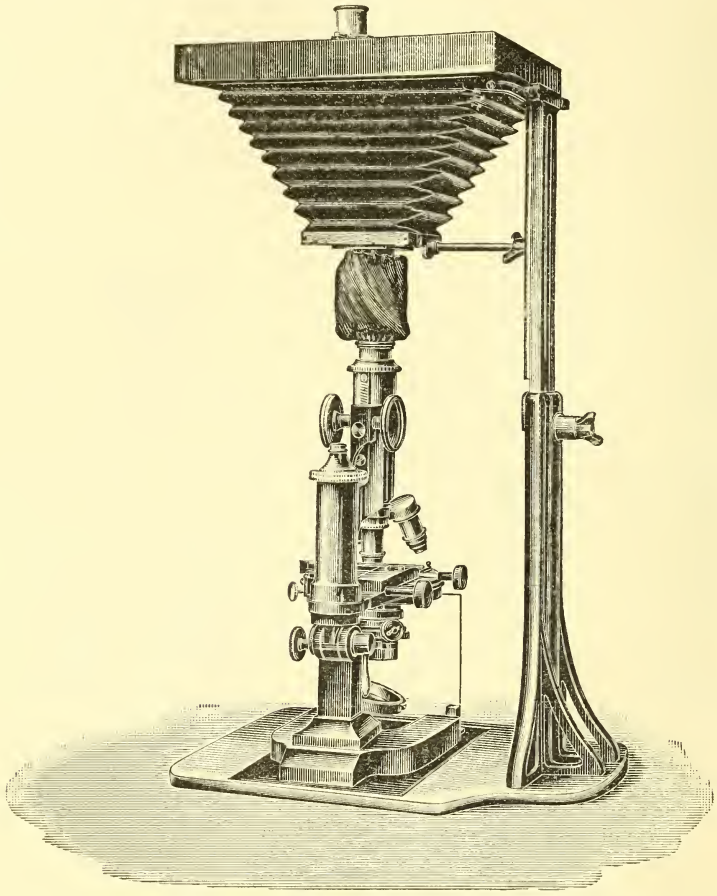


image-plate. The plate-holders are made for plates of the sizes, 9 by 12 cm. ($3\frac{1}{2}$ by $4\frac{3}{4}$ in.) and 13 by 18 cm. (5 by 7 in.).

On Instantaneous Photomicrography.* — Herr G. Marktanner-Turneretscher remarks that three methods of making instantaneous photographs of microscopic objects have been proposed besides the primitive process of simply placing an instantaneous shutter between the source of light and the object.

In the first method, which requires the most intense illumination, the light from the object is reflected by a suitable arrangement of prisms

* American Annual of Photography, 1894, pp. 245-8 (1 fig.).

into a side tube through which the living object is observed. At the moment selected for the exposure, the prism is rapidly pushed aside, its motion being followed by a slit cut into the movable portion of the shutter attached to the objective, so that the plate enclosed in the camera is illuminated for an instant.

The disadvantages of the method are the blinding of the eyes by the intense light when watching for the most favourable moment for exposure, and the continuous exposure of the object to light and injurious heat rays.

The second method consists in the employment of a source of light which flashes up instantaneously. For this purpose magnesium powder is used; but the method is improved by adding to the powder substances which render the flame greenish-yellow, so that photographs can be obtained with but imperfectly corrected lenses. The objection to this method is the impossibility of selecting the moment of exposure.

The third method, designed by the author in order to obviate the difficulties in the preceding methods, is necessarily more complicated and consists of two principal parts. The first part is represented by a slide shutter interposed between the source of light and object and showing successively:—

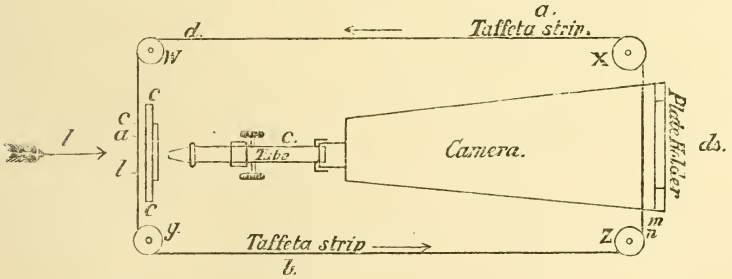
(1) A circular opening covered with coloured glass or gelatin, by which the light and heat rays can be reduced as much as is desired.

(2) A rectangular slit which makes the exposure by sliding forward.

(3) A non-perforated portion of the shutter which excludes all light after the exposure is made.

The second part of the apparatus consists of another slide carrying a reflecting prism by which the light is thrown into a side tube. When the slide is released the prism is rapidly pushed aside, and passage is opened for the light to the main tube. Both shutters must be pneumatically released at exactly the same time. The prism-carriage, which is

Fig. 9.



best fastened directly behind the objective, then moves rapidly aside, opening a path for the light rays to the sensitive plate; the slit of the first slide passes across and the exposure is made.

The only difficulty which can occur in this method is insufficient rapidity of the two shutters.

The author makes an improvement on the ordinary Anschuetz

shutter by passing the strip of taffeta, as seen in fig. 9, over four rollers in such a way that a circular aperture cut in one end of the taffeta passes directly in front of the plate at exactly the same time that a rectangular opening cut in the other end of the taffeta passes between the source of light and the object. The prism arrangement remains the same as above described, and must be released by a device similar to the mechanism by which the propelling of the taffeta strip is effected.

In fig. 9 *m n* represents the slit for exposure, *a b* the circular aperture covered with a red gelatin pellicle, *c d* the rectangular aperture, allowing light to enter during exposure, *w*, *x*, *y*, *z*, the rollers upon which the taffeta strips are propelled.

On the Cooling of Projection Preparations.*—Dr. O. Zoth points out the difficulties attending projection by means of very intense sources of light, when the object is sensitive to a rise in temperature, as in the case of living animals or plants. The usual method for absorbing the heat rays consists in the use of troughs of water and concentrated solutions of alum, or of plates of alum. The author gives the following table showing the effect of different thicknesses of water in the absorption of the heat rays in the case of the Locatelli lamp:

Layer of water in mm.		Percentage of heat-rays transmitted.
1	..	19·3
5	..	9·1
10	..	7·7
50	..	2·4
100	..	1·3
150	..	0·7
200	..	0·7

The table shows that no very great advantage is obtained by increasing the thickness of water beyond 50 mm.

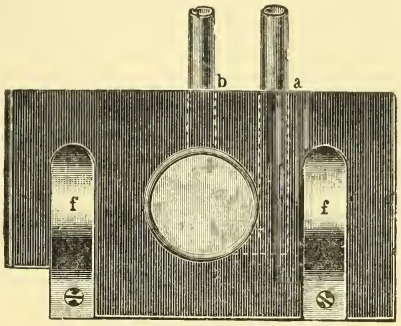
The best and simplest heat-absorption apparatus consists of a trough about 5 cm. thick, which is filled with distilled water and placed in the path of the illuminating pencil. An experiment made in order to test the utility of such an absorption-cooler showed, in the case of a Duboscq projection lantern, that whereas the rise in temperature without the absorption apparatus was as much as 35° within two minutes, after the cooler had been introduced the rise in five minutes only amounted to 10° and the temperature then remained constant at 30° to 35°. The absorption-cooler, however, does not suffice for all cases; even preparations mounted in resin which are to be observed under very high powers begin to shrink, and the resin softens as soon as the focus of the Abbe illuminating apparatus is brought near to the preparation. For such cases, therefore, the author recommends, besides the cooling by absorption of the heat rays, the direct cooling of the preparation by conduction.

The apparatus which he has designed for this purpose consists, as seen in fig. 10, of a brass plate 6·25 mm. thick, 70 mm. long, and 40 mm. broad, in the middle of which is bored a circular hole of 18 mm.

* Zeitschr. f. wiss. Mikr., x. (1893) pp. 152–6 (1 fig.).

diameter which is closed on both sides by round cover-glasses 21 mm. in diameter. The latter are let into the plate so that their upper surfaces are exactly in the same plane as the surfaces of the plate. The two borings made in the side of the plate at *a* and *b* communicate, as seen in the figure, with the cylindrical space enclosed between the cover-glasses. The object-holder is fastened to the cooler by means of the two clamps *f*, and the whole apparatus is set in a movable object-slide. The cooling is effected by a stream of cold water which enters by the pipe at *a*, and is carried off at *b*. Experiments made as before to determine the effect of the cooler showed that, when both coolers were used, in five minutes the temperature only rose 1°·5, from 25° to 26°·5, and then remained constant at 26° to 27°. In these experiments the thermometer was mounted in a mercury trough, 5 mm. thick, the sides of which were thickly coated with lamp-black.

Fig. 10.



The cooler has the disadvantage that it limits the use of the ordinary Abbe condenser since it is impossible, owing to the thickness of the cooler (6·25 mm.), to adjust the focus in parallel light on the plane of the object or near it. A special condenser, however, of greater focal length can be used, since for projection purposes an aperture higher than 1·0 is not required.

Orthochromatism applied to Photomicrography.* — Before the Société Française de Photographie on May 5th, M. Monpillard read a paper on this subject, in the course of which he said that the design of photomicrography is, given an object visible to the naked eye, to obtain an enlarged image of it, scrupulously accurate both in form and detail. Nothing is more easy in the case of colourless objects, such as diatoms, sections of bones, &c., the great perfection of modern objectives permitting of the obtainment of great sharpness and detail of image. It is not equally so when the objects are coloured, either naturally or artificially, and it may be said—for experience has proved it to be so—that all coloration degrades the perfection of the photographic image, obtained with ordinary gelatin plates, so that if the object be of blue or violet colour (the most actinic colours), it stands out badly from the ground, and has its details poorly rendered. On the other hand, if it is yellow, orange, or red, the object is vigorously rendered on the ground, but the details, bathed, as it were, in a light that is powerless to affect the sensitive salt, will, if the object be green, be very small, and less so with yellow and red.

In all cases, the employment of orthochromatic plates requires also the use of coloured screens.

* Anthony's Photographic Bulletin, xxiv. (1893) pp. 608–11.

Orthochromatic Sensitiveness.—Though commercial orthochromatic plates are sensitive for the green and red, and generally give satisfaction, M. Monpillard says that, for scientific purposes, he prefers ready orthochromatized plates, which, when used shortly after preparation, have a maximum of sensitiveness to the luminous radiations. The operation of orthochromatization demands only elementary care. The dark-room lamp should have two thicknesses of deep ruby glass, the flame being reduced to as small a degree as convenient during the bathing of the plates. After the plates are bathed they are passed through three dishes of distilled water, and are finally dried in a drying cupboard containing a vessel in which calcium chloride is placed.

For photomicrographic purposes the following colours give the best results:—(1) Erythrosin (for green-yellow, yellow, and yellow-orange); (2) Cyanine (for red-orange and red).

M. Monpillard says the following formulas have given him satisfaction:—

Erythrosine (stock solution):—Erythrosine 1 part; distilled water 1000 parts.

Sensitizing bath:—Stock solution of erythrosine 4 ccm.; water 100 ccm.; ammonia, 0·5 ccm.

Cyanine (stock solution):—Cyanine 0·1 part; alcohol (95 per cent.) 100 parts. Only a small quantity of the solution should be prepared and it should be kept in the dark.

Sensitizing bath:—Stock solution of cyanine 4 ccm.; water 100 ccm.; alcohol (95 per cent.) 5 ccm.; ammonia 1·5 ccm. The plates are immersed in either of the foregoing baths for two minutes, and are then washed and dried as directed.

Erythrosine and cyanine plates bathed in both erythrosine and cyanine are rendered sensitive to yellow and red. The first bath consists of:—Stock solution of erythrosine 20 ccm.; distilled water 80 ccm. After two minutes' immersion the plates are washed in two waters, and are then bathed in the cyanine solution given, washed and dried.

Plates so treated are, it is pointed out, very much slower, but this is no disadvantage in photomicrography, and, on the other hand, they do not fog in development, which frequently happens when, to raise their general sensitiveness, the orthochromatizing bath is preceded by an alkaline bath.

Coloured Screens.—Coloured screens may be used either in the form of stained collodion, or, preferably, a small glass trough with parallel faces may be fitted with either of the following solutions:—

(1) For light-yellow screen:—Neutral chromate of potash 1 grm.; water 100 parts.

(2) For deep-yellow screen:—Neutral chromate of potash 5 grm.; water 100 parts.

(3) For orange screen:—Bichromate of potash 8 grm.; water 100 parts.

(4) For red screen:—Erythrosine 0·2 grm.; water 100 parts.

No. 1 weakens the blues and yellows; No. 2 extinguishes them; No. 3 cuts off the blue; No. 4 accentuates the action of the red.

With those coloured screens, and having sensitized the plates for given colours, it will be easy to obtain in their true values reproductions

of objects coloured or uncoloured. It is necessary, however, that the focus and the exposure should be made in the same monochromatic light, corresponding to a determined spectrum colour; this method of working assures the perfect sharpness of the image, inasmuch as the chemical focus is corrected. For this reason it is desirable to avoid, in exposing on one object, the use of screens of two different colours, except in the case where, on account of the presence of a deep red, it would be useful to prolong the exposure. The plates, after treatment with erythrosine and cyanine, being sensitive to the red and blue it is indispensable, to give the image its maximum of effect, to illuminate the object with a yellow or orange light, arresting or moderating the action of the actinic rays, and leaving free to pass the radiations corresponding to the colour of the object, if that is green, yellow, orange, or red.

The following table will give an idea of the employment of coloured screens with plates sensitized with cyanine and erythrosine:—

Object in Monochrome—Actinic Rays.

Colour.	Sensitizer.	Screen.
Blues or violets { deep / pale } ..	Erythrosine	{ Pale yellow. / Deep yellow or orange.

Chemical Rays.

Greens .. .. / Yellows .. .. / Yellow-orange	Erythrosine	Deep yellow or orange.
Orange-red .. .. .. / Red .. .. / Deep red	Cyanine	{ Deep yellow or orange. / Orange-red.

Coloured Objects—Non-Actinic Colours.

Green and yellow	Erythrosine	Deep yellow.
Green and red .. .. .. / Yellow and red	Erythrosine	{ Deep yellow or orange, then / red.
Green and red .. .. .. / Yellow and red	Erythrosine and cyanine	Deep yellow or orange.

Actinic Colours in the Presence of Non-Actinic Colours.

Blue or violet with yellow.	Erythrosine	Light or deep yellow, or orange, according to the intensity of the blue or violet.
Blue or violet with red ..	Cyanine	Same screens; in case red is very deep continue the exposure with a red screen.

At first sight it might seem abnormal to attempt to photograph an object of a blue or violet colour with an emulsion sensitized for yellow, but M. Monpillard says nothing is more rational. It will suffice to obtain an image showing vigorously, with the shadows and half tones well rendered. Now, with an emulsion which is particularly sensitive to the blue and violet, the object in question will appear so luminous that the ground will be slightly lost, and the half tones will not come up well. The interposition of a yellow or orange screen will retard the

luminous impression, by neutralizing the rays emanating from the blue or violet parts of the object; but the emulsion not being sensitive to the yellow, a general cutting off will result, both for the ground as well as for the object, and the image will not have gained. Retaining the same screen and substituting for the ordinary plate a plate sensitized for the yellow, the ground will be forcibly rendered, while the blues and the violets, partly reduced by the coloured screen, will act with less rapidity, and will be rendered on the plate in their proper value. In a word, the plate sensitized for the yellow will reproduce the object as if it were grey and black on a white ground.

Where an object combines red and yellow colours it would be possible, at a push, to obtain a true rendering with a plate sensitized for yellow by commencing the exposure with a yellow screen, and continuing for the red with a screen equally red; although, for the reasons already given, the substitution of one screen for the other would endanger the sharpness of the image. It would be better to sensitize for red and yellow and, according to the intensity of the former, expose with a deep yellow or orange screen. If blues and violets are found in the presence of yellows, oranges, or reds, it would suffice to use a plate sensitized for the least actinic colour (yellow or red), and as the plate is, of course, sensitive to the blues and violets, a yellow screen, pale or deep, could be used according as the more actinic parts of the object are more or less coloured.

For development the author recommends hydroquinone with an alkaline carbonate and bromide, and the use of a feeble light in the dark room.

(5) Microscopical Optics and Manipulation.

Chromatic Aberration of Lenses.*—Prof. L. Weber gives the following practical method of demonstrating in the simplest way from the law of refraction the chromatic aberration of a lens:—

The aperture of a simple, moderately large lens L L (fig. 11) is covered with an opaque screen S S, in which two small holes *o o*, 1–2 mm. in diameter, are bored near the rim of the lens on the horizontal middle line. If a point of light be then brought into the focus F of the lens, the rays proceeding from the holes *o o* will be parallel. The eye at a distance of 10 to 20 m. from the lens, looking along *r*, will then see one of the holes in the screen as a bright point of light, and in order to see the other hole will have to be displaced through a distance equal to the distance between the holes. If the distance be exactly equal to the distance between the pupils of the two eyes, the two holes will be seen simultaneously by both eyes. The smallest movement of the head will then cause the two points of light to appear unequally bright.

The difficulty of getting a point of light, such as a needle-hole in a screen in front of a lamp, in the focus of the lens may be obviated by the use of a vertical slit about 1/2 mm. broad.

The above observations will only be rigidly exact provided that monochromatic light (e. g. soda light) is used, and that the slit is exactly in the focus of the lens which corresponds to this particular colour.

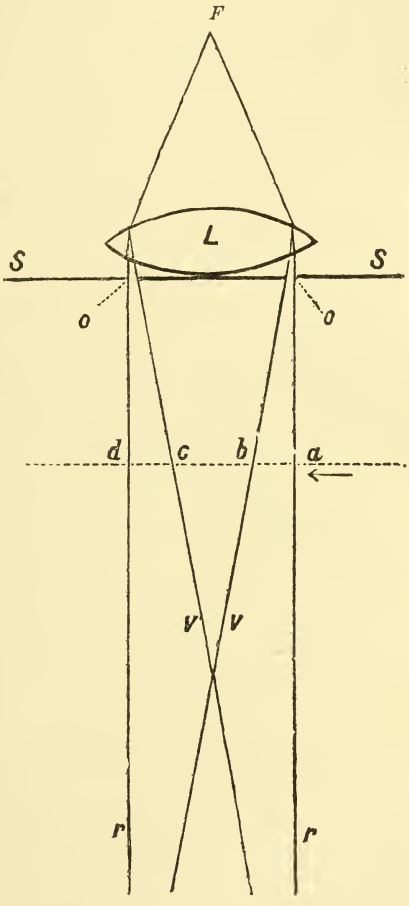
The observation will be quite different if the slit is illuminated

* Central-Ztg. f. Optik u. Mechanik, xiv. (1893) pp. 241–2.

by light of all colours, e. g. by ordinary lamp-light, since the lens has a special focus for each special colour. If the slit is exactly in the focus of the red light, only the red rays through the two holes will be parallel, while the rays of other colours will converge.

The consequence of this is that the two holes in the screen will be seen as two stars shining in spectral colours. The eye in moving in the direction *a b c d* will first see a red star and then successively an orange, yellow, green, blue, indigo and violet one. From *b* to *c* there will be a short extinction of the light; then the second hole will come into view and will appear at first violet, and then the other colours in inverse order. By simultaneous observation with both eyes, in the direction *r r*, two equally bright red stars will be seen. The focus belonging to the red rays lies farthest from the lens. If, therefore, the slit be brought a little nearer the lens, the red colour of the two stars will change to orange.

Fig. 11.



Since for this observation with both eyes the distance of the holes in the screen must be equal to the distance between the pupils, two observers with different pupil-distances will, under otherwise the same conditions, see different colours.

If the slit is moved farther from the lens than the focus of the red rays, then all the rays converge, but the point of intersection of the red rays lies farthest from that of the violet nearest to the lens. This point of intersection is easily found by observing with one eye and finding the point where both stars appear equally bright and equally coloured.

The spherical aberration may also be demonstrated by the same method. For this purpose, beside the first pair of holes, a second pair may be bored nearer to the centre. The marginal rays in all colours will then be found to converge nearer to the lens than those nearer the centre.

(6) Miscellaneous.

The late Dr. Kützing.—Traugott Friedrich Kützing, the Nestor of European algologists, died at Nordhausen on the 7th of September, 1893, in the eighty-seventh year of his age. Kützing had withdrawn for so many years from practical scientific work and from scientific literature, that he belongs altogether to a past generation. He was one of the first to place the study of Algæ, and especially of seaweeds, on a scientific foundation. As a describer and delineator he was almost unrivalled, and a very large number of his genera and species still hold their place in all works on algology. His 'Phycologia Generalis,' published in 1843, his 'Tabulæ Phycologicæ,' issued in 20 volumes between 1845 and 1870, with 2000 illustrations which are still of the greatest use to all workers on the lower forms of vegetable life, and his 'Species Algarum,' published in 1849, were among the first general systematic works on Algæ in which modern principles of classification were employed. This was a period of great activity in algology. Nearly contemporaneously with these classical works appeared also Harvey's 'Phycologia Britannica' (1846–1851), Hassall's 'British Freshwater Algæ' (1845), Nägeli's 'Die neuern Algensysteme' (1847), and Agardh's 'Species, genera, et ordines Algarum' (1848–1880). Even before that time Kützing had published (in 1841) his 'Umwandlung niederen Algenformen in höhere'; and in 1844 appeared his 'Die kieselschalige Bacillarieen oder Diatomeen,' the first important work on the structure of diatoms. The first discovery of the siliceous nature of the shell of the diatom is due to Kützing rather than to Ehrenberg. Since 1870 nothing has appeared from his pen. Kützing's extensive type-collection of Algæ is at the University of Leyden.

Prof. A. Milnes Marshall.—We have to express our sympathy with the Manchester Microscopical Society in the sudden death of their President, who, as the daily papers will have informed our readers, met with a fatal accident on Scawfell on December 31st last. But it is not only the Manchester Microscopical Society, nor Owens College, which has lost one of the most distinguished of its Professors, that has to lament his loss. He was in the van of morphological science in this country, and his text-books on the 'Frog,' on 'Practical Zoology,' and on 'Embryology' have taken the first place among the handbooks for the biological student. He was associated with the late Prof. Balfour in the early stages of the formation of the now famous School of Morphology at Cambridge, and as Professor in Manchester he was the teacher of several morphologists who have already distinguished themselves. His early death at the age of 41 calls to mind that of A. H. Garrod and of W. A. Forbes, like himself Fellows of St. John's College, Cambridge, and adds another to the many severe losses which morphology has suffered in this country during the last fifteen years. Lately he assisted in the editorship of our valued contemporary the 'Quarterly Journal of Microscopical Science.'

Prof. P. J. Van Beneden.—The Society has lost, by the death of Prof. Van Beneden, on the 8th of January last, one of the most venerable and distinguished of its Honorary Fellows. Somewhat younger than Owen, for he had only just entered his eighty-fifth year, P. J. Van

Beneden was the oldest of Belgian zoologists, and one of that band of pioneers of whom Svén Lovén is alone now left to us. It is to him that we owe much of what is now elementary knowledge with regard to the wonderful "alternations of generations" exhibited by the Hydroid Polyps, and the history of the changes undergone by tapeworms in their different hosts. He was devoted to the study of parasitic Crustacea, and he was the first to show that *Pentastomum* is a modified and degraded Arachnid. So far we have spoken of his work as a student with the Microscope, but it is not to be forgotten how largely he added to our knowledge of the hugest of living creatures—the Cetacea, and the admirable use to which he put the opportunities afforded him to study the fossil Whales, of which the deposits near Antwerp are so full.

The Measurement of Light and Colour Sensations.*—Mr. E. M. Nelson writes:—Mr. J. W. Lovibond in 'Measurement of Light and Colour Sensations,' deals with an instrument invented and called by him a "Tintometer." Before describing this instrument, it is important to bear in mind that the ground traversed is in the main psychological rather than physical, because it is light and colour as appreciated by the human eye, that are only taken account of. If, for instance, we look at monochromatic light of wave-length ·52 μ, we should call it green, and would be unable to distinguish it from light passed through a piece of green glass. But if we examine by a spectroscope the light transmitted through the green glass we shall find it composed of blue as well as of green light. Thus while there exists an essential difference between the two greens the unassisted eye is wholly unable to recognize it.

It would seem, therefore, that all measurements of light and colour, which depend solely for their appreciation on the human eye, must be valueless. In other words, such measurements in order to be trustworthy must be on a physical, and not on a psychological basis.

That this, however, is only a shallow view of the question is amply proved in this work, for by means of the "tintometer" minute differences of colour may be perceived and measured, which are quite beyond the range of the spectroscope. To adequately describe the "tintometer" and its applications would exceed the limit of this note, because intricate and complex combinations arise before one has proceeded very far, but an elementary idea of the principle which underlies its construction can be conveyed in a brief description.

Pure white diffused daylight, such as that observed in a sea mist, can be totally absorbed by passing it through certain thicknesses of red, yellow, and blue glass. These red, yellow, and blue glasses are divided into arbitrary units, so that an equal number of red, yellow, and blue units always yield a neutral tint of a certain depth.

Although the units are arbitrary they are *uniform* and *recoverable* if lost; thus they in no wise differ from ordinary measures of length, weight, and capacity. The limit of perception is ·006 of a unit. The mechanism of the instrument is very simple. A tube is longitudinally divided into two halves, through one half the object to be tested is viewed, and its colour is matched in the other half by the insertion of the requisite number of red, yellow, and blue units.

* 'Measurement of Light and Colour Sensations,' London, 8vo, 1893, 132 pp., 12 pls. and 13 figs.

The simplest example is that of "carmine," which is exactly balanced by 38 units of red.

"French mauve" is balanced by 8·4 units of red, ·6 units of yellow, and 6·8 units of blue. Here we have ·6 units common to the three colours, therefore we find as a first result ·6 neutral tint units, viz. ·6 units of black. We have left 8·4 − ·6 = 7·8 units of red, and 6·8 − ·6 = 6·2 units of blue; but as red and blue form violet, 6·2 units of violet may be taken out of the 7·8 units of red and the 6·2 units of blue, leaving as a remainder 1·6 units of red. The total result is, therefore, 6·2 violet + 1·6 red + ·6 black.

Another comparison result is of interest. "Ivory-black" is balanced by 10·6 units of red, 9·2 of yellow, and 11·0 of blue. Proceeding as in the former case, we obtain 9·2 units of black, 1·4 of violet, and ·4 of blue. "Lamp-black," however, gives 9·2 units of black, 1·4 of violet, and 1·9 of blue. There is, therefore, a difference between "ivory-black" and "lamp-black" amounting to 1·5 units of blue. The recognition and measurement of such a difference would not be possible with a spectroscope. The economic value of this instrument is great; for example, the price of flour, which is dependent on its colour, can be indisputably fixed by the "tintometer"; and the percentage of carbon in steel can be determined by inspection, without the trouble of a difficult chemical analysis.

Perhaps microscopists will be more interested in the values obtained from drinking water. A thickness of two feet from a chalk well gave ·14 green, ·24 blue; when filtered it gave ·29 green, ·05 yellow; when distilled ·37 green, ·15 yellow; but after aeration with CO_2 it gave ·16 green, ·24 blue. The restoration of the blue by means of aeration is an interesting result.

A thickness of 2 feet of river water, taken above a sewage outfall, gave ·5 green, ·7 blue; but two inches of the same river, taken below the sewage outfall, gave 1·9 black, 1·4 yellow; this when filtered gave ·44 green, ·86 yellow.

After such examples it will be needless to call attention to the scientific value of the "tintometer," which is so thoroughly and clearly explained in Mr. Lovibond's book.

Patents for Inventions.—The Comptroller-General of Patents, Designs, and Trade Marks has submitted to us a volume dealing with "abridgments of specifications" of Class 97, Philosophical Instruments,* for the years 1877–83. A glance through it is sufficient to show that it will be of much value to the microscopist whose experience leads him to suggest what he thinks to be an improvement in our favourite instrument.

B. Technique.†

Microtomist's Vade-Mecum.‡—Mr. A. Bolles Lee is to be congratulated on the appearance of the third edition of his now well-

* London, 1893, sold at the Patent Office Sale Branch, 105 pp., with figs. in text.

† 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, 8vo, 1893, viii. and 509 pp.

known handbook, which is a distinct advance on the two earlier editions. His knowledge and experience fully entitle him to select the methods which he thinks should be recommended to the worker, and to bury in the cold shade of absence from his book those that have been superseded or have not stood the test of work. It is difficult to select where so much is admirable, but we think the severest critic will be satisfied with the paragraph on methyl-green or those on carmine staining. The chapter on Hæmatein and other organic stains must be studied by every microscopist. But it is not only he who makes microscopical preparations that should obtain this book, it has many useful hints for the dissector of animals or the preparer of parts or specimens for museums.

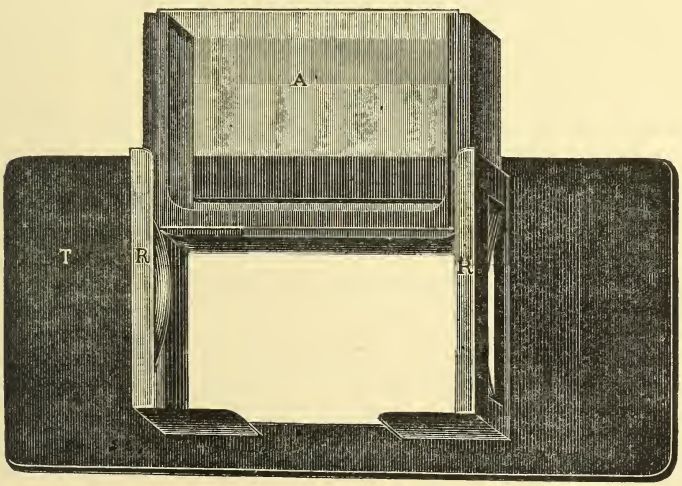
The microscopist who is unacquainted with the German tongue—and we fear there are still one or two left in out-of-the-way villages—will be misled by the term "juice of fruits" in par. 358; retranslation into German shows, however, that liquor amnii is meant. The author informs us that there is an error in par. 151, where 1 per cent. salicylic acid should read 0·1 and 5 per cent. salicylate 0·5; those who use the book must note this correction.

NABIAS, B. DE, & J. SABRAZÈS—**Remarques sur quelques points de technique histologique et bactériologique.** (Remarks on several points of Histological and Bacteriological Technique.) *Arch. Clin. de Bordeaux*, 1893, pp. 165–72.

(1) Collecting Objects, including Culture Processes.

Stage-Aquarium.*—Dr. C. J. Cori has made some improvements in the stage-aquarium described by him in 'Lotos,' xiii. (1893). The apparatus there described consisted of an object-holder, 5 by 10 cm. in size,

FIG. 12.



on which a strip of glass bent into the form |____| was cemented. This bent strip of glass served as side walls and bottom of the aquarium,

* Zeitschr. f. wiss. Mikr., x. (1893) pp. 148–51 (1 fig.).

while the object-holder formed the back wall, and a cover-glass, 30 by 40 mm., the front wall. The whole apparatus was fastened by clamps on the stage of a horizontally inclined Microscope. This aquarium could thus be very easily made; but it had the drawback, which made itself especially felt in embryological investigations, that it only allowed of observations being made from the side of the front wall.

On this account, in the new form of apparatus the aquarium proper is detachable from the holder. As seen in fig. 12, the aquarium A consists of a strip of glass 8 mm. broad, bent into the form |____| , which serves as side-walls and bottom, and of two cover-glasses, 30 by 40 mm., which are cemented by Canada balsam to the glass strip and form the front and back walls.

The holder T for the reception of the aquarium consists of a metal plate of dimensions 4 by 9 cm. with a large rectangular aperture, on the sides of which two strips of metal bent at right angles are riveted. In the frame R thus formed, which is provided with two springs, the aquarium is inserted with either cover-glass in front, so that creatures which have attached themselves to either one or the other cover-glass can be brought under observation.

Apparatus for Regulating the Temperature of Hatching-Ovens, &c.* —Herr A. Koch describes the method of regulating the temperature made use of in the hatching-ovens supplied by Sartorius of Göttingen. For this purpose there is in the interior of the oven a metal capsule containing a liquid, with a high co-efficient of expansion, which, as the temperature rises, causes the walls of the capsule to bulge outwards. This has the effect of raising the rod S (fig. 13) which rests upon it. This rod then acts upon the lever *j g h*, from the free end of which *h* hangs a chain, carrying a cover *d*, which fits over the chimney *s* of the heating apparatus. From the side of the chimney projects at right angles a tube *c*, which traverses the water-jacket of the oven and emerges again near the place where it entered.

When the cover *d* closes the top of the chimney, the hot air from the flame passes into the horizontal tube and warms the water of the oven. As the temperature in the interior rises up to a certain point, the capsule *k* (represented more particularly at B) expands until the rod S acts on the adjusting screw *j* of the lever, and the cover is lifted off the chimney. As soon as this happens the hot air from the flame passes out freely from the upper end of the chimney *s*, and ceases to warm the oven. The latter therefore begins to cool, the capsule works in the opposite way, the cover closes over the chimney, and the oven is again heated.

The adjustment of the apparatus for definite temperatures is easily effected by means of the adjusting screw *j* of the lever, and the sliding weight *g*, which can be fixed in any position on the arm. The apparatus allows of temperatures from 20° to 70° being kept constant, but for the production of the different temperatures, in all, six different capsules *k*, each covering an interval of 10°, are necessary.

To prevent, as far as possible, the apparatus from being affected by the variations in temperature of the surrounding air, the space be-

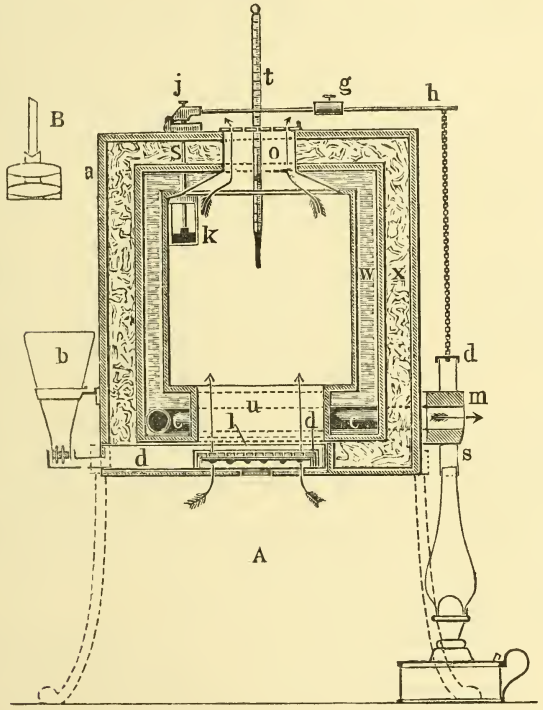
* Zeitschr. f. wiss. Mikr., x. (1893) pp. 161-4.

tween the water-jacket and the outer walls of the oven is filled with non-conducting earth X.

In filling the water-jacket, water is poured in through a hole in the upper surface of the oven, until it begins to flow out from a side opening at *a*.

To prevent the condensation of water, the chimney and side tube projecting from it are covered with a metal jacket *m*, which tends to reduce the cooling of the parts of the tube outside the oven.

Fig. 13.



The oven, finally, possesses an arrangement for ventilation by moist air. For this purpose the insulating jackets are cut through above and below at *o* and *u*. The upper opening is closed by two metal plates, which are pierced by two holes, and can be adjusted so that the holes fit over each other and give passage to the air, or not. The air entering from below passes over a box *d d*, in which a piece of moist linen *l* is stretched. The water for keeping this linen moist is supplied by an inverted Erlenmeyer flask *b* outside the oven, which is in communication with the box *d d*.

Cultivating Protozoa.*—Prof. M. Ogata has obtained pure cultivations of a few Infusoria, e. g. *Polytoma uvella*, *Paramæcium aurelia*, on

* Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 165-9.

artificial nutrient media. The medium is composed of meat-broth 500 ccm. (250 grm. meat), grape sugar 12·5 grm., and 25·0 grm. of an alga mixture, chiefly *Porphyra vulgaris*. This is boiled, neutralized, filtered, and sterilized in glass vessels.

A single species is isolated from its natural habitat and separated from bacteria, &c., by means of a capillary glass tube; the external diameter of this is 0·4–0·6 mm., the lumen about 0·3–0·5 mm., and the length 10–20 cm. One end of the tube is immersed in the medium, and when all but 1–2 cm. is filled it is removed to the fluid containing the Bacteria and Infusoria, and the remaining space completely filled. The two fluids must not be separated by an air-bubble. Both ends of the capillary tube are then sealed up in the flame. In from 5–30 minutes the Infusoria will be found on microscopical examination to have invaded the medium, and when they have removed several centimetres from the original fluid the spot is marked under the Microscope, broken off, and the end melted up. In this way one or several Infusoria may be isolated and kept alive for a month, but on the whole they do not thrive in the capillary tube. So the medium, placed in test-tubes, is inoculated with the contents of a tube which has been ascertained to be pure. The ends are broken off and the contents blown in. The Infusoria grow slowly, and clouding of the medium is not visible to the naked eye for 7 or 8 days, though microscopical examination will reveal presence of the organisms before this. After a time a distinct scum forms on the surface.

Polytoma uvella can also be grown on solid media by making plate cultivations and inoculating them from the fluid in which they are contained.

The colony on the plate may be recognized as a little white point in from 7 to 8 days. In 2 to 3 weeks it attains size of a millimetre. There is no liquefaction of the gelatin. The colonies are mostly round, and the centre of the larger ones dark and somewhat yellowish, while the periphery is greenish. The form and structure of the cells is easily made out, but their movements are sluggish.

Puncture cultivations also succeeded, though the colonies along the track were less strong than those on the surface.

Puncture Cultivations.*—Dr. Beneke points out that puncture cultivations can be rendered much more useful if the needle be thrust into the medium close to the glass instead of being stuck down the centre of the tube. This could be done with the ordinary straight needle, but better if it be bent to the shape of a bayonet. In this way the growing colonies can be observed microscopically even with objectives of short focus.

Culture Media for Biochemic Investigations.†—Dr. E. A. de Schweinitz finds that Fermi's solution—which consists of 1000 ccm. H_2O, 0·2 grm. magnesium sulphate, 1·0 grm. acid potassium phosphate, 10 grm. ammonium phosphate, and 45 grm. glycerin—forms an excellent basis for general cultivation purposes when mixed with nutrient substances appropriate to the particular organisms. Thus, for hog-cholera and swine-plague 1 per cent. agar is added, and in this medium the

* Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 174–5.
† New York Med. Journ., lvii. (1893) p. 267.

germs of these diseases grow quite characteristically. For tuberculosis the above-mentioned solution of salts containing 7 per cent. glycerin and 1 per cent. pepton, and for solid media this latter liquid without pepton plus 1 per cent. agar was used. The growth of the germ in both these media is rapid and characteristic.

For the cultivation of glanders the mode of preparation was the same as for tuberculosis except that only 5 per cent. glycerin was used, the solution was allowed to remain slightly acid instead of being neutralized, and no pepton was added.

The solution of salts used for these media when first prepared is alkaline, but by boiling it can be rendered neutral or acid as ammonia is given off.

Inoculation Apparatus for Rats and Mice.*—Dr. K. Müller uses an apparatus for fastening down rats and mice when required for inoculation purposes. It merely consists of a board with a couple of spring clamps, one at either end; one of these serves to fix the tail, and the other the forceps which hold the neck. To ensure perfect stillness, a second pair of forceps applied to the loose skin about the neck or lower jaw, and fetters for the feet are necessary.

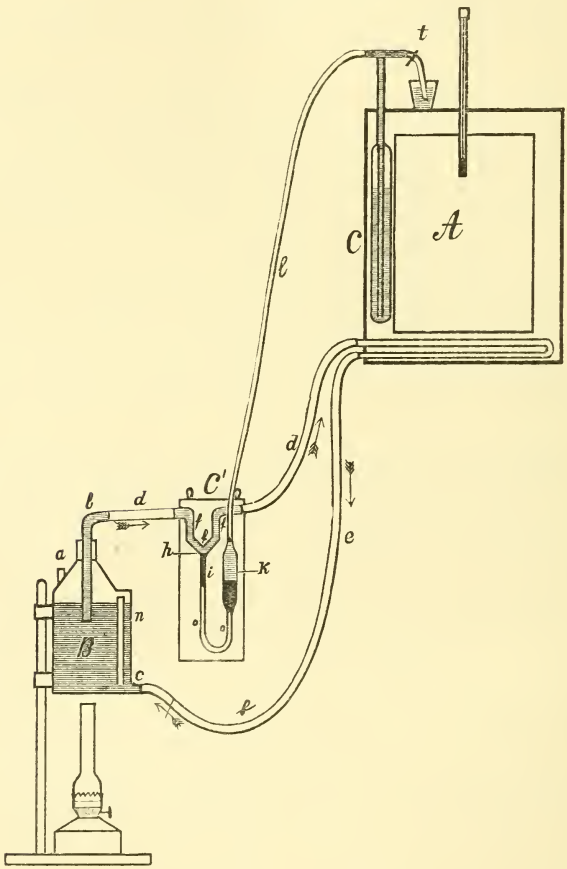
Hot-water Thermostat with Automatic Regulator.† — Dr. E. A. Schepilewsky has devised a thermostat which is heated by a current of hot water, and in which the desired temperature is maintained by means of an automatic regulator. In general plan the apparatus somewhat resembles that of Kurtschinski,‡ and the regulator is not unlike that of Heydenreich.

The apparatus consists of three parts, the thermostat A, the boiler B, and the regulator C, C'. In the water-jacket of the thermostat is a worm (only partially represented in the illustration, fig. 14) made of thin copper tubing with a diameter of 7–8 mm. The boiler is a copper vessel incased in asbestos. At its top are two apertures *a* and *b*; the former, always open, is for pouring in water, the latter is closed by a cork through which passes a glass tube with an elbow. The lower end of the tube reaches below the water-level in the boiler, and its upper end is connected with a rubber tube *d*, through which the water passes to the thermostat. At the bottom of the boiler is the short tube *c*, connected with the rubber tube *e e*, by which the water is returned from the thermostat to the boiler. The source of heat is a petroleum lamp. The regulator consists of two parts, a glass reservoir C, and a set of tubes C' fixed to a piece of board. The Y-piece *f f f* is intercalated in the course of the rubber tube *d*. It is a glass tube with a diameter of 6–7 mm. the arms of which are set at an angle of about 80° while the leg *i*, 8 cm. long and 3 mm. in diameter, is connected by means of a rubber tube *o o* with the glass cylinder K (8 mm. in diameter and 10–12 cm. long). The upper end of K is connected with the reservoir C, by a thick rubber tube *l*, having an internal section of only 1–2 mm. The reservoir C, made of thin glass, is 2 cm. in diameter, and 24 cm. long. Passing through its upper end and reaching nearly to the bottom is a stout glass tube, the external extremity of which is T-shaped, one arm

* Centralbl. f. Bakteriol. u. Parasitenk., xiii. (1893) pp. 596–7 (1 fig.).
† Op. cit., xiv. (1893) pp. 131–8 (1 fig.). ‡ See this Journal, 1893, pp. 384–5.

being connected with the rubber tube b and the other with a clamped tube t plunged into a vessel filled with water. The large reservoir C is filled with ether and water, the small reservoir k with mercury and water. The water in the apparatus is distilled. The boiler must always stand at a lower level than the thermostat, in order that the heated water may flow upwards easily. The apparatus is regulated

Fig. 14.



for any desired temperature by raising or lowering the small reservoir k, if the difference do not amount to more than 2°; if, however, higher temperatures be desired, the clamp at t is undone and some water allowed to escape from the reservoir C; if a lower temperature be required, the petroleum lamp is removed, the clamp at t opened and some water allowed to be sucked in from the glass vessel. The general principle of the regulator is that as the water in the jacket

of the thermostat gets hotter the ether expands in the reservoir C, drives the water on to the mercury in *k*, and this ascending into the Y-shaped tube *f f f*, cuts off the hot stream from the boiler. Numerous and complicated details are given for the avoidance of air-bubbles, but for this the original must be consulted.

Cultivating Ascospores.*—Dr. H. Wichmann says that he has cultivated ascospores on firebrick blocks since 1888. They are shaped like a truncated cone, the upper surface having a diameter of 55 mm., the lower 65 mm., and the height being 30 mm. The broader surface is somewhat hollowed out. The blocks are cleaned by first scrubbing and drying them, after which they are sterilized by exposure for two hours to a dry heat at 150°. During the sterilizing they are placed inside a glass vessel, the lid of which is left loose, the whole contrivance being wrapped up in filter-paper.

The conical form of these blocks prevents the cultivation surface from coming in contact with the side of the containing glass vessel, and thus prevents the condensation water from damaging the cultivation.

Cultivating Vibrios.†—In his experiments with water vibrios Dr. J. Sanarelli used large quantities of water for isolating these organisms. Usually 200 ccm. of liquid were poured into a sterilized flask sufficiently large for a large surface of water to be in contact with air, and then 8 ccm. of the following mixture were added :—Gelatin 20 ; pepton 10 ; sodium chloride 10 ; potassium nitrate 1.

This mixture, made in advance, is kept in sterilized tubes, and when dissolved up for cultivation purposes has the following composition :—Gelatin 2; pepton 1; sodium chloride 1; potassium nitrate 0·1; water 100. In this medium vibrios thrive excellently well when incubated at 37°, and in twelve hours form a surface scum, from which loopfuls may be removed for microscopical or further bacteriological experiments. In the latter case the loopful should be plunged into a tube full of sterilized water, and from this dilution gelatin plates may be made. In this way perfectly pure cultivations are easily obtained.

The author further notes that the presence of too much albuminoid matter, e. g. meat broth, more especially with agar, is detrimental to the development of vibrios, and replaces it with distilled water. By this substitution is obtained a medium of exceptional transparency, which is peculiarly adapted for the cultivation of all kinds of vibrios at incubation temperatures ; it has also been employed for differential diagnosis of various species of vibrios.

Cultivation Media for Anaerobic Bacteria.‡—Prof. F. G. Novy recommends the following media, all of which he has used with success, for the cultivation of anaerobic bacteria :—

(1) Meat broth, to which are added 1/2 per cent. sodium chloride, 2 per cent. grape-sugar, and 2 per cent. pepton. (2) The foregoing, plus the addition of 2 per cent. gelatin. (3) 10–15 per cent. gelatin to which salt, pepton, and grape-sugar have been added as above. (4) 1/2–2 per cent. agar, with the addition of salt, pepton, and grape-sugar

* Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 62-3.
† Annales Inst Pasteur, vii. (1893) pp. 700-2.
‡ Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 595-9.

as before. To all of these media litmus may be added; and their reaction should be slightly, but distinctly alkaline.

The addition of litmus would seem to be valuable, not only as an indication of the reaction excited in the media, but also because it seems to possess some action protective of anaerobic bacteria.

Urine-Agar for Cultivating Diphtheria Bacillus.*—Dr. H. Schlosser obtained very favourable results from using urine-agar for cultivating the bacillus of diphtheria, though the method has no superiority over that of Loeffler, who used blood-serum mixed with 25 per cent. grape-sugar meat-broth.

Urine-agar is a mixture of 2 parts of meat-pepton-agar and 1 part sterile urine. Sterile urine was obtained by first washing the external meatus with sublimate, and then passing the urine into sterilized test-tubes. The urine was used in this condition or was sterilized by heating for half an hour to 70°–80°.

Growth of Cholera Bacilli on Potato.†—Dr. O. Voges found that cholera bacilli inoculated on ordinary potato do not grow, but when 2–3 per cent. common salt is added, the organisms develope freely. A very similar result to the latter is obtained when the potato is treated with 1/4–1/2 per cent. soda. The temperatures used in the experiments were 37° and 20°, and the only difference was that growth was less rapid at the latter.

It would seem that the effective factor is the presence of sodium chloride rather than the chemical reaction, for the reaction of the potatoes treated with common salt was acid, and the others alkaline, the results being in both instances approximately equal.

Isolating Bacillus of Diphtheria from Toys.‡—Dr. R. Abel adopted the following procedure for determining the presence of diphtheria organisms in a box of bricks which were suspected of being the source of contagion. After several unsuccessful attempts made by scraping the surface of some of the bricks and sowing the scrapings in blood-serum, agar, and bouillon, the whole lot of bricks were finally soaked for about half a minute in sterilized bouillon.

Serum and agar tubes were inoculated with some drops of the bouillon. A guinea-pig was inoculated with 1 ccm., and the residue was incubated in a flask. On the third day after the inoculation the guinea-pig died with symptoms of diphtheria, and undoubted diphtheria bacilli were found at the inoculation site. Apparently only one serum-tube took with diphtheria, while in the bouillon diphtheria bacilli were found on the sixth day, and urine-serum subcultures from this bouillon showed diphtheria colonies. Some of this was mixed with salt solution, and 0·1 ccm. was injected into a guinea-pig, which died of diphtheria on the third day. Round about the inoculation wound there was hæmorrhagic œdema of the subcutaneous tissue, with considerable hyperæmia of the skin, effusion in the pleural sacs, hæmorrhagic consolidations in the lungs, catarrhal nephritis, swelling and redness of the adrenals. Pure cultivations were obtained from the inoculation site, cultures from other parts remaining sterile. It was therefore concluded that the bricks were the source of the contagion.

* Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 657-62.
† Op. cit., xiii. (1893) pp. 543-50. ‡ Op. cit., xiv. (1893) pp. 756-61.

(2) Preparing Objects.

Investigating Histology of Vertebrate Liver.*—Dr. H. J. Berkley recommends the following as a method for showing the hepatic nerves. Liver tissue is cut into slices not more than 1·5 mm. thick, and while quite warm, is immersed in a saturated solution of picric acid, diluted with an equal volume of warm water. After remaining in this for from 15 to 30 minutes, it is immersed for 48 hours in a hardening fluid composed of 100 parts of aqueous solution of bichromate of potash (saturated in sunlight) and 16 parts of 2 per cent. osmic acid; this solution must be made several days before, and exposed to full sunlight. The specimens, however, must be hardened in absolute darkness at a temperature not lower than 25°; after hardening, the tissue is to be treated with 0·25 and 0·75 per cent. silver solutions in the usual manner, and allowed to remain in them for five or six days. After very rapid washing in running water they must be rapidly dehydrated, immersed for a few minutes in celloidin, placed on a cork, and the celloidin hardened in 75 per cent. alcohol in a closed jar; this jar is to be cooled either by ice or under a current of cool water, so as to harden the celloidin as rapidly as possible. The sections are then to be cut under 95° alcohol, rapidly dehydrated, cleared in oil of bergamot and mounted in xylol-balsam without cover-slip. The details obtained by this method are clearer than if the rapid silver process is used.

Embryology of Chiton.†—Mr. M. M. Metcalf found that of the agents used to fix embryos of *Chiton* the best results were, perhaps, got with an aqueous solution of picric acid to which sufficient sodium chloride was added to bring the solution to the density of sea-water. In the early stages it was necessary to remove the chorion and the yolk with which all the cells were crowded; for this purpose eau de Labarraque (hypochlorite of soda) was used; the embryos were passed from water into the ordinary eau de Labarraque, cold and of full strength; after one-third to three-quarters of a minute they were removed to water, where the chorion soon swelled to more than twice its usual size, and could be removed by agitation of the water or by currents from a pipette.

The sodium hypochlorite, if allowed to act for three minutes or more on the embryos, completely dissolves them. As it acts, however, much more rapidly on the yolk than on the protoplasm and nuclei, it is possible, by regulating the time of immersion, to obtain embryos with the yolk almost wholly dissolved, and the protoplasm and nuclei almost uninjured. Though the method is crude it was the only way by which Mr. Metcalf was able to successfully get rid of the yolk.

In staining early stages, after treatment with the eau the embryos were placed in weakly acidulated water, and passed thence into Delafield's hæmatoxylin. As the acid washes out from the protoplasm before it leaves the yolk-granules, one may, by regulating the time of immersion, obtain preparations in which the nuclei and cell-boundaries are well stained, while the yolk-granules are unstained.

* Anat. Anzeig., viii. (1893) pp. 772 and 3.

† Stud. Biol. Lab. John Hopkins Univ., v. (1893) pp. 251–3.

Investigation of Reticulated Tissue.*—M. L. Demoor found that the most satisfactory results were obtained with organs fixed in Hermann's fluid for from six to fifteen days. After this the pieces should be washed in running water, and left for a day in absolute alcohol; they should then be put in acetic acid, again washed, and again placed in absolute alcohol. By this means the protoplasm is more deeply stained, and there is no need for double staining. A concentrated solution of corrosive sublimate or of chrom-acetic acid may also serve as the fixing agent. Safranin was found to give very good results as a staining reagent. The author did not make use of several ingenious methods, such as artificial digestion with trypsine, which have been proposed, as he feared they would produce artificial or pathological changes.

Method for the Histological Examination of Osseous Tissue.†—Dr. J. Schaffer, in a review of the technique of the minute anatomy of bone, has put in a compendious form the advice of most well-known histologists on the preparation of osseous tissue for microscopical demonstration. In the course of his remarks the author mentions the experience of eighty different writers who have devoted some attention to the finer structure of bone, and discusses the procedures for examining bony tissue under the following heads:—Examination of fresh bone tissues; making sections of undecalcified bone; sections from decalcified bone; demonstration of bone cells, canals, and canaliculi; examination of the ground substance and of the soft parts of bone; how to examine for the developmental appearances; and the examination of bone by polarized light.

Demonstration of Psorosperms.‡—Dr. Heneage Gibbes makes a saturated solution of anilin oil, to which he adds a 2 per cent. solution of rosanilin sulphate for his No. 1 stain, and a 1 per cent. solution of iodine-green for his No. 2 stain. Stain No. 1 is filtered into a watch-glass, and in it there are left for 10 minutes some sections of rabbit's liver, hardened in alcohol. After washing in water and then in alcohol, they are placed in stain No. 2. The staining may be considered to be sufficient when the original red colour has changed to a dull purple. If the sections are now washed in water, alcohol, clove-oil, balsam (xylol) the parasites are stained red, nuclei and leucocytes green, fibrous tissue and protoplasm of liver cells purplish-red. Dr. Gibbes was unable by this method to demonstrate parasites in sections of fresh cancer, and he appears to doubt their presence.

Conservation of Bacterial Cultivations by means of Formalin.§—Dr. G. Hauser has observed that gelatin which has been exposed for some time to the action of formalin can no longer be liquefied at any temperature, even in the flame of a Bunsen's burner or by boiling in soda. At the same time it seems to have a permanently disinfecting action. If a plate fixed by means of formalin be exposed for a whole day, the development of aerial germs is never observed, nor can other cultures be successfully inoculated thereupon.

* Arch. de Biol., xiii. (1893) pp. 5–7.

† Zeitschr. f. wiss. Mikr., x. (1893) pp. 167–211.

‡ Amer. Journ. Med. Sci., July 1893. See Brit. Med. Journ., 1893, No. 1703, p. 32.

§ Münchener Med. Wochenschr., 1893, No. 35. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 468-9.

Thus tube and plate cultivations can be permanently preserved provided that they be prevented from drying. Formalin may also be used for making permanent microscopical preparations. A flat piece containing the colony is cut out of the gelatin plate with a sharp knife; this is placed on a slide, imbedded in gelatin, and a cover-glass put over. The preparation is then put in a formalin-chamber for 24 hours, by which time the imbedding gelatin is fixed as well as the rest of the specimen. The preparation is then run round with some protective.

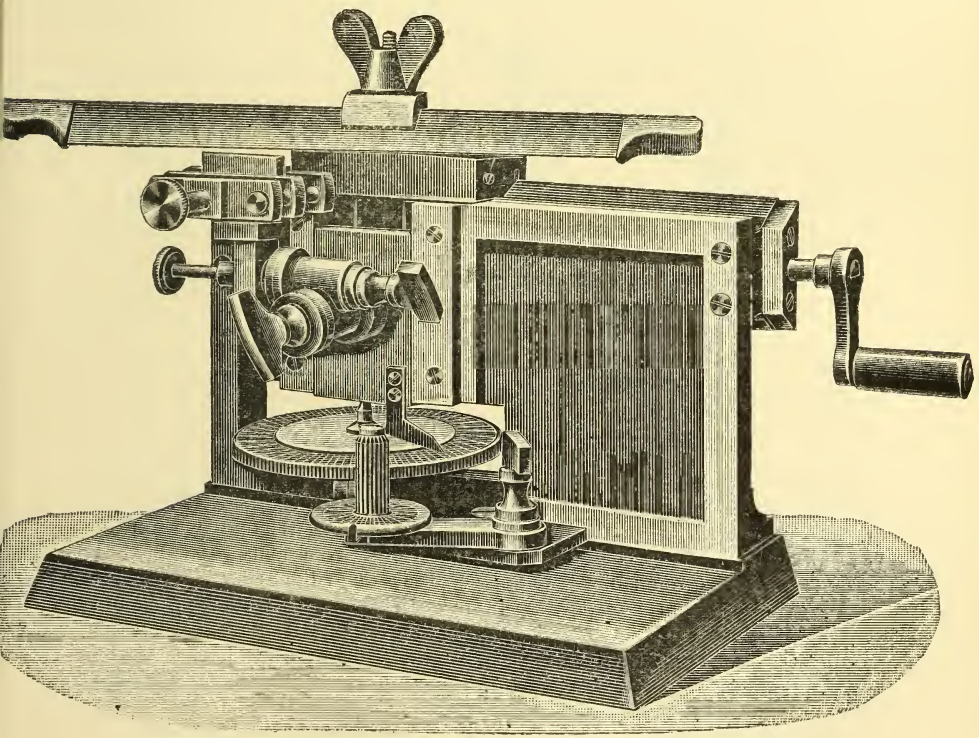
The cultivations may also be stained by placing the pieces from the gelatin plates for 24 hours in a weak aqueous solution of fuchsin; the bacteria are deeply stained, while the gelatin is only of a pale red hue.

Stained preparations may be imbedded and mounted as before, or they may be allowed to dry on the slide, and then mounted in Canada balsam.

(3) Cutting, including Imbedding and Microtomes.

Leitz's Microtome.*—In this instrument, represented in fig. 15, the preparation is firmly held in a carriage moving vertically in a groove

FIG. 15.

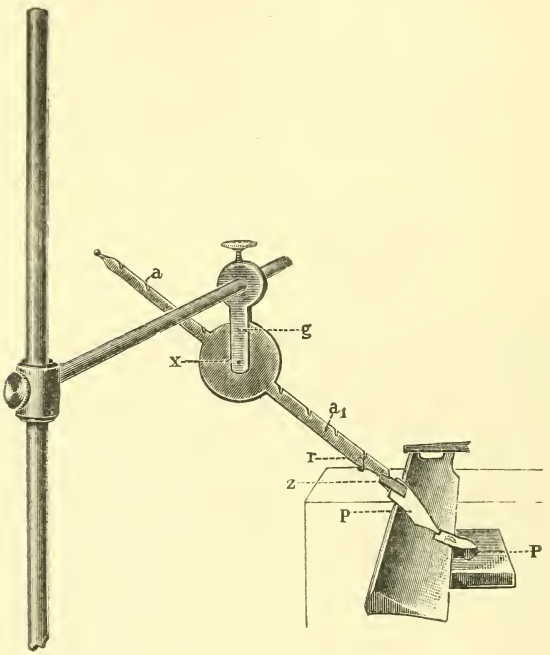


* Catalogue No. 34 of Microscopes and Accessory Apparatus, Ernst Leitz, Wetzlar, 1892, p. 41.

and is raised by means of a graduated micrometer screw. The sliding of the knife is effected by a crank so that the irregularities of movement, inevitable when the hand alone is used, are avoided.

A New Section-stretcher.*—Prof. G. Born describes a new device for preventing paraffin-sections from rolling up. It depends upon the principle of holding down the section with a minimum amount of force. The apparatus employed for this purpose consists, as shown in fig. 16, of an equilibrated lever *a* which turns very easily about a horizontal axis *x* fixed in a fork *g*. This fork can be displaced along a horizontal rod and

Fig. 16.



fixed in any position by means of a screw. The horizontal rod can be adjusted in height on a vertical holder. The lever carries at one end a small flat spring-clamp *z*, in which is fastened a piece of paper *p*, rounded or cut square at the free end. The weight of the paper is not sufficient to disturb the equilibrium of the lever in favour of the arm a_1. A small rider of wire is therefore placed in one of the notches on the upper edge of the lever. The instrument is so adjusted that the free end of the paper lies on the front edge (the edge turned towards the knife) of the paraffin-block P. During the forward motion of the knife through the paraffin-block the paper keeps the section on the blade. The section can then be very easily removed with a broad needle. When the knife

* Zeitschr. f. wiss. Mikr., x. (1893) pp. 157–60.

is brought back, the paper again falls on the edge of the paraffin-block, and the process can be repeated.

Another mode of using the instrument, which may be advantageous in certain cases, consists in fixing the fork g on the horizontal arm in the opposite direction so that the clamp-arm a_1 of the lever points away from instead of towards the microtome. In this case in the forward motion of the knife the effect of the paper is to push the section up the blade.

The thinner the sections, the smaller should be the rider and the nearer to the axis should it be suspended. The kind of paper used should also vary with the thinness of the sections.

(4) Staining and Injecting.

Fiocca's Method for Spore-Staining.*—Dr. R. Fiocca states that by the following method spores can be stained with great efficiency and certainty. The reagents necessary for the process are a 10 per cent. solution of ammonia, an alcoholic solution of an anilin dye, a 20 per cent. decolorizing solution of sulphuric or nitric acid, and an aqueous solution of a contrast stain. Into a capsule are poured about 20 ccm. of ammonia solution, and then are added 10 to 20 drops of the alcoholic solution of the anilin pigment. The solution is warmed until it begins to vaporize, and then the already prepared cover-glasses are treated therewith in the usual manner.

On the average, spores are stained in from 3 to 5 minutes, and only in the case of very resistant spores, such as anthrax, are 10 to 15 minutes required. When sufficiently stained, the preparations are treated with the decolorizing fluid; they afterwards are washed in water and then contrast-stained.

For staining spores, alcoholic solutions of gentian-violet, fuchsin, methylen-blue, safranin give excellent results; and for contrast, aqueous solutions of vesuvin, chrysoidin, methylen-blue, malachite-green, and safranin may be used.

By this method not only are the spores stained, but those protoplasmic granules which precede spore-formation, while degenerative conditions are unaffected.

As in Gabbett's formula for bacilli of tubercle the contrast-stain may be dissolved in the decolorizing solution; but in such case the solution must be less strong (not more than 10 per cent. of acid), and the preparations remain therein a correspondingly longer time.

Employment of Vesuvin for Fossil Plants.† — Herr O. Lignier recommends the use of an alcoholic solution of vesuvin for staining sections of fossil plants which have first been cleaned by chloroform. It is especially useful for bringing out the xylem portion of the vascular bundles.

Demonstrating Intercalary Rings of Nerve-fibres.‡—M. B. Ségall adopts the following procedure for examining medullated nerve-fibres. A quite fresh nerve, from a frog or a guinea-pig, a day old, is rapidly teased out in a few drops of 1 per cent. osmic acid. When the nerve

* Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 8–9.

† Bull. Soc. Linn. Normandie, vi. (1892) pp. 9–10. See Bot. Centralbl., lvi. (1893) p. 18.

‡ Journ. Anat. et Physiol., xxix. (1893) pp. 586–603 (1 pl.).

has turned brown it is transferred to distilled water, in order to remove excess of osmic acid, and then teasing out is resumed in a 2 per cent. solution of silver nitrate. The nerve-bundle is exposed to light for 20, 30, or 40 minutes, and must be occasionally moved about. The excess of silver nitrate is removed in distilled water and the preparation mounted in glycerin.

Impregnation is much facilitated if the nerve-fibres are treated with an aqueous 1 per cent. solution of eosin, neutral carmine or even hæmatoxylin before mounting in glycerin.

By this method the author claims that a series of rings situated at the level of the myelin segments can be demonstrated, and from the illustrations it would seem that the overlapping of two myelin segments is related to the well-known appearance called Ranvier's node, the cuff of the outer myelin tube overlapping the inner segment being the transverse bar of the Latin cross.

Cox's Method for Demonstrating the Nerve-fibres of Central Nervous System.*—Prof. S. Ramón y Cajal found that Cox's method gave very satisfactory results when employed for demonstrating nerve-fibres in the cornu Ammonis and elsewhere. This procedure consists in placing pieces, not too large, in the following fluid:—5 per cent. bichromate of potassium, 20 parts; 5 per cent. sublimate, 20 parts; distilled water, 30–40 parts; 8 per cent. chromate of potassium with strongly alkaline reaction, 16 parts. In this fluid the pieces remain for 2-3 months in the winter, and at least one month in the summer. Before being imbedded the pieces are immersed in 36° alcohol for 30 to 60 minutes. The sections are placed in 40° alcohol, cleared up in oil of cloves, mounted in xylol-dammar without a cover-glass.

The author also used the Weigert-Pal and Golgi's rapid methods, and also tried Berkeley's rapid method (osmic-copper-hæmatoxylin), of which he speaks very favourably.

Examining Street Dust for Tubercle Bacilli.†—The examination of dust from the street, dwelling-rooms, of dirty water, &c., depends, says Dr. Marpmann, for its success on the recognition of those granules into which the bacilli have become disintegrated rather than finding the intact organisms. The staining reaction is exactly the same, but the red particles require to be sought for with an apochromatic immersion instead of with the ordinary 1/12. The dust used for the examination was just scraped up and digested for some hours in water at 40°; it was then strained through a woollen cloth. Some of the filtrate, about 50 ccm., was then treated with a drop of iron chloride, and 10 drops of carbonate of ammonia in solution. A precipitate of iron oxide and earthy carbonates slowly formed, and this was separated either by sedimentation for twenty-four hours in a conical glass or by centrifuging.

The sediment was then stained on cover-glasses with phenol-fuchsin treated with hydrochloric acid-alcohol (HCl, 0·5; 80 per cent. C_2H_6O, 100) and examined in fat-blue (*Fettblau*) in xylol.

It only remained to find out whether these fragments of bacilli were infectious, and cultivations were made therefrom in agar tubes and

* Zeitschr. f. wiss. Zool., lvi. (1893) pp. 616-8.

† Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 229-34.

in bouillon. After an incubation of four weeks a microscopical examination showed that tubercle bacilli were as constantly present in the agar and as constantly absent from the bouillon.

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

Formalin as a Hardening and Preservative Medium.*—Prof. F. Hermann writes very enthusiastically on the fixative and preservative properties of formaldehyde, known commercially as formalin. Used in 0·5 to 1·0 per cent. solution it is found to thoroughly fix and harden not only pieces but whole organs (e. g. a calf's heart) in from 12 to 24 hours. Its particular advantage is that the transparency of living tissues is almost perfectly retained, the best examples of which are those of the eyes of small animals. Formalin also preserves the natural colours of the skin, though it rapidly extracts blood-pigment, and thus bleaches portions of the preparation, yet its fixative property, coupled with the advantages of preserving the transparency of tissues and structure, and its conservation of the natural colours of integuments indicate that it is especially adapted for museum purposes. As a fixative for microscopical preparations formalin has no advantage over the ordinary fixative media. It fixes as well but not better, and its use is associated with the inconvenience that tissues previously treated with formalin are not suited for after hardening with alcohol. It is obvious, therefore, that until this inconvenience has been surmounted, the use of formalin cannot be recommended when microscopical sections are required.

Cleaning New Cover-glasses.†—Prof. Zettnow finds that the best way to remove all traces of grease, which prevents the regular distribution of fluids, from new cover-glasses is to burn it off, and for this purpose he uses a piece of sheet iron 8–10 cm. square. The imperfectly cleaned cover-glass placed on the iron is held in the flame of a Bunsen's burner for several minutes. The glasses never crack, and twelve to fifteen can be cleaned at a time.

Dr. M. Kuster's Hollow Spheres for Microscopic Objects.‡—Dr. A. Zimmermann gives the result of his examination of Dr. Max Kuster's hollow spheres. They are made of thin glass, and have a diameter of about 15 mm., with a circular opening about 3 mm. wide, through which the objects to be observed are introduced. For observation, the spheres can be brought directly under the Microscope, and serve at once as object-holder and cover-glass. The use of the spheres is naturally confined to small objects suspended in liquids; they are therefore especially recommended for preparations of bacilli.

A further advantage claimed for them is that the reagents, which are simply introduced into the hollow space, in this way act much more uniformly and intensely, while no air-bubbles or displacements are produced as when a cover-glass has to be raised.

A disadvantage in the new method consists in the difficulty experienced in the observation and in the displacement of the preparation.

* Anat. Anzeig., ix. (1893) pp. 112–5.
† Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 63–4.
‡ Zeitschr. f. wiss. Mikr., x. (1893) pp. 164–6.

The spheres can only be used when the object-stage of the Microscope possesses an opening suitable in size for their reception. Even where this is the case, the displacement of the spheres is not so easy as with the ordinary object-holders. The last two defects, however, may be remedied by the use of a metal plate having a suitable opening in the centre and provided with a rectangular screw-motion.

The use of the Abbe illuminating apparatus with the spheres is impossible, and this defect is not adequately remedied by filling the spheres with a strongly refracting liquid.

Altogether the author is not inclined to recommend the spheres in their present form for general use, although he does not deny that, if properly modified, they might be of good service in many cases.

(6) Miscellaneous.

Atlas of the Clinical Microscopy of the Blood.*—The object of Rieder's Atlas is to present in a few plates the numerous deteriorations in the histological characters of the blood for clinical purposes. The text is very condensed and serves merely for the explanation of the plates. All the illustrations are from original drawings, chiefly from stained preparations, though a few are uncoloured. The introduction gives the methods for the clinico-microscopical examination of the blood and describes the way to obtain a drop of blood, the fixation of dry preparations, eosin-hæmatoxylin staining, the demonstration of the nuclear structure of leucocytes, Ehrlich's granules, the blood-plates, the amœboid movement of leucocytes, and a short recital of the course of clinical blood-examination.

The illustrations are well executed; the magnifications are 300, 400, and 1100, except three in which 1600 has been used for showing myelæmia and malaria plasmodia.

It would have added to the value of the work if there were a table of contents or an index.

Diagnosis of Water Bacteria.†—The second edition of this work by Dr. A. Lustig is published in Italian and German. It deals with water bacteria and pathogenic bacteria found in water, and describes 181 species. The first part deals with bacteria pathogenic to man, the second with those pathogenic to animals, and the third with non-pathogenic bacteria. The third group is subdivided into (*a*) Micrococci, (*b*) Bacilli, (*c*) Spirilla, (*d*) Schizomycetes of different developmental forms.

Micrococci and bacilli are further distinguished according as they liquefy gelatin or not. In each division the bacteria discussed therein are fully described in reference to form, arrangement, mobility, spore-formation, and development in different media. The diagnoses are in tabular form and resemble in this respect Eisenberg's tables, though the arrangement is different and less clear. The greatest share is devoted to bacilli found in water, yet it should be noted that the author's description of a bacillus does not accord with de Bary's conception. Of

* Leipzig, 1893, 12 pls. and 48 figs. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) p. 208.

† Jena and Turin, 1893, 128 pp. See Bot. Centralbl., liv. (1893) p. 335.

Micrococci forty-six are described, and among them are figured some species of *Sarcina*. Nine spirilla and twenty-one pathogenic bacteria are mentioned. With regard to *Crenothrix*, *Beggiatoa*, and *Cladothrix*, the old views controverted by Winogradsky about pleomorphism are still upheld. That writer's work on the sulphur bacteria appears to be quite unknown to the author, for *Beggiatoa* is full of contradictions throughout and it decomposes sulphur compounds with development of sulphuretted hydrogen.

Kitt's Bacteriology and Pathological Microscopy.*—Dr. Th. Kitt has published the second edition of his 'Bacteriology and Morbid Histology,' with an alteration of title. The work is intended for the use of veterinary surgeons and students; it is a text-book, in fact, but of a superior kind, and well adapted to the wants of those to whom it is addressed. The illustrations are numerous, and superior to those of the first edition.

Gedoelst's Bacteriology for Veterinary Surgeons.†—This book, which deals with the diseases of animals from a bacteriological standpoint, is intended chiefly for veterinarians, though much of it will be found useful to those occupied with human pathology. The first portion of the work is occupied with micro-biology, immunity, and other general questions; the second section deals with the bacteriology of separate diseases; and the third portion deals with bacteriological technique.

Günther's Bacteriology.‡—Dr. C. Günther has just published the third edition of his 'Introduction to the Study of Bacteriology and Microscopical Technique.' The work, which has been revised throughout, is much enlarged and brought up to date.

Friedländer's Microscopical Technique.§—The fifth edition of Friedländer's 'Microscopical Technique' has just been brought out by Prof. C. J. Eberth. The present edition is intended not only for beginners, but also for experienced histologists. The whole work has been thoroughly revised, and the most recent methods of researches are given in their appropriate places. Special attention has been devoted to the examination of the central nervous system, the demonstration of micro-organisms in tissues, and to photomicrography.

Von Kahlden's Microscopical Technique.‖—The third edition of Von Kahlden's Technique for the Histological Examination of Pathologico-Anatomical Preparations has been improved, and enlarged to 122 pages. Special attention has been paid to the chapters on staining bacteria, the skin and the central nervous system, and to that on the examination of the blood. In the last chapter the examination of blood-spots, hairs, seminal fluid, and fragments of decidua are described.

* Vienna, 1893, 450 pp., 140 figs. and 2 pls. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) p. 858.

† Lierre, 1892. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) p. 729.

‡ Leipzig, 8vo, 376 pp., 12 pls. See Centralbl. f. Bakteriol. u. Parasitenk,, xiv. (1893) p. 729.

§ Berlin, 1894, 336 pp. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) p. 741.

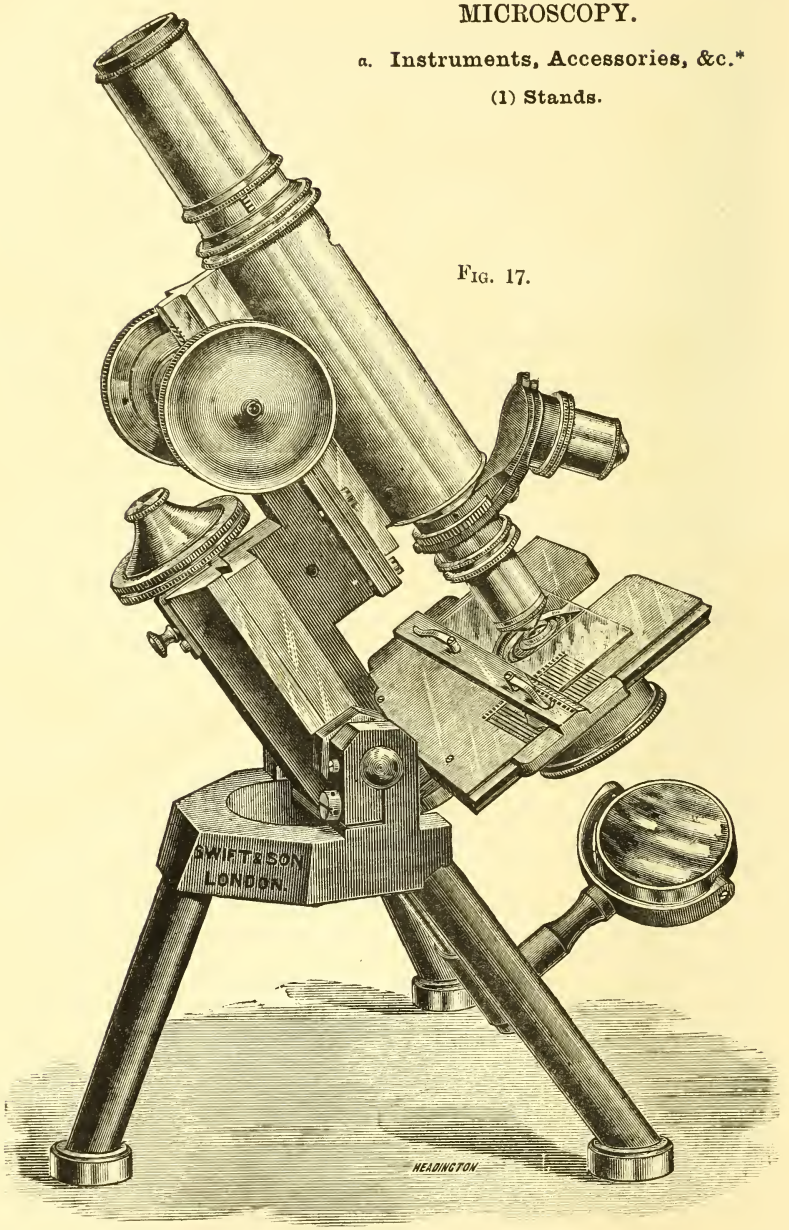
‖ Jena, 1893. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893), p. 787.

MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

FIG. 17.



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

Swift's New Histological and Physiological Microscope.—This instrument, represented in figs. 17 and 18, is specially designed to meet the requirements of students in general biological work. The optical

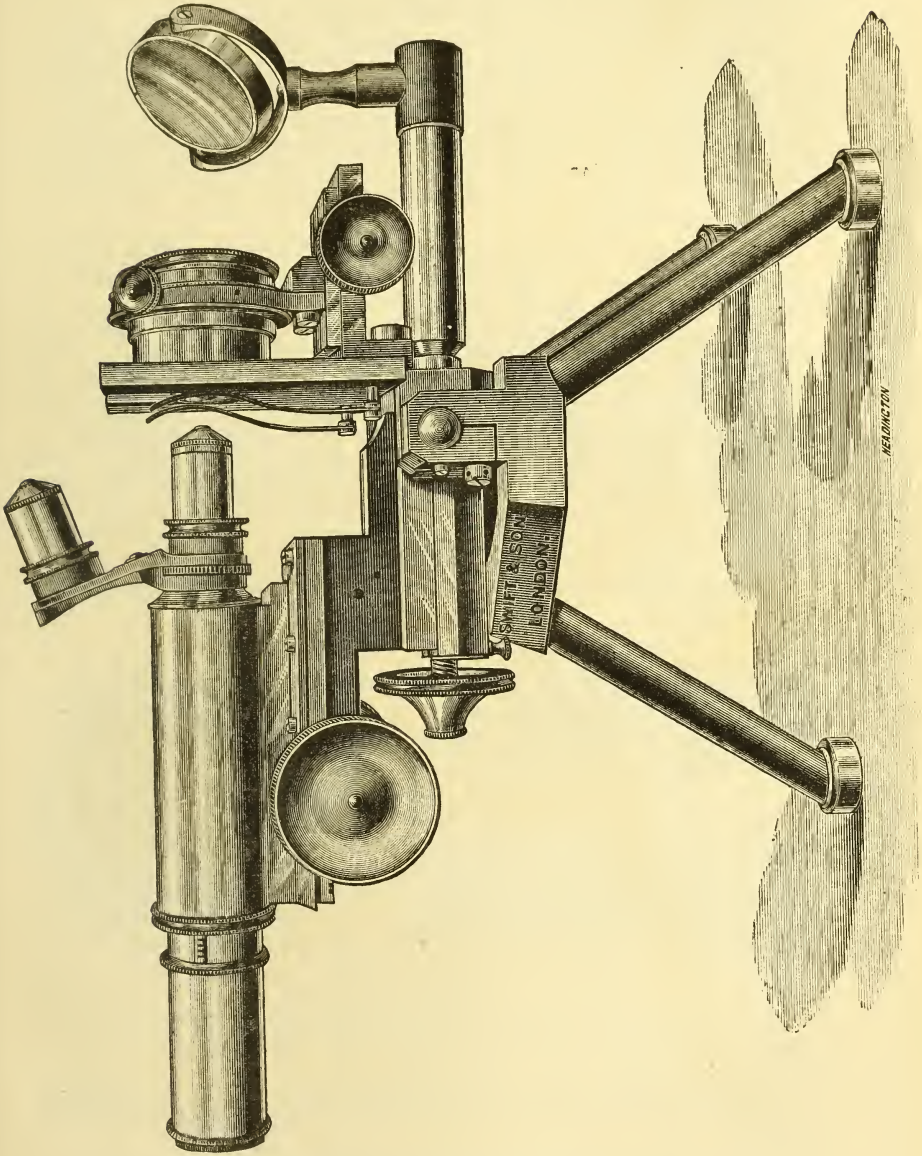


FIG. 18.

tube is provided with a draw-tube divided in mm. The coarse-adjustment is by the spiral rack-and-pinion motion patented by the makers, while the fine-adjustment is by micrometer-screw of entirely new con-

struction. The action of the latter, it is claimed, is direct and perfectly steady with the highest amplification.

The stage is large and of the horse-shoe form; below it is a fitting for receiving all illuminating apparatus.

The stand is a modified form of Powell and Lealand's tripod.

In fig. 18 the Microscope is represented in the horizontal position, with the addition of a substage provided with universal adjustments for centering and focusing the illuminating apparatus. The special form of the tripod-stand renders the Microscope very steady when used in the horizontal position for photomicrographical purposes; for, as seen in the figure, the pillar of the fine-adjustment rests squarely on the top of the tripod, and the centre of gravity falls well within the triangle formed by the supports.

New Substage.*—Mr. G. Whitfield Brown, jun., describes a substage made by Zentmayer, of Philadelphia, according to his specifications, which "has given perfect satisfaction."

The substage consists of a double elbow with two arms, each of which contains a tubular holder for receiving accessory apparatus. A centering set-screw secures it to a bracket which slides or is moved by rack and pinion on the tail-piece. Between the upper and lower holders is a removable iris diaphragm. The lower arm of the substage is provided with a revolving plate, upon which there is a sliding plate moved by rack and pinion. In the central opening of this sliding plate the iris diaphragm fits by means of a flange, and can be readily inserted and removed. For the iris diaphragm may be substituted revolving receivers for the reception of selenites, mica-plates, diaphragms, &c.

In this substage the Abbe condenser is fitted into the upper holder from above.

3) Illuminating and other Apparatus.

Production of Exact Micrometer-Screws.†—Dr. Hugo Schroeder gives a detailed description of the mode of production of exact screws. A short account of the process employed will be found in the Encyclopædia Britannica, 9th edition, Part 83, p. 552.

The principle of the method consists in first preparing as exact a screw as possible by the best of the ordinary methods, and then in eliminating the errors by systematic grinding and polishing.

For this purpose a nut (fig. 19) is prepared of brass, or better, of Bessemer steel, the length of which is to that of the screw as 11 to 9. The nut is made up of four segments *a* (fig. 20), which are fastened together by means of the collars *b b*, the rings *d d*, and the screws *c c*, so that during the polishing the screw and the nut may be always kept in contact. The long nut is brought slowly over the screw and moved backwards and forwards over it after oil and emery have been introduced. Towards the end of the grinding finer emery is used, and finally oxide of iron only.

Copies of a perfect screw thus prepared can be made by the following process:—The normal screw is set in the support instead of the ordinary

* Amer. Micr. Journ., xiv. (1893) pp. 347–50 (2 figs.).

† Zeitschr. f. Instrumentenk., xiii. (1893) pp. 217–29.

guiding screw, and is provided with a toothed wheel which engages in another toothed wheel attached to a so-called "Spitzenfutter" screwed on the spindle of the lathe. The screw is then cut slowly and carefully by the tool C (fig. 21), consisting of a three-sided prism, which can be easily removed for sharpening by loosening the steel wedge B, and can then be replaced in the holder A with the cutting plane in exactly the same position as before.

The author also describes the so-called "Spiegelfühlhebel," an instrument which may be used for all purposes of very fine adjustment and measurement, as e. g. in the fine-adjustment of large Microscopes.

Fig. 19.

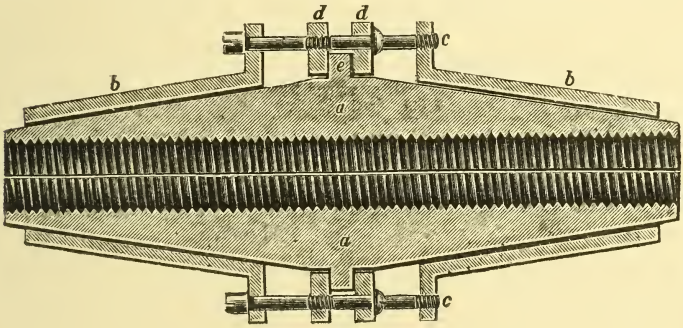


Fig. 20.

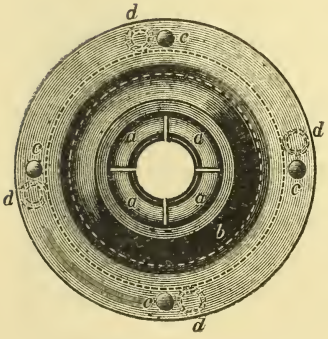
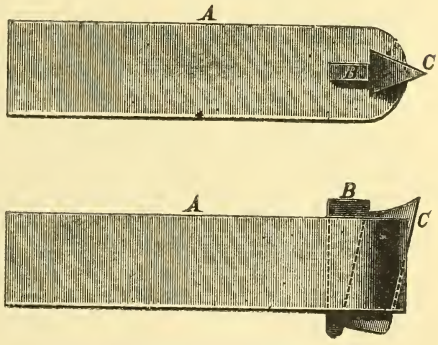


Fig. 21.



The micrometer screw moves in a nut which is regulated by screws, and is terminated by a small, hard, highly polished ball. This screw carries a nut, on the edge of which is cut a screw-thread (usually 100 teeth) in which an endless screw engages. This endless screw is fixed in a metal piece, and carries on its head a division; so that with this arrangement 1/1000 of a screw rotation can be measured, i. e. in this case 1/20,000 mm. The screw is not in direct connection with the

nut, so that it can be used without having any influence on the fine-adjustment. To bring the fine-reading apparatus into play it is only necessary to turn one screw, which then by means of a screw segment presses on another screw. With this instrument it is possible to measure the depth of the furrow produced on a piece of glass by making a finger-stroke upon it with some fine polishing powder.

For the cutting of normal screws the author recommends a tool which he calls a "Schneideneisen." The teeth of the tool cut the thread quite gradually up to the right depth, for the first tooth only cuts a slight dent in the material, which each of the succeeding teeth deepens by a certain amount.

Construction of Silvered Lens Mirrors.—Mr. Edward M. Nelson contributed the following to the meeting last December:—

Although the idea of making a mirror by silvering one side of a convex lens is an old one (probably dating back more than 100 years),* it has more than once been reinvented and brought forward as something quite new. It is, however, strange that such a simple, excellent, and cheap contrivance, and one so eminently suited for microscopical purposes, should have received so little attention.

With the object of keeping the price of the Farmer's Microscope as low as possible, I had two silvered equiconvex lens mirrors fitted to it, one being for substage, and the other for superstage illumination.

While experimenting with these mirrors, their practical usefulness so greatly impressed me that I at once proceeded to investigate the theory of their action. On looking up the subject, I was fortunate to find in an article by Sir D. Brewster a passing notice of a reflecting telescope, designed by the late Astronomer Royal, which was composed of silvered lenses.

Referring to the original paper in the 'Cambridge Philosophical Transactions for 1822,' we find that Sir G. Airy was led to investigate the optical principles of lens mirrors, both on account of the difficulty he experienced in obtaining flint discs for achromatics, and also because he found that metallic specula were liable to tarnish.

He had two Cassegranian telescopes made from formulæ he had computed. After trial he said that "the image of a star or planet was surrounded with radiations which made the telescope quite useless for practical purposes;" the reason of this he did not discover, but he did not think it arose from any residual chromatic error.

In his paper the foci, radii, and refractive indices of the glasses are not given, but there is an able mathematical analysis of the destruction of the aberrations of one lens mirror by those of another, which was of assistance.

The problem now before us, viz. the aplanatism of a single-lens mirror for parallel rays independently of chromatic aberration, though fortunately simpler, nevertheless requires a cubic equation for its mathematical solution. I say mathematical solution, because with much additional labour, a result sufficiently near for all practical purposes might be obtained without mathematical knowledge. The data,

* See this Journal, 1890, p. 88.

however, given at the end of this paper have not, so far as I am aware, been published before.

In order that all the points may be perfectly clear, a few lines of elementary optics are necessary. It is obvious that the rays pass twice through the lens and undergo one reflection from the mirror. If f be the focus of the lens, and f' that of the mirror, F the focus of the combination, when its thickness is neglected, will be

$$\frac{1}{F} = \frac{2}{f} + \frac{1}{f'}. \qquad \text{(i.)}$$

Now if μ is the refractive index, r the radius of the incident surface, and s that of the silvered surface, f the focus of the lens taken alone will be $\frac{r\,s}{(\mu - 1)(s - r)}$ and f' that of the mirror $\frac{s}{2}$.

Putting these values in equation (i.) we have in terms of the radii the focus of the entire system.

$$F = \frac{r\,s}{2\{\mu(s - r) - s\}}. \qquad \text{(ii.)}$$

When $\mu = \frac{3}{2}$

$$F = \frac{r\,s}{s - 3r}. \qquad \text{(iii.)}$$

Therefore, if $\mu = \frac{3}{2}$, and the lens is equiconvex $s = -r$, then $r = 4F$; but if the lens is a plano-convex, r being the plane side $= \infty$, and $s = 3F$, that is the radius of the silvered side is four and three times the focus respectively.

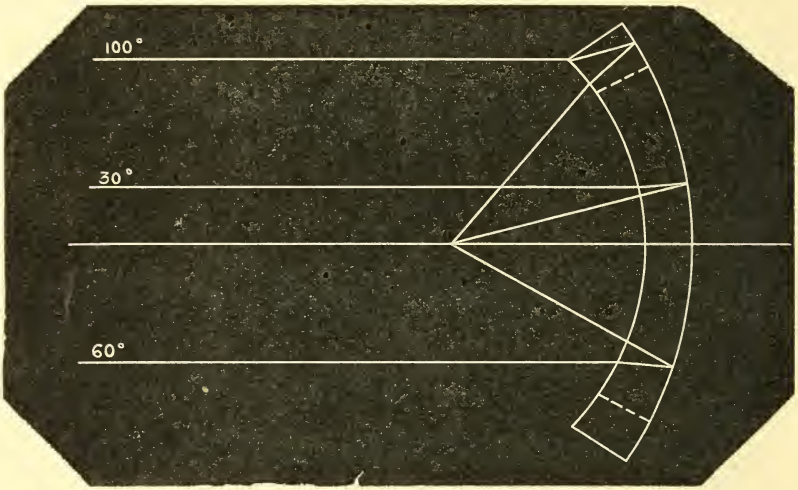
With regard to the aberration of lens mirrors, it is obvious that in the equiconvex form an amount of refraction equal to that of an equiconvex lens is obtained with only a fourth of the depth of curvature.

In the plano-convex form the incident parallel rays pass through the plane surface without aberration, but then there is the spherical aberration of the concave mirror, as well as the aberration on the final emergence of the rays at the plane surface; in addition to this, the radius of the curvature of the mirror is less in the proportion of 3 to 4; nevertheless, calculation shows that the aberration of the plano-convex is less than that of the equiconvex form. For example, when y is the semi-aperture, F the focus, and $\mu = \frac{3}{2}$, the aberration of an equiconvex lens mirror is $\frac{32 \cdot 4\,y^2}{r^3}$, or $\cdot 5\frac{y^2}{F}$, that of a plano-convex mirror lens being $\frac{8 \cdot 5\,y^2}{s^3}$, or $\cdot 315\frac{y^2}{F}$; whereas the aberration of an ordinary plano-convex

bull's-eye when in its best position is $1 \cdot 16 \frac{y^2}{F}$, viz. more than double that of the equiconvex lens mirror.

Now, if we consider carefully the action of the plano-convex lens mirror, we see that we have the aberration of the concave mirror plus that of the plane surface, these aberrations being positive, or the same as those of converging lenses; it is evident that if we wish the system

Fig 22..



to be aplanatic we must neutralize these positive aberrations by introducing the negative aberration of some concave surface. Suppose we make the first surface concave, and of a radius equal to the focus of the system. It is obvious, in the first place, that there will be no aberration on the emergence of the rays, because they will be normal to the surface, and, further, the aberration of the first curve for the incident parallel rays will be of an opposite kind to that of the concave mirror. We may therefore conclude, without entering into any mathematical calculation, that the total aberration of such a system will be greatly reduced, and also we may infer that aplanatism is a possible condition. Hence the problem in the determination of the ratio of the curvatures of the incident and silvered surfaces. Following out the argument above, if we put $F = -r$ in equation (iii.) we shall find that $\frac{r}{s} = \frac{2}{3}$; as both are negative, the lens will be a diverging meniscus. We have therefore arrived at the following conclusions:—(1) That aplanatism is possible. (2) The form of the lens will be a diverging meniscus. (3) That the ratio of the curvature is about $\frac{2}{3}$. Further than this by mere inspection we cannot go; but, as hinted above, by a laborious method of trial and

error, a result sufficiently correct for practical purposes might be arrived at.

By solving a cubic equation,* the details of which possess no special interest, the ratio of the radii is found; then by means of equation (ii.) we obtain this final result:

$$r = -1{\cdot}165\ \mathrm{F} \qquad \text{and} \qquad s = -1{\cdot}608\ \mathrm{F}.$$

There are, however, some quantities which, for the sake of simplifying the calculation, have been neglected, and one of these is the thickness of the lens. If a lens mirror is of large size the thickness must be considerable, in order that it may stand the strain of grinding and polishing, and as thickness influences the aplanatism of the system we cannot disregard it.

Further, one of the great advantages of the lens mirror is, that it permits a very wide-angled system to be usefully employed, because no ray makes an excessive angle with its normal; the incident ray makes the largest angle, and that must always be less than half the angle of aperture. The effect of thickness and large aperture can be very well seen by making a drawing of a lens mirror on a large scale, and by tracing out wide, medium, and narrow angled rays.

If the lens is drawn on the above formula, and with no thickness, it will be seen that the medium and narrow rays have both been spherically aberrated to the extent of $-\frac{\mathrm{F}}{66}$, but the extreme ray will be further displaced to $-\frac{\mathrm{F}}{40}$. If in a drawing of a lens mirror, on the same formula, which possesses sufficient thickness for practical construction, say $\frac{\mathrm{F}}{5}$, we have three similar rays, we shall obtain $-\frac{\mathrm{F}}{12}$ for the values of the aberration of the medium and narrow-angled rays, and $-\frac{\mathrm{F}}{8}$ for that of the extreme ray. From this we learn that the results obtained by the solution of the cubic equation are not suitable for the construction of an aplanatic lens mirror. A glance at the drawing of the thick lens will show that the curvature ratio is not large enough, and on trial a ratio of 2 : 3 will be found to yield far better results.

No great difficulty will be experienced in determining curves that will bring an extreme and a central ray to an identical focal point; but it is by no means easy to find the precise curves that will render a lens mirror strictly aplanatic for all zones. I thought the subject sufficiently important to justify the trouble of working out the following curves for three different thicknesses of lens mirrors. These curves, when drawn on a large scale and tested by tracing three rays for apertures of 100°, 60°, and 30°, show perfect aplanatism. A slight deviation from these curvatures will destroy the aplanatism. It is probable that errors arising from the thickness of the lenses were the cause of the fluffiness which Sir G. Airy observed in his telescopes, as he distinctly states that no

* The equation is given in some of the text-books, but not its solution.

allowance was made for thickness in his calculations. Let r be the radius of the incident, and s that of the silvered surface, t the thickness, and d, D, the diameter when the mirror has an aperture of 80° and 100° respectively, F being the true focus, and the refractive index $\mu = 1{\cdot}516$, then the following are the formulæ for aplanatism:

r	s	t	80° d	100° D
$-1{\cdot}086$ F	$+1{\cdot}652$ F	$\frac{F}{5}$	$1{\cdot}26$ F	$1{\cdot}56$ F
$-1{\cdot}086$ F	$+1{\cdot}627$ F	$\frac{F}{6{\cdot}3}$	$1{\cdot}3$ F	$1{\cdot}58$ F
$-1{\cdot}089$ F	$+1{\cdot}611$ F	$\frac{F}{9}$	$1{\cdot}32$ F	$1{\cdot}61$ F

It must be remembered that the focus F, given in the above formulæ, is the true focus, measured from the silvered surface, but, to save those intending to construct a lens-mirror trouble, I have drawn out the appended table (see p. 260) of the actual radii, thicknesses, and diameters of such lens mirrors as are likely to be useful to the microscopist. In this table f, the working focus, viz. the focus measured from the incident surface, is given, instead of F, the theoretical or true focus, which is measured from the silvered surface. The diameters given in the table are the lengths of the chord of the incident surface, and as the edge of the lens should be a radius of the silvered surface (see fig. 22) the diameter of the silvered surface will be somewhat larger. If the lens is edged parallel to its axis the aperture of the mirror will be reduced. It is clear that the mirror must have a diameter greater than that portion which subtends the angle of aperture. For example, the extreme ray in the fig. makes an angle of 50° with the axis, but if the mirror had only just sufficient aperture to include that angle the ray would never pass out of the lens.

In the aplanatic lens mirror the chromatic aberration is less than in a bull's eye, because the greater part of the angular bending of the ray is performed by reflection instead of by refraction. In the following aplanatic lens mirrors of 100° of aperture, $\frac{3}{5}$ of the total bending is accomplished by reflection without any dispersion.

If an aplanatic lens mirror be compared with a bull's-eye of two planos of best form its superiority is at once manifest.

First, the bull's-eye cannot approach the lens mirror in aperture; secondly, in the bull's-eye all the bending is accompanied with dispersion, whereas in the lens mirror only $\frac{2}{5}$ of the total bending suffers dispersion; thirdly, the spherical aberration, even with two planos of the best form, amounts to no less than $\cdot 36\,\frac{y^2}{F}$; fourthly, the diameter of the bull's-eye soon reaches a limit, because of the thickness of the lenses.

Before concluding it will be as well to investigate for the sake of comparison the aberration of the commonest form of mirror, which is found in every Microscope, viz. a silvered shell of glass, in other words a lens mirror, where $-r = -s$. Formula (ii.) shows that when $-r = -s$, $r = 2$ F; this is precisely the focus of a metallic concave mirror, therefore the glass part of the system has no influence at all. The equation for aberration, however, indicates a reduction in the aberration from $\cdot 125 \frac{y^2}{F}$, that for a concave mirror, to $\cdot 1 \frac{y^2}{F}$, that for the silvered shell. Practical experiments with thick shells yield somewhat different results; with a thickness of $\frac{F}{7 \cdot 3}$, it will be found that the focus has been lengthened by $\frac{F}{8}$, and the aberration slightly reduced to $\cdot 085 \frac{y^2}{F}$.

Thickness therefore is, in this case, an advantage.

Aplanatic lens mirrors will be found useful for lieberkuhns, side reflectors, superstage and substage illuminators; they are especially adapted for parallelizing wide-angled beams, and would therefore advantageously take the place of bull's-eyes or parallelizing condensers. They would of course be invaluable for search lights and lighthouses.*

As the manufacture of these aplanatic lens mirrors can present no difficulties but what are met with in the most ordinary optical work, I can see no reason why they should not be largely used, and I trust that this effort of mine may be the means of not only improving, but also of cheapening a common and useful portion of microscopical apparatus.

Note.—The radius of the silvered surface s is throughout this paper considered negative, because it is measured from the surface to the centre, that is from right to left, but in the table it is entered positive, so that it may agree with the practice of manufacturing opticians.

Fig. 22 is drawn to scale from one of the formulæ in the third block of the table, it therefore illustrates an aplanatic lens mirror of the thickest type.

The following are some of the angles of the lens mirrors of the middle block having an aperture of 100°. The extreme ray parallel to the axis makes an angle of 46½° with its normal at the incident surface. The corresponding angle in glass is 28½°, viz. 13° less than the critical angle. This ray undergoes a reflection of 28½°, therefore this reflected ray in glass is parallel to its normal at the incident surface. In the thin lenses of the first block the angles of the extreme rays are slightly greater, but in the third block they are a trifle less than 28½° in glass.

* The following are the radii, &c., of large mirrors :—

D 100°	f	t	$-r$	$+s$
12·0	6·62	0·82	8·11	12·0
12·0	6·40	1·20	8·25	12·36
12·0	6·15	1·54	8·35	12·71

Two and three foot mirrors will of course have twice and three times those values respectively.

f	t	$-r$	$+s$	d 80°	D 100°
¼	·031	·306	·453	·37	·45
½	·062	·612	·906	·74	·91
¾	·093	·918	1·359	1·12	1·36
1	·125	1·225	1·812	1·49	1·81
1¼	·156	1·531	2·266	1·86	2·27
1½	·187	1·837	2·719	2·23	2·72
1¾	·218	2·143	3·172	2·60	3·17
2	·250	2·450	3·625	3·0	3·6
2¼	·28	2·76	4·08	3·3	4·1
2½	·31	3·06	4·53	3·7	4·5
2¾	·34	3·37	4·98	4·1	5·0
3	.37	3·67	5·44	4·5	5·4
3½	·44	4·29	6·34	5·2	6·3
4	·50	4·90	7·25	6·0	7·2

t	$-r$	$+s$	d 80°	D 100°
·047	·322	·483	·39	·47
·094	·645	·966	·77	·94
·141	·967	1·449	1·16	1·41
·187	1·290	1·932	1·55	1·87
·234	1·612	2·416	1·94	2·34
·281	1·935	2·899	2·32	2·81
·328	2·257	3·382	2·71	3·28
·375	2·580	3·865	3·1	3·7
·42	2·90	4·35	3·5	4·2
·47	3·22	4·83	3·9	4·7
·52	3·55	5·31	4·3	5·2
·56	3·87	5·80	4·6	5·6
·66	4·51	6·76	5·4	6·6
·75	5·16	7·73	6·2	7·5

t	$-r$	$+s$	d 80°	D 100°
·062	·339	·516	·39	·49
·125	·679	1·032	·78	·97
·187	1·018	1·549	1·18	1·46
·250	1·357	2·065	1·57	1·95
·312	1·697	2·581	1·96	2·44
·375	2·036	3·097	2·35	2·92
·437	2·376	3·614	2·75	3·41
·500	2·715	4·130	3·1	3·9
·56	3·05	4·65	3·5	4·4
·62	3·39	5·16	3·9	4·9
·69	3·73	5·68	4·3	5·4
·75	4·07	6·19	4·7	5·8
·87	4·75	7·23	5·5	6·8
1·00	5·43	8·26	6·3	7·8

f, Focus measured from incident surface.
r, Radius of incident surface.
d, Diameter of incident surface when aperture = 80°.
D, Diameter of incident surface when aperture = 100°.

t, Thickness measured on principal axis.
s, Radius of silvered surface.

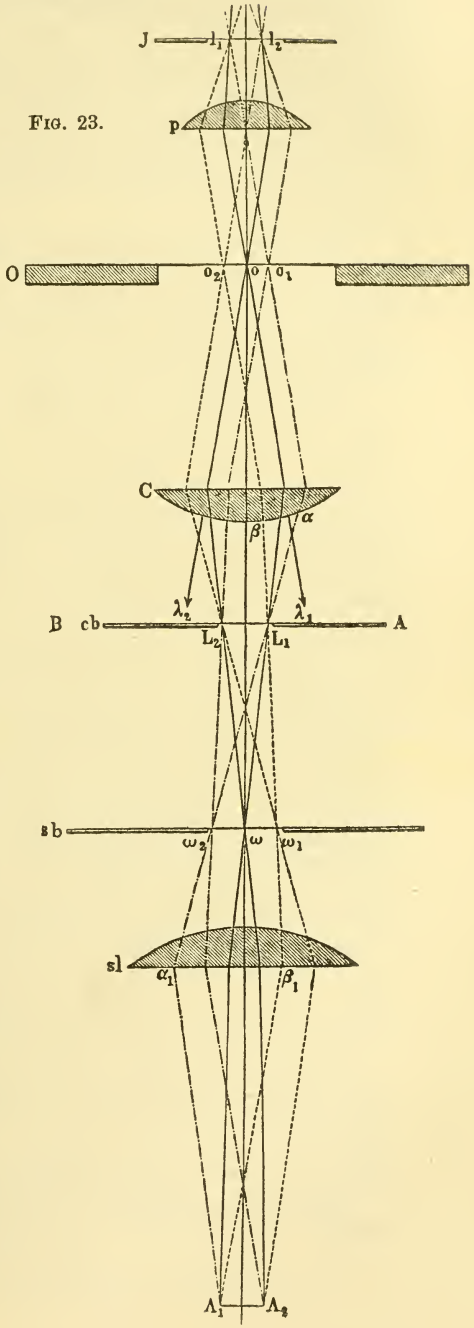
Refractive index = 1·516.

(4) Photomicrography.

New Method of Illumination for Photomicrographical Purposes.*—Dr. A. Köhler's method of illumination consists in so adjusting the relative positions of the condenser beneath the object and the source of light that an image of the source is formed approximately in the plane which is the common base of all of the pencils proceeding from the projection system to the several points of the image. This plane will usually be near the hinder focal plane of the objective. The source of light must therefore be placed approximately in the hinder focal plane of the condenser. The course of the rays in this case is seen in the upper part (above the line A B) of fig. 23. L_1 L_2 is the source of light in the hinder focal plane of the condenser C. O is the plane of the object in which three points o_1 o o_2 are marked. The position of the object is chosen so that it is beyond the focal length of the condenser. p is the objective serving for the projection, with the iris diaphragm J in its hinder focal plane. In this plane there is produced an inverted real image l_1 l_2 of the source of light L_1 L_2.

The angular aperture of the pencil which meets the plane of the object in the optic axis is equal to the angle under which the virtual magnified image of the source of light λ_1 λ_2, produced by the condenser, appears from the plane of the object. This can be regulated by diaphragms placed directly in front of the source of light. The figure shows that the illumination of the whole field of view is uniform, even if

Fig. 23.



* Zeitschr. f. wiss. Mikr., x. (1893) pp. 433-40.

the brightness of the different points of the source is different; for every part of the plane of the object is illuminated by a pencil to which every single point of the source contributes rays.

A disadvantage to this method of illumination is that the source of light comes too close to the object. Other difficulties are that a graduation of the angular aperture of the illuminating pencil cannot be conveniently obtained, and that a sharp limitation of the illuminated surface in the plane of the object is impossible.

The author succeeds in obviating these three difficulties by the following devices.

The heating of the object due to the close proximity of the source of light is avoided by not bringing the source itself into the hinder focal plane of the condenser, but rather a magnified or diminished image of it produced by a suitable condensing lens of not too small focal length. The second difficulty is then also removed by the use of suitable diaphragms in the plane of this image.

The third difficulty is got rid of by the use of what the author calls a field of view diaphragm (*Sehfeldblende*) placed in the conjugate plane of the condenser to the plane of the object. The condenser then throws a real image of this diaphragm in the plane of the object, the size and form of which depend upon the size and form of the diaphragm.

The whole path of the rays is seen in fig. 23, taking into account now also the part below the line A B. The source of light is no longer in this plane, but far below at A_1 A_2, and L_1 L_2 now represents its image produced by the condensing lens *s l*. The "Sehfeldblende" is at *s b* and ω_1 ω ω_2 represent conjugate points to o_1 o o_2.

The author adds some practical suggestions as to the adjustment of the apparatus, and choice of lenses and sources of light.

Stereoscopic Photomicrography.*—Dr. W. C. Borden points out the advantages offered by stereoscopic photomicrographs in representing microscopic objects in their real form through the effect of relief. The advantage generally claimed for a drawing over a photomicrograph is that the former may be constructed so as to represent an object as it appears viewed at different focal planes; but by means of stereoscopic photomicrography a similar result may be obtained, for the two most important planes of an object may be superimposed and combined so that a picture having natural relief and sharpness is produced. This result is attained by using a different focus for each exposure in the two negatives necessary for the stereoscopic picture. When viewed in the stereoscope the sharp outlines of each negative are found to override the blurred outlines of the other, and a single stereoscopic picture is produced presenting different planes of the object in sharpness and relief.

In taking stereoscopic photomicrographs the necessary lateral views of the object are obtained either by tilting the object or by using different halves of the objective for each view. With low power objectives the first method is the best to employ. In tilting the slide the axis of the tilt must be parallel with the upright axis of the object.

Remarkable Collection of Photomicrographs.†—Mr. K. M. Cunningham calls attention to a remarkable collection of photomicro-

* Amer. Micr. Journ., xiv. (1893) pp. 329-33. † Tom. cit., pp. 339-42.

graphs which were prepared about the year 1860 by a physician, Dr. Henderson, residing in Mobile, Alabama. The collection consists of sixty-five silver prints, each 6 in. in diameter, mounted on a page of an album about 12 in. square. Traced on the negative with a pin are the words "Dr. Herapath's 1/4 in. lens, 'Ross,' April 25th, 1860." The name of the object and the magnification employed are given with each photomicrograph. The collection includes specimens derived from insect or parasitic life, specimens of diatoms, specimens from plant life, specimens from sea life, and histological specimens.

Photographing Plate Cultivations.*—In the usual method of lighting for photographing plate cultures, says Mr. G. F. Atkinson, the finer characteristics are often lost, and in case of very transparent colourless organisms the image is throughout very dim. By covering the bottom and top of the culture dishes (Petri's capsules) with an opaque screen, the light is admitted only through the sides of the vessel, and the object is thus photographed by reflected instead of transmitted light. In this way very clear and minute details are obtained.

(5) Microscopical Optics and Manipulation.

Theoretical Limit to the Capacity of the Microscope.† — Herr K. Strehl gives an investigation of the limit to the resolving power of the Microscope. In his book 'Theorie des Fernrohrs auf Grund der Beugung,' he has given a theoretical proof on the ground of diffraction that the limit of the resolution of a double star occurs for the value $Z = 3{\cdot}2$.

Here $Z = \dfrac{2\pi r\sigma}{\lambda p}$, where r denotes the radius of the aperture of the wave-surface, p the radius of the wave surface or the focal length, σ the distance apart of the two points of light in the focal plane, and λ the wave-length of the light, all measured in mm.

Taking the case of a pencil of rays from the Microscope objective, and considering wave-surfaces drawn as normals to the rays through the hinder focus, p will represent the so-called "optical tube-length," and r must be measured in the hinder focal plane of the objective. Now according to Abbe $r = fa$ where f is the hinder focal length of the objective and a its numerical aperture. If ϵ denote the minimum distinguishable distance in the object, then in the plane of the image $\sigma = \epsilon\dfrac{p}{f}$.

We have now, corresponding to the limiting value $Z = 3{\cdot}2$, the following:

$$\sigma = \frac{3{\cdot}2\,\lambda p}{2\pi r}; \qquad \sigma = \frac{1{\cdot}6\,\lambda p}{\pi a f}; \qquad \epsilon = \frac{1{\cdot}6\,\lambda}{\pi a} = 0{\cdot}5093\,\frac{\lambda}{a}.$$

Thus for extremely obliquely illuminated objects $\epsilon = 0{\cdot}5\,\dfrac{\lambda}{a}$; and for $\lambda = 0{\cdot}00055$ mm. and $a = 1$ we obtain $\epsilon = 0{\cdot}28\,\mu$, i.e. 3570 striæ in

* Bot. Gazette, xviii. (1893) p. 333.

† Central-Ztg. f. Optik u. Mechanik, xiv. (1893) p. 277.

1 mm., as the limit of resolving power. This result, $\epsilon = 0{\cdot}5\,\frac{\lambda}{a}$, is the same as that obtained by Helmholtz in the case of self-illuminating objects and full aperture; so that even if it were possible to make all microscopic objects self-illuminating and to observe them with full aperture, no advantage would be gained over observation with as narrow as possible and extremely oblique illumination.

(6) Miscellaneous.

Liverpool Microscopical Society. — From the twenty-fifth Annual Report * of this Society we are glad to learn that its affairs are prospering, and that the ordinary meetings have been well attended. A new departure is the holding of field meetings during the summer months.

Microscopical Society of Calcutta.—We are glad to learn from the sixth Report of this Society (for the year 1893) that its meetings have been well attended, and that the finances are in a more satisfactory condition than they have ever been; the always present *aliquid amari* is, in this case, the regret felt at the death of the President, Prof. Wood-Mason.

The late Mr. C. Haughton Gill, F.R.M.S.—We regret to announce the sudden death, on February 21st, from heart disease, of Mr. C. Haughton Gill. Mr. Gill was born at Wells on the 12th June, 1841. He received the greater part of his scientific education at University College, London, and in 1858, at the age of seventeen years, gained the Gold Medal for Chemistry. The following year he took the Silver Medal for Analytical Chemistry, and about two years afterwards he was appointed assistant to Dr. A. W. Williamson, then Professor of Chemistry at the College. He remained at the College about fifteen years, when he was offered and accepted the appointment of analytical chemist and scientific manager to the firm of David Martineau and Sons, sugar refiners; when the business was a few years back turned into a limited company Mr. Gill was made the managing director, and from this position he retired only a few months ago.

While at University College Mr. Gill published a text-book of chemistry for schools, which is still esteemed as a text-book.

Some five years ago Mr. Gill devoted the greater part of his time to microscopical research, chiefly in connection with the life-history of the Diatomaceæ, and on this subject he made some important discoveries, which he communicated to our own and other Societies. But his interest in microscopy was wide and deep.

Mr. Gill joined the Society in 1889, and was elected a member of the Council in February of last year; he was also a Fellow of the Chemical Society and a member of the Quekett Microscopical Club.

The following are the papers which Mr. Gill contributed to the Journal of the Society:—

1889. Preparing Diatoms, pp. 834–5.

1890. On some Methods of Preparing Diatoms so as to exhibit clearly the Nature of their Markings, pp. 425–8, plate VII.

* Liverpool, 1894, 8vo, xii. pp.

1891. On the Structure of certain Diatom-valves as shown by sections of charged specimens, pp. 441–2, plate VIII.

1893. On an Endophytic Parasite of Diatoms, pp. 1–4, plate I.

B. Technique.*

Hints in Bacteriological Technique.†—For examining bacteria in hanging drops, Prof. J. Marek instead of using a cover-glass run round with vaselin, paraffin, or the like, takes a hollow-ground or plane slide and sticks on with cedar oil a plate of black "patent-gum." The gum plate is about 1 mm. thick, and a circular hole with diameter 8–10 mm. is cut out of the middle. In the hollow is placed a droplet of water, and the cover-glass with hanging-drop put over. The cover-glass is then covered with a slide from which a circle with a diameter of 16–20 mm. has been cut out. The whole is held together by rubber rings and then examined under the Microscope, or it may be held together and kept in position by means of the stage clips.

For simultaneously staining many preparations of bacteria, a modification of the method suggested by Kutner and Tröster is advised. On a piece of plate glass 6 by 12 cm. and about 1 mm. thick are scratched vertical and horizontal lines at a distance of about 6 mm. apart. From the same kind of glass are cut four strips, 6 and 10·8 cm. long and about 6 mm. broad. Two of each of these strips are well smeared with soluble glass, and having been accurately adapted to the edges of the plate and with moderate pressure, are allowed to dry for some hours and then incubated for half an hour at 120°–150°. When cold the inner edges of the strips are smeared with soluble glass, and the drying and heating repeated. When cold the plate can be used as a slide. The bacteria are fixed by heating the slide for 5–10 minutes to 120°–130°, and then the stain is poured on into the slide-pan, the rest of the manipulation being as usual.

By enlarging the size of the glass plate and the strips to be fixed on a capsule can be made for the cultivation and examination of micro-organisms which possesses advantages over those of Petri, Soyka, and others. The glass plate should be 12 by 16 cm., and about 1–1·15 mm. thick; of these plates two are required, one serving as the lid. The strips, eight in number, are 8 and 13·2 cm. long. A capsule having a superficial area of 96 ccm. is thus formed and is especially convenient for photographic and enumeration purposes.

Doubt as to whether a certain colony has been inoculated from or not may be avoided by the use of a chart subdivided into definite areas by vertical and horizontal lines. The chart is placed underneath the capsule or plate, the position of the colony noted and then registered.

A moist chamber for plates or double capsules is conveniently made with a large glass rectangular pneumatic trough, the edge of which is protected with cotton-wool and covered with a glass plate larger than the

* 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., xv. (1894) pp. 112-4.

opening. At the bottom of the pan is placed a 1 : 1000 solution of sublimate forming a layer about 2 cm. high. In each corner of the trough is placed a cube made of some material which is unacted on by water or mercury (side of cube about 4 cm.). On these four cubes a glass plate rests, and the plates or capsules are placed on this. They may be put upon each other or near together, though it is advisable that they should be separated by strips of glass plate.

Manual of Microscopical Technique.*—Herr O. Bachmann has published the second edition of his handbook, which will, no doubt, be found useful. Whether there are not now in English manuals of various sizes and degrees of merit which will make the work unnecessary to the English microscopist is another question.

Piersol's Histology.†—This is stated to be the only American manual of histology that has yet been published to meet the requirements of modern methods of teaching. One great point appears to be the large number of original figures, and another the inclusion of sufficient embryology for medical students.

(1) Collecting Objects, including Culture Processes.

Quadrangular Culture-Capsules.‡—Dr. M. Lunkewicz uses quadrangular capsules for cultivation purposes, the sides being luted on with Leyboldt's cement, the composition of which is kept secret. This cement answers quite well and is fireproof at 200°. Capsules of this form have many advantages over the ordinary circular capsules with their uneven bottom; thus the enumeration of the colonies is more easily made either with the counter or by having the bottom of the capsule divided into squares; the distribution of the medium and of the colonies is much more regular, and as the lid and the bottom are exactly parallel and only a short distance—1 cm.—apart, the growths may be examined with Zeiss objectives a_3 and A.

Cold Stage.§—Dr. M. Lunkewicz states that in Tiflis, where the summer temperature is often 30°–35° R. in the shade, examination of gelatin cultures is difficult unless precautions be taken for preventing the liquefaction of the gelatin. The device he has adopted is to place the capsule, &c., to be examined on a cold stage. This is nothing more than a glass box, the sides of which are parallel, and is somewhat larger than the hot stage. At one end ice-water flows in and at the other flows out.

Behrendsen's Steam Sterilizer.‖—Herr Behrendsen's apparatus is chiefly intended for the sterilization or disinfection of surgical dressings and instruments. It consists of an ordinary cylindrical boiler and of the receiver which fits inside; the latter is of the same shape, but not of the same size. Both are closed by the same lid. The steam from

* 'Leitfaden zur Anfertigung mikroskopischer Dauerpräparate,' Munich and Leipzig, 1893, 8vo, 332 pp., 104 figs.

† 'Text-book of Normal Histology,' by G. A. Piersol, Philadelphia, 1893, 8vo, 439 pp. and 409 figs.

‡ Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 42-3. § Tom. cit., p. 44.

‖ Deutsch. Med. Wochenschr., 1893, Nos. 28 and 29. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) p. 676.

the water in the boiler finds its way into the receiver through a number of holes made through the sides near the top, and escapes therefrom through a pipe running from the bottom up the side to the top.

It is stated that condensation water deposits only on the lid, and thus the articles to be disinfected are not damped. For the sterilization of instruments a special receiver is required, and this is filled with 1 per cent. soda solution and then boiled in the sterilizer. Is it superfluous to add that all this trouble might be saved by means of an ordinary tin saucepan?

Berkefeld Filter.*—This filter, which has been much bepraised, has received some severe criticism at the hands of Dr. M. Kirchner, who stated that it became used up in a comparatively short time, and that it had the inherent defect of being brittle, so that, as it required sterilizing every few days, it was really an expensive luxury. The filter proper consists of calcined infusorial earth, and the special property of this material was supposed to reside in the sharpness of the edges and angles of the passages through which the water percolated; pathogenic bacteria were cut up as they hurtled by.

These remarks were replied to by Prof. M. Gruber, who seems to have expressed a favourable opinion of the apparatus. This author appears to consider that it is rather hard on filters to expect them to be immaculate, and in estimating the value of a filter he lays it down that the appearance of germs is to be assigned to one of two causes. Either the germs percolate through along with the water, and so form part of the filtrate, or they grow through. If germs percolate through the filter, the principle or the make of the filter may be considered essentially bad, but if they grow through, this is to be regarded somewhat in the light of an unfortunate accident, and one not indicative of danger.

In reply to Prof. Gruber, Dr. M. Kirchner reiterates his former statement, and points out again that while he thinks this filter is a good one as filters go, yet it soon becomes clogged, or allows the transit of pathogenic and non-pathogenic bacteria, and that it is constructed of material too brittle for general use. It possesses good features, and if it were made so as to be more durable it might be recommended for general purposes.

Apparatus for Boiling and Cooling Water.†—Dr. H. Laser gives a short description of an apparatus made by the Continental Gas Company in Dessau, which seems to be practical and effective. It consists of two parts, one in which the feed-water is partially heated before it gets into the boiler proper in which it is heated for ten minutes. It is then returned to the feeder through a pipe, and so becomes cooled down.

The author's observations chiefly deal with the freedom of the water from bacteria. On the whole the water is fairly well sterilized, and is delivered at a temperature varying from 15° to 25°, usually nearer the latter. The apparatus is only made to be heated by gas.

* Zeitschr. f. Hygiene u. Infektions., xiv. (1893) p. 299. Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 488–93, 516–27.

† Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 749–55 (1 fig.).

Formalin as Test for Typhoid Bacillus.*—According to Dr. Schild formalin may be used for distinguishing between the bacillus of typhoid fever and other bacteria resembling it. After exposure of gelatin cultivation of typhoid to the vapour from 5 ccm. of formalin for 75 minutes, no results were obtained when subcultures in other media were incubated. On the other hand a water bacterium resembling the typhoid bacillus or *Bacterium coli commune* was found to be still capable of development even after two hours' exposure.

When a solution of formalin was added to the medium the difference was still more striking; the growth of the typhoid bacilli was stopped by 1 part per 15,000, while *Bacterium coli* grew strongly at 1 per 3000, and the water bacterium at 1 per 6000.

Pure cultivations of the three kinds of bacteria were also examined in the following way. To test-tubes containing 7 ccm. of sterilized neutral bouillon 0·1 ccm. of formalin was added. The formalin was therefore present in the proportion of 1 per 7000. The medium cannot of course be sterilized after the addition of the formalin, as the volatile aldehyd would be driven off by the heat. Tubes prepared in this manner were isolated with pure cultivations of typhoid bacilli, *Bact. coli com.* and the water bacterium, and then incubated. Only the typhoid tubes remained clear, those inoculated with *Bact. coli com.* or with the water bacterium becoming cloudy in 24 hours.

Germicidal Properties of Human Mucus.† — According to Drs. Wurtz and Lermoyez, mucus collected with suitable precautions from the nasal mucosa possesses a bactericidal influence on some micro-organisms, e. g. *Bacillus anthracis*, the spores of which are killed after three hours' exposure to its action. Nasal mucus exerts a similar action on many other pathogenic organisms, but this action is of variable intensity.

Antibacterial Action of Oxychinaseptol.‡—Dr. F. Rohrer finds that oxychinaseptol (diaphtherin) has a highly inhibiting action on the development of micro-organisms, as shown by experiments with pure and mixed cultivations of pyogenic bacteria, and with pure anthrax cultivations. Oxychinaseptol in 1 per cent. solution prevents the development of *Staphylococcus pyogenes aureus* if 2–4 drops be added to 9–12 ccm. bouillon; mixed cultivation 3–4 drops, and 1–4 drops for anthrax.

Egg-albumen as a Cultivation Medium for Micro-organisms.§—Sig. C. Parascandole finds that hen's egg albumen is not inferior to other media for cultivation purposes. His experiments were made with *B. anthracis*, *B. typhi*, *Sp. choleræ*, *Sp. Deneke*, *Sp. Finkler-Prior*, *St. pyogenes aur.*, *Str. pyogenes*, *B. choleræ gallinæ*, *M. tetragenus*. New-laid eggs were first cleaned with 90 per cent. spirit, and then washed for 10 minutes in 1–1000 sublimate, and after a second cleaning were coated with paraffin in order to preserve them. When required for experiment most of the paraffin layer was scratched off with a sterilized knife and the rest removed with turpentine. This was followed by alcohol, sub-

* Centralbl. f. Bakteriol. u. Parasitenk., xiv (1893) pp. 717–8.

† Journ. British Dental Assoc., xiv. (1893) p. 713.

‡ Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) p. 551.

§ La Riforma Med., 1893, p. 101. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) p. 291.

limate, and again alcohol. An opening was next made at one end with a red-hot iron and the egg inverted over a sterilized test-tube. Another opening was then made at the opposite end and the contents of the egg evacuated into the test-tube. The medium was immediately inoculated and the tube closed with cotton-wool. All the tubes were kept at the room-temperature, and in all a copious growth was observed. Thus cultivated, the micro-organisms could be successfully transferred to the ordinary media.

Egg-yolk Medium for Cultivating Influenza Bacillus.*—Dr. M. Nastiukow prepares an artificial medium in which influenza bacilli thrive wonderfully and can be cultivated through several generations. One litre of distilled water is made alkaline by mixing with 5 grm. of 10 per cent. solution of caustic soda, and in this are dissolved 100 ccm. of yolk of egg. This is the liquid medium, and to obtain a solid one 15–25 grm. agar are dissolved in one litre of the yolk solution by boiling, and then passed through a Plantamur's filter. The media are sterilized in Koch's steam sterilizer. The cultivations were made from saliva, and on plates formed small round transparent yellowish colonies. In the liquid medium, after an incubation of twenty-four hours, little white wedge-shaped lumps sank to the bottom of the test-tube.

Blood-Serum as Diagnostic Cultivation Medium for the Cholera Vibrio.†—The method devised by Dr. A. Maassen for diagnosing cholera bacilli depends on the observation that these organisms flourish freely on solid serum, and that they have the power of liquefying the medium, a property in which they excel all other bacteria found in fæces or in the contents of the alimentary tract.

The procedure is very simple, and merely consists in smearing some of the soft portions of the dejecta or flakes, &c., with a platinum instrument on the serum surface of several tubes. When cholera vibrios are present the inoculated places seem as if they had been eroded in from 6–12 or at latest in 20 hours. From the holes or fissures thus formed cholera vibrios in almost pure cultivations may be fished out. The proliferation of the vibrios may often be demonstrated even before the softening and liquefaction is apparent (3–4 hours). In many cases it may be necessary to inoculate from the first to a second serum surface or a pepton-salt solution.

For the demonstration of cholera in water the blood-serum may be used directly after the preliminary pepton-salt solution. Such experiments have shown that spirilla and vibrios which do not grow on other media thrive in this solid serum, and can be easily obtained in pure cultivations. The advantages of oblique blood-serum have been found to be that in non-diarrhœic stools which contain only few comma-bacilli more material can be sown than in pepton-tubes. The liquefaction of the serum within 24 hours renders it probable that cholera vibrios are present, and if this indication be absent these organisms are not present. The cholera vibrios are not so easily overgrown by other bacteria as in other media.

* Wratsch, 1893, Nos. 30, 32, 33. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 815–6.

† Arbeiten a. d. Kaiserl. Gesundheitsamte, 1894, pp. 122–6. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 251–2.

Inspissated Must and the Cultivation of Fungi.*—Though grape must is especially suitable for cultivating fungi it has been little used, because it is only obtainable at certain times of the year and in small quantities. This inconvenience can be obviated, says Dr. J. Wortmann, by obtaining inspissated must, and he recommends that made from white grapes which has been filtered before concentration. The must is evaporated down to about one-fourth of its original bulk, and, when used, four vols. of water are added to one vol. of must. Owing to the large quantity of sugar present, about 65 per cent., inspissated must does not deteriorate and has the special advantage for experimental purposes of possessing a fixed composition (20 per cent. sugar, 0·24 per cent. acid, and 0·027 per cent. nitrogen). The amount of nitrogenous matter is from one-fourth to one-half of natural must and if desirable may be increased by adding tartrate of ammonia when diluting.

Plate Cultivations of Anaerobes.†—Dr. Arens uses the following simple but efficacious method for cultivating anaerobic organisms. A small exsiccator such as is found in every laboratory is nearly filled with a mixture of sand and pyrogallic acid, space being left for one or more small Petri's capsules. The plates are made in the usual way, except that it is advisable that they should consist of the contents of two tubes instead of one. A sufficient quantity of 10 per cent. caustic potash is then added to the sand and pyrogallic acid mixture, the capsule is laid on the surface, and then the exsiccator, the lid of which must fit well and be greased, is closed.

Detection of growth may be facilitated by covering the sand surface with blackened paper, and the absorption of oxygen hastened, when the plate has set, by just tilting up the exsiccator. As the absorption of air takes place quickly there is no fear either of the growth of aerobic bacteria before this has happened or of the suppression of anaerobic fungi owing to slowness of absorption. Of course, for cultivation purposes the whole apparatus is incubated.

Method for Imparting Correct Reaction to Nutrient Gelatin.‡—Dr. H. Timpe gives the following procedure for making nutrient gelatin. The meat broth is freed from albumen by boiling and then as usual mixed with 1 per cent. pepton, 1/2 per cent. cooking salt, and 10 per cent. gelatin. This mixture is for some time kept at a gentle heat until the gelatin is completely dissolved, and is finally allowed to boil. The boiling-hot solution is then treated with 25 per cent. caustic potash until a drop of it on a piece of filter paper moistened with an alcoholic solution of phenolphthalein leaves a red-edged spot. When a small portion and a couple of drops of the phenolphthalein solution are brought together in a test-tube there should be a distinct red colour; if not the alkali must be added drop by drop until the reaction occurs. This step must be taken with great care, for excess or defect of alkali results in an imperfect medium. Should the medium have cooled down too much during this process of neutralization it must be reboiled, but for a short time only as too prolonged boiling injures the property of gelatinization. The precipitate of calcium phosphate is rapidly thrown down in gelatin

* Bot. Zeitung, li. (1893) p. 177.
† Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 15–7.
‡ Op. cit., xiv. (1893) pp. 845–52.

solutions neutralized in this way, the filtrate is quite clear and 1 litre of fluid is obtainable in about 15 minutes without having recourse to the hot water filter. A portion of the filtrate, which should still give an alkaline reaction with phenolphthalein, is mixed with an estimated quantity of acid, e. g. for cholera cultures the most favourable acidity is that which is equivalent to 16 ccm. 1/10 acid in 100 ccm. gelatin.

Sputum as Cultivation Medium for Pneumonia Cocci.*—Dr. A. Schmidt finds by cultivating pneumonia cocci on sputum that noteworthy differences occur in the microscopical appearances. When grown in agar small bacilli, devoid of capsules, with tendency to form chains, appear, while on sputum the cocci assume the form as observed in the body and blood of infected animals. Inoculations from agar cultures to a sputum-medium reproduce the well-marked capsule bacilli. Pneumonic sputum, which is highly albuminous, was treated as serum, the only difficulty being the presence of air-bubbles. The most suitable sputum was that before the crisis. It was sterilized by heating it five times to 55° for one hour at a time.

Nastŭkow, M. M.—**Eigelb als Nährstoff für Bakterien.** (Yellow of Egg as a Nutrient Material for Bacteria.) *Wratsch*, 1893, pp. 912–4, 950–1 [Russian].

(2) Preparing Objects.

Method of Preparing Fresh Sections of Brain.†—Dr. Middlemass recommends a few alterations in Bevan Lewis's excellent method of cutting fresh sections of brain. He advises that the sections should be floated out on to ice-cold water as soon as they are cut, as it prevents any considerable breaking up of the section. The result is still better if sufficient solution of permanganate of potash be added to the water to give it a fairly dark-red colour. With thick sections it is especially necessary to free them as much as possible from water. As anilin-blue-black is not a pure chemical substance, but a mixture, the best way to get a good stain is to take one which already gives a fairly satisfactory result, make a saturated watery solution of it, and pour it into a considerable quantity of absolute alcohol. This is quickly filtered, washed, and dried. The black amorphous powder which is precipitated dissolves completely in water, and gives a more delicate and a blacker stain than the original, while its action is more uniform.

Investigation of Spermatogenesis of Salamandra.‡—Dr. O. vom Rath reports that, in addition to better known aids to preservation of the testis, he got particularly good results with a mixture of picric-acetic acid and platinum-chloride-osmic acid. This mixture was prepared by adding 500 ccm. saturated watery and filtered solution of picric acid, 3 ccm. of acetic acid, 5 grm. platinic chloride (dissolved in about 5 ccm. of water), and 2 grm. crystalline osmic acid. The testes were placed whole in this mixture, and, after they had become hardened to a certain extent, they were punctured with a fine entomological needle, whereby the preservative fluid and, later on, stains, xylol, and paraffin were the better able to enter. After staying for three to five days in this mixture it was washed off with methyl-alcohol, and the objects were placed for several days in absolute alcohol which was several times renewed. Some

* Centralbl. f. Klin. Med., xiv. p. 625. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 70-1.

† Proc. Scott. Micr. Soc., 1892–3, pp. 86–8.

‡ Zeitschr. f. wiss. Zool., lvii. (1893) pp. 102 and 3.

of the preparations thus treated were placed for one to two days in acetic acid, when subsequent staining was usually unnecessary; others were stained, either in mass or on slides, by means of Flemming's saffranin-gentian-orange method.

The advantage of the picric and platinum method is that there are revealed not only the most subtle details of the nucleus, but also the finest structural relations, and that with great clearness and regularity; while there is no crumpling or swelling of the cell or nucleus. Careful measurement has convinced the author that the size and general habit of the cells and nuclei are remarkably similar to those of the living tissue.

Preparation of Eggs of Trout.*—Prof. H. Blanc had some difficulty in studying the eggs of *Trutta lacustris*, as they are too large to be observed directly under the Microscope, and are somewhat opaque. As they have a thick shell-membrane, and as the yolk hardens more than the blastoderm, it was necessary to discover some special method. At last, eggs fertilized by the Russian method were fixed in a mixture of 600 vols. water, 2 vols. concentrated sulphuric, 100 vols. concentrated picric, and 8 vols. glacial acetic, acids. After remaining for several hours, or even days, in this mixture, the eggs were opened in 10 per cent. acetic acid; this partly dissolved the nutrient yolk and allowed the germs to be picked out. The latter were then treated with 80 per cent. alcohol till they were completely colourless, then preserved in absolute, and afterwards stained with borax-carmine, before being placed *in toto* in glycerin or balsam. This method is recommended as giving good results even in the hands of beginners.

Preparing Molluscan Ova.†—Mr. E. J. Conklin finds the following to be the best method of preparing surface-views of the whole egg or embryo:—Transfer the object, previously fixed in Kleinenberg's stronger picro-sulphuric, 70 per cent. and 95 per cent. alcohol, gradually from alcohol to water; stain from five to ten minutes in a solution of Delafield's (Grenacher's) hæmatoxylin diluted about six times with distilled water, and rendered slightly acid by a trace of hydrochloric acid; dehydrate and clear in oil of cedar or cloves; mount in balsam, supporting the cover-glass, so as to prevent crushing. By occasionally softening the balsam with a drop or two of xylol, and slightly moving the cover-glass, the objects can be rolled into any position desired. This method has also been successfully employed in the preparation of surface-views of the embryo chick, English sparrow, and the eggs and embryos of Annelids and Echinoderms. One great advantage of it is that the preparations are permanent.

Study of Spermatogenesis of Crustacea.‡—M. A. Sabatier made use of very numerous and various reagents, always dealt with organs taken from living specimens, and used most of the known fixing reagents. In rapid teasings he found admirable Ripart and Petit's cupric fluid, whether used pure or with the addition of 1 per cent. osmic acid solution. With this and acetic-methyl-green he was able to very profitably study nuclein, whether in or out of the nucleus.

* Ber. Naturf. Gesell. Freiburg i/B., viii. (1894) p. 163.
† Amer. Natural., xxvii. (1893) pp. 1026 and 7.
‡ Acad. de Montpellier, Mem. Sec. Sci., i. (1893) pp. 21 and 2.

Organs were well fixed and adapted for sections after having been fixed in a cold saturated solution of bichloride of mercury, to which 5, 10, or even 20 per cent. of (crystallized) acetic acid were added. Many staining reagents were used and served as controls on one another.

Preparation of Cestodes.*—Dr. C. W. Stiles states that the fixation of Cestodes for the Bureau of Animal Industry has lately been effected by adding 50 parts of alcohol of 70 per cent. and a few drops of glacial acetic acid to 50 parts of an aqueous solution of corrosive sublimate. The liquid was heated to 45° to 53° C., before adding; it was then allowed to cool for an hour or less; the parasites were next washed in running water and passed through 30 per cent., 50 per cent., 70 per cent., 95 per cent. and absolute alcohol.

Investigation of Myxotheca.†—Herr F. Schaudinn recommends strongly a mixture of hot watery sublimate solution with twice the quantity of absolute alcohol; the alcohol accelerates the entrance of the fluid, while the sublimate preserves the nucleus excellently.

Method for Obtaining Hæmin Crystals.‡—Mr. J. Becker describes the following method for obtaining hæmin crystals from blood-stains mixed with rust. Place some rust in a test-tube, add a little powdered ammonium chloride, and pour over them a little strong solution of ammonia. Cork the test-tube, and shake at frequent intervals. Filter, evaporate by gentle heat a little of the filtrate on a slide, add cover-glass, introduce glacial acetic acid, gently heat and allow to cool. If blood be present hæmin crystals will be seen under a high power.

Demonstrating the Cancer Parasite.§—Dr. P. Foà found the best way to demonstrate the cancer parasite was to fix in Hermann's solution, stain for 2–3 hours in a solution of five parts hæmatoxylin and two parts saffranin in twenty parts water, the cell nuclei appearing red and the parasites blue. The latter were distinguishable by the tone of the colour from different kinds of cell degeneration, fragmentation of the nuclei, and from paranuclei. In sixty carcinomas there were only twenty undoubted parasites, and there were special forms in each case. The author notes the presence of numerous granules, frequently in groups, and distinguished as cyanophilous and erythrophilous. He considers these are derived from the cell nuclei, from which they separate to form independent cells, and hence they may form a factor in carcinoma development.

Preparing Sections of Living Cultivations without previous Hardening.‖—Dr. F. Winkler recommends the following method for obtaining sections of cultivations. Of paraffin the melting point of which is 42° he takes a block of a size sufficient to be easily fitted in a microtome clamp, and through this block makes a small hole with a fine cork-borer. By filling up one end with paraffin a culture-tube is made. The paraffin block is then laid in sublimate for one hour, after which

* U.S. Dep. of Agriculture, Bureau of Animal Industry, Bulletin No. 4, 1893, pp. 13 and 14. † Zeitschr. f. wiss. Zool., lvii. (1893) p. 19.

‡ Brit. Med. Journ., 1894, No. 1729, p. 350.

§ Archivio per le Scienze Med., xvii. p. 253; Arch. Ital. de Biol., xx. No. 1. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) p. 813.

‖ Fortschr. d. Med., xi. (1893) No. 22. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 814–5.

the hole is filled with inoculated medium, or the medium may be poured in first and inoculated afterwards. By stopping the opening with paraffin an apparatus for the cultivation of anaerobes is obtained. The block is sectioned under alcohol and may be stained with dilute phenol-fuchsin.

Easy Method for Demonstrating Cholera Vibrios in Water.*—Dr. S. Pouiklo has frequently adopted the following procedure when examining water suspected of containing cholera bacteria. From the top of the sample of water one litre is placed in a sterilized flask, and 10 per cent. sterilized bouillon added. After having been incubated for 24 hours the scum is examined by the ordinary plate method. If large incubators are available two or more litres of water can be used, and the chance of discovering the bacilli much enhanced.

Demonstrating Protozoa and Spirilla in Drinking-water.†—Dr. M. W. Beyerinck finds that the "bacteria-level" procedure adopted by him for describing the respiration figures of micro-organisms is very suitable for demonstrating the presence of Protozoa and spirilla in drinking-water. In this method a small quantity of nutrient gelatin, agar, &c., is placed at the bottom of a test-tube and the latter then filled up with the water to be examined. Very favourable conditions for the development and growth of micro-organisms are found in the column of water exposed to the air on one side, and to an absorbable pabulum on the other. Among the organisms isolated by this method are mentioned the following:—*Oikomonas termo*, *Spirillum undulata*, *Colpoda cucullus*, *Cladothrix dichotoma*, a *Crenothrix*, and various Bacteria.

(4) Staining and Injecting.

Staining Nervous Tissue with Methylen-blue.‡—Mr. G. H. Parker demonstrates the nervous elements of crawfish as follows. Into the ventral sinus of the animals 1/10–1/20 ccm. of a 0·2 per cent. aqueous solution of methylen-blue are injected and the animal is kept alive for about 15 hours. By that time special elements are stained dark blue, and in order to fix the colour, the parts are excised and washed with physiological salt solution and then immersed in a cold saturated aqueous solution of sublimate for about 10 minutes, The water is extracted with a mixture of 5 ccm. methylal and 1 grm. sublimate, in which an abdominal ganglion is allowed to stay for about 15 minutes.

In order to extract the sublimate and to replace the methylal by xylol the preparation is placed in a mixture of 1 vol. pure methylal, 1 vol. of the mixture of methylal and sublimate first used, and 2 vols. pure xylol. After 10 minutes the preparation is placed in pure xylol, wherein it remains for 4–5 days until the methylal is entirely replaced by xylol and the last trace of sublimate is extracted. In order to obtain a good result the preparation must remain in the xylol for a longish time because sublimate is but little soluble in this fluid. When saturated with xylol the preparation may be imbedded in xylol-balsam and inspected

* Wiener Klin. Wochenschr., 1893, No. 14. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1893) p. 27.

† Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 10–15.

‡ SB. Gesell. Naturforsch. Freunde zu Berlin, 1892, pp. 97–8.

as a transparent object, or it may be imbedded in the usual way in paraffin and sectioned. The sections may be stuck on with the Schällibaum mixture of clove oil and collodion, and though they gradually lose colour, are quite useful for a few weeks.

Demonstrating Axis-cylinders.*—Dr. H. Stroebe demonstrates axis-cylinders in the central and peripheral nervous system as follows. The specimens are hardened in Müller's fluid (4–5 months and afterwards for a short time in a thermostat). The hardening is completed in spirit and absolute alcohol, and the specimen having been imbedded in celloidin sections of about 10 μ are cut in the usual manner. The sections are stained in a saturated aqueous solution of anilin-blue for from 10–60 minutes, and then having been washed in distilled water are differentiated in absolute alcohol to a capsuleful of which 20–30 drops of 1 per cent. caustic potash-alcohol have been added. The latter solution is prepared by mixing 100 ccm. of absolute alcohol with 1 grm. of caustic potash, and allowing it to stand for 24 hours and then filtering.

The sections are next washed in distilled water for 5 minutes or so, after which they should be of a bright blue hue. They are then contrast-stained with a saturated aqueous solution of saffranin diluted with an equal volume of distilled water. This takes from 15 to 30 minutes. They are next washed to dehydration in absolute alcohol, and then cleared up in origanum oil or xylol, and mounted in xylol balsam.

Staining Crystalloids of Cell-nuclei.†—Dr. A. Zimmermann finds that while nuclear crystalloids and nucleoli have very similar tinctorial relations, yet there are methods which allow of their being differentiated and, further, of showing that they belong to the erythrophilous constituents of the nucleus.

The material was fixed with alcoholic solution of sublimate, with absolute alcohol, or with Merkel's fixative (1 vol. 1 per cent. chromic acid, 1 vol. 1 per cent. platinum chloride, and 6 vols. water).

The preparations were then stained with: 1, acid fuchsin; 2, acid fuchsin-picric acid; 3, fuchsin-picric acid; 4, fuchsin-iodine-green (in this case the sections, after having been stained with a mixture of aqueous solutions of fuchsin and iodine-green, were placed in a solution of 100 ccm. alcohol, 1 ccm. acetic acid, and 0·1 grm. I, then in xylol, and afterwards mounted in balsam); 5, anilin-water-safranin (in this case, also, the sections were treated with the alcohol-acetic-acid-iodine mixture); 6, hæmatoxylin: the solutions used were those known as Mayer's hæmalum, Delafield's, Ehrlich's, Friedlaender's; 7, hæmatoxylin and ammonia-sulphate of iron $(NH_4)_2Fe_2(SO_4)_4$. When these last were used the solutions were first placed for 30 minutes to 3 hours in 2 per cent. iron solution, and then in an aqueous solution of pure hæmatoxylin for 1/2–12 hours (4 ccm. saturated alcoholic solution of hæmatoxylin, water 100 ccm.). The sections were then washed with water and once more treated with the iron solution, and having been washed in water were mounted in balsam. With this method the results vary with the method of fixation.

* Centralbl. f. Allgem. Pathol. u. Pathol. Anat., iv. (1893) pp. 49–57 (1 colrd. pl., 2 figs.). † Zeitschr. f. wiss. Mikr., x. (1893) pp. 211–9.

Fixing and Staining the Nuclei and Spores of Yeast.*—Herr H. Moeller, after trying many fixatives for yeast preparations, such as 1 per cent. iodo-potassic iodide, absolute alcohol, boiling in amyl-alcohol, and boiling in glycerin, finds that boiling for 1 to 2 minutes in distilled water succeeds best. The author has given up gentian-violet and taken to Heidenhain's method, which consists in treating the fixed cover-glass preparations with ammonium ferric sulphate $[(NH_4)_2Fe_2(SO_4)_4]$. In a 3 or 4 per cent. solution of this ammonia-iron fluid the preparations are immersed for two hours at least. They are next washed in water and then stained for half an hour in a saturated aqueous solution of pure hæmatoxylin. After removal the preparations are again washed in water and then differentiated in the iron solution (1/2 to 2 minutes). This last procedure should be watched under the Microscope.

Staining Spores.†—Dr. P. Jaisohn recommends the following modification of Möller's method. After preparing a slide so that a drop of water spreads evenly on the surface, he gently passes a needle that has touched a recent culture a few times through the water. The slip must then be kept in a thermostat at 35° to 38° till the water is entirely evaporated; the slide is then passed three times through a flame, and placed in 5 per cent. chromic acid for two minutes, washed in water, and placed for three minutes in a solution of 3·5 grm. fuchsin, 35 ccm. absolute, 13 grm. phenol, and 230 ccm. water. After the superfluous stain is washed off, put in Loeffler's solution for two minutes; wash and mount. The bacteria will stain blue and the spores red.

Selective Power of Cells in the Absorption of Pigments.‡—Herr L. Lilienfeld states that nuclein acids derived from various sources take up the same pigment as the framework of the nucleus, while pure albuminoids behave in the same way as the cell-protoplasm. The nuclein-substances of the nucleus always take up the basic, while the albuminoids of the cell-body absorb the acid pigment out of a mixture. If a blue basic and a red acid pigment are mixed, the framework of the nucleus assumes a blue, the cell-protoplasm a red colour. The staining of nuclein-acids by basic pigments suggests the formation of a salt.

Staining Tubercle Bacilli in Sublimate Solutions of Anilin Dyes.§—Drs. Nastiukow and Pewsner have devised the following method for staining tubercle bacilli. A 1 : 2000 solution of sublimate is mixed with anilin oil and then filtered. Of this 10 ccm. are mixed with 1 ccm. of a 10 per cent. alcoholic solution of gentian-violet, methyl-violet or fuchsin, and in this solution the preparations are immersed for five minutes. After having been washed in distilled water they are completely decolorized in dilute hydrochloric acid. The preparation may be contrast-stained in one per thousand solution of malachite-green, or one per two thousand of eosin in sublimate. Preparations thus stained need not be fixed in the flame, nor need the staining fluid be warmed.

* Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 358–60.

† Amer. Mon. Micr. Journ., xiv. (1893) pp. 321 and 2.

‡ Verhandl. Phys. Gesell. Berlin, 1893, No. 2. See Bot. Ztg., li. (1893) 2te Abtheil., p. 297.

§ Wratsch, 1893, No. 3. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) p. 816.

Simultaneous Double Stain for Leprosy and Tubercle Bacilli.*—Dr. P. G. Unna describes a new method of staining leprosy and tubercle bacilli with polychrome methylen-blue, a pigment which must be obtained from Grübler. The method resulted from the observation that some sorts of methylen-blue contained methylen-red as well. By adding alkaline carbonates the red hue was found to be greatly improved, and it is well differentiated by acids, but still better by saturated aqueous tannin solution. The sections are stained for ten minutes to some hours in polychrome methylen-blue solution. On removal they are washed in water and then differentiated by immersion in 33 per cent. tannin solution. They are again washed in water and then dehydrated in absolute alcohol, cleared up in bergamot oil, and mounted in balsam.

After removal from the tannin solution, and having been carefully washed, the process may be varied as follows: immersion in spirituous gold-orange solution or 25 per cent. nitric acid; then dilute spirit, water, absolute alcohol, bergamot oil, balsam.

Staining-differences of Male and Female Cells.†—According to Dr. v. Raciborski, these differences, while well displayed in all higher plants, are wanting in many of the Coniferæ. This author has come to the conclusion that even in the higher plants there is no essential difference between the male and female nuclei, and that their staining phenomena present no argument against the theory of impregnation propounded by Hertwig, Strasburger, and Boveri.

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

Preservative Fluid for Animals.‡—M. Wiese (*sic*) is reported to recommend the following fluid for preserving the bodies of animals in their natural form and colours. 600 grm. of hyposulphite of soda are dissolved in 5 litres of water, and 75 grm. of chloride of ammonia in 250 grm. of water. The two solutions are mixed, and 4 to 6 litres of spirits of wine added.

Formaldehyde for Hardening and Preserving.§—Dr. F. Blum calls attention to the importance of formaldehyde (formol) as a reagent which does not affect the transparency of the tissues, does not precipitate mucin, often allows the natural colours to persist, and causes no shrinkage. He refers to his father's use of this fluid in preserving eyes,‖ and criticizes a recent communication by Hermann.¶ Formol is a 40 per cent. solution of formaldehyde, and the hardening fluid is formol diluted ten times with water.

Microscopical Preparations of Algæ.**—M. A. Lemaire recommends the following process for permanent preparations of green algæ. Fix in a saturated solution of uranium acetate with 0·3 per cent. chrome-alum; leave for from 6–12 hours in the solution, and then wash thoroughly; place on the slide in 2 or 3 drops of a 10 per cent. solution of glycerin;

* Monatshefte f. prakt. Dermatol., xvi. (1893) pp. 399–403.
† SB. Bot. Ver. München, Jan. 8, 1894. See Bot. Centralbl., lvii. (1894) p. 168.
‡ Rev. Scientif., 1893, p. 543. See Bull. Soc. Zool. France, xviii. (1893) pp. 211 and 2.
§ Anat. Anzeig., ix. (1894) pp. 229–31.
‖ Zool. Anzeig., 1893, No. 434.
¶ Anat. Anzeig., ix. No. 4.
** Journ. de Bot. (Morot), vii. (1893) pp. 434–40.

concentrate the glycerin under a bell-glass by means of calcium chloride ; and finally mount in Kaiser's glycerin-gelatin or Behrens' glycerinated ichthyocol.

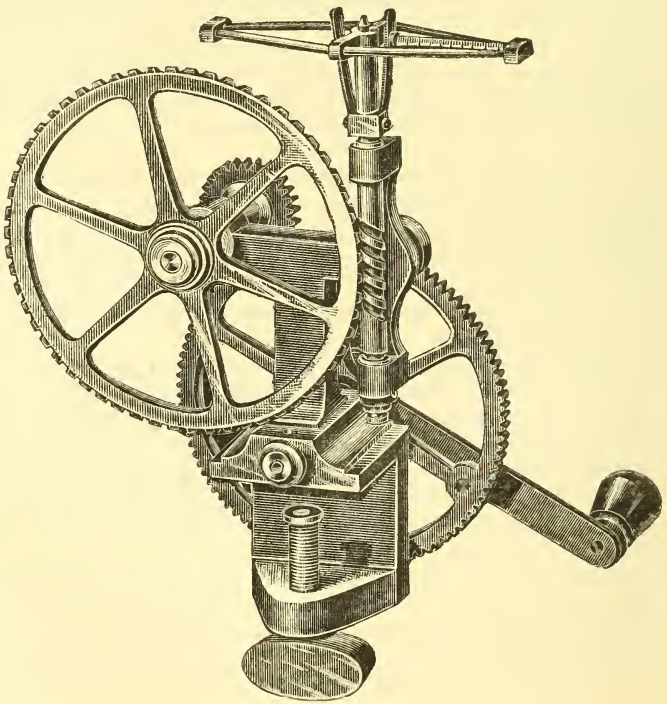
Cleaning Diatoms.*—M. J. Tempère gives a variety of instructions for obtaining diatoms in a condition perfectly free from impurities, including the use of a "sieve-filter" made of silk.

Dr. P. Miquel† states that diatoms even of the length of 50–80 μ will pass through ordinary filter-paper ; and that Berzelius filter-paper is permeable to *Cyclotellæ* of 13–14 μ diam. Diatoms of which both the longitudinal and transverse dimensions are from 20–40 μ do not easily pass these filters, but are liable to be drawn up by capillary attraction.

(6) Miscellaneous.

New Method of Separating the White from the Red Blood-corpuscles by means of the Hæmatokrit.‡— Dr. Judson Daland, in a

Fig. 24.



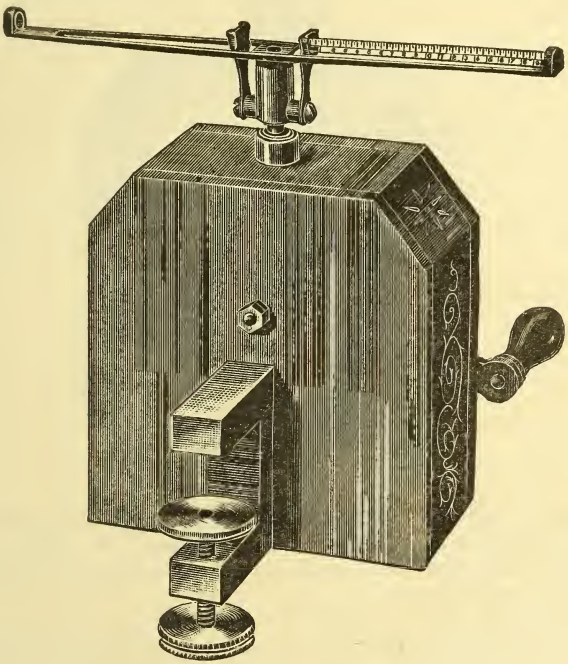
lecture delivered before the Franklin Institute, December 9, 1892, described a modification of the apparatus for separating the white from

* Le Diatomiste, ii. (1893) pp. 21–6 (3 figs.). † Tom. cit., pp. 26–9.
‡ Journal of the Franklin Institute, cxxxvi. (1893) pp. 204–14 (5 figs.).

the red blood-corpuscles which was first suggested in 1885 by Prof. Blix and later perfected by Dr. Hedin.

In Dr. Hedin's apparatus, represented in fig. 24, the glass tubes containing the blood are held securely by a spring in a brass frame at the top of an upright which is caused to revolve 104 times for one turn of the handle. In determining the volume of corpuscles the blood is mixed with an equal quantity of a fluid preventing coagulation and is then rotated, when the red corpuscles form a column at the periphery of the tube.

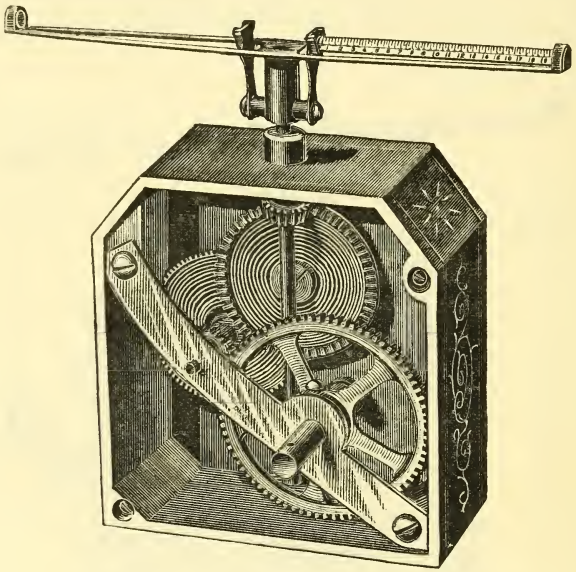
Fig. 25.



The author's improved hæmatokrit (see figs. 25 and 26) presents the following advantages :—The tubes are double the length of those used in Dr. Hedin's apparatus, viz. 70 mm., the lumen is reduced from 1 to 1/2 mm. in diameter, while the divisions on the scale outside the tubes are increased to 200, so that the percentage is at once determined. A series of experiments made by the author on nineteen different solutions led to the choice of a $2\frac{1}{2}$ per cent. solution of bichromate of potassium as the most useful liquid with which to dilute the blood for counting red blood-corpuscles. When this diluting liquid was employed, 100 revolutions of the large wheel or 10,000 revolutions of the frame containing the tubes was found to be amply sufficient to secure a constant volume of red blood-corpuscles. Experiments made by the author upon twenty-five healthy men, with an average age of twenty-six years, in order to determine the normal volume and its

variations, showed that the percentage volume varied from 66 to 44, averaging 51·8. To determine the probable number of corpuscles for each percentage volume, the red blood-corpuscles in each case were carefully counted by means of the Thoma-Zeiss Hæmacytometer.

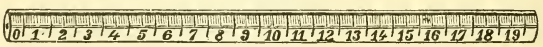
Fig. 26.



The average of all the counts was 5,088,442, so that 1 per cent. volume was the equivalent of 98,578 red blood-corpuscles. One percentage volume may therefore for convenience be considered as representing 100,000 red corpuscles.

From his various experiments the author deduces the opinion "that the hæmatokrit gives as accurate, if not more accurate, results than the Thoma-Zeiss apparatus as ordinarily employed, requires less skill, calls for no eye-strain, and the volume of red blood-corpuscles and number per cubic millimetre, and volume of white corpuscles, may be determined within ten minutes."

Fig. 27.



A table is added showing the variation in the volume of the blood-cells in a variety of diseases.

Bacteriological Examination of Air.*—Mr. J. E. Siebel made a bacteriological examination of air by passing it at about 40° through a

* Mittheil. d. Zymotech. Inst. zu Chicago, ii. No. 9. See Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) p. 140.

Mitscherlich's apparatus, which contained sterilized water. In this way it became saturated with moisture, and this, together with the contained germs, was deposited when the current was transmitted through a Liebig's tube kept quite cold. The deposit was collected and examined bacteriologically, and the quantity of air used was determined by means of an aspirator.

Dithion, a New Antiseptic.*— From his experience in veterinary practice Herr. L. Hoffmann finds that dithion has pretty strong antiseptic action. The medium appears to be useful in the treatment of wounds. A case of tetanus in a horse turned out favourably under the influence of large doses of this substance.

Action of some Sozoiodol Preparations and of Tribromophenol-Bismuth on Cholera Bacilli.†—Dr. A. Dräer finds from experiments that sozoiodol preparations, especially the mercurial and acid, have a powerful disinfecting property as regards cholera, while tribromophenol, even when used of twice the strength (4 per cent.) is not nearly so effective.

* Repertorium d. Tierheilkunde, 1893, No. 1. See Centralbl. f. Bakteriol. u. Parasitenk., xiii. (1893) p. 634.

† Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) p. 97.

MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

Some Improvements and Additions to the Microscope Stand.†—Herr J. Amann points out some slight improvements and additions to the Microscope stand which might be easily realized without raising the price of the instrument to any great extent.

In the first place, he considers that, at least in the larger stands, the lens-system of the Abbe condenser should be made perfectly centering, and remarks that the centering of the condenser has for a long time past been regarded by English authorities as an indispensable condition for any perfect Microscope.

The method of introducing the polarizer employed in most Continental stands, viz. by supporting it in the diaphragm-holder of the condenser, is also capable of improvement, and a simple arrangement which would allow gypsum and mica plates to be rotated independently of the polarizer in a plane at right angles to the optic axis of the instrument is much to be desired.

A further desideratum concerns the use of the fine-adjustment for exact measurements in the direction of the axis. By long use of a Fuess stand, in which the fine division of the screw-head allowed of readings, with the help of a vernier, of a thousandth of a millimetre, the author has convinced himself that an exactness of from 1 to 2 μ can be attained, and that the usual division of the screw-head into 0·01 mm. is not sufficient to bring out the advantages of the present highly perfect construction of the fine-adjustment. For the coarse-adjustment a division which would allow the displacement of the whole optic system to be measured, would be very useful, e.g. in the determination of the focal length of lens-systems. Such a division could be easily made on the body-tube, while a fixed index, or better still, a vernier, was screwed to the arm which connects the body-tube with the fine-adjustment.

It would be further desirable that in all stands the diaphragm on the lower end of the draw-tube should be provided through an intermediate piece with the English or Hartnack screw, in order to be able to adjust weak objectives on the upper focal plane of the stronger objective which serves for the observation. This simple arrangement serves a number of useful purposes; it allows of the micrometric measurement of the iris of the objective, and thus of the numerical aperture; the observation of the diffraction spectra and that of the axial figures in convergent polarized light; it simplifies further the introduction of an analyser immediately above the objective. This arrangement of the adjustment of the Microscope on the upper focal plane of the objective is besides indispensable in the use of the micro-refractometer.

Finally the author expresses the wish that the lacquer of the lower part of the objective should be replaced by an electro-deposit of platinum

* 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., xi. (1894) pp. 1–4.

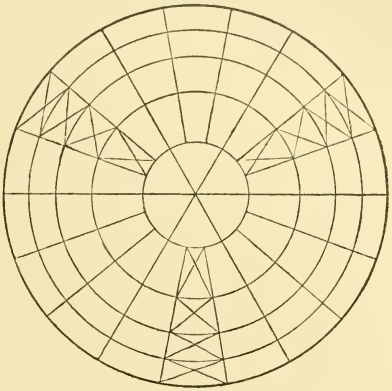
or palladiridium, and better still, that the whole objective and even the whole instrument should be protected from the deleterious effect of chemical reagents by a similar deposit.

3) Illuminating and other Apparatus.

Counting Apparatus specially adapted for Petri's Capsules.*—Dr. F. Lafar has devised a circular counting apparatus in which the area of the main sectional divisions is equal to 1 qcm. Each of these six divisions has an angle of 60° and these are further subdivided into smaller compartments of 20°, so that the whole field is in 18 divisions. The radii of the circles are 13·8 mm., 27·6 mm., 36·6 mm., 43·7 mm., and 50 mm. Three of 20° sectors are further subdivided by cross lines for counting very closely set colonies.

The glass plate in which these lines and circles have been etched is mounted in a circular frame of wood or brass, about 8 mm. high and 9·5 cm. in diameter.

Fig. 28.



(4) Photomicrography.

Photomicrography and Projection.†—Dr. R. Neuhauss contributes the article on Photomicrography to the Photographic Encyclopædia published by W. Knapp, of Halle a. S. It is intended especially for those who have no time to study the more comprehensive text-books, and yet wish to be instructed in the methods which are proposed to obtain useful photomicrograms by simple means.

Simple Photomicrographic Camera.‡—Herr S. Engel has constructed a small camera, resting at right angles on three feet, and considers that the Francotte camera and all other photomicrographic apparatus are greatly inferior to it. Dr. R. Neuhauss, however, states that the Engel model does not differ essentially from apparatus which saw the light forty or fifty years ago, and that the photomicrograms which were taken by Engel with his camera were greatly inferior to most of the photomicrograms taken by others with the Francotte camera and all other photomicrographic apparatus.

Stereoscopic Photomicrography.§—Herr Hansemann describes a method for obtaining stereoscopic photomicrograms which is essentially

* Zeitschr. f. Nahrungsmitteluntersuchung, 1893, p. 429. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 331-3 (1 fig.).

† Encykl. d. Photographie, W. Knapp, Halle a. S., 1894. See Zeitschr. f. wiss. Mikr., xi. (1894) p. 25.

‡ Berliner Klin. Wochenschr., 1893, No. 47. See Zeitschr. f. wiss. Mikr., xi. (1894) p. 26.

§ Verhandl. der Berliner Physiol. Gesellsch., 1892-3; Arch. f. Physiol., 1893, H. 1, 2, p. 193. See Zeitschr. f. wiss. Mikr., xi. (1894) p. 26.

the same as that employed by Dr. W. C. Borden, as described in the April number of this Journal, p. 262.

Photomicrograms for Purposes of Instruction.*—Herr K. Karg recommends the use of photomicrograms for purposes of instruction in preference to the drawings used hitherto. The want of colour is the great drawback, but in spite of this, the beauties of a good photomicrogram are so manifest as to make it preferable to any drawing, even when the latter is really exact.

Hints on Photomicrography.†—Those interested in photomicrography should consult Mr. E. M. Nelson's Presidential Address to the Quekett Microscopical Club, where this experienced and expert worker gives some of the results of his work.

(5) Microscopical Optics and Manipulation.

An Instrument of Precision for producing Monochromatic Light of any desired Wave-length, and its Use in the Investigation of the Optical Properties of Crystals.‡—Mr. A. E. Tutton has devised an instrument for use in the investigation of the optical properties of crystals, which enables the whole field of any optical instrument whose aperture does not exceed 2 inches to be evenly and brightly illuminated with monochromatic light of any desired wave-length.

In this instrument, which resembles a compact spectroscope in appearance, the exit slit is fixed, while the dispersing apparatus is rotatory.

The apparatus consists of a strong stand, carrying a fixed horizontal circle about which two exactly similar optical tubes are capable of counterpoised rotation. These tubes carry at the ends nearest the centre of rotation lens-combinations of 2 in. aperture and 9 in. focal length, and at the other ends a special form of slit with jaws capable of equal movement on each side of the central line, which thus remains fixed. The lenses of the combinations are not cemented together, but held in metal frames, so that no alum cell is required to protect them from the heat rays.

The dispersing apparatus, consisting of a single 60° prism, with large faces, $4\frac{1}{2}$ in. by $2\frac{1}{2}$ in., is carried by a divided and rotating circle, parallel with and above the fixed circle.

One of the optical tubes is chosen as collimator, and sunlight is reflected along it from a mirror attached to a tapped annulus projecting from the slit frame. The other tube is converted into a telescope by the similar attachment of one of three eye-pieces. By the proper adjustment of prism and telescope, it is then possible by rotation of the prism to bring the whole of the spectrum past the exit slit, and to mark the readings of the prism when prominent solar lines are adjusted between the edges of the slit. The mirror and eye-piece are then removed, and by illuminating the receiving slit with any artificial source of light, light of any wave-length may be made to issue from the exit slit by setting the prism to the reading corresponding to that wave-length. The issuing light is diffused by means of a screen of ground glass of fine texture, which is contained in a tube of 2 in. diameter attached to the

* Verhandl. d. Anatom. Gesellsch. 7. Vers. in Göttingen vom 21–24. Mai 1893. See Zeitschr. f. wiss. Mikr., xi. (1894) pp. 25–6.

† Journ. Quek. Micr. Club, v. (1894) pp. 348–65.

‡ Proc. Roy. Soc., lv. (1894) pp. 111–3.

tapped annulus of the frame of the exit slit. The instrument to be illuminated is brought close up to the diffusing tube, which is best distant about 1½ in. from the slit.

The Limits of the Visible.*—Dr. A. Fock discusses the limits of the power of the Microscope, and in view of recent bacteriological discoveries, seeks to answer the question whether there may not be still many enemies to mankind, which our present Microscopes are unable to render visible.

The magnification of a Microscope depends essentially on three factors, viz. the curvature of the lenses, the degree of perfection in their compensation of the so-called chromatic and spherical aberration, and lastly the angle of aperture of the objective.

Now the image formed by the Microscope will only perfectly correspond to the object if all the rays into which the incident light is split up by the dispersive effect of the object are again collected by the objective. If this condition is not fulfilled, an image, it is true, will result, but it will not perfectly correspond to the object; and, according as different parts of the pencil are admitted into the Microscope, one and the same object can give quite different images.

The angle enclosed by the rays resulting from diffraction on the object is smaller, the greater the number of diffracting parts. When those parts have dimensions many times greater than the wave-length the diffracted light forms a narrow pencil, and a small angle of aperture of the Microscope suffices in order to receive all the light. But when the dimensions of the parts of the object are comparable to or less than the wave-length, then the diffracted rays may occupy half the angular space. In this case the Microscope can no longer give a perfectly exact image, since the extreme angle of aperture which the objective can give with the help of immersion lenses is 130°.

Our best Microscopes can resolve with central illumination 2500 divisions in 1 mm. Thus, with central illumination the minimum distinguishable distance is 0·0004 mm. or 0·4 μ. With oblique illumination this can be reduced one-half, and by the use of the ultra-violet rays in producing photographic pictures to 0·12 μ. All objects and structures then, which do not reach these limits, must for ever remain hidden from the human eye.

Now determinations of the size of molecules, made from the kinetic theory of gases, have given for water the molecular diameter of 0·00017 μ, and for carbonic acid 0·00009 μ. The smallest visible object is thus about a thousand times larger than a molecule. From the stand-point of the atomic theory therefore, the existence of an invisible world of life, which would represent a continuation of the micro-organisms known at the present day, is not altogether impossible.

(6) Miscellaneous.

The late Prof. Fol.†—M. M. Bedot has a biographical notice of our late Honorary Fellow, whose fate will, we suppose, remain for ever wrapt in mystery. Hermann Fol was born near Paris, on July the 23rd, 1845; at Geneva, whence his parents came, he was brought under the

* Central-Ztg. f. Optik u. Mech., xv. (1894) pp. 76–8.
† Arch. Sci. Phys., xxxi. (1894) pp. 264–83.

influence of the illustrious Claparède, by whose advice he went to Jena to continue his studies under those two great naturalists, Gegenbaur and Haeckel, with whom the biologists of our time will always associate the name of that little German town. In 1866–7, Fol went with Haeckel to the Canary Islands, having for companions Richard Greef and Nicolas de Miclucho-Maclay. On his return to Europe, Fol studied at Heidelberg, Zurich, and Berlin, presenting at the last his thesis for the doctorate of medicine in the form of a treatise on the anatomy and development of Ctenophores.

At Messina and at Villefranche he devoted himself to the study of the development of marine Invertebrates, and in 1879 he published his well-known "Recherches sur la fécondation et le commencement de l'hénogenie chez divers animaux." For some time he filled the chair of Comparative Embryology in the University of Geneva.

In bacteriology, photomicrography, and the teaching of histology he took considerable interest, and made important additions to our knowledge.

In 1892 he left Havre in the yacht 'Aster' for the coast of Tunis, but the vessel was never heard of after touching at Benodet.

A bibliographical list of 143 papers is appended to M. Bedot's memoir.

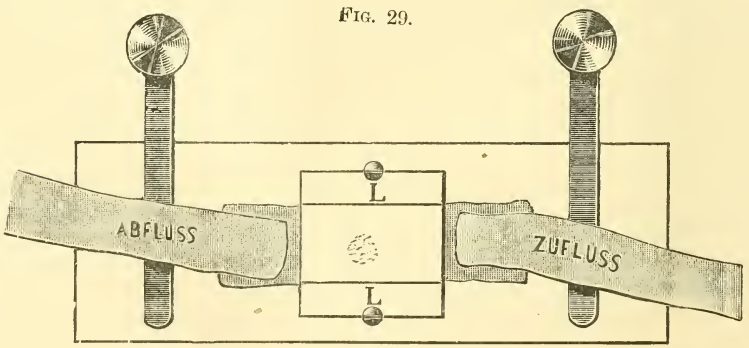
B. Technique.*

Manual of Technique.†—Dr. D. Luis del Rio y Lara has published a manual of technical micrography. It is prefaced with a commendation from Dr. Ramón y Cajal. The first part deals with instruments, the second with reagents, the rest of the book with special methods. It appears to us to be a terse and clear practical guide.

(1) Collecting Objects, including Culture Processes.

Improvement in J. af Klercker's Arrangement for the Cultivation of Living Organisms under the Microscope.‡— Herr A. Scherffel's

Fig. 29.



* 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.

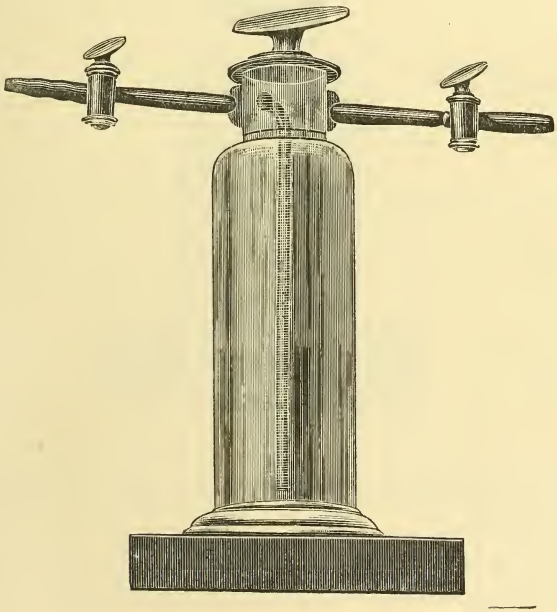
† 'Manual de Técnica Micrográfica general,' Madrid, 1893, 8vo, x. and 277 pp., 208 figs. ‡ Zeitschr. f. wiss. Mikr., x. (1893) pp. 441-3 (1 fig.).

modification of J. af Klercker's arrangement consists in substituting for the caoutchouc ring a quickly setting cement with which to fasten on the cover-glass, fig. 29. The disadvantage of the caoutchouc ring was that it prevented the observation of the whole cultivation space, and necessitated the use of a second object-holder, the effect of which was to raise the preparation so far above the stage that the use of the diaphragms was injuriously affected.

By the author's simplification in the mode of fixing the cover-glass it is possible to observe the whole of the cultivation space and to dispense with the second object-holder.

Apparatus for Cultivating Anaerobic Bacteria.*—The apparatus devised by Prof. F. G. Novy consists of a cylindrical glass vessel closed by a hollow glass stopper, at opposite sides of which are two apertures (fig. 30). From one of these openings a glass tube runs nearly to the

Fig. 30.



bottom of the flask. From the neck of the flask project at right angles two glass tubes which can be closed by means of stopcocks. The openings of these tubes in the neck of the flask are made to correspond with the openings in the stopper. It is, of course, obvious that if a half turn be given to the stopper the flask will be closed.

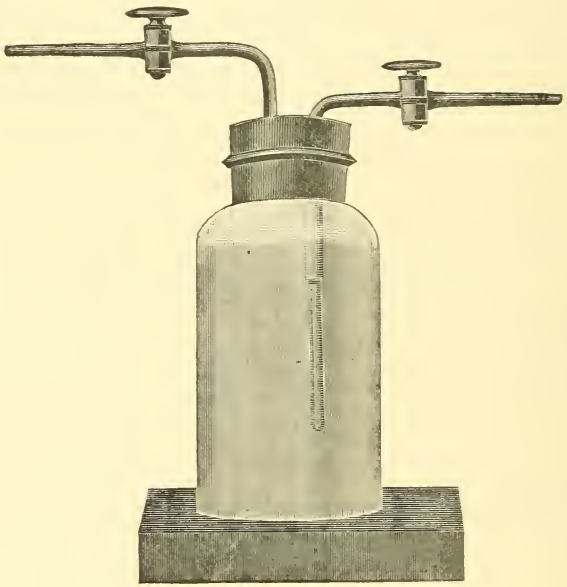
The apparatus can be used for anaerobic cultivation either by filling it with some gas or by exhausting the air. The apparatus is used by first putting the inoculated tubes inside the flask. The stopper is then

* Centralbl. f. Bakteriol. u. Parasitenk., xiv. (1893) pp. 591–5 (2 figs.).

inserted so that the openings therein coincide with those in the neck. The air can then be exhausted by an aspirator attached to one of the tubes or the vessel filled in an analogous way with hydrogen or carbonic acid. If hydrogen, it is advisable to put the gas in at the top and draw out from the bottom, i. e. through the tube opening, and conversely with carbonic acid.

The apparatus is also adapted for the absorption method of cultivation. A strong solution of caustic potash or soda is placed at the bottom

Fig. 31.



of the vessel, the inoculated tubes are put in, and the stopper having been inserted, a strong solution of pyrogallic acid is aspirated through the tube in the stopper.

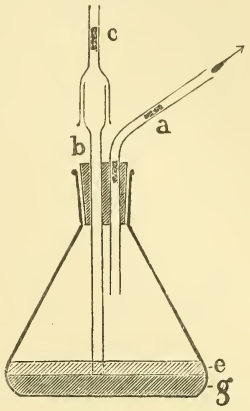
A less costly substitute is easily made out of a wide-mouthed bottle fitted with a caoutchouc stopper perforated with a couple of holes, into which are inserted a couple of glass tubes bent at right angles. Both of these are fitted with stopcocks, and one reaches nearly to the bottom of the bottle (fig. 31).

Apparatus for Bacteriological Examination of Air.* — Dr. H. Cristiani describes the following method for examining air obtained at considerable altitudes from a balloon. A flat-bottomed flask is hermetically closed with a rubber plug perforated by two holes for the passage of two glass tubes (fig. 32). The tube *a* is bent, and is stopped in two places with cotton-wool plugs. Its lower leg only just reaches below the

* Ann. Inst. Pasteur, vii. (1893) pp. 665–71 (1 fig.).

rubber plug. The tube *b* reaches nearly to the bottom of the flask while its upper end is expanded. Over the expansion fits the glass cap *c*, the free end of which is plugged with cotton-wool. This apparatus is termed an aëroscope. The bottom of the flask is covered with a layer of nutritive medium composed of 10 grm. bouillon containing 20 per cent. gelatin. The apparatus and its contents having been sterilized in the usual way, the gelatin bouillon layer is covered with a similar bulk of sterilized bouillon. The tube *b* almost, but not quite, touches the solid layer.

Fig. 32.



A known volume of air, say 10 litres, is drawn through the apparatus by attaching an ordinary pump at *a*. The air bubbles through the liquid medium and deposits its germs there. The two nutritive layers are then melted together by placing the flask in warm water; after which plate or rod cultivations can be made, or what is better, the whole mass may be left in the flask. In the last case the rubber stopper should be replaced by a cotton-wool plug. From the author's experiments made with this apparatus he determined that the atmosphere at an altitude of 1000 metres is extremely pure.

Absence of Phosphorescence in Cholera Cultures.*—In the course of some experiments made for comparing the cholera vibrio with other organisms having some resemblance to it, Dr. Kutscher remarked that two cultivations were distinguished by a strong greenish-white phosphorescence. Further observations made on material from various sources such as water, dejecta, &c., established the fact that no inconsiderable number of these vibrios were endowed with phosphorescence, but that in the cholera vibrio this was absent. The optimum temperature for phosphorescence was found to be about 22° C. Hence the absence of phosphorescence may occasionally be found useful as a negative criterion in the diagnosis of cholera.

Preparation of Nutrient Medium for Bacteria from Eggs.† — In Koch's original method of employing eggs there was the disadvantage that there was a want of uniformity in the composition of the medium; this has been overcome by Dr. Wesener who mixes the yolk and albumen by shaking the egg before boiling; when the egg has been well shaken it should be placed in water at 75° to 80° C. for 1/2 to 3/4 of an hour. It is then transferred to sublimate solution for cooling and for sterilization of the surface; after drying with sterilized wool the shell and its membrane are removed, when the contents are seen to be of a uniform golden-yellow colour. Three or four slices are cut with a sterilized knife, placed in Esmarch's dishes, and sterilized as usual. Among the advantages of this medium are its alkaline reaction, its richness in albumen, and the fact that it is unfavourable to the growth of moulds.

* Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 44–6.

† Centralbl. f. Allgem. Path., Jan. 1894; see Brit. Med. Journ., No. 1736, 1894, p. 56.

Cultivation of Cholera in Uschinsky's Medium.* — Dr. O. Voges finds that Uschinsky's medium (see this Journal, 1893, p. 796) is eminently suitable for the cultivation of cholera, and in many respects decidedly superior to the pepton solution. The experiments showed that cholera bacilli not only formed a fine scum after eight hours' incubation, but that with the exception of *Bact. coli*, other organisms had little tendency to develope and thus complicate the process as they do with the pepton solution. In other words the cholera bacillus can exist on a more scanty diet than many other organisms and are therefore found to predominate. The experiments were conducted in three stages, the first cultivations being made in test-tubes, the second on gelatin plates in Petri's capsules, and the third in Erlenmeyer's flasks in order to ascertain the behaviour when large quantities of the medium and of the material to be consumed were used.

When prepared in large quantity the author found that the medium became cloudy and threw down a precipitate of calcium chloride. This was purposely omitted after it was found that the cholera bacillus throve equally well without it.

The author further found that the medium could be adapted for the examination of water suspected of containing cholera germs. As ordinary water contains the salts suitable for the cholera bacillus it was merely necessary to compose a medium of the following composition :— sodium chloride 4, biphosphate of potash 1, lactate of ammonium 3, asparaginate of soda 2, are dissolved in 100 aq. dest. and the mixture sterilized. By adding 400 ccm. of the water to be examined to this solution a fluid of similar composition to the original Uschinsky's medium is obtained. It is not, however, necessary that a special solution should be made, it is quite sufficient to put the salts alone in the water to be examined.

The chief merit of this medium is that after an incubation of eight to ten hours a thick scum of cholera vibrios in almost pure cultivations is obtained. By admixture with 2 per cent. of agar a good solid medium is obtained and on this the cholera colonies grow readily and in characteristic shape. One peculiarity of this medium is noticeable, it never gives the indol reaction.

Obtaining Germ-free Blood-serum.†—It is of the greatest importance to obtain blood-serum quite uncontaminated by mixture with air, says Dr. J. Kuprianon, as then its qualities need not be damaged by the action of heat or disinfectants. A sheep is brought into the laboratory and having been properly fixed the neck is shaved, and the vein and artery are exposed with the usual precautions. The blood is received into flasks holding about 1 litre ; these are stopped with caoutchouc plugs in which are two holes for the passage of glass tubes. One of these, bent at a right angle, is joined on to a rubber tube, to which is fixed a glass cannula. The vein or artery having been clamped the cannula is inserted into the distended part of the vessel and then ligatured. The other tube is stopped with cotton wool. It may be necessary to use several cannulas as they occasionally break. When the blood ceases to flow

* Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 453–7.
† Tom. cit., pp. 458–62 (2 figs.).

from the vein or chokes the cannula, the artery is tried. In this way a large quantity of perfectly germ-free blood is obtained.

The flasks containing the blood are to be kept in a cool place, and by the next day the pale red clear serum has separated. This is removed from the flasks into similar vessels by siphoning the serum from a first flask into another empty one. Air contamination is prevented during this procedure by joining the flasks with a rubber tube, which passes by the intervention of glass tubing through the stopper of one vessel into that of the other. The end of this tube dips into the serum of the first tube. Each stopper has another perforation through which passes a glass tube plugged with cotton wool for filtering the air. If the blood have been carefully taken, and the vessels filled without a mistake, serum thus obtained can be kept for a long time. The quantity of blood obtainable from a lamb weighing 50–60 lbs. amounts to 2–2½ litres, and the blood-serum from this is about 700–800 ccm.

In order to distribute the serum into test-tubes without being contaminated, the author uses the following apparatus. A burette, the upper opening of which is stopped with cotton wool, is connected below with a glass Y-tube, the other two arms of which are joined by clamped rubber tubes; one of these is long and connects with the glass tube dipping into a serum flask. The serum from the flask is put into the burette by siphon action and when a sufficient quantity is obtained the connecting tube is clamped, and then the other tube from which the tubes are to be filled is unclamped, and so on.

(2) Preparing Objects.

Technique for Studying Tubercle Bacilli in Lung.*—Dr. A. Borrel, who has been studying pulmonary tuberculosis after intravenous injection, recommends as fixative saturated aqueous solution of sublimate to which 5 per cent. glacial acetic acid has been added, or a mixture of sublimate and Flemming's fluid. The whole of the lungs are immersed for five or six hours in the fixative, they are then incised to aid the penetration of the fluid. Fixation is complete in about 12 hours. From the sublimate the pieces are transferred at intervals of 24 hours to alcohols of increasing strength (50, 80, 96, 100), after which they are immersed in toluene for 24 hours, then in a mixture of equal parts of paraffin and toluene and finally in paraffin. The sections are fixed to the slide and stained by a method devised by Kühne of Wiesbaden, not published but communicated orally to the author. It consists in using hydrochlorate of anilin (salzsaures Anilin) as a decolorant, and its special advantages are that it is less harmful to the tissues than acids, and while it will decolorize the tissues in a few seconds it does not remove the stain from tubercle bacilli. The preparations are stained for 10–15 minutes in Ziehl's solution and then treated with an aqueous 2 per cent. solution of anilin hydrochlorate. They are then differentiated and dehydrated in alcohol and mounted in balsam, or the following procedure may be adopted:—(1) Stain the sections in hæmatoxylin or better still in hæmatein. The latter is preferable and the solution is thus made:—(A) dissolve 50 grm. of alum in 1000 grm. water by aid

* Ann. Inst. Pasteur, vii. (1893) pp. 593–627 (3 pls.).

of heat; (B) dissolve 1 grm. of hæmatein in 50 grm. absolute alcohol. Mix the two while still warm, allow to cool and filter. (2) Wash in water; (3) stain with Ziehl 15 minutes; (4) anilin hydrochlorate 2 per cent. a few seconds; (5) decolorize in alcohol; (6) xylol; (7) balsam.

After decolorizing the preparation may be contrast-stained in aqueous solution of aurantia or of Indian yellow in order to show up the red corpuscles in the blood-vessels and the protoplasm.

New Method for Detecting Tubercle Bacilli in Phthisical Sputum.*—Dr. K. Ilkewitsch dilutes about 1/2 ccm. of sputum with 20 ccm. distilled water and some drops (8–12) of a 30 per cent. solution of KHO. When by the aid of heat and constant stirring the sputum is completely dissolved, some casein, which has also been dissolved by heat-stirring, and 1–2 drops of KHO, are added. This imparts a milky appearance to the hitherto transparent fluid. The mixture is then poured into a test-tube, a few drops of acetic acid are added, and the whole is transferred to a brass tube (about 20 ccm. contents), the end of which is conical. The tube is then fixed in the centrifuge by means of a special apparatus devised by the author, but which is unimportant so far as the principle of the process goes. After centrifuging for 5–10 minutes the sediment which has collected in the conical end is removed by unscrewing the cap. The cap is just like the end of a pencil or stylograph, and the sediment is prevented from escaping by dropping down a little ball which shuts it in during removal. The sediment is then removed, spread on cover-glasses and treated in the usual manner.

The principle on which the foregoing method is founded is derived from the fact that casein of milk (lactoglobin) is of all proteids the most sensitive to the action of acetic acid. Hence in this mixture of casein, sputum, and acetic acid, the casein is the first to coagulate, and accordingly, after centrifuging, so much sediment is obtained as casein has been added.

Investigation of Blood of Necturus and Cryptobranchus.†—Miss E. J. Claypole prepared the tissues of these Amphibians by hardening them according to Prof. Gage's picric-alcohol method—95 per cent. alcohol 250 ccm.; water 250 ccm.; and picric acid crystals 1 grm. After two or three days the animal was transferred to 67 per cent. alcohol for from 24 to 36 hours, and then placed in 82 per cent. alcohol. For imbedding, small pieces were dehydrated in 95 per cent. alcohol for 12 to 24 hours, soaked in chloroform for the same time, infiltrated four to five days in an incubator, and imbedded in pure, hot paraffin. For acid staining, hydrochloric acid carmine was found to be most successful.

Investigation of Ancylus.‡—M. E. André found grave disadvantages in the two methods often recommended for fixing Gastropods—the use of picro-sulphuric acid or boiling sublimate. He found that he got the best results by placing the animals on their ventral surface on the bottom of a capsule containing a very little water, and then killing them by suddenly adding boiling water. They should then be placed in a tepid

* Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 162–5.
† Proc. Amer. Micr. Soc., xv. (1893) pp. 66 and 7.
‡ Rev. Suiss. Zool., i. (1893) pp. 429–31.

fixing liquid containing 90 parts of saturated solution of bichloride of mercury and 10 parts of glycerin. After staying in this for a quarter of an hour the animals may be treated with a series of alcohols, beginning with alcohol at 70° containing in solution a small quantity of camphor. Borax-carmine was found to be the best stain.

Development of Cirripedia.*—Mr. T. T. Groom was able to trace in watch-glasses part of the development of ova of Cirripedes obtained by direct removal from the ovaries, but after a certain time the process invariably ceased; the cause of this could not be discovered. Most of the embryos were sufficiently transparent to show most of the details of their anatomy by transmitted light; Abbe's condenser was frequently found to be of considerable assistance, the oblique light often being very necessary in order to make out the cell boundaries.

For the histology of the embryos picro-nitric, picro-acetic, and picro-sulphuric acids and Perenyi's fluid were good. For examination of unstained Nauplii weak osmic acid, as recommended by Dr. Koch, was found useful, as was also weak iodine. Embryos preserved with corrosive sublimate or with Perenyi's fluid stained well with borax-carmine, but those that had been treated with chromic acid were difficult to stain, as might indeed be expected.

A useful table is given of the months in which eggs, Nauplii or Cypris-stages have been obtained by the author or others.

Preparing and Staining Cover-glass Preparations.†—Dr. A. A. Julien describes at some length procedures for obtaining undistorted and well stained preparations of micro-organisms and their cilia, and suggests that the dried bacterium film should be obtained in the following way:—A drop of the cultivation is to be diluted with sterilized distilled water. Some of this fluid is distributed on cover-glasses and the organisms there killed and fixed by the addition of some suitable reagent (e. g. tannin or chromic acid). The covers are allowed to dry slowly and at a low temperature. Before staining the film is treated with some mordant. The mordant recommended is a mixture of tannin and acetate of iron. (To 10 ccm. of 20 per cent. aqueous solution of tannin a solution of acetate of iron is added until it becomes violet-black; then add 5–10 drops of acetic acid, and 4 ccm. of 12 per cent. carbolic acid, and filter.) For staining the films, a solution is made by mixing 100 ccm. of anilin with 1 per cent. sodium hydrate added drop by drop until a neutral reaction is obtained. Then 1/2 grm. of fuchsin is dissolved therein, with shaking. The solution must be filtered before using, and when it loses colour more fuchsin must be shaken up with it.

The author lays considerable stress on two points, rapid fixation and slow drying of the film.

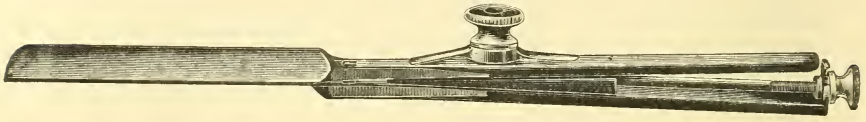
(3) Cutting, including Imbedding and Microtomes.

New Double-knife.‡ — Herr P. Schiefferdecker describes a new double knife made by W. Walb, of Heidelberg. As seen in fig. 33 the blades have the razor form. The handle, which like the blades is

* Phil. Trans., 183 B. (1894) pp. 122–5.
† Journ. New York Micr. Soc., x. (1894) pp. 1–14.
‡ Zeitschr. f. wiss. Mikr., xi. (1894) pp. 4–5 (1 fig.).

nickel-plated, consists of the two shanks belonging to the two blades, and a metal piece between them, which in longitudinal section forms a very acute-angled isosceles triangle. To the base of this is attached a rod provided with a screw-thread which works in a nut at the end of the handle. By means of the screw the rod and, with it, the metal prism can be moved up and down; the effect of this is to separate the

Fig. 33.



knife-handles, and therefore also the blades, more or less apart. A second nut at the side, by means of a strong spring acting on one handle and a pin on the other, serves to fix the blades in the required position, and at the same time to make them practically parallel. The parallel position is not mathematically exact, but is sufficiently so for many purposes. The knife can be easily taken to pieces to be cleaned.

Imbedding Delicate Objects in Celloidin.*— Dr. A. Elsching recommends that very delicate objects should be immersed in thin celloidin solution for 3–8 days. They are then placed in a glass capsule on the bottom of which the necessary description has been already marked with a coloured oil-pencil. Thick celloidin solution is then poured over them and the capsule closed with a glass plate smeared with thin celloidin solution. This effectually excludes the air, though it is advisable to cover the apparatus with a bell-jar in case of accidents. In 24 hours air-bubbles are removed by turning the preparation over with a needle dipped in the thin solution, and then reclosing the capsule as before. After a few hours, all the air-bubbles will have disappeared and then the capsules may be closed with a dry glass plate. In a few days the celloidin will have become stiff enough to be completely set in 85 per cent. spirit.

Air- and Water-free Celloidin Solutions.†— It is important, says Dr. A. Elsching, that celloidin solutions should be free from air and water. To effectually deprive celloidin of water, the tablets should be cut up into little blocks, the sides of which are not bigger than 5 mm. These are placed between folds of blotting-paper, and first allowed to dry at the room temperature, and then desiccated in an incubator. At this stage they should be of a yellowish hue and of horny consistence. Absolute alcohol may be easily obtained entirely free of water, by repeated treating with freshly dried copper sulphate. The dried cubes are placed in a narrow-necked bottle, with air-tight stopper, and form a layer not exceeding one-fourth the volume of the bottle. The celloidin is then just covered with absolute alcohol, and allowed to stand for about 24 hours, after which the ether is poured in. In a very short time the celloidin is all dissolved, and thus, as no stirring is required, the solution is kept free of air-bubbles.

* Zeitschr. f. wiss. Mikr., x. (1893) pp. 445-6. † Tom. cit., pp. 443-5.

(4) Staining and Injecting.

Use of Thionin.*—Dr. Kantorowicz recommends thionin, which is related to methylen-blue, for staining tissues affected by amyloid changes. While ordinary cells, nuclei, and connective tissue are stained blue or violet-blue, amyloid material stains a light blue or lilac. Preparations should be hardened in alcohol or sublimate, and imbedded in celloidin; sections, after being in 80 per cent. alcohol and washed in water, should be placed for from three to five minutes in a saturated aqueous solution of thionin. The tint may be preserved by removing the section from water to a slide, drying with filter-paper, and dehydrating and cleaning by means of a mixture of anilin oil and xylol (2 parts to 1), or carbolic acid and xylol (1 to 3). Wash off the mixture with xylol and mount in dammar; in other words, avoid alcohol.

Formic Acid Hæmatoxylin.†—Dr. G. Pianese commends the following hæmatoxylin stain, which is made by mixing 6 ccm. of a saturated alcoholic solution of hæmatoxylin with 50 ccm. of a saturated aqueous solution of alum. The solution is exposed to daylight for eight days, and then 20 ccm. of formic acid and 5 ccm. neutral glycerin are added and the mixture filtered. The solution is quite clear and of a reddish hue. It is said to give excellent results in the examination of nerves and their finest ramifications, though, of course, as might have been expected from its composition, it is valuable as a general stain.

New Method of Staining Cilia of Bacteria.‡—M. E. Van Ermengem recommends (1) washing of slides in a solution of 60 grm. bichromate of potash, 60 grm. of concentrated sulphuric acid, and 1000 grm. water; (2) recent agar-cultures; (3) a fixing-bath of 1 part of 2 per cent. solution of osmic acid and 2 parts of a 10 to 25 per cent. solution of tannin, to every 100 ccm. of which 4 or 5 drops of acetic acid may be added. This mixture forms a black ink, a drop of which should be left on the slide for from 5 to 30 minutes according to the temperature. The preparations, after washing in water and in alcohol, should be placed in a nitrate of silver bath (0·5 to 0·25 per cent.). They should then be put into a bath of 5 grm. gallic acid, 3 grm. tannin, 10 grm. acetate of soda, and 330 grm. of distilled water. After a few seconds, replace in silver bath, wash, and mount in balsam.

Method for Staining Flagella.§—Sig. Sclavo states that the flagella of certain micro-organisms are easily stained if cover-glass preparations be treated in the following way. (1) One minute in tannin solution (tannin 1·0 in 100 ccm. of 50 per cent. alcohol). (2) Wash in distilled water. (3) One minute in 50 per cent. phosphomolybdic acid. (4) Careful washing in distilled water. (5) 3–5 minutes in warmed staining

* Centralbl. f. Allgem. Path., Feb. 1894. See Brit. Med. Journ., No. 1736 (1894) p. 56.

† Giornale Internaz. Sci. Med. Napoli, xiv. (1892) pp. 881–94. See Zeitschr. f. wiss. Mikr., x. (1893) p. 501.

‡ Ann. Soc. Med. Gand, June 1893. See Bull. Soc. Belg. Micr., xx. (1894) pp. 29–32.

§ Ministero del Interno: Laboratori Sci. d. Direz. di Sanità, Roma, 1893. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 507–8.

solution of powdered fuchsin dissolved to almost saturation in anilin water and filtered. (6) Wash in distilled water. (7) Dry on blotting-paper and mount in balsam.

By this method the author stained the flagella of *Bac. cyanogenes*, *Proteus vulgaris* and *mirabilis*, *Bac. megaterium*, *mesentericus vulgatus*. With the "typhoid" group the results were variable and inconstant; thus, with *Bac. typhosus* the flagella sometimes stained and sometimes did not. Among the "typhoid-like" bacteria some varieties stained and others did not. The method failed with *Bact. coli*, and the Spirilla of Koch, Metschnikoff, Prior-Finkler and Deneke, though beautiful flagella were seen in some water-organisms.

Staining Flagella.*—MM. M. Nicolle and V. Morax have simplified the somewhat complicated procedure invented by Loeffler for staining the flagella of vibrios. A small piece taken from a recent agar cultivation is placed in a watchglassful of tap-water; the mixture should be only just cloudy. Some of this fluid is spread on clean cover-glasses which have been further purified by passing them frequently through the flame. The cover-glass held with forceps by the edge is inclined at an angle, and the superfluous fluid removed by means of a pipette. It is then allowed to dry without fixation in the flame. The surface is then covered with the mordant (aqueous solution of tannin 20 per cent., 10 ccm.; aqueous solution of cold saturated ferrous sulphate, 5 ccm.; saturated alcoholic solution of fuchsin, 1 ccm.) and heated for 10 seconds. When the fluid begins to vaporize the mordant is tossed off and the surface washed by a stream of water from a dropper. The mordanting and washing are repeated three or four times more. After each washing the under surface of the cover-glass should be dried carefully. The preparation is next stained with phenol-fuchsin and heated once or twice for a quarter of a minute. It is then washed and examined in water. If the staining have been successful the cover-glass is dried and mounted in balsam.

The points on which the authors lay most stress are that the cover-glasses should be perfectly clean, the mordant applied several times, and that the tannin must be pure.

Staining Nuclei of Anthrax Spores.†—Dr. W. Ilkewicz has succeeded in staining the nuclei of anthrax spores by a modification of Kolossow's method, which consists in first treating the preparation with osmic acid and afterwards with tannin or pyrogallic acids. The details of the process are as follows:—The cover-glasses smeared with anthrax are first fixed in the flame and afterwards in the osmic acid mixture, heated until the fluid begins to vaporize. It is then washed and treated a second time in the same way and afterwards goes through a similar process in the reducing fluid. It is then dried and examined in glycerin or balsam.

The fixative is composed of 7 ccm. of a 1/2 per cent. osmic acid solution and 3 ccm. of formic acid. Kolossow's reducing fluid is made by dissolving 30 grm. tannin in 100 ccm. of distilled water and allowing this to stand in an open vessel for 24 hours. It is then filtered and the filtrate mixed with 30 grm. pyrogallic acid dissolved in 100 ccm. distilled water. The mixture is further diluted with 250 ccm. distilled

* Ann. Inst. Pasteur, vii. (1893) pp. 554–61 (15 figs.).

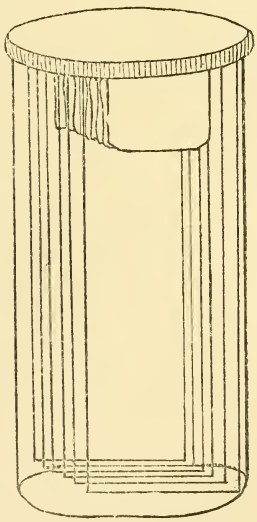
† Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 261–7 (1 fig.).

water, 100 ccm. 85 per cent. spirit, and 50 grm. glycerin. This was modified by the author in the following way; instead of 85 per cent. spirit, 95 per cent. was used, and then with the original reducing fluid two different solutions made. One of these consisted of equal parts of Kolossow's fluid and a mixture of 8·0 pyrogallic acid, 3·0 citric acid, 17·0 natrum sulfurosum, and 150·0 distilled water. The other was composed of 10 ccm. of the Kolossow solution, 3 ccm. spirit, 2 ccm. 20 per cent. tannin, and 1 ccm. glycerin.

Microchemical Staining Reactions of Mucin.*—Besides the already known microchemical staining reactions for mucin, Sawtschenko proposes the following:—Hardening in sublimate; staining with borax-carmine followed by Gram. The smallest particles of mucin, the mucous degeneration of cells of mucous glands, the contents of cancer cells simulating Coccidia and designated by some Sporozoa, assume when stained by this method a deep violet-blue hue, while the capsules of these bodies, as well as the whole of the protoplasm of the cells, are of a pink or red hue.

Weigert's Fibrin Method.†—Dr. S. Ehrmann points out that his previous work on pigmentation has not been duly recognized by Kromayer in his recent application of Weigert's fibrin-method. What is new in Kromayer's communication is the conclusion that the pigment-lines in the epithelial cells represent a breaking-down of the protoplasmic fibres, and this, Ehrmann says, is not true. He believes that the blood-pigment is the material out of which the cell-protoplasm forms the pigment just as the plasmodium malariæ forms melanin. Ehrmann discusses Weigert's method in some detail and has further criticism of Kromayer's work.

Fig. 34.



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

Slide-holder.‡—Dr. Fabre-Domergue has devised a contrivance for holding a number of slides, so that the preparations thereon may be treated by various fluids or reagents without disturbance, and with little trouble and loss of time.

It is a disc of copper, 40 mm. in diameter, on the surface of which are soldered six metal clips. The clips are simply brass plates bent on themselves into a U-shape. In these clips the slides are slipped and fixed with Mayer's albumen and heat. The slide-holder is then transferred successively to a series of bottles containing the various stains and re-agents. These bottles are 85 mm. high and 35 mm. broad, and are placed in a common wooden support.

* Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) p. 485.
† Arch. f. Mikr. Anat., xliii. (1894) pp. 79–95.
‡ Annales de Micrographie, vi. (1894) pp. 84–6 (1 fig.).

(6) Miscellaneous.

Drawing imperfectly visible Details with Camera lucida.* — Dr. J. W. Chr. Goethart uses red-tinted paper for drawing with the camera lucida, and thus obviates the inconvenience arising from the glare of the paper which, under high powers especially, often renders the picture or its details difficult to be seen. One volume of a saturated alcoholic solution of fuchsin is mixed with two or three volumes of 96 per cent. spirit, and the sheets of drawing-paper are immersed in the solution for a few seconds. The paper is then hung up by one corner to dry. After drawing the paper may be decolorized by immersing it in 1–2 per cent. solution of nitrite of potash or soda, to which, while the dish is being moved to and fro, a small quantity of sulphuric acid is gradually added. At a temperature of 40–50° decoloration rapidly ensues, while at room-temperature it is rather slow. As soon as the paper assumes a light yellow tone it is to be carefully washed in clean water, and then dried. The point of the lead pencil should be painted white.

* Nederlandsch Kruidkundig Archief, vi. (1892) pp. 161–5. See Zeitschr. f. wiss. Mikr., x. (1893) p. 467.

PROCEEDINGS OF THE SOCIETY.

The Conversazione.

The Conversazione was held on April 4th, 1894, in the Town Hall of St. Martin's-in-the-Fields, Charing Cross, W.C., and was attended by 378 persons. The following is the list of objects exhibited at the Meeting:—

J. M. Allen, Esq.:—Rotifera: *Brachionus pala*, *Asplanchna priodonta*, *Conochilus*.

Rev. G. Bailey:—Foraminifera from the Neocomian Clay: *Pleurostomella*, *Vaginulina*, *Ammodiscus tenuis*, *Cristellaria*, &c.

Messrs. C. Baker & C. Lees Curties:—Arranged Diatoms, Scales, &c., by E. Thum, Leipzig. Diatoms on Coralline. *Podura* Scale, green screen—Leitz Pantachromatic 1/8 N.A. ·87, Abbe Achromatic Condenser. Pond-life. Arranged Diatoms—Zeiss Apochromatic 1 in. N.A. ·30, Abbe Achromatic Condenser; *Coscinodiscus asteromphalus*, fracture through secondary markings—Zeiss Apochromatic 1/8 N.A. 1·40, Abbe Achromatic Condenser.

Messrs. R. & J. Beck:—Cheese-mites; *Daphnia vetula*; *Diaptomus Castor*.

W. Burton, Esq.:—Rotifera: *Asplanchna*, *Brachionus*, &c.

Mons. A. Certes:—*Spirobacillus gigas* Certes, from the water-supply of Aden.

W. J. Chapman, Esq.:—Rotifera: *Brachionus quadratus*, &c.

H. G. Coombs, Esq.:—Larvæ of Lobster.

T. R. Croger, Esq.:—Vertical Section of *Æcidium*; Group of Seeds.

E. Dadswell, Esq.:—*Frustrella hispida*; *Coryne fruticosa*.

C. G. Dunning, Esq.:—*Limnocodium Sowerbii*, Royal Botanic Gardens, April 1888; *Serialaria lendigera* with polyps expanded.

F. Enock, Esq.:—Fairy Fly, *Camptoptera*. These flies lay their eggs in those of injurious insects.

T. D. Ersser, Esq.:—Frog's Foot showing the circulation, the corpuscles magnified about 450 times—1/7 Ob., B eye-piece.

J. W. Gifford, Esq.:—*Surirella gemma* (axial illumination) in realgar, Spectrum of Malachite-green, glycerin screen.

Commander C. E. Gladstone, R.N.:—Young Sole.

F. Goddard, Esq.:—*Lophopus crystallinus*.

J. G. Grenfell, Esq.:—*Oscillatoria* Tracks and Diatom Threads and Films.

H. Groves, Esq.:—*Nitella flexilis*, showing cyclosis.

J. D. Hardy, Esq.:—Marine Life, &c.

Dr. Hebb:—The "Cancer Parasite" × 600; Psorosperms from Rabbit's Liver; Leukhæmic Blood; Bacilli of Leprosy in Nerve.

F. W. Hembry, Esq.:—*Cladonia coccinea*; *Lamium album*.

E. Heron-Allen, Esq.:—Foraminifera from Torres Straits, 80 varieties.

Rev. R. Hollis:—An African Diamond in the rough condition.

Messrs. W. Johnson & Sons:—Advanced Students' Microscopes; *Filaria sanguinis hominis;* Anthrax Bacilli; Larva of *Anthomyia;* Young Star-fish; Head of *Syrphus ribesii;* Spicules of *Synapta.*

G. C. Karop, Esq.:—Transverse Section of Echinus Spine (*Echinothrix?*); Chromatoscope.

T. J. Lambert, Esq.:—Indian Tortoise Beetle; Head of Earwig.

R. T. Lewis, Esq.:—Eggs and Larvæ of Hemiptera from Natal.

R. Macer, Esq.:—A living Blow-fly.

G. Mainland, Esq.:—*Asterina gibbosa.*

Marine Biological Association (Dr. G. H. Fowler):—Crustacea Decapoda, and Mollusca Nudibranchiata—Collection illustrating the Plymouth Fauna. Collection of Oysters (*Ostrea edulis*), showing local variations.

H. S. Martin, Esq.:—Precious Opal from Queensland.

The President (A. D. Michael, Esq.):—A new and undescribed Acarus from New Zealand, intended to be called *Notaspis spinulosa.* Eggs of the Stone-mite (*Petrobium lapidum*); these eggs appear suddenly, generally in a single night, and often cover large districts; the specimens came from near Bath, where 12 acres were covered as thickly as the stone shown. They may not appear again for many years. *Plumularia setacea* with extended tentacles as in life.

H. Morland, Esq.:—Starch-grains of *Euphorbia splendens; Syndetoneis amplectans.*

E. T. Newton, Esq.:—Kerosine Shale with *Reinschia.*

Messrs. Newton & Co.:—Triple Rotating Electric Lantern. (Figs. 35 and 36.)

The body of this instrument is made entirely of bronzed brass, mounted on four brass pillars and mahogany stand; the base is fitted to a traversing table of polished gun-metal and steel, and has screw movements for centering the arc light and for keeping it centered during use. There are three fronts to the lantern, each placed at an angle of 120 degrees from each other; between each front is a door and sight-hole through which the light may be observed. The front on the left carries a $4\frac{1}{2}$-in. condenser with slide-stage and double achromatic objective for exhibiting ordinary slides and diagrams. The second front is also fitted with a $4\frac{1}{2}$-in. double condenser for parallel beam work, and has a slit front having screw motions and rotating diaphragm. The third front carries the Microscope and micro-polariscope (fig. 36), and is fitted with quadruple 5-in. primary condensers, alum-cell, rotating stage, diaphragms, coarse- and fine-adjustments, and rotating polarizing and analysing prisms, &c. All the parts are interchangeable, and are so arranged that the instruments can be bolted on at will.

W. J. Parks, Esq.:—Water-flea, *Daphnia pulex;* House-fly.

F. A. Parsons, Esq.:—*Perophora Listeri; Daphnia Schæfferi;* Larvæ of *Corethra plumicornis.*

Dr. H. G. Plimmer:—Living Cultures made by Dr. Král, of Prague, of Non-pathogenic Micro-organisms, and of the Bacilli of

Fig. 35.

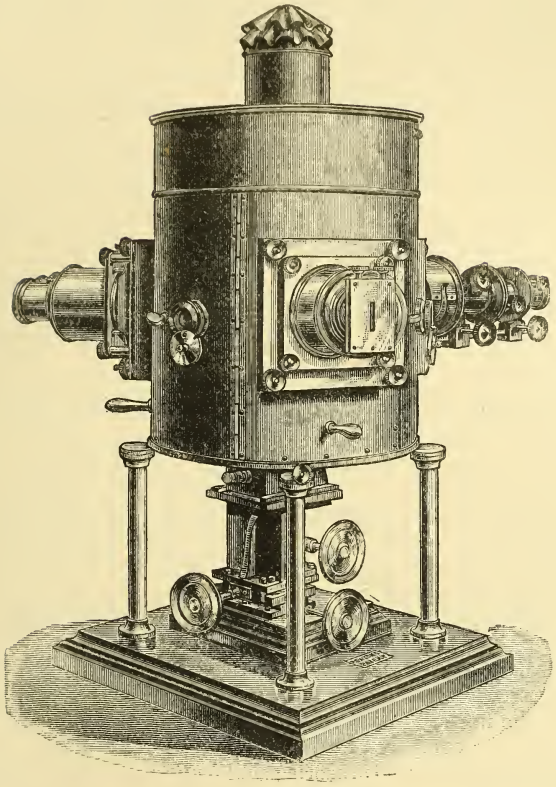
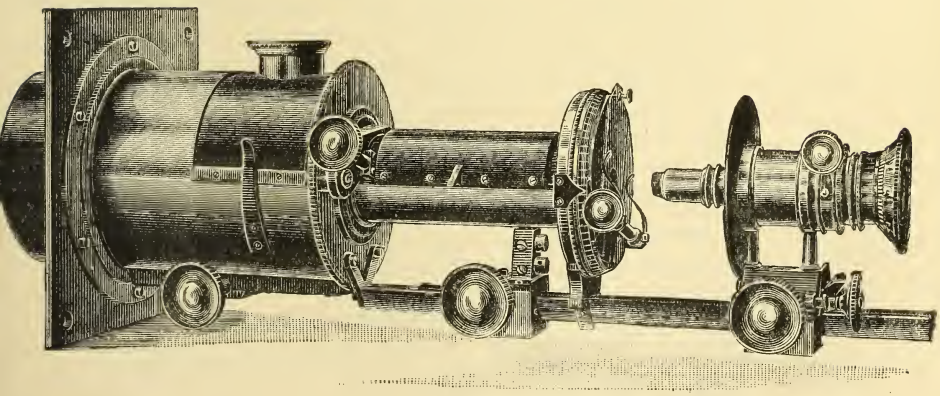


Fig. 36.



Third front.

Tubercle (Consumption), Influenza, Whooping-cough, Thrush, and of various other Pathogenic Bacteria. Protozoa found in Cancer; Flagella of *Spirillum undula;* various Pathogenic Micro-organisms.

T. H. Powell, Esq.:—Circulation in *Vallisneria* with 4/10 Apochromatic Objective, 1/4 Eye-piece, and Dry Apochromatic Condenser.

B. W. Priest, Esq.:—Fossil Sponge Spicules; Sponge—*Lanuginella pupa* Schmidt, 'Challenger' Expedition, Station 192.

J. W. Reed, Esq:—Puckered Schist from Rocks above the Garner Glacier, Zermatt; Granitite from Montanvert; Gneiss.

F. Reeve, Esq.:—Stem of *Eucalyptus globulus;* Stem of *Andromeda floribunda;* Stem of *Pteris aquilina.*

C. F. Rousselet, Esq.:—Micro-aquarium and Aquarium Microscope; Rotifera and Infusoria; Preserved and Mounted Rotifers: *Melicerta ringens*, *Limnias ceratophylli*, *Stephanoceros Eichhornii.*

D. G. Simpson, Esq.:—*Salticus*, Eyes, &c. (Jumping Spider); Arranged Diatoms; Mildew on Wheat (*Puccinia graminis*).

A. Smith, Esq.:—*Bostrychia scorpoidea* with Tetraspores.

G. J. Smith, Esq.:—Rock Sections under polarized light: Andesite from Kremnitz, Hungary, Melaphyre (Palatinite) from Martinstein, and Mica Schist from the Malvern Hills.

A. W. Stokes, Esq.:—Menthol, with a little Fatty Acid (polarized).

W. T. Suffolk, Esq.:—Lips and Mouth of Blow-fly killed with chloroform while feeding.

Messrs. J. Swift:—Alloxanate of Ammonia; Oxalate of Soda; Platinocyanide of Strontia.

J. Terry, Esq.:—*Conochilus volvox.*

J. J. Vezey, Esq.:—Specimens of elaborate mounting: A vase of flowers—the flowers composed of scales from the wings of butterflies, the vase composed of diatoms.

H. J. Waddington, Esq.:—Infusoria: *Folliculina ampulla;* Cœlenterata: *Hydra tuba*, Strobila and Ephyra forms; Ascidia: *Perophora Listeri; Clavellina* just commencing development from winter stage; Annelida: *Cirrhatulus*, &c.; Nudibranchiata: *Doris tuberculata*, the embryos almost mature; Preserved specimens of *Asterina gibbosa* at various stages.

For preserving the *Asterinæ* as permanent objects and at any stage of their development, the best method is to use cocaine hydrochlorate and to allow them to come under its influence very gradually. In this way they die without undergoing any distortion, and may be transferred to weak alcohol of 30 or 35 per cent., and preserved in this fluid, or carried through higher percentages of alcohol to oil of cloves, this removed with re-distilled turpentine, and then mounted in Canada balsam.

Messrs. W. Watson & Sons:—Palate of *Haliotis; Actinomycosis* in Tongue of Cow; Scales and Hairs of Insects arranged as a "Wreath of Flowers"; Winter Bud of Plane-tree; Type-slide of Eggs of Butterflies and Moths; Group of Diatomaceæ from Japan; Young Lobster; Parasol Ant from Trinidad; Bacillus of Leprosy in Section of Skin.

MICROSCOPY.

a. Instruments, Accessories, &c.*

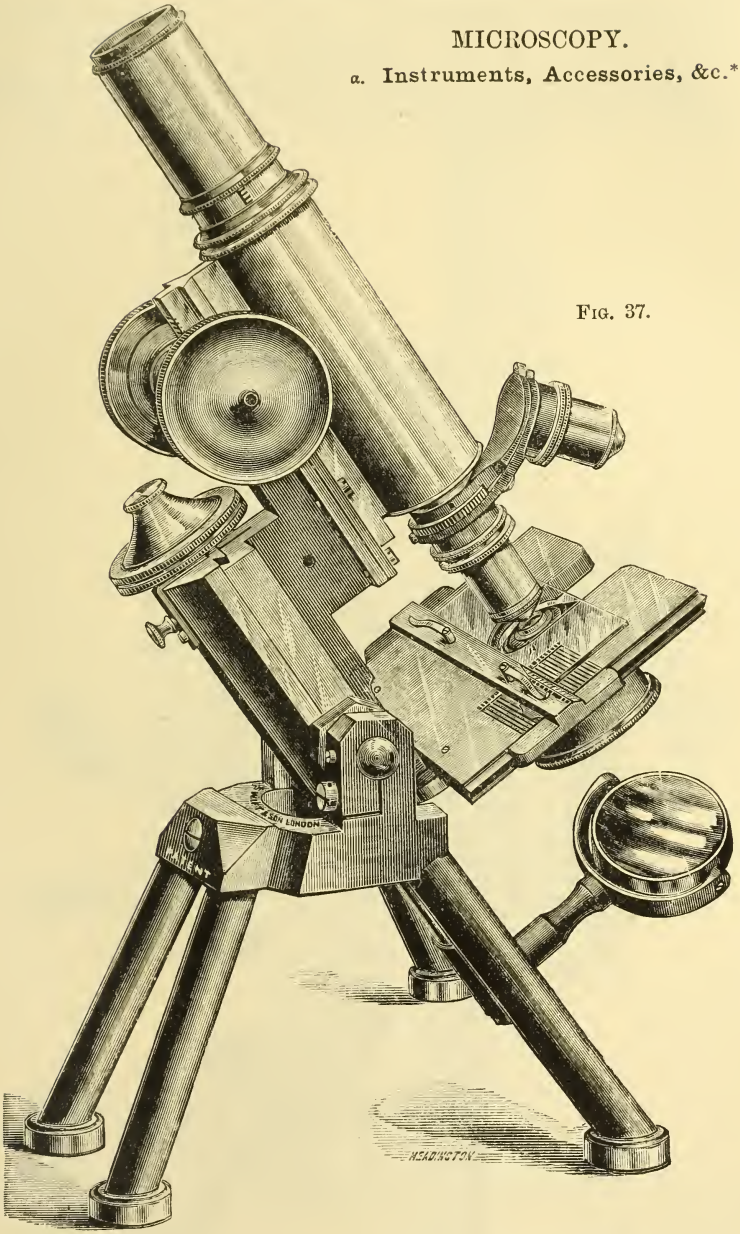


Fig. 37.

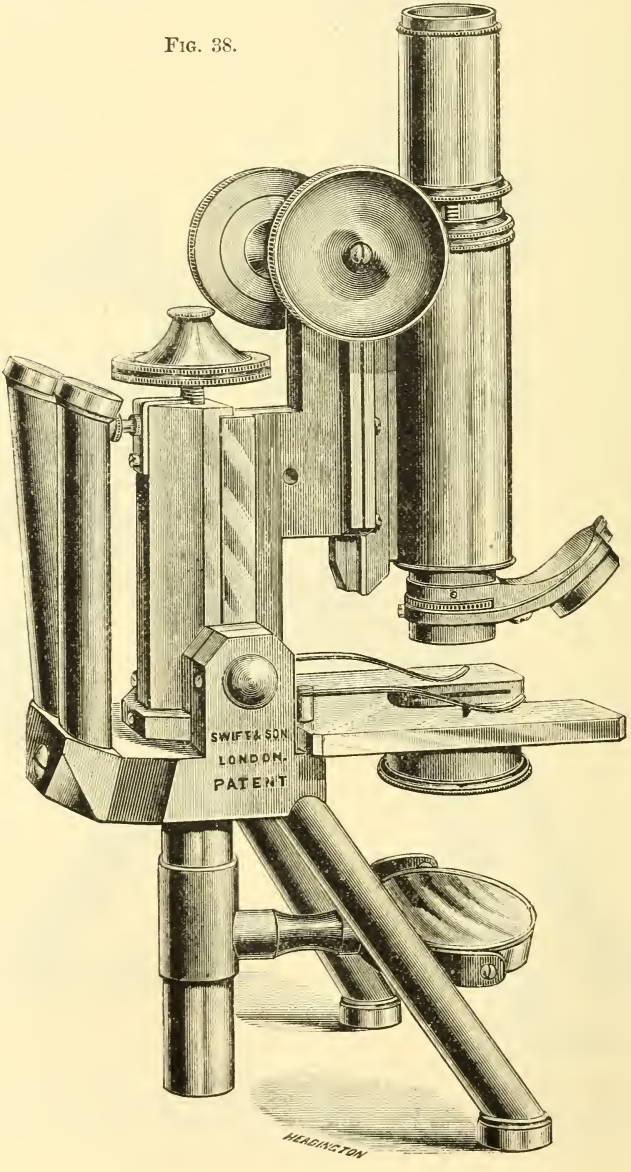
* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

Beauregard, H.—Le Microscope. Paris, 1893, 12mo.

(1) Stands.

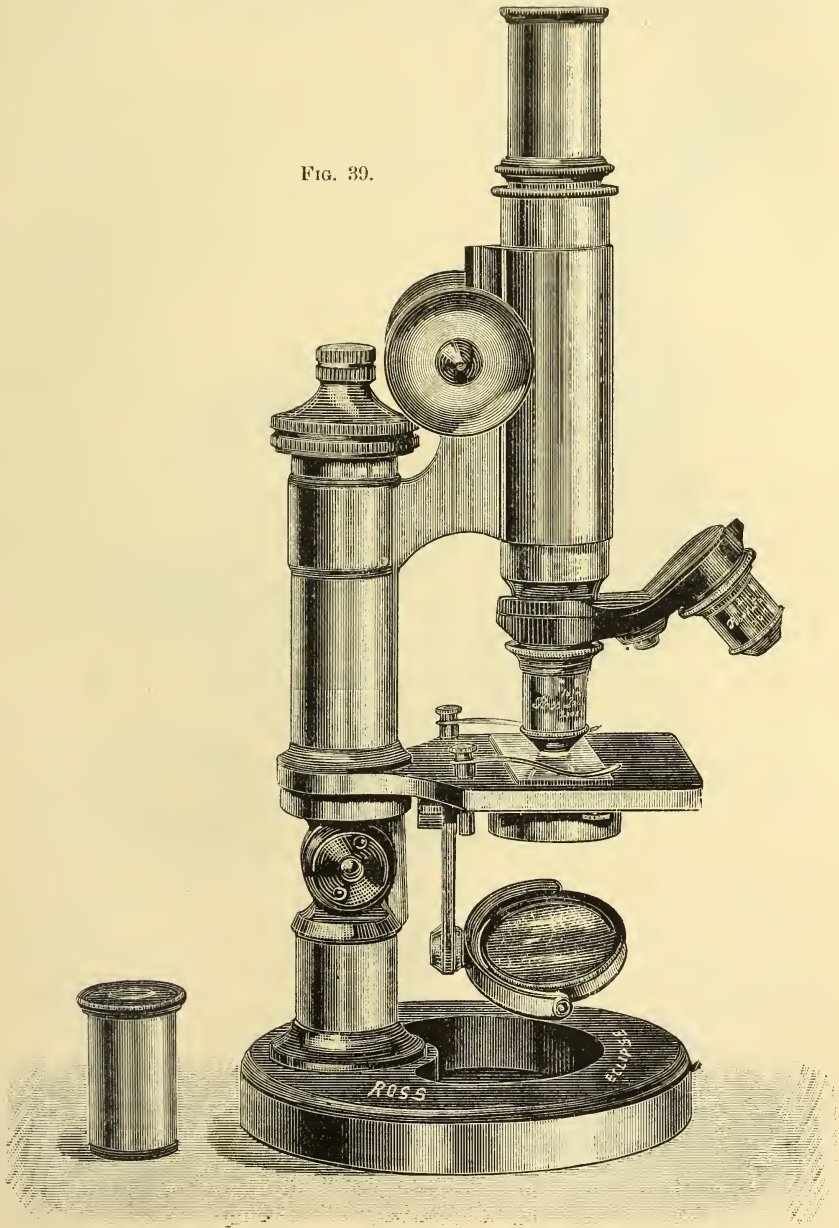
Messrs. J. Swift's Four-legged Microscope.—We give two figures (37 and 38) of this Microscope which was described by Dr. W. H. Dallinger at the meeting of the Society in March last (see p. 285).

Fig. 38.



Messrs. Ross & Co.'s "Eclipse" Microscope.—The stand is mounted on a circular foot, the centre of gravity being so situated that steadiness is secured in every direction (fig. 39). To permit of the inclination

Fig. 39.



of the instrument it is provided with a knee-joint below the stage, and an arrangement has been designed by means of which the pillar rotates on the base, reversing the position of the stand on the foot (fig. 40) so that stability is maintained in all positions. The stage is firmly fixed and is not liable to flexure. The body-tube has the standard screw and

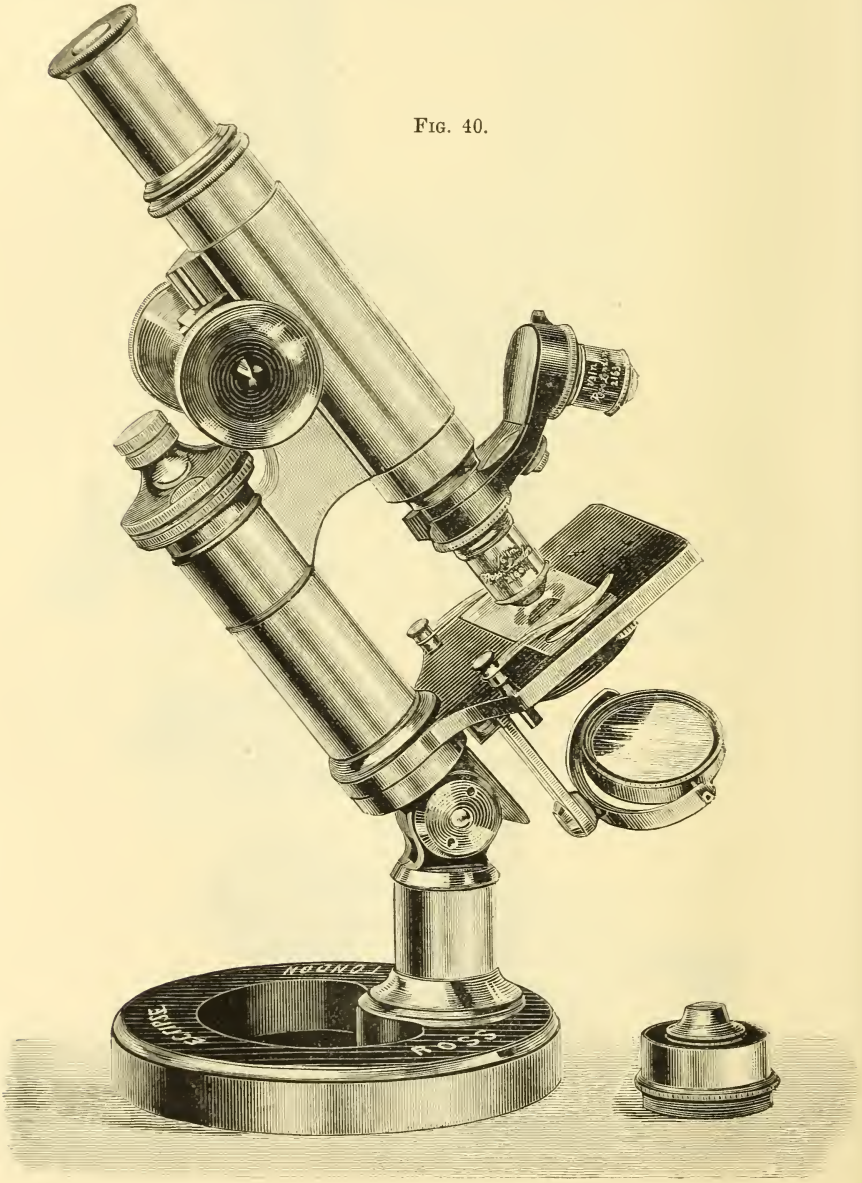
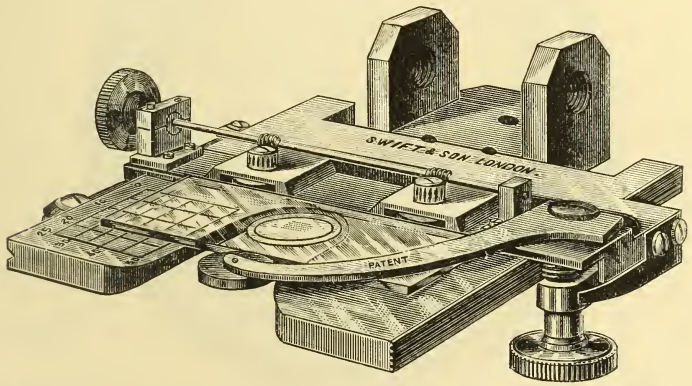


Fig. 40.

carries eye-pieces of the Continental size; it gives the optical tube-length of 160 mm., for which the object-glasses are adjusted, and is extended by means of a draw-tube to 200 mm. The fine-adjustment is sensitive and direct in action, and being independent of set-screws is not subject to derangement; its fitting is by a new contrivance completely covered at all points, and is thus preserved from injury by dust.

The instrument can be obtained in a rigid form, and with sliding tube instead of coarse-adjustment. A petrological stand is also made similar in size and form to the foregoing. It has a revolving circular stage divided to 360°. The analyser, which can be drawn out when not needed, is fitted into the lower end of the body-tube, where also a slot is cut at the angle of 45° for the insertion of the quartz wedge. The polarizer is pivoted to swing out of the field, it has a circle divided into eight and clicked at 0° and 180° to indicate when the nicols are crossed. The eye-piece is furnished with crossed webs.

Fig. 41.



Messrs. J. Swift's new Mechanical Stage (fig. 41).— This stage was described by Dr. W. H. Dallinger at the meeting of the Society for June last (see p. 537).

(2) Eye-pieces and Objectives.

New Objective Setting.*—Dr. R. Steinheil has devised a new method of mounting the lenses of large objectives in their setting, by which the unequal expansion of the glass of the lenses and the brass or steel of the setting is compensated. The mode of compensation hitherto used in large objectives has been by means of a spring on one side of the setting, but this has the effect of destroying the centering of the objective owing to the unequal expansion of the crown and flint glass of the lenses. The author obviates this difficulty by placing between the glass and the setting small rods like the spokes of a wheel. In order that these rods may have the effect of equalizing the different expansions, the material of which they consist and their length must be settled by calculation

* Zeitschr. f. Instrumentenk., xiv. (1894) pp. 170–3 (1 fig.).

from the coefficients of expansion of the glass of the lenses and the metal of the setting.

Now, considering only the linear expansion, a body of length l and coefficient of expansion α will increase in length $l \,.\, \alpha \,.\, t$ for a change of temperature of $t°$. If then γ denote the coefficient of expansion of

Fig. 42.

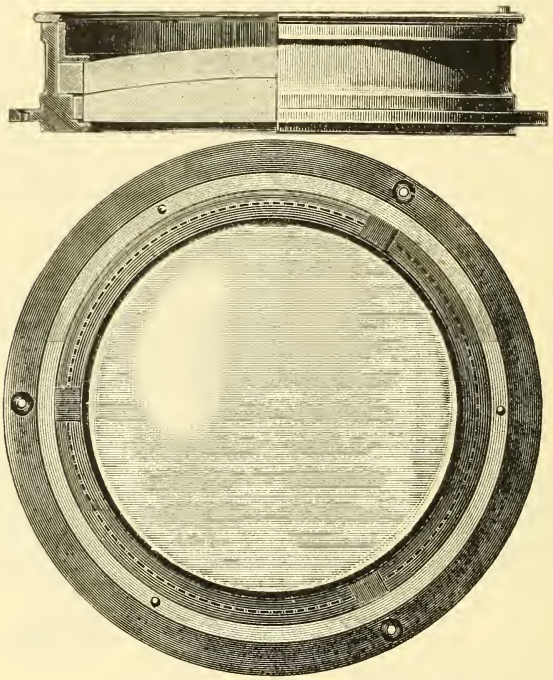


Fig. 43.

the glass, ϕ that of the material of the setting, and σ the required coefficient of expansion of the rod whose length is equal to the difference of the radius of the setting ρ and that of the glass r, we have

$$\rho \,.\, \phi \,.\, t - r \,.\, \gamma \,.\, t = (\rho - r)\,\sigma \,.\, t,$$

or

$$\sigma = \frac{\rho\,\phi - r\,\gamma}{\rho - r},$$

and for $r = 1$,

$$\sigma = \frac{\rho\,\phi - \gamma}{\rho - 1}.$$

Putting $\rho - 1 = l$, the length of the rod, we have

$$\sigma = \frac{(l+1)\,\phi - \gamma}{l} = \phi + \frac{\phi - \gamma}{l}.$$

For a determined length of the rods, this formula gives the coefficient of expansion of the rods and thus the material of which they are to consist. On the other hand. when written in the form

$$l = \frac{\phi - \gamma}{\sigma - \phi}$$

it gives for a determined material the length which must be given to the rods.

The formula shows that the rods can be so much shorter, the more nearly equal are the coefficients of expansion of glass and setting, and the more widely different those of the rods and setting. As an example the author takes the case of a large telescope objective of 50 cm. diameter, consisting of a flint glass lens with coefficient of expansion $\gamma = 0{\cdot}00000788$, and crown glass lens with $\gamma = 0{\cdot}00000954$. The setting was of cast iron, with $\phi = 0{\cdot}00001061$, while the rods were of zinc with $\sigma = 0{\cdot}00002918$.

For the flint, therefore,

$$l = \frac{1061 - 788}{2918 - 1061} = \frac{273}{1857} = 0{\cdot}147.$$

The radius of the flint was however 25 cm., so that the rods for the lens had to be 3·675 cm. long.

For the crown,

$$l = \frac{1061 - 954}{1857} = \frac{107}{1857} = 0{\cdot}05762,$$

and in this case the rods had to be 1·44 cm. long. The objective is seen in section and plan in the figure.

The widest internal diameter of the setting at the part where the flint lens lay was 57·35 cm., while the diameter of the part where the crown glass lay was 52·88 cm. It is quite sufficient if three rods only, separated 120° from each other, are placed between glass and setting.

3). Illuminating and other Apparatus.

Hearson's Biological Gas Incubator (fig. 44).—In this incubator the tank forming the water-jacket is made of stout copper, the outer case being of pine; the space between it and the water-jacket is filled with a non-conductor of heat. The chamber is closed with an inner glass door and an outer wooden one. All the mountings are of bright lacquered brass, and the wood is stained and varnished.

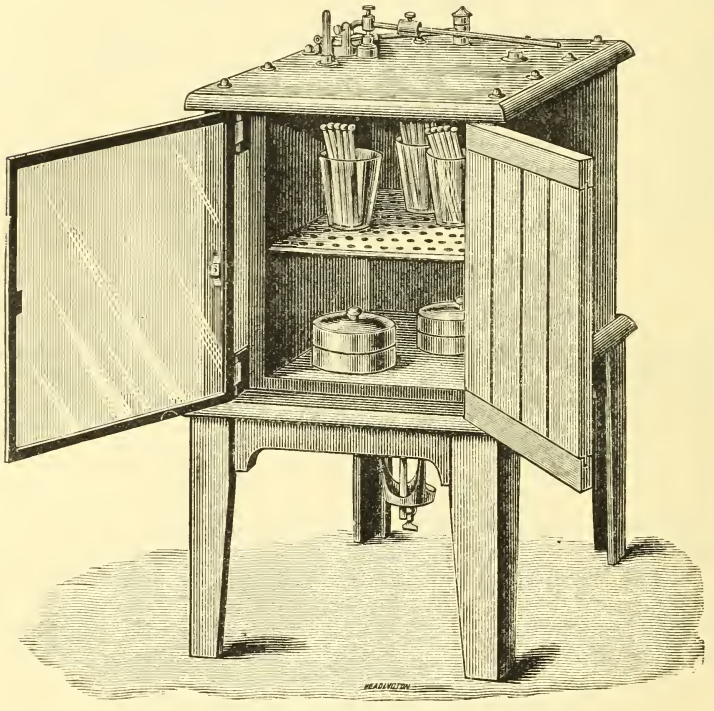
In the incubator, and immediately below the gas valve (fig. 45) which occupies the left-hand back top corner of the apparatus, is a small metallic hermetically sealed capsule, which contains a few drops of a liquid having a boiling point at or near the temperature at which the heated chamber is to be maintained.

The capsule lies in a little holder suspended below the tube, through which the needle under the screw P passes. Soldered to the upper side

of the capsule is a thick piece of metal, having a central depression. In this depression the lower end of the needle seen in fig. 45 rests, and the upper end of the said needle enters a short distance into the socket end of the screw P. Communication is thus established between the capsule inside and the valve outside.

A is the inlet for gas. C the outlet to burner. B D a lever pivoted

Fig. 44.

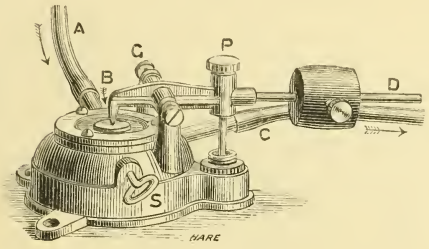


to standards at G, and acted upon by the capsule through the needle which enters the socket below the screw P. The construction of the acting portion of this valve is such that, whenever the end B of the lever B D presses on the disc below the end B, the main supply of gas is entirely cut off. At such times, however, a very small portion of gas passes from A to C, through an aperture inside the valve, the size of which aperture can be adjusted by the screw-needle S, hence the gas flame, which burns in a little lantern below the incubator, is never extinguished.

Changes in atmospheric pressure, however, tend to make the temperature fluctuate about a degree (Fahr.) on either side of the normal. To compensate for these variations, a sliding weight runs on the lever-rod D. But this weight serves a yet more important function. It gives the opportunity of retarding within certain limits the boiling point of

the capsule, and of thus adjusting the temperature at which the capsule shall expand several degrees above that at which it first commenced to

Fig. 45.



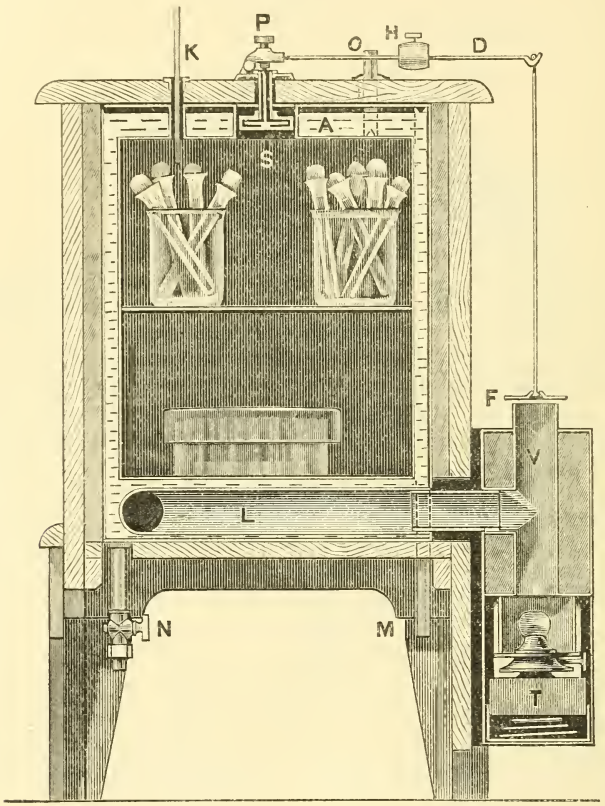
act. By this means a range of about 8° with any particular capsule is obtained.

Hearson's Biological Incubator working with a Petroleum Lamp.—The outer case of this apparatus (fig. 46) is similar to the one already described, save only that the woodwork on the right-hand side is carried lower down to form a support for the lantern in which the lamp T burns. The general construction of the water-jacketed chamber is also the same; but there is a larger water-space below the chamber to make room for a pipe L, which leads the heated products from the flame through the water and back again to the lantern, the lantern being furnished with a second chimney which discharges into the open air a short distance behind the one seen in the illustration. A is the water-jacket surrounding the chamber containing the cultures. O is the pipe through which the water-jacket is filled with water. N is a cock for emptying the same. M is the overflow. S is the capsule contained in a case attached by a tube to the lever plate outside. D is a lever pivoted on the left, and carrying at its free end a damper F, which when resting on the chimney V effectually closes it. P is a screw for adjusting the damper when starting the apparatus. The end of this screw is concave, and into this concavity is inserted the upper end of a wire, the lower end of which rests on the capsule. H is a lead weight for bringing more or less pressure to bear on the capsule. K is the thermometer, the bulb of which is inside and the scale outside the heated chamber. The apparatus having been adjusted according to the instructions, the action is as follows;—The heated products of combustion, not being able to find any exit at the chimney V, pass along the flue L, and parting with the greater portion of their heat *en route*, return again to the lantern by a flue behind and parallel with the one seen in the section, and are thence conducted into the open air by a second chimney placed in the lantern a short distance behind the one covered by the damper F.

The products of combustion continue to move in this direction until the water and, consequently, the chamber are sufficiently heated to distend the capsule. When this point is reached the wire S and P will be pushed up by the capsule, and the lever will cause the damper to rise more or less off the chimney V. In a short time the damper

will be found to hang steadily in one position, and on examining the thermometer at intervals the inside of the chamber will be found to remain steadily at one temperature.

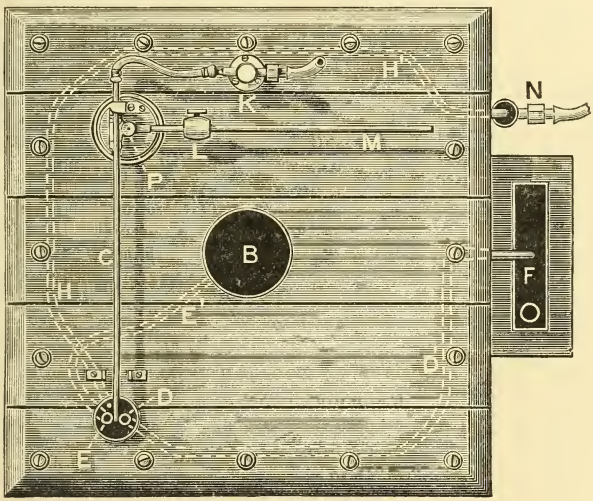
Fig. 46.



Hearson's Patent Cool Biological Incubator for Gelatin Cultures —This incubator consists of a water-jacketed chamber, surmounted by a vessel B (fig. 47) which contains ice, the whole apparatus being surrounded by a thick layer of non-conducting material and wood to protect it as far as possible from the effects of external influences. The regulation of temperature within the chamber is effected by a small stream of water which runs continuously through the apparatus in one of three directions, the choice being automatically determined by a thermostatic capsule. On the top of the apparatus is a lever plate and lever M, similar to the one used in the lamp incubator already described, only, in this case, the damper is dispensed with. A bracket screwed to this plate supports a vertical shaft, pivoted on centres at the top and bottom, which carries a horizontal tube C. In the incubating chamber is a capsule in a holder, supported by a tube screwed to the lever plate. A

stiff wire communicates the motion of the capsule to the lever M, and this lever is so connected with the tube C, that when the capsule expands the tube moves horizontally to the left. At the side of the apparatus is a lantern containing an open boiler F, heated by quite a small gas or petroleum lamp-flame. The bottom of the boiler is connected with the bottom of the water-jacket by a tube, so that the water in the boiler always stands at the same level as that in the water-jacket. The bottom of the ice vessel B has also an outlet which communicates with the water-jacket above the incubating chamber. The water-jacket is provided at the top with an overflow and waste-pipe at N, through which the surplus water escapes. The front end of the little tube C is bent downwards, and immediately under the bent end are two tubes D and E,

FIG. 47.



standing vertically side by side in an open vessel, with a short interval between them. The vertical tube E is connected with the top of the ice-box by a tube E′, and the vertical tube D is connected with the boiler F by a tube D′. The valve K is connected on the right with a continuous water supply, and on the left by means of a small indiarubber tube with the small tube C. The apparatus having been adjusted according to the instructions, the action is as follows:—The stream of water passing the valve K, flows along the tube C, down the tube D, and along the tube D′ to the boiler F, where it is heated, and thence flows into the water-jacket, and increases the temperature. After a time the capsule expands and moves the tube C to the left, thus causing the water to fall between the two tubes D and E. In this case the water is collected in the open vessel in which the tubes D and E stand, and is conducted by the pipe H H′ to the waste-pipe N, without producing any effect whatever on the incubating chamber. If the temperature of the room in which the incubator is placed is above the boiling-point of the capsule,

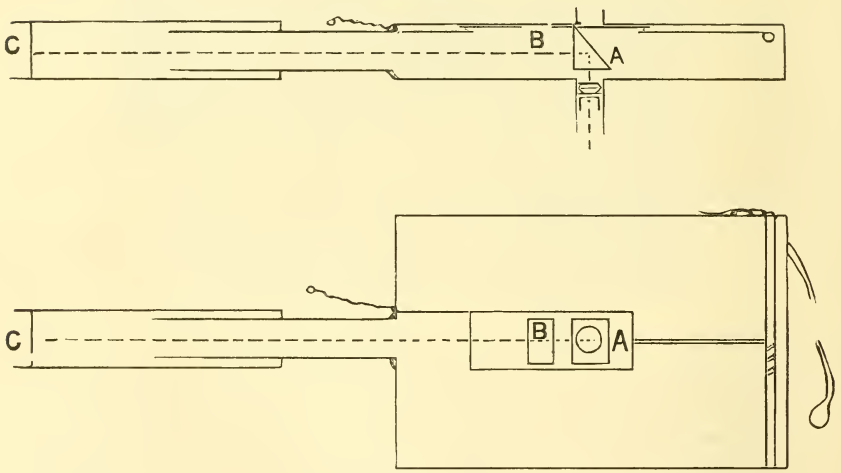
the horizontal tube will continue to travel towards the left, so that presently the water will run down the tube E, along the tube E′, and, passing through the ice-box, will so lower the inside temperature that the capsule will collapse a little, and cause the flowing water to again take up a position midway between the two tubes.

Incubator for any Source of Heat.*—This incubator, described by Dr. H. Reichenbach, is practically a copy of Hearson's. The only difference is the insertion of a pan to contain water on the floor of the incubator. This is intended to moisten the incubation air. The bottom of the incubator is perforated by a series of holes which can be closed by means of a damper. Through these holes the air enters, and passes through the water in the pan before it reaches the incubation space. The level of the water is kept constant by means of a funnel at the side of the incubator. This addition seems rather a complication than an improvement.

(4) Photomicrography.

Apparatus for Obtaining Instantaneous Photomicrographs.—The following is an account of the apparatus exhibited by Mr. C. Lees Curties on May 16th last. This instrument can be attached to any

Fig. 48.



ordinary photomicrographic apparatus, whether horizontal or vertical, and consists essentially of an instantaneous pneumatic shutter, fitted with means of observing and focusing the object to be photographed until the moment of exposure. This is arranged by means of a prism A (fig. 48), mounted in front of the shutter aperture B, reflecting the image at right angles to a grey glass screen C, fitted in adjustable tube.

In using this instrument the shutter is half set, so that the image can be accurately focused in the plane of the sensitized plate. When

* Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 847-50 (2 figs.).

full set, that is, the prism in the path of the optic axis, the image can be focused on the grey glass screen C, by means of the adjustable tube. As any variation of focus in the Microscope will affect both screens equally, all further observations can now be made on the screen C.

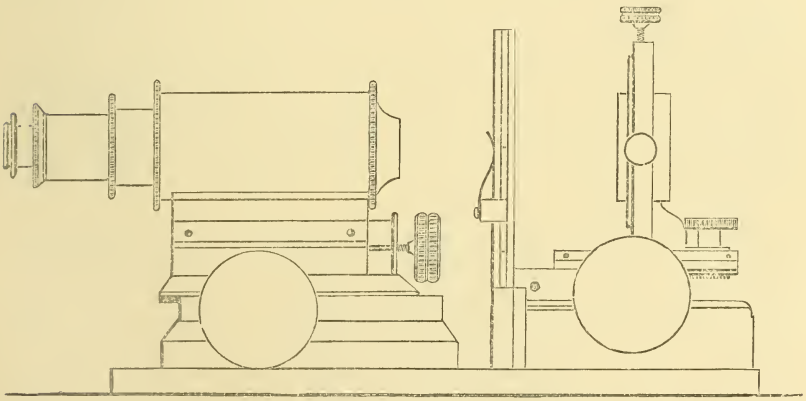
When the shutter is released the prism is carried out of position and the plate momentarily exposed as the shutter aperture crosses the optic axis, the length of exposure being regulated by the width of the shutter aperture, and also by fixing a fan to the pulley.

Human blood taken directly from the arm to the Microscope has been photographed by this apparatus, employing Zeiss apochromatic 1/8 objective N.A. ·95, projection ocular 3, oxyhydrogen illumination, also living specimens of the Rotifera and freshwater animalcula taken with lower power objectives.

Baker's Photographic Microscope.—This instrument is made on the lines suggested by Mr. E. Hartley Turner, of Manchester, and consists of a solid brass base carrying body, stage, and sub-stage.

The body is 3 in. long by $1\frac{1}{9}$ in. diameter, thus ensuring the passage of the whole of the rays emergent from even the lowest power objectives. It is fitted with universal adapter to carry micro-objectives,

Fig. 49.



and its width of tube allows of ordinary short focus photographic lenses being used. Mechanical tube-length from 150 mm. to 270 mm. can be obtained by the use of draw-tubes. The fine-adjustment is of the Campbell differential screw form, and carries only the body, as in the large Nelson model Microscope.

The stage is fitted with sliding bar and removable spring clips, and has a clear aperture of 2 in., which can be reduced by diaphragms. The instrument can be fitted with mechanical stage if desired.

The sub-stage is of universal size, and is fitted with rackwork and centering screws; it has also a sliding adjustment, enabling condensers, differently mounted, to be brought within the limits of the rackwork movement.

All the fittings are sprung, and provided with adjustable screws to compensate for wear.

Lemardeley's Photographic Microscope.*—This apparatus consists simply of an objective, a condenser, and stage for holding the preparation, all attached to a disc which is mounted directly upon the camera. It is thus a Microscope minus the illuminating mirror and tube carrying the eye-piece. The clips on the stage for holding the preparation are below instead of above, so that the preparation may be always placed in the same plane whatever the thickness of the cover-glass. The apparatus is provided with a system of automatic focusing for the use of those who are not familiar with the Microscope.

(5) Microscopical Optics and Manipulation.

A Suggested Method of Increasing the N.A. of Old Achromatic Object-glasses.†—Dr. Piffard, in a paper in the 'Medical Record' for March 24, calls attention to what he claims to be a "simple means of increasing the aperture and improving the performance of some immersion-lenses." He says, "About seventeen or eighteen years ago I purchased of Powell and Lealand a 1/4-in. water-immersion, rated by its makers as having an angular aperture of 143°. This would correspond to a numerical aperture of 1·26, and is, I believe, the highest aperture ever given to a water-immersion lens. Two or three years ago I discovered that it would work perfectly well with cedar-oil, which raised its aperture to N.A. 1·44.

More recently I have ascertained that, by closing the systems as far as the correction-collar would permit, and shortening the tube-length to about 155 mm., the objective would correct perfectly with monobromide of naphthalin. Not only was the over-correction introduced by the monobromide completely neutralized, but the character of the image remarkably improved.

I next investigated the possibility of error in the makers' statement as to the angular aperture, and found that with systems open and water contact the angle measured 143°; with systems half closed and oil contact the angle was 144°; and with systems entirely closed, using monobromide contact, the angle was also 144°. Applying the usual formula N.A. $= n \sin u$ the result gave N.A. = 1·56, the highest aperture, so far as known to me, that has ever been obtained with an achromatic lens, working with crown-glass slides and covers. With the lens used in this manner I have resolved the *Amphipleura pellucida* on a dry mount, and this has been separately verified by my friend, Mr. H. C. Bennett, of this city. I mention this fact in order to show that the lens remained in a state of perfect correction, and stood up to the high eye-piecing which was needed to amplify the image to a point that would enable the resolution to be seen.

A duplicate of my lens and a Powell and Lealand 1/8-in. water-immersion N.A. 1·26, the property of Dr. William Stratford, were also found to work correct perfectly with the monobromide. A 1/6-in. oil-immersion N.A. 1·50 of the same makers failed to do so, possibly owing to insufficient range of adjustment.

Two American oil-immersion lenses of 1/10-in. equivalent focus,

* English Mechanic, lix. (1894) pp. 383-4.
† Medical Record, xlv. (1894) pp. 362-4.

rated by their maker (Spencer) as having N.A. 1·32 and N.A. 1·38, were next tried with monobromide, and found to respond to it perfectly, it being necessary, as with the others, to close the systems and shorten the tube-length. I carefully measured the angular aperture of one of these with water, oil, and with monobromide; I found that its numerical aperture with water was 1·22; with oil, 1·39; and with monobromide, 1·51."

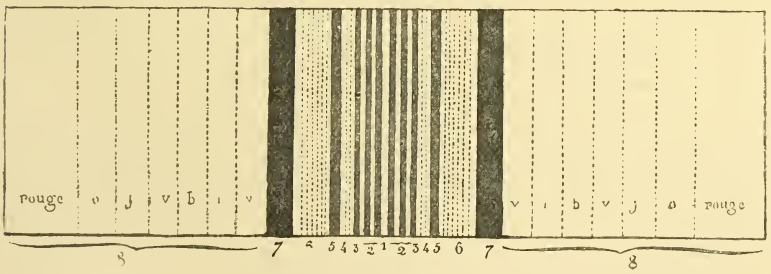
On this quotation it may, Dr. Dallinger remarked, be said that by the use of pure monochromes of the spectrum we can with our achromatic lenses get what is, in effect, a much larger N.A. than the monobromide will represent; and we do not despair of the ultimate use of such a monochrome as will bring the N.A. in practice up to 2·00, or even 2·20, and this will be done with media much more tolerant of organic tissues than the monobromide. Moreover, there is great uncertainty in the results obtained with this latter medium; it is very uncertain with different lenses presenting no normal reason for such difference; and we have in no case obtained what is in an eminent sense a "critical image."

Researches on the Optical Properties of Wood.*—M. C. Houlbert describes the diffraction phenomena exhibited by thin sections of wood, and makes use of them in order to determine the dimensions of the fibres.

In thin tangential sections of wood the opaque walls of the fibres, disposed longitudinally, together with the alternating clear spaces in the interior of the fibres, constitute a system of lines which acts as a diffraction grating.

The following phenomena (fig. 50) are exhibited on looking at a vertical luminous slit across a thin tangential section of sideroxylon

Fig. 50.



(*S. laurifolium*) placed in such a way that the axis of the fibres is parallel to that of the slit:—

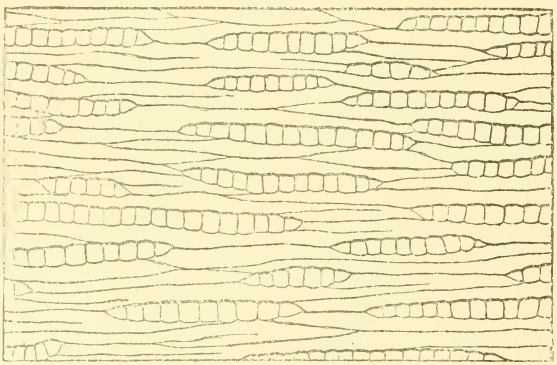
(1) The luminous slit appears very bright, with luminous bands to right and left, diminishing in brightness as they separate from the centre. (2) On each side of the central slit and separated from it by a black band, are two very narrow brilliant lines which represent really two very narrow spectra. (3) Next to these lines comes a black band of slight width. (4) A clearly visible, but narrow spectrum. (5) A black band. (6) A spectrum of appreciable width, in which all the fundamental

* Rev. Gén. de Bot., xvi. (1894) pp. 49–59 (5 figs.).

colours can be clearly distinguished. (7) A black band, wide, but less intense than the preceding ones. (8) A very wide spectrum, of which about half the width is formed by the red colour. Beyond this spectrum comes a grey band of uniform colour.

Analogous results, varying only in the disposition or number of the images observed, are obtained with other kinds of wood. A tangential section of *Stillingia sebifera* (fig. 51) gives two fine spectra on each side of the central slit, but less wide than in the preceding case.

Fig. 51.



The well-known formula giving the intensity I of a monochromatic light of wave-length λ in a direction making an angle δ with the direction of the rays falling on a grating is:

$$(1)\quad I = a^2 \frac{\sin^2 \frac{\pi a \sin \delta}{\lambda}}{\left(\frac{\pi a \sin \delta}{\lambda}\right)^2} \quad \frac{\sin^2 \frac{n \pi (a+b) \sin \delta}{\lambda}}{\sin^2 \frac{\pi (a+b) \sin \delta}{\lambda}},$$

in which a represents the constant width of the transparent parts left between the lines of the grating (corresponding to the lumen of the fibres), and b the width of the opaque lines (corresponding to the thickness of the walls of the fibres); n is the total number of lines of the gratings.

The angle of deviation δ of a monochromatic colour of wave-length λ is given by the relation

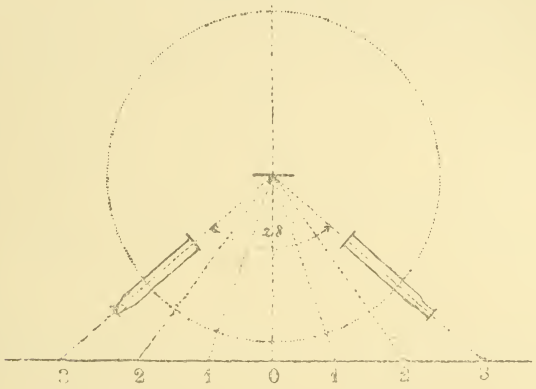
$$(2)\quad \delta = \frac{m \lambda}{a+b},$$

m representing the number of order of the spectrum. Consequently the angle d enclosed between the directions of a simple colour belonging to two spectra of the same order, the one on the right and the other on the left of the central image, is given by

$$(3)\quad d = 2\,\delta = \frac{2\,m\,\lambda}{a+b}.$$

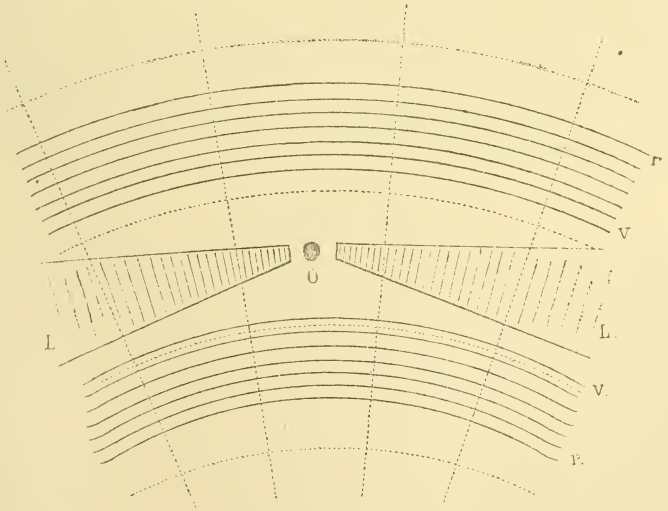
The author has applied the last formula to the calculation of the dimensions of the fibres. The section is mounted on a Babinet goniometer (fig. 52), and the angle 2 δ measured for sodium light by means of the telescope.

Fig. 52.



If a transverse section is taken instead of a tangential one, and a small circular aperture is observed across it instead of a narrow slit, phenomena of very brilliant coloured arcs are exhibited. The luminous circle is seen very clearly in the centre of the figure (O, fig. 53); on each

Fig. 53.



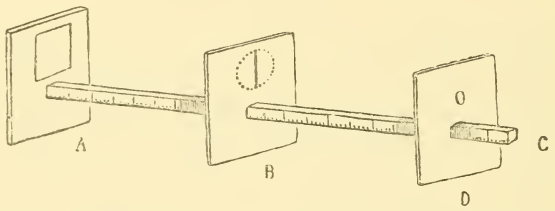
side, inclined in the direction of the layers of the wood, two luminous bands, which widen and become more coloured as they recede from the centre (L), are observed. Above and below these oblique bands, spectra

in concentric arcs are formed, having the violet inside and their concavity in the same direction as the annular layers.

The author describes the *eriometer*, or instrument devised by Young in order to compare the dimensions of organic powders. It depends upon the phenomenon of *crowns*, consisting of a zone of concentric coloured rings, exhibited when a luminous point is examined across a glass plate on which a fine powder is spread.

The instrument is formed of a divided scale C (fig. 54), to which are

Fig. 54.



attached three vertical plates. On the plate A the powder to be examined is placed. The eye is applied to a small aperture O in the fixed screen D. At B is a screen carrying one or more circular series of holes, and a wide slit across which a part of all the rings formed by the powder is seen, when a luminous point is placed behind the plate A. The screen B is made to slide on the rule C in such a way that a ring of the same order coincides in all cases with one series of holes. The angular diameters of the rings are then between them as the distances of the screen B from the aperture O.

Upon the normal phenomena of spectra or of crowns produced by thin sections of wood are sometimes superposed phenomena of interference which complicate them. In the case, for example, when there is a great difference between the dimensions of the clear spaces and the opaque walls, interference fringes are superposed on the diffraction fringes; but, as these interference fringes are very brilliant, they are easily distinguished.

(6)] Miscellaneous.

Introduction to the Study of Microscopy.*—Dr. E. Giltay's work is intended as an introduction to the study of microscopy, and the intention is carried out in a logical and systematic manner by means of a consideration of seven objects, the microscopical characters and peculiarities of each being described and explained, such as coloured objects, starch-grains, milk, air-bubbles, diffraction plate. The description of the objects is preceded by an introductory chapter explanatory of the parts of a compound Microscope.

Micro-Chemistry.†—Prof. H. Behrens' manual is the first general treatise on micro-chemistry which has appeared in the English language.

* 'Sieben Objecte unter dem Mikroskop,' Leiden, 1893, 66 pp. and 8 pls.

† 'A Manual of Micro-Chemical Analysis.' By Prof. H. Behrens. With an introductory chapter by Prof. John W. Judd. London, Macmillan & Co., 1894. See Nature, l. (1894) pp. 122–3.

The first portion of the book treats of the suitable reactions and methods employed in the identification of the different elements. In the second part the author attempts to give a systematic scheme of examination, although at present a general scheme at all comparable with those used in ordinary analysis is impossible. The concluding portion of the work shows the application of the method to ores, alloys, rocks, &c.

"A Little Diversion from the daily cares often comes to those in active business life. Here are some trifles that have come to hand from time to time, which we will share with our readers.

One earnest student, on inspecting the Microscope which we then knew as the 'Histological,' inquired, having some familiarity with the name, whether this is the 'Historic Microscope'?

Another—we think he was a 'first-year man'—made careful inquiry whether we keep the binaural Microscopes? We do not; Microscopes have not yet reached this stage of development, but we make an excellent binocular, of beautiful adjustment, that we can highly recommend. . . .

Did you ever hear of a mythological Microscope? We did, once. Can it be a Microscope for the study of rock sections?

An 'emersion' objective surely must be a dry lens—what say the etymologists?

A daily paper speaks of the wonderful homogeneous inversion object-glasses.

Do our readers know of any objective powerful enough to 'dissolve the striæ of *Amphipleura*'"*

"Some students may have the Leitz's mechanical stage. The following directions copied from the American edition of Leitz's 'Catalogue of Microscopes and Accessories,' published by Richards & Co., of New York, *may* enable them to apply the apparatus to their stands. 'The screw on the right must be lost so, that the lever, of the form of an arc of a bow, can turn around the axis at which it is fixed on the left. Afterward, the stage is to be put on the stage of the Microscope so, that both angle pieces, opposite to the lever, drives the column of the stand; after putting the lever to its place, the screw gets fastened again. At last, the stage, must be fixed to column, by drawing close the other screw, being in the middle part of the lever.'" †

B. Technique.‡

Zimmermann's Botanical Micro-technique.§—Prof. J. E. Humphrey has published an English edition of this useful work, with notes. It is a complete handbook for the botanical laboratory, treating of the following subjects:—The observation of living plants and tissues, the investigation of dead plants, maceration, swelling, clearing, live staining, fixing and staining methods, and microtome technique.

* Microscopical Bulletin, xi. (1894) pp. 9 and 10.

† Amer. Natural., xxviii. (1894) p. 550.

‡ 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.

§ 'Bot. Microtechnique,' by Dr. A. Zimmermann. Translated by J. E. Humphrey, S.D., xii. and 296 pp. New York, 1893.

Short Notes on Bacteriological Technique.*—Prof. Miller calls attention to the following "tips" (*Kniffe*) which he has found useful in bacteriological work:—

(1) Cover-glass preparations may be satisfactorily dried by means of a dentist's air-bellows. The drying may be accelerated by holding the nozzle of the bellows in the flame of a burner.

(2) Collection of condensation water on the cover of a Petri's capsule by turning the capsule upside down in the incubator. Experience has shown that impurities do not arise more often by this procedure than on the usual one.

(3) After a streak cultivation on agar has been made, part of the plate may be covered with a thin layer of agar so that deep and superficial growths may be simultaneously observed. This device is specially useful for photographic purposes, as the deep and superficial growths lie on the same plane.

(4) Fungus-spores in capsules or test-tubes may be destroyed by putting a little calcium chloride on the agar surface and then pouring over it some hydrochloric acid. After this the culture is closed. The spores are killed in a few seconds.

(5) When mice are inoculated they should be narcotized with ether. Take the mouse by the scruff of the neck and the root of the tail and hold it over a Florence flask which contains some ether. (A little practice is necessary for this.) The mouse is anæsthetized in 20–30 seconds and inoculation is much more easily effected than by the aid of any fastening arrangement. Besides this the mouse does not feel the pain, a point always to be considered. Etherization is also extremely useful for examining the character of inflammatory products after inoculation.

Bacteriological Technique.†—Drs. Acosta and Grande Rossi have found that they can leave vessels containing nutrient media and needles uncovered without impairing their sterility for $1\frac{1}{2}$ minutes. In two minutes only one test-tube, and that inverted, remained uninfected, and from $2\frac{1}{2}$–3 minutes nothing remained sterile.

(1) Collecting Objects, including Culture Processes.

New Method of Preparing Culture Media.‡—Dr. J. Lorrain Smith points out the difficulty bacteriologists have to contend with in the fact that the composition of many of the media used for cultivations of pathogenic microbes differs so widely from that of the blood and other fluids found in the animal tissues. He describes a method by which media can be prepared directly from these fluids by a process which reduces the difficulties of manipulation to a minimum.

Break up the white of a hen's egg with an egg-beater till it loses its consistency; add 40 per cent. of water and mix well; pass the mixture through muslin to remove any shreds of insoluble material; add 0·1 per cent. of caustic soda, and solidify in the autoclave. With a little care in clearing it a jelly of egg-white can be obtained which closely

* Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 894–5.

† Crónica Médico-quirúrgica de la Habana, 1893, No. 16. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) p. 876.

‡ Brit. Med. Journ., No. 1744 (1894) p. 1177.

resembles gelatin in consistency. Substances like glucose can be added if desired.

A large variety of bacteria have been found to grow on this medium with great readiness.

Non-albuminous Cultivation Media for Vibrios.*—Dr. A. Maassen recommends that vibrios be cultivated in a normal medium, one made up according to definite rules. The composition of the normal solution is as follows:—7 grm. of malic acid are dissolved in about 100 ccm. of H_2O and neutralized with pure KHO. The solution is diluted with distilled water up to 1 litre, and then there are added 10 grm. finely powdered asparagin, 0·4 grm. magnesium sulphate, 2·0 grm. biphosphate of soda, and 2·5 grm. of pure crystalline soda. When the whole of these ingredients are properly dissolved 0·01 grm. of dry calcium chloride is added.

In this solution the malic acid can be replaced by equivalent quantities of other organic acids suitable as nutrient material, the potash by soda, the asparagin by an ammonia salt of an organic or inorganic acid, by various other nitrogenous organic substances, amides, amido-acids, urea, kreatin; the soda may be diminished and the quantity of water increased. Moreover, to this normal solution in its simple or varied form other assimilable carbohydrate compounds may be added, e. g. mannit, or other kinds of sugar, ethylen-glycol, glycerin, or dextrin.

In such nutrient solutions with variable amounts of cane-sugar, milk-sugar, maltose, galactose, grape-sugar, or dextrin, scum-forming vibrios develope luxuriantly, forming a thick membranous scum in 24 hours. The scum in a few days becomes puckered, and the fluid, at first as clear as water, turns yellow or yellowish-brown, the reaction altering just as it does in sugar-serum-bouillon. When pepton is added the production of indol occurs after the recurrence of the alkaline reaction. In non-albuminous solutions luminous vibrios develope luminosity in 18 hours.

The Bujwid Reaction and Bouillon Cultivations.†—Dr. Inghilleri finds that some micro-organisms are capable of living in bouillon in which cholera bacilli have been previously cultivated and which gives the nitroso-indol reaction very clearly. Their behaviour is, however, not the same, since they act differently on the inorganic combinations of nitrogen; for example, while some develope without modifying the Bujwid reaction, others destroy it. This is specially frequent with the bacilli of the alimentary canal, e. g. *B. coli commune*, which reduces nitrates to ammonia and other combinations of nitrogen. The indol is, however, undecomposed, and in the *B. coli* cultures it actually increases so that it is always possible to demonstrate its presence by means of Kitasato's reaction.

If *B. coli* or *B. typhosus* be cultivated along with cholera bacillus on meat-pepton solution, then the fluid shows, instead of Bujwid's reaction, only that of Kitasato. In this way an important diagnostic criterion of cholera is lost, and this should be borne in mind in reference to bacteriological examination of suspected cholera stools, for notwith-

* Arb. a. d. Kaiserl. Gesundheitsamte, ix. (1894) pp. 401–4. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 922–3.

† Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) p. 688–9.

standing the presence of cholera bacillus the nitroso-indol reaction may fail if microbes capable of reducing nitrates be present in the stools.

Cultivating Influenza Bacillus.* — Dr. Huber, who has examined twenty cases, recommends blood-agar in preference to hæmatogen-agar, as the bacilli grow less vigorously on the latter, and also because puncture cultivations are possible with it. The chief property of hæmoglobin which renders it valuable for cultivating the influenza colonies is that it contains iron, and not because it is a carrier of oxygen. The bacillus can also be cultivated on hæmatogen-bouillon, while the presence of caustic soda was found to be unsuitable.

Growing and Examining Bacterium Zopfii.†—In their experiments Drs. R. Boyce and A. E. Evans employed 10 per cent. gelatin with neutral or faintly alkaline reaction, though there was no appreciable difference in the growth when the reaction was slightly acid. The method of cultivation consists in placing a small piece of moist cotton-wool in the bottom of a test-tube large enough to hold the ordinary 1 by 3 in. slide. The test-tube is plugged and the whole steam-sterilized at 120° for 20 minutes. When cool, a thin uniform layer of sterilized gelatin is spread over the slide, kept in horizontal position, by means of the Pasteur balloon pipette. The test-tube is then plugged and capped to prevent drying. When a streak culture has been made and it is desired to examine the growth, the slide is removed and placed in slightly diluted spirit for a few hours to fix the growth and extract the salts. The slide is then carefully dried, stained by Gram's method, and mounted in balsam.

Ordinary test-tube growths may be examined microscopically *in situ* by just warming the test-tube sufficiently to set the gelatin free, and then sliding it off on to a glass plate. A cover-glass is then put on and the growth examined. The best temperature was found to be about 21° C., which in 24 hours gave a perfect growth; this might be hastened if the back of the gelatin were painted black.

Cultivating Cholera on Eggs.‡—Herr Zenthöfer finds that when pure cultivations of cholera bacilli are grown on eggs there is no evidence of the development of H_2S, the yolk preserving its normal honey-like colour, while the white becomes cloudy and liquefied. When H_2S was demonstrable in any quantity its presence was found to be due to the impurity of the cultivation, the other bacteria predominating over the cholera bacilli. The eggs used were purified by leaving them for more than an hour in a 1–1000 solution of sublimate, a procedure which possibly exerted some slight inhibitory effect on the growth. Some of the cultures were anaerobic, and were grown in an atmosphere of hydrogen.

Plate Diagnosis of Cholera.§—Dr. Elsner adds to 1 litre water 250 grm. gelatin, 10 grm. Liebig's extract, 10 grm. pepton, and 5 grm.

* Zeitschr. f. Hygiene u. Infektionskr., xv. (1893) pp. 954–9. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) p. 439.

† Proc. Roy. Soc., liv. (1894) pp. 300–12 (2 pls.).

‡ Zeitschr. f. Hygiene u. Infektionskr., xvi. pp. 362–7. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) p. 752.

§ Hygienische Rundschau, 1894, No. 7. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) p. 877.

salt, and then heats the mixture in a water-bath at 50° until the ingredients have dissolved. The mixture is then neutralised with soda solution until it has a clearly alkaline reaction, whereupon the white of an egg is added and the whole strongly shaken. The solution is next steam sterilized at 100° for one hour, and afterwards hot-filtered. The filtrate, having been distributed in test-tubes, is steam sterilized on three consecutive days for 16 minutes. This 25 per cent. gelatin remains firm up to 30° C. When plates are inoculated with cholera and incubated at 27°·5–28° the colonies attain in 9–10 hours the same size as when grown on 10 per cent. gelatin at 21° in two days.

Examining Water for Anaerobic Bacteria.*—Herr G. P. Drossbach finds that the absorption method of cultivating anaerobes may be successfully carried out in the following manner. Petri's capsules uncovered are placed on wire triangles and piled up one over another in an exsiccator, the floor of which is covered with some substance eagerly absorbent of oxygen. The author uses iron protoxide or chromium acetate. In using the former the floor of the exsiccator is covered with a layer, 1–2 cm. high, of caustic soda, upon which an equivalent quantity of iron chloride solution is deposited. The lid having been imposed the two fluids are mixed by just turning the exsiccator round and round.

Chromium acetate acts still more energetically than iron oxide as an oxygen absorbent. In this case instead of caustic soda a saturated solution of sodium acetate is used. Upon this an unfiltered saturated solution of chromium sesquichloride is deposited. This solution is previously reduced to a blue colour with Zn + HCl.

Experiments as to Vitality of Anthrax Spores in Earth and Water.†—Drs. S. Sirena and G. Scagliosi record some facts relative to the vitality of anthrax in earth, in sea, drinking and drain water. These media were used sterilized and unsterilized, and kept at rest and in motion. It was found that anthrax spores were alive and retained their virulence in distilled water for over 20 months; in earth, moist, dry, or covered with water, for over 2 years and 9 months; in sea-water for 1 year and 7 months; in drinking-water and in sterilized sea-water for 17 months; in drain-water for nearly 16 months; and in a decomposing spleen for more than 2 years. It would seem that the media in which the anthrax has lived has some influence on the virulence of the organism.

Microbicidal Action of Gallanol.‡—MM. Cazeneuve and Et. and N. Rodet have made experiments relative to the effect of gallanol on the vitality and pathogeneity of bacteria. The organisms used were *B. anthracis*, *Staphylococcus aureus*, *Pyocyaneus*, *Bacillus typhosus*, and *Bacterium coli commune*. They mixed gallanol in various proportions with nutrient bouillon (5–10 per cent. and 0·1 and 0·02 per cent.). Cultivations of the above-mentioned bacteria were quite killed in a short

* Chemikerzeitung, xvii. (1893) p. 1483. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 775–6.

† Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) p. 952.

‡ Lyon Médicale, 1893, No. 45. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 574–5.

time in the 5–10 per cent. mixture. In the 0·1 per cent. the typhoid bacilli were killed. While *St. aureus* was weakened *Pyocyaneus* and *B. coli* were unaffected. The 0·02 per cent. gallanol bouillon had no effect. Experiments on rabbits and guinea-pigs inoculated with 5–10 per cent. gallanol cultivations, confirmed the death of the micro-organisms and showed that the medium was harmless. Inoculations with 0·02 per cent. gallanol bouillon showed that the vitality of the microbes was unaffected, though their virulence was diminished. On account of its harmlessness the authors recommend gallanol for parasitic skin diseases.

Testing Resistance of Bacterium coli commune to Drying.*—Dr. H. Walliczek has made a series of experiments relative to the resistance of *Bacterium coli commune* to drying.

(1) As control experiments pieces of filter-paper saturated with bacterial cultivations were placed for 5 minutes in sterile water, and then sown in gelatin tubes. Many thousands of colonies grew up.

(2) Infected pieces of paper were dried in vacuo by means of the air-pump. This took about 30 minutes. Thereupon they were placed in sterile water for 5 minutes and afterwards in gelatin. In a series of four, 6, 11, 17, and 58 colonies developed.

(3) Pieces of paper were dried under the air-pump, the tap remaining open so that fresh air was constantly aspirated. They dried in 45 minutes. 0, 28, 45, 78, and more than 1000 colonies grew up.

(4) Pieces of filter paper were placed in a sterile capsule. All were dry in 18 hours. 0,0,0,0,0,0 developed.

(5) Infected papers were dried in an exsiccator over sulphuric acid. All were dry in 17 hours. 0,0, 1, 10, and 25 colonies grew.

The author concludes from the foregoing experiments that *B. coli commune* is killed by drying.

Method for Inoculating Gelatin Plates.†—Dr. W. Kruse finds that the most practical and successful way of inoculating gelatin plates is to brush them over with an ordinary camel's-hair brush dipped in the fluid to be examined. The procedure is of great use when examining water for typhoid bacilli, but it has been successfully used for demonstrating diphtheria and influenza bacilli, various streptococci, and Gonococcus. (It might be cheaper and safer to use strips of sterilized blotting paper.)

Technique of Disinfection Experiments.‡—Dr. H. Walliczek, after pointing out the disadvantages of silk, filter and cover-glasses as recipients of bacteria in disinfection experiments, suggests the use of material made out of glass-wool. Such a substratum would allow of the equal distribution of the bacteria, the disinfectant could be easily removed, and would offer a suitable surface upon which the infection-material could be properly disposed, and that too without drying. In default of the general adoption of glass-wool for disinfection experiments, he suggests that the following rules should be adhered to. If the bacteria are resistant to drying and no indifferent medium is known which paralyses the action of the disinfectant, then cover-glasses should be

* Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 949–50.
† Tom. cit., pp. 419–21. ‡ Tom. cit., pp. 947–9.

used for the distribution of the bacteria, and the bacteria should be dried on. If an indifferent medium be known which stops the action of the disinfectant, it is advantageous to use filter-paper, and not to dry the bacteria. If cover-glasses be used the material should be previously dried on in order to prevent it from being washed off unequally.

When the bacteria are not resistant to drying, and no indifferent medium is known, cover-glasses should be used and the material not dried. If a paralysing agent be known then filter-paper should be chosen and drying avoided.

As a substitute for cover-glasses and filter-paper the author has used thin layers, leaves in fact, of gelatin, in order to obtain a regular dissemination of the material. This procedure is, however, not of universal application.

Modification of Wolffhügel's Colony Counter.*—Dr. G. Mie has devised an improvement of the usually adopted counter, the modification of which consists in making the under plate the counter, and using a simple glass plate as cover. The distance between the counting plate and the gelatin is thereby much diminished.

Distribution of Bacteria Colonies in Esmarch's Roll Tubes.†—Dr. B. Körber points out that calculations based on observations of cultivations in Esmarch's tubes are often erroneous, the chief sources of error being that the internal diameter of the tubes is not the same throughout; the section is often not circular but oval, and all tubes have a turn on their long axis.

Combination Hot Filter and Steam Sterilizer.‡—Mr. F. W. Mally recommends that agar and other solid media should be filtered hot in a steam sterilizer, as thereby filtration is facilitated and a germless filtrate produced. A sort of diaphragm with a central hole is placed inside the sterilizer, and on this is fitted a structure 8 in. high, and having a handle at one side. Herein is placed a hollow cone, the upper diameter of which is 4 in., and that of the lower 2½ in. For the top a lid is provided.

Besides the conical funnel, there is a thermometer attached, and the whole is surrounded like the sterilizer with asbestos. The fluid to be filtered is placed inside the sterilizer, and an empty flask of equal size as well. The funnel receives a filter paper, and when sufficiently damped by the moist heat of the sterilizer the contents of the first flask are poured into the funnel and filter into the empty one which has been placed below.

Chamberland Filter Système André.§—M. Lacour-Eymard has examined the working of the Chamberland-Pasteur filter système André. This system adapts to the porcelain bougie a layer of an indifferent powder, "poudre d'entretien," in such a way that dirt is prevented from

* Hygienische Rundschau, 1894, No. 7. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) p. 876.

† Zeitschr. f. Hygiene, xvi. p. 513. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 921–2.

‡ Modern Medicine and Bacteriological World, 1893, p. 275. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 877–8.

§ Rev. d'Hygiène et de Pol. San., 1893, No. 6. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) p. 621.

clogging the filter, which can thus be mechanically cleaned more easily. The author finds that the use of this powder in no way alters the chemical composition of the water, only absorbs about one-tenth of the gases dissolved in the water, and has no influence on the bacteria therein.

The filter will continue to deliver germless water for quite 10 days, provided the pressure be not more than 1 or 2 atmospheres, which the André regulator provides for. The filter should be sterilized every 10 days or oftener, and this is better done by means of alcohol or alum than by heat.

Natural Pure Cultivations of Skin Fungi.*—Dr. P. G. Unna procures scales and crusts which he wishes to examine, by pressing on the diseased portions of skin zinc plaster-mull for some minutes, so that on removal the scabs adhere to it. They are then placed first in benzin and afterwards in hydrochloric acid alcohol, by which they are freed from the plaster. The pieces are then placed on a slide and stained for 15 minutes in strong anilin-water gentian-violet solution. They are next dried and treated for two or three minutes with an iodine solution (5 per cent. iodide of potassium and peroxide of hydrogen solution, of each equal volumes). After this they are again dried, and thereupon immersed for 2 to 12 hours in picro or eosin-anilin.

Demonstrating Sulphuretted Hydrogen generated by Bacteria.†—M. Orlowski availed himself of Fromme's method for demonstrating the disengagement of H_2S by bacteria, the basis of which method is the presence of a metallic salt in the medium; thus Fromme added to peptonized gelatin 3 per cent. of tartrate or saccharate of iron, and cultivated thereon very successfully bacteria of anthrax and typhoid fever, the medium being stained black owing to the development of H_2S.

The author extended the research in two directions by observations on a large number of different species, and by the use of several kinds of chemical substances. To the ordinary cultivation media (gelatin was chiefly used) the chloride or sulphate of iron, the lactate, sulphate, or acetate of copper, the iodide or basic acetate of lead, and also the nitro-prussiate of soda were added. On media of the foregoing composition, numerous different species of organisms were cultivated with the result that while the copper salts strongly retarded growth, the iron, lead, and nitro-prussiate in no way interfered with it.

Bacillus typhosus, *B. coli commune*, *B. neapolitanus*, and bacillus of malignant œdema generate sulphuretted hydrogen as is shown by the discoloration of the medium containing iron. *B. typhosus* gives the strongest evidence, the medium along the track being quite black from the second day. On the nitro-prussiate gelatin the positions are reversed, for *B. typhosus* imparts only a faint blue colour at the end of the track, while with *B. coli* and malignant œdema the colour is deep or bright blue. With lead salts the results were similar to those for iron, a deep black stain along the inoculation track with *B. typhosus* on the second day.

* Monatshefte f. Prakt. Dermatol., 1894, No. 6. See CentralbJ. f. Bakteriol. u. Parasitenk, xv. (1894) pp. 701–2.

† Wratsch, 1893, No. 48. See Ann. de Micrographie, vi. (1894) pp. 120–2.

Copper salts produce a faint red coloration of the medium.

Cultivations from "typhoid" stools by this method showed deep black discoloration of the medium, and in Petri's capsules each colony was stained black, and without liquefaction of the gelatin.

(2) Preparing Objects.

Examination of Eggs of Limax maximus.*—Mr. F. L. Washburn found the most satisfactory procedure was to quickly open the body-cavity of a laying slug, and placing the animal for one minute into a boiling hot solution of corrosive sublimate; then to transfer to water, remove eggs from oviduct, and shell them. The vitellus was allowed to remain in distilled water 2 minutes, then transferred to 35 per cent. and 50 per cent. alcohol for 3 minutes each, and then permanently preserved in 70 per cent. alcohol. For examination of eggs *in toto*, Czokor's alum-cochineal gave, as a rule, good results. Picrocarminate of lithium was also found to be excellent, on account of its differentiating nuclear structures. For section staining on slide, safranin was used for 2½ minutes followed by acid (1/2 per cent. hydrochloric) alcohol of 90 per cent. for 7 to 10 minutes.

Freshly laid eggs placed for 5 minutes in Fol 99 (1 per cent. chromic 25 vols., 2 per cent. acetic 50 vols., water 25 vols.) were shelled in water; the vitellus was in the same solution for 5 minutes, water 10 minutes, and 35 per cent. and 50 per cent. alcohol 5 minutes each, 70 per cent. 30 minutes, and 90 per cent. *ad libitum;* the results were good, taking picrocarminate of lithium very well, if left long enough in stain. They all took borax-carmine very well. Both of these stains did well after the eggs were immersed in chromic 1/3 per cent. for 10 minutes, then shelled in a large quantity of water, vitellus in chromic 1/3 for 4 minutes, and water and grades of alcohol as before.

For permanent preservation of whole eggs it was found satisfactory to use 1 per cent. osmic acid for 5 minutes, and Merkel's fluid for 4 hours; after shelling, water and grades of alcohol, 2 minutes each to 70 per cent. alcohol.

Examination of Tentacular Nerves of Helix pomatia.†—Dr. P. Samassa worked only with fully extended tentacles; these he placed in a 2 per cent. solution of bichromate of potash; for four days a tentacle was laid in a mixture of 4 parts of 2 per cent. bichromate of potash and one part 1 per cent. osmic acid, and then for not more than a day in 3/4 per cent. solution of silver nitrate; 6 or 8 hours will generally be found enough to sufficiently blacken the fibres. Special care was taken to cut the object as soon as possible after removal from the silver solution; it was not hardened in alcohol, but in chloroform, and sections of 25 μ were obtained an hour after removal from silver. Although the author was unsuccessful with Golgi's methylen-blue method he does not despair of ultimate success.

Making and Preserving Specimens of Bacteria for Museum Purposes.‡—Dr. C. Krückmann highly commends the use of formalin for

* Amer. Natural., xxviii. (1894) pp. 528–31.

† Zool. Jahrb. (Anat. Abth.), vii. (1894) pp. 584 and 5.

‡ Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 851–7.

preserving cultivations of bacteria for museum purposes. Formalin, which has a tanning action, is best employed in conjunction with sublimate. The process of conservation is best begun with a solution of moderate strength, and gradually increased to pure formalin, as the colours, if any, are thereby better retained, and the crumpling, which is more or less inevitable, much diminished. This reagent acts well with all media except potato, and the water used for diluting it should be previously boiled. Some of the author's preparations were fixed in the following manner. They were placed in an exsiccator containing formalin instead of sulphuric acid, in order to tan the surface of the medium. They were then covered with a 1 to 10 solution of formalin containing 0·1 per cent. of sublimate. This was afterwards changed for a somewhat stronger solution, and the test-tubes eventually hermetically sealed up.

Preservation of Marine Animals in Formaldehyde.*—Dr. Th. Pintner has obtained excellent results by using 1 per cent. solution of formaldehyde in the preservation of Medusæ, Sponges, and the like. The form and colour are very perfectly retained, and the organisms are usable for histological or anatomical purposes.

(3) Cutting, including Imbedding and Microtomes.

Orienting Small Objects for Sectioning.†—Mr. W. Patten's method for orienting large numbers of small objects is as follows:—Small strips of glazed writing-paper, marked with two sets of raised parallel lines running at right angles to each other, are cut, and at suitable intervals a very small drop of thick collodion and clove oil, about the consistence of honey, is added. The drops are arranged close together along one of the ribs that run lengthwise of the paper. The object to be imbedded is cleared in clove or bergamot oil, not turpentine. It is then raised on the point of a knife, and after the excess oil is drawn off, transferred to a drop of the thick collodion. It may then be adjusted at leisure and will stay in any desired position.

When half a dozen or more objects are oriented in reference to the cross lines (which are to be parallel to the section planes), the whole thing is to be placed in turpentine. This washes out the clove oil and fixes the objects very firmly to the paper. When submerged in turpentine, the relation of each object to the orienting lines can be determined under the Microscope with greater precision than before.

The paper with the attached objects is now placed in the paraffin bath and finally removed and covered with paraffin in the usual way. After cooling in water the block is trimmed and the softened paper peeled off, leaving the objects in the paraffin close to the under surface of the block. This surface is now marked by the orienting lines of the rubbed paper, and also by the record numbers which before imbedding were written with a soft pencil on the paper. The block is now fixed on the microtome, and the objects cut one after the other, as though a single object had been imbedded; or a number of them may be cut together, if they have been arranged with that object in view. For

* Verh. Zool.-Bot. Ges. Wien, xliv. (1894) p. 8.
† Amer. Natural., xxviii. (1894) pp. 360–1.

example, we may use a thinner collodion and arrange a large number of insect embryos or small worms in a compact bundle like a package of cigarettes, and cut them all at once.

New Machine for Cutting Thin Sections of Rocks and Minerals.* —This machine was constructed for the petrographical laboratory of the John Hopkins University in Baltimore, by the Donaldson Macrae Electric Company. Its most interesting feature is that it is driven by an electro-motor.

(4) Staining and Injecting.

Modification of Golgi's Method for Study of Human Brain.†—Dr. W. Lloyd Andriezen states that he obtains good results with the following method :—Slices of brain 2 to 4 mm. in diameter were suspended in 95 ccm. of 2 per cent. bichromate of potash ; after 10 to 15 minutes 5 ccm. of 1 per cent. osmic acid was added, and the whole left in the dark for a day; the specimen was then suspended for 2 days in 90 ccm. of 2·5 per cent. bichromate and 10 ccm. of 1 per cent. osmic ; and was finally changed into Golgi's mixture of 80 ccm. 3 per cent. bichromate and 20 ccm. of 1 per cent. osmic. It is well to have two specimens, hardened 3½ and 4½ days respectively. After this rinse in distilled water, plunge into 3/4 per cent. silver nitrate solution for 5 to 15 minutes in the dark, change into 100 ccm. of silver nitrate to which *one* drop of formic acid has been added; place in incubator in the dark at a temperature of 25° to 27°, change silver solution for fresh after a day; after three or four days rinse in methylated spirit and fix in wax, cut under spirit, pick out best sections, and place in a large quantity of distilled water till nearly freed from spirit (about 5 minutes) ; then place sections in 3/4 per cent. silver nitrate for 1/2 to 1 hour; dehydrate in spirit, and then in xylol-piridine, equal parts, clear twice in xylol, and mount in xylol-dammar, hastening drying by placing the slides in an incubator at 37° to 40° for a day or rather more.

Successful preparations will show the nerve-cells and their processes down to their finest ramifications and endings, and all the cell-elements will be sharply differentiated from one another and from the clear ground substance. The method is applicable to adult human brains (which Golgi's methods are not), provided post-mortem changes are not too advanced, or the tissue disintegrated or softened.

Two new Staining-reagents for Meristems.‡—In the place of the anilin-brown and ferric tannate hitherto employed, M. A. Lemaire recommends, for staining the walls of cells in process of division, the use of two staining reagents, known in Germany as "Schwarzbraun" and "Kernschwarz," the composition of which is not given. To the walls of cells deprived of their protoplasmic contents the former gives a brown colour which is not destroyed by absolute alcohol, xylol, or Canada balsam. The latter reagent stains the nucleus black, the rest of the protoplasm being nearly unaffected unless the solution is very strong. The sections must first be treated with hypochlorite and potassa, and the latter removed by water slightly acidulated by acetic acid.

* Amer. Journ. Sci., iii. 45 (1893) p. 102. See Zeitschr. f. Instrumentenk., xiv. (1894) pp. 184-5. † Brit. Med. Journ., No. 1739 (1894) p. 309.
‡ Bull. Soc. Bot. France, xli. (1894) pp. 88-90.

Staining Reactions of Sputum.*—Dr. A. Schmidt finds that the fluid or fundamental substance of sputum assumes different colours, according to its origin. While the cell elements always stain uniformly, the red corpuscles are orange-red, the protoplasm of other cell elements is red-violet, the nuclei are blue-green, the eosinophilous cells brick-red. The method for staining the fundamental substance is as follows:—Put a piece of sputum about the size of a pea in a test-tube. Half fill the tube with a $2\frac{1}{2}$ per cent. alcoholic solution of sublimate, shake until the sputum is broken up into fine lumps; then allow to stand for 2 or 3 minutes. Decant off the fluid and wash the lumps with distilled water, after which stain with Ehrlich-Biondi solution for 5–6 minutes. Excess of colour is next removed by washing again in distilled water. The whole procedure does not last more than a quarter of an hour. By this procedure pneumonic sputum rich in albumen is stained red; mucous sputum a greenish blue; the greener the sputum, the greater the quantity of mucus. The serous sputum of pleurisy is of a red-violet. Purulent sputum, rich in leucocytes, is also red-violet. Sanious sputum is of an orange-red, owing to the presence of hæmoglobin.

New Procedure for Staining Gonococcus.†—Dr. Lanz dries the secretion on cover-glasses in the usual way. The covers are then placed for 1/2 to 2 minutes in 20 per cent. trichloracetic acid. Having been washed in water, the film surface is treated for 5 minutes with methylen-blue solution (30 ccm. water, 1–2 drops of 5 per cent. KHO solution, saturated alcoholic solution of methylen-blue until the mixture assumes a dark-blue hue). They are again washed, then dried and mounted in balsam. By this procedure the gonococci stand out in bold relief from the cells, which have been rendered transparent by the trichloracetic acid. The preparations may be contrast-stained with Bismarck-brown (1/4–1/2 minute) after the methylen-blue.

Bleaching Animals and Sections fixed with Osmic Mixtures.‡—Dr. D. Carazzi finds that the inconveniences of the chlorine or the peroxide-of-hydrogen mixtures are not to be found in his peroxide-of-sodium method. The compound has the formula Na_2O_2, and is a yellowish powder; when put into water it is alkaline, caustic soda being formed. If, however, the water be mixed with acid, the soda combines with the acid; mineral acids must not be used, but tartaric or acetic. Ten-per-cent. solution of acid is put in a vessel for animals and in a test-tube for microscopical sections; add a small quantity of peroxide and slowly add 70 per cent. alcohol to the surface of the water; put the objects into the alcohol; the oxygen escapes from the water, rises quickly, dissolves slowly in the alcohol and bleaches the specimen.

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

Mounting Small Objects in Cells.§—Mr. W. Patten mounts a large number of objects under one cover, in perfect order and in any desired

* Berlin Klin. Wochenschr., 1893. See Bull. Soc. Belge de Microscopie, xx. (1893–4) pp. 182–3.

† Deutsch. Med. Wochenschr., 1894, No. 9. See Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) p. 776. ‡ Zool. Anzeig., xvii. (1894) p. 135.

§ Amer. Natural., xxviii. (1894) p. 362.

position, in the following manner:—A cell of the requisite dimensions is constructed and small drops, close together in rows, of thick collodion and clove oil, are placed therein. An egg of Limulus or head of insect embryo, &c., is taken out of the clove oil, drained and placed in a drop of collodion in any desired position. A great many eggs may thus be arranged like serial sections under one cover-glass. Before adding the balsam the slide is immersed in turpentine, which serves to wash away the clove oil, and leave the eggs firmly fixed in the collodion. The only precaution necessary is not to use too much collodion. It is surprising to find the small amount necessary, and the firmness with which the objects are held in place by it.

Cleaning Dirty Slides and Cover-glasses.*—Prof. Zettnow finds that the following fluid is very useful for cleaning slides or covers dirty with oil or balsam. Two litres of the fluid, which may be used five or six times, will clean 150–200 slides and about 300 cover-slips:—200 grm. of red chromate of potash are dissolved in 2 litres of hot water, and then 200 ccm. of strong sulphuric acid are gradually added, the mixture being stirred constantly the while.

It is necessary, of course, to previously remove the covers from the slides. This is easily done by heating them for two or three seconds over a Bunsen's burner, when the two can be easily separated. Slides when soaked in this fluid are easily cleaned, as the fluid softens the resin, and after an immersion in spirit they are brightened up with a cloth.

Cover-glasses should be placed in a porcelain vessel filled with the fluid and this heated in a water-bath for 10 minutes. The softened resin floats up as a greenish scum, and this can be easily removed from the surface. When all the covers seem clean they are to be washed with water, and afterwards immersed in a dilute caustic soda solution. This should be warmed again in a water-bath for about 5 minutes. The last two stages are repeated, after which the covers are placed in spirit for a while, and then dried with a clean cloth.

(6) Miscellaneous.

Diagnosis of Cholera by the Microscope.†—M. J. Denys states that it is almost always possible to make a diagnosis of cholera by means of a microscopical examination of the vomit or dejecta, the basis of the diagnosis being founded on the mobility of the organisms, which is much greater in these fluids than in cultivations. The presence of the bacilli during the acute stage is constant, while when the patient is recovering they are less frequent. This examination of the stools and vomit, put up naturally or mixed with a drop of bouillon, is superior to the permanent stained preparations. It is not intended to supersede any further examination by means of cultivations.

* Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 555-6.
† Tom. cit., pp. 818-9.

MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

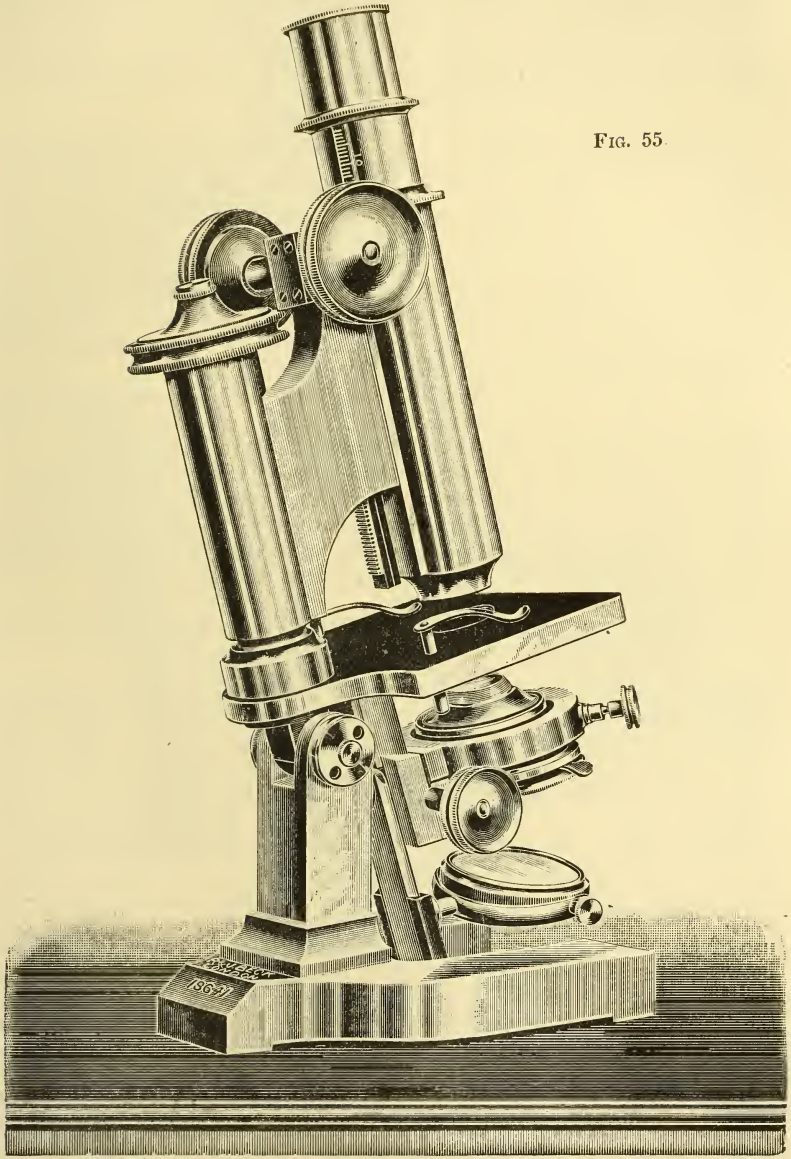


FIG. 55.

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

Messrs. R. and J. Beck's Large "Continental" Model Microscope.—This instrument (fig. 55) is on the model of the Continental Microscope, the special feature being the improved slow motion, which, Messrs. Beck claim, is extremely delicate, and being made without adjusting pieces cannot become deranged. The instrument has a rack and pinion and centering substage carrying condenser with iris diaphragm. The draw-tube is nickel-plated and graduated in millimetres. The whole instrument is heavy, rigid, and compact.

Koristka's Microscopes.*—The large model I *a* (fig. 56) is provided with a movable stage having two rectangular movements besides the movement of rotation about the optic axis. Each of the rectangular movements is of the extent of 20 mm., so that a space of more than 400 sq. mm.. can be explored. A vernier for each movement allows of readings to 1/10 mm. The movements are sufficiently rapid, and at the same time of absolute precision. By means of the verniers and scales any given point of a preparation can be quickly found again. The stage is specially intended to hold the ordinary glass slide, but allows of the adaptation of slides of any dimensions.

The small model IX. (fig. 57) has the base and column of nickeled cast iron. The stage has dimensions 75 by 70 mm., and the body-tube has a fixed length of 16 cm. The rack-and-pinion movement is of special construction, so that the smallest displacements can be made, and it is possible to focus for magnifications of more than 300 diameters. The instrument is provided with a concave mirror with lateral adjustment, and with diaphragms cut in a disc applied to the under surface of the stage, so that it can be rotated and the central position of each aperture marked by a catch.

This stand is specially intended for small schools, as an instrument of instruction for boys.

Koristka Mineralogical Microscope.†—The model C (fig. 58) for mineralogical work, has coarse-adjustment by rack and pinion, and fine-adjustment by micrometer-screw with head divided into 5/1000 mm. The rotating stage has a diameter of 100 mm. and is divided in degrees with a vernier reading to 10′. There are divisions on the stage for the orientation of the preparation. The arrangements for polarized light, and for passing from convergent polarized light to parallel polarized light, are very simple and rapid. The double mirror is adjustable laterally and in height. The polarizing nicol has a large field. The analyser has a circle divided in degrees, and allows of the use of any eye-piece and also of the introduction of other accessories between the eye-piece and the analyser. There is a slide-piece for the reception of Klein's plate or other accessory. A large opening in the body-tube allows of the introduction of a second analysing nicol between the objective and the eye-piece. The nicol is so adjusted as to produce no displacement of the image, and is united to a lens which maintains the constancy of the focal length of the system of objective and eye-piece. This nicol, which is of the Glan-Thompson construction, does not greatly restrict the field of view.

* F. Koristka, Catalogo Illustrato Descrittivo, N. 7, Milan, 1894. † Op. cit.

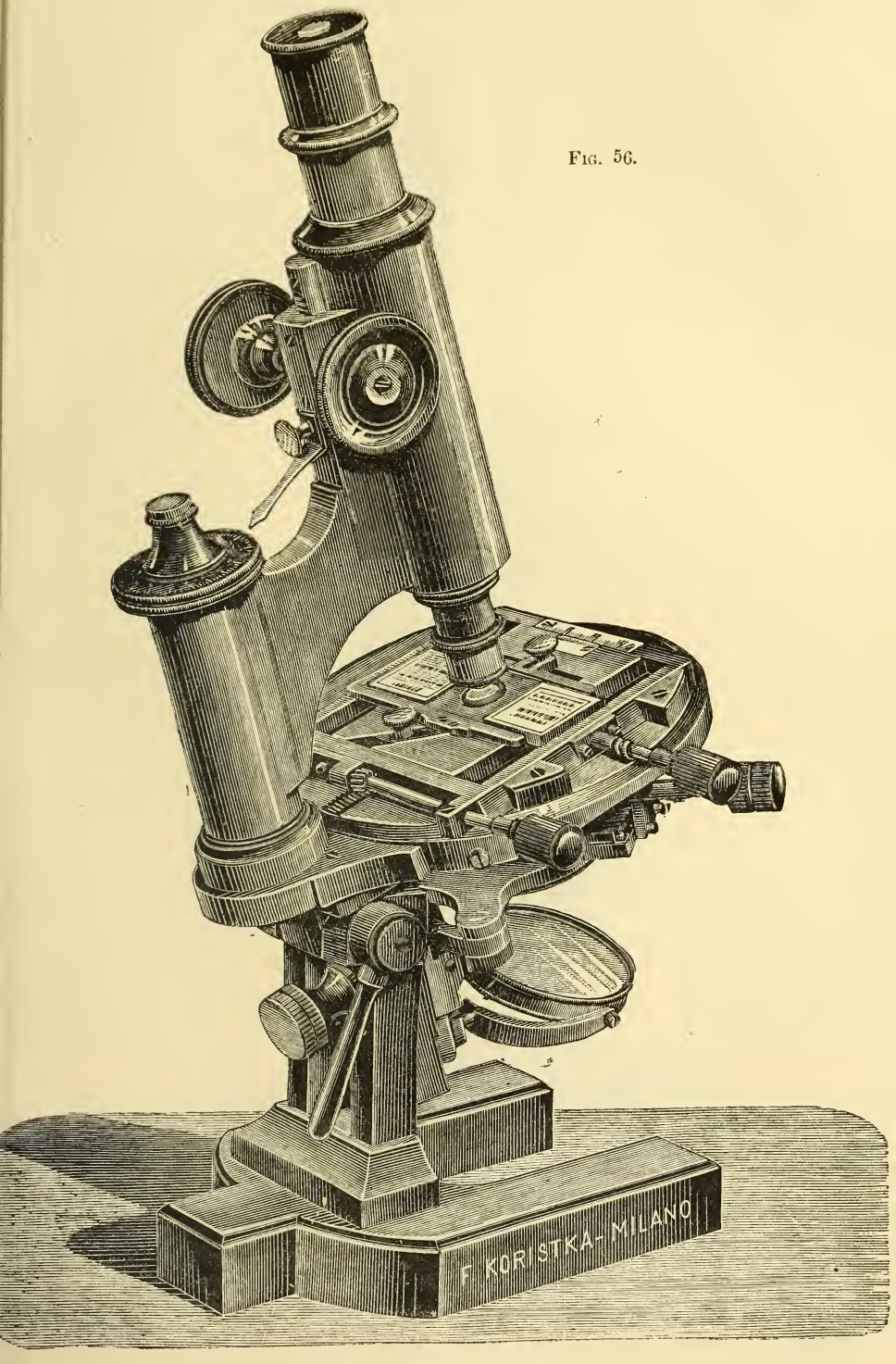


Fig. 56.

Fig. 57.

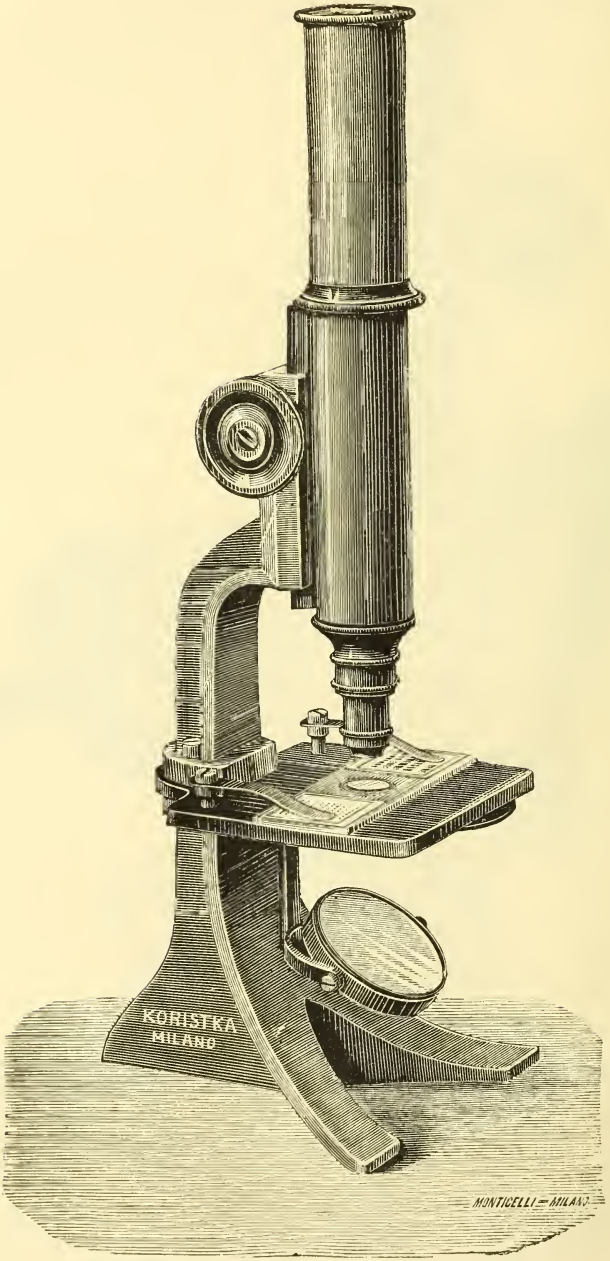
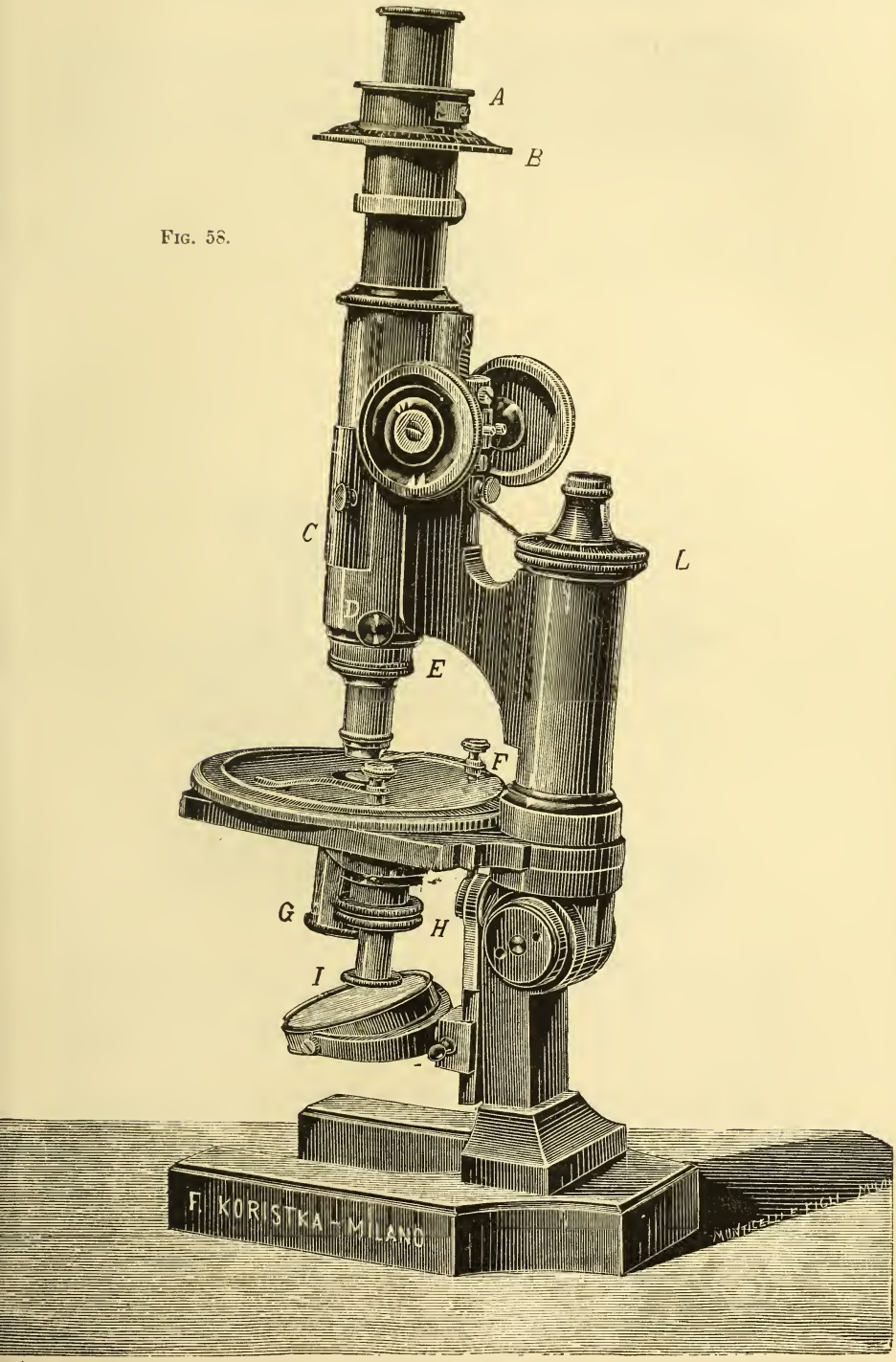
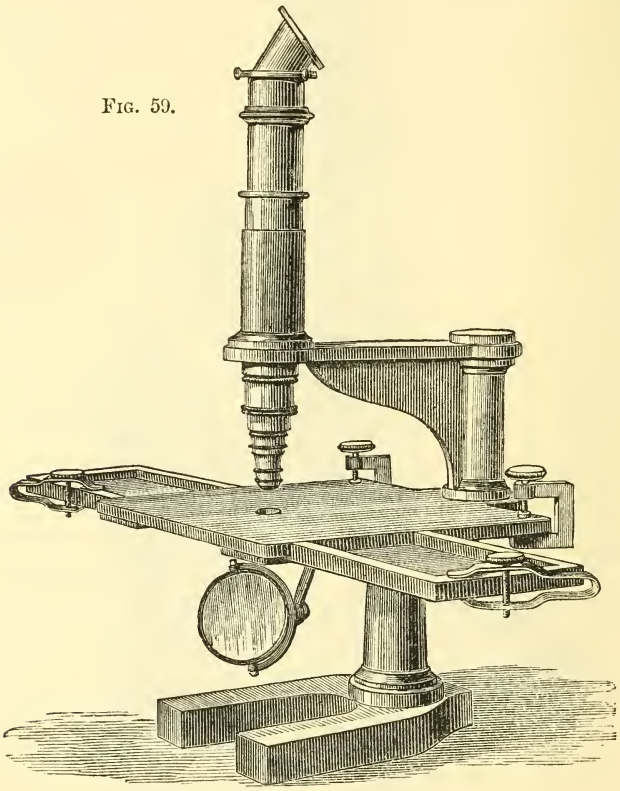


Fig. 58.



Koristka Microscope.*—The stand represented in fig. 59 was constructed according to the design of Prof. C. Giacomini, for the examination of the interior of the human brain. The square stage, of 16 cm. width, can be enlarged by the addition of two lateral wings, each 40 cm. long, so that preparations of more than 50 cm. length can be examined.

Fig. 59.



The coarse-adjustment is by sliding in the tube, the fine by micrometer movement of 5 mm. extent. The double mirror is laterally adjustable. There are clamps, &c., for fixing the preparations. For greater convenience of observation the instrument can be provided with an erecting prism.

Practical Instructions for Making a Student's Microscope.†—Mr. J. Swift gives a series of working drawings with practical instructions which should enable a good amateur brass-worker to construct a useful and efficient Microscope. A simple form of small hand-planing machine is sufficient for the purpose, but in the absence of such a machine the dovetail slides shown in fig. 60, *a*, *c*, *d*, may be filed to the required

* F. Koristka, Catalogo Illustrato Descrittivo, N. 7, Milan, 1894.
† English Mechanic, lix. (1894) pp. 548 and 9.

angle by means of a small protractor, and screwed on. The woodcuts are drawn to exactly half size so that wood patterns may be easily made from them. In making the patterns for the brass castings, the female dovetails as in figs. *c* and *d* should be left solid. The slot shown in fig. 60 should be cut with an ordinary circular saw and screws inserted so that the dovetails can be pulled down to fit the male slides. In fig. 61 *a* is shown the optical body and draw-tube.

A light ring about 3/8 in. from the top is soldered upon the draw-tube, and two stops to prevent internal reflections are fitted inside. The upper stop is fitted about 1/8 in. below the total length of the body

Fig. 60.

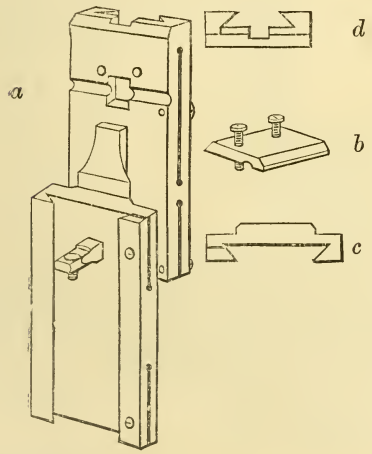
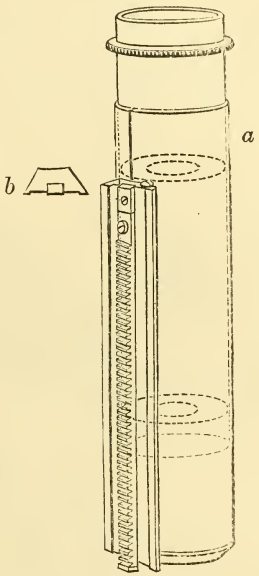


Fig. 61.

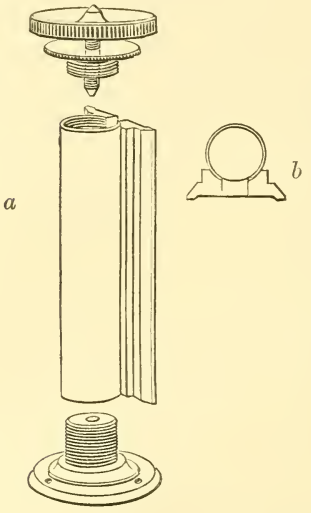


of the eye-piece when this is inserted in the tube; the second stop, with aperture of about 6/10 in. in diameter, is nearly at the lower end. At the end of the body-tube a brass casting is soldered, which must be screwed to the standard of the Royal Microscopical Society. The total length of the optical tube should be 160 mm. To the body is soldered a gun-metal dovetail (fig. 61 *b*) which slides into the upper part of fig. 60 *a*. A similar slide is soldered on to a tube as in figs. 62 *a* and *b*, to form the main portion of the fine-adjustment. A section of the fine-adjustment is seen in fig. 63. The screw should be about 50 threads to the inch, and is made out of No. 20 pianoforte wire; its point bears upon a hardened steel stud.

The rack-and-pinion coarse-adjustment is of the spiral form originally patented by Messrs. Swift and Sons. A piece of steel pinion wire of 12 leaves and $2\frac{1}{2}$ tenths in diameter is taken, and the ends hammered flat so that one can be held in a bench vice and the other clamped by a hand vice; the pinion wire is then twisted through a right angle, when

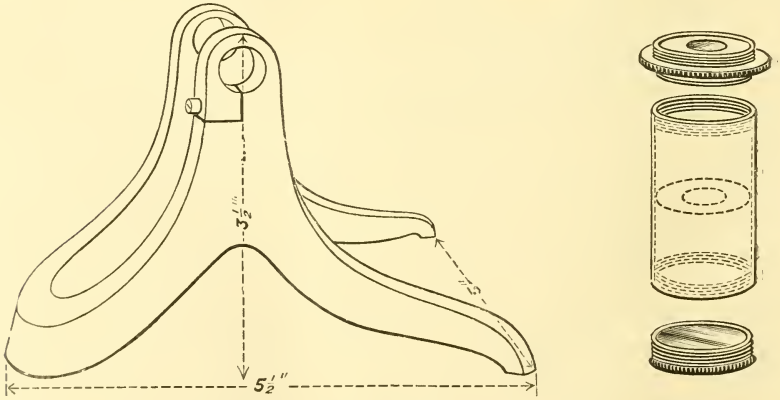
it is geared into the rack. The teeth of the rack should be 18 to the inch and cut at an angle of about 15° less than a right angle. When the pinion has been turned with its proper bearings and the milled head

Fig. 62. Fig. 63. Fig. 64.



fitted on, the borings should be brooched taper; the hollow and square hole in fig. 60 *a* should be made to receive it and the plate (fig. 60 *b*) fixed on with two screws. The bar on optical tube (fig. 61 *b*) must be care-

Fig. 65. Fig. 66.



fully adjusted to female fitting (fig. 61 *a*), and a little pumice powder and oil can be used to secure a perfect fitting.

The tube beneath the stage for carrying the apparatus should be of

the usual size, viz. 1½ in. in diameter. The mount holding the mirror is gimballed in a stout ring of well-hammered brass. Between the gimbal and the screw is a brass collet which fixes the gimbal on to the sliding tube. The tail-piece on which the mirror slides is shown in fig. 64.

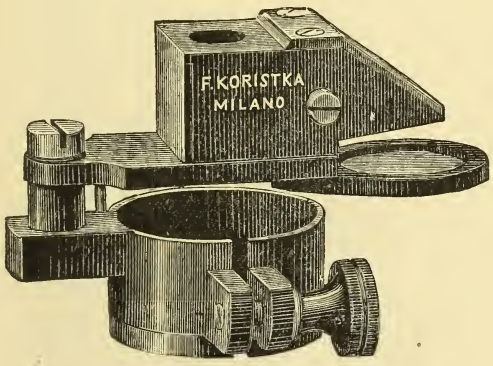
The tripod (fig. 65) should be 5/16 in. thick. One of the holes of the tripod has a saw-cut at right angles, and is fitted with a screw to produce the required tension on the axial motion of the instrument.

The lower field lens of the eye-piece should be 2½ in. solar focus, and the eye or upper lens 1¼ in. focus. Length of tube and diameter of stop are given in fig. 66.

(3) Illuminating and other Apparatus.

Koristka Camera Lucida after Nachet.* — In the camera lucida represented in fig. 67 the prism has one surface gilded and transparent according to the design of Prof. G. Govi. The layer of gold allows of

Fig. 67.



the transmission of the image given by the eye-piece, and at the same time reflects to the eye the image of the pencil and drawing paper.

(4) Photomicrography.

Koristka Photomicrographic Cameras.†—The large model seen in fig. 68 has a double bellows, each half of which has an independent movement. The stage supporting the stand is of cast iron and is provided with levelling screws. The arrangement for moving the micrometer screw at a distance is of special construction, and can be used for magnifications of more than 5000 diameters with as much precision as if the head of the micrometer screw were moved directly by hand. The camera is provided with a ground-glass plate and a transparent plate for more exact focusing, and with slides of sizes 9 by 12, 12 by 16, and 18 by 24 cm. The total length of the camera when fully extended is 1·80 m.

The small model, shown in fig. 69, has a base-plate with guides

* F. Koristka, Catalogo Illustrato Descrittivo, N. 7, Milan, 1894. † Op. cit.

Fig. 68.

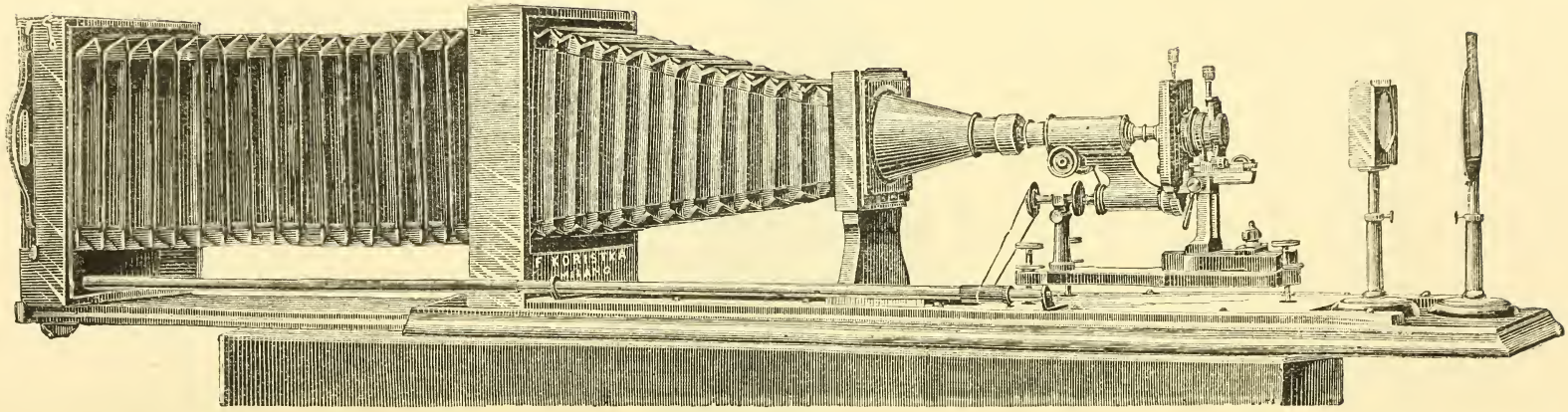
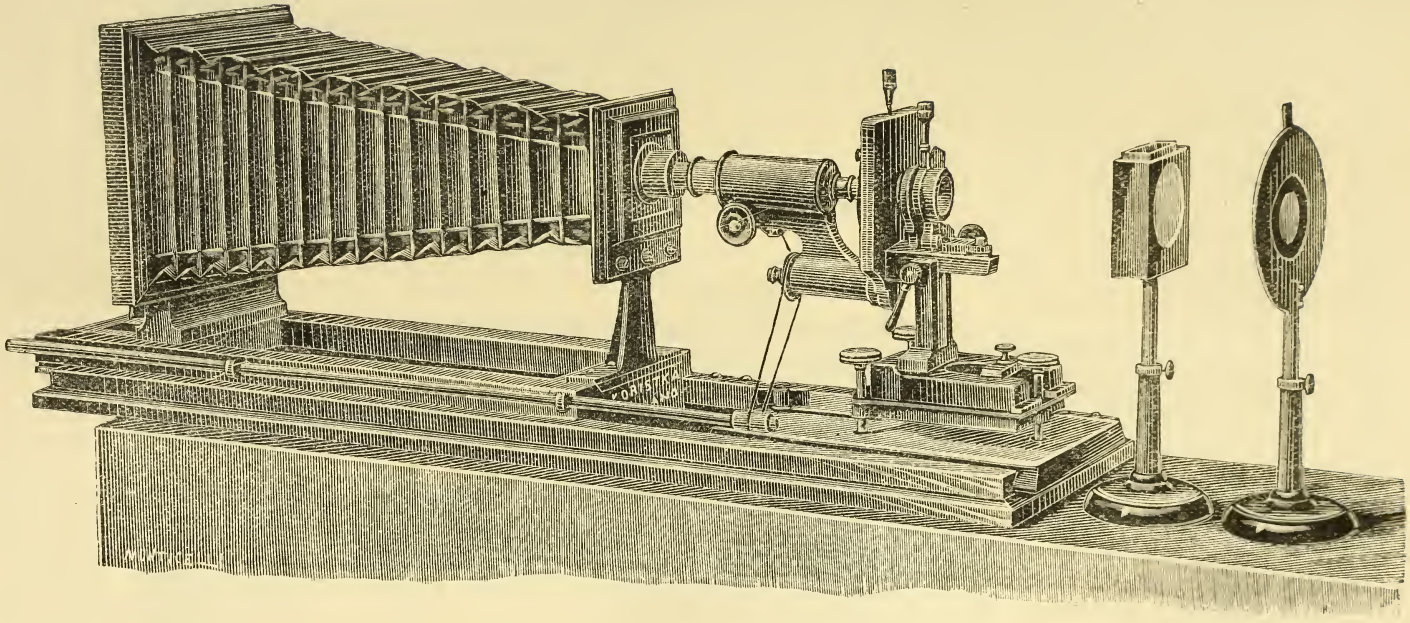
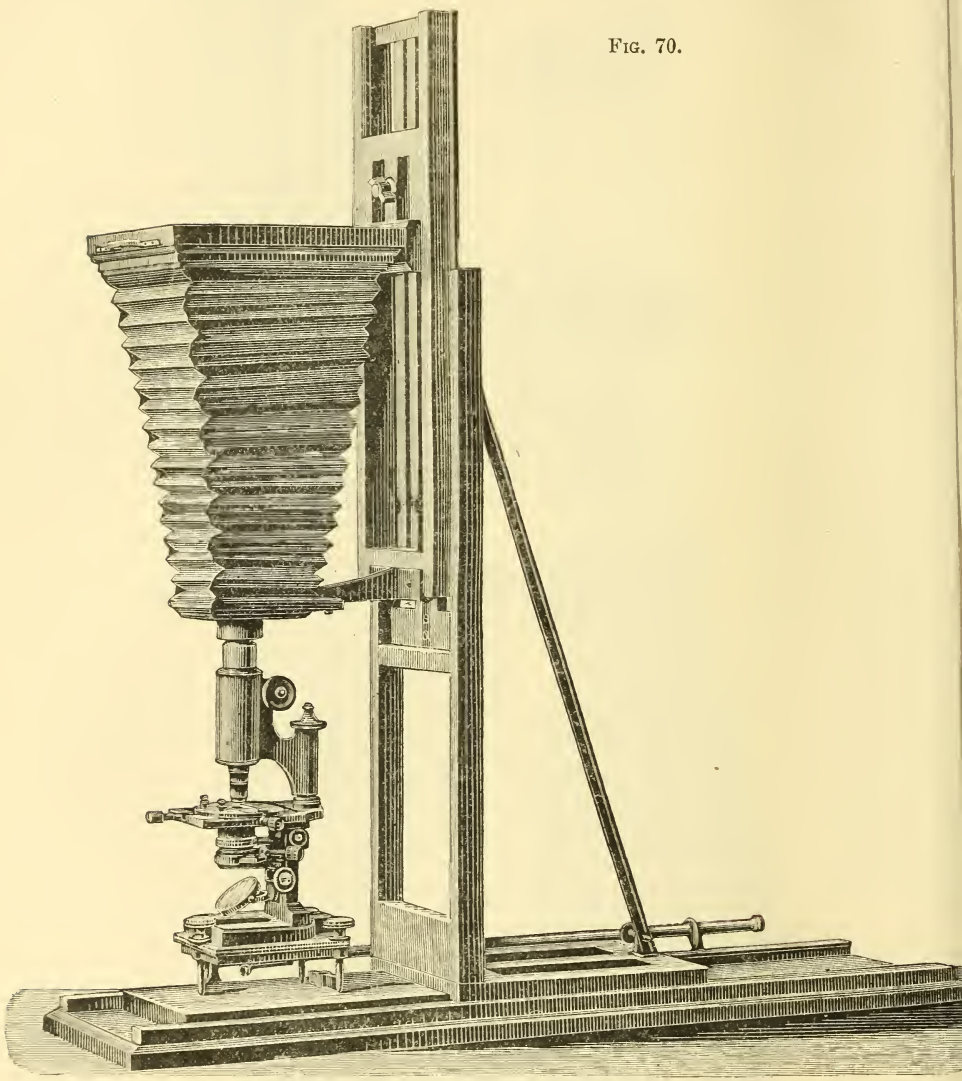


Fig. 69.



1 m. in length on which run independently the frame carrying the bellows and the wooden plate which supports the cast-iron stage carrying the stand. At one extremity of the frame carrying the bellows is fixed the small mouth of the bellows, while the other extremity is attached

Fig. 70.



to a smaller frame sliding in the first, and can be fixed in any position by a clamping screw. The total length of the bellows is about 0·70 m. The arrangement for moving the micrometer screw at a distance is very sensitive. The camera is provided with a ground-glass plate and transparent plate, and with slides of sizes 9 by 12, 12 by 16, and 18 by 18 cm.

The vertical camera represented in fig. 70 is the preceding camera (fig. 69) with the addition of a special frame for fixing it vertically so that it may be used for photographing liquid preparations.

Comparison between Petroleum, Gas, and the Auer Incandescent Light with respect to their Usefulness for Photomicrographic Work.*—Herr R. Neuhauss comes to the conclusion from his experiments that—

(1) The Auer incandescent light is very convenient for photomicrography, and the time of exposure is four times shorter with this light than with petroleum.

(2) Petroleum light is to be preferred to the Argand gas-light.

(3) No advantage for photomicrographic purposes is gained by the addition of camphor to petroleum.

The disadvantage attending the use of the Auer light—that by the projection of the source of light in the plane of the image the luminous network is seen, and so no uniformly illuminated field of view obtained—is obviated by not exactly focusing the image of the source of light. No sensible diminution of the illumination is thereby produced.

(6) Miscellaneous.

Plea for Systematic Instruction in the Technique of the Microscope at the University.†— Mr. Jacob D. Cox, in his presidential address to the American Microscopical Society, urges the desirability of a somewhat extensive course of instruction in the technique of the Microscope in Universities. He considers that the University is the place where the worker should be able to find everything of value which has been invented in connection with the Microscope, as well as opportunity to test its value by actual comparison in use. The exhibits of Microscopes and microscopical apparatus at each of the great exhibitions were of great value in affording scientific visitors the opportunity of comparing what was being done in different countries; but of how much greater service would such exhibits be, if they were permanent at the centres of learning, open not only to inspection, but to continuous use under the guidance of expert teachers!

The author gives a brief analysis of the lines of work open to the microscopical student, and treats of the various points with regard to the technique of the Microscope which may be said to be still undecided. In the first place, in the case of the lenses the student needs a competent instructor to show him the differences between them, the purposes for which each is adapted, and the manner in which the aperture limits the power. In treating of immersion lenses the author insists on the need for collar-adjustment for cover.

The use of the eye-pieces opens another series of problems, as to the distance apart of objective and ocular, the size of the field-lens, and the relative values of the various forms of oculars.

The various ingenious devices which have been employed in the fine-adjustment, the use of the so-called sub-stage accessories, the advantages to be derived from oblique illumination and its relation to the

* Internat. Med.-photogr. Monatschrift, i. (1894) pp. 29–30. See Eders Jahrb. f. Photogr. u. Reproductionstechnik, vii. (1893).

† American Microscopical Society. Address of the President, 1893, 16 pp.

phenomena of diffraction, all afford interesting subjects of study. As regards the stage, the size and form best adapted for various purposes have to be considered. The relative advantages of small and large instruments have to be determined. The author refers those who say that the largest English instruments cannot be conveniently used in an upright position to Dr. Dallinger's method of using his Powell and Lealand upright, as illustrated in the new edition of Carpenter.

The author considers that all sound reasoning and practical experience agree in sustaining his proposition "that systematic and thorough training in the use of the Microscope is highly desirable, and that the University is the school to which we naturally look for the means to meet the want."

Stereoscopic Vision applied to Diatoms.*—Count A. F. Castracane points out the utility of binocular stereoscopic apparatus in microscopic observation and photography, particularly in relation to diatoms. He suggested and practised this manner of observation twenty years ago, but his example does not seem to have been followed, until recently—by Dr. G. Fritsch and O. Müller.

B. Technique.†

(1) Collecting Objects, including Culture Processes.

Apparatus for Anaerobic Cultivations.‡—Herr W. Lubinski describes some apparatus which he has devised for the cultivation of anaerobic micro-organisms.

The first apparatus consists of a glass jar A, 25–28 cm. high and 15–17 cm. diameter, the upper part of which is expanded as shown in fig. 71 at B. Into A is fitted the part C which is provided with a sort of flange, perforated with two openings placed opposite one another. The part D is also provided with two openings, and a handle serves as a cover. When required for use a rubber tube is fitted on to the opening a' of the part C; this reaches to the bottom of the jar. The culture tubes all having been arranged in position, the cover D is put on, so that the openings l and m abut against those of the part C. All the cracks and joins of the apparatus must be smeared up with vaselin. Gas is introduced into the jar by the openings l or m, according to the specific gravity, if heavy through m, if light through l. When all the air has been driven out, a turn of 90° is given to the lid D. In order to prevent any diffusion of gases, the expanded portion of the jar which acts as a reservoir is filled with water. During incubation it is advisable to put a weight on the lid to prevent it being raised by the increased gas tension, though this may be avoided by filling the jar with warmed gas.

Another apparatus, fig. 72, is a glass jar of similar size to the last, and closed by a glass stopper. At opposite sides of the jar are two tubes, to which are adapted bulbs, something like Woulf's bottles, t_1 for the introduction of gas, t_2 for the exit of air. These bulbs are partially filled with fluid paraffin or vaselin. The upper bulb in t_2 is to

* Atti Accad. Pontif. de' Nuovi Lincei, xlvi. (1893) pp. 145–8.

† 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. xvi. (1894) pp. 20–5 (4 figs.).

prevent any back flow of fluid when the gas pressure is lowered from cooling of the apparatus. The gas is to be introduced by a gasometer or Kipp's apparatus.

Fig. 71.

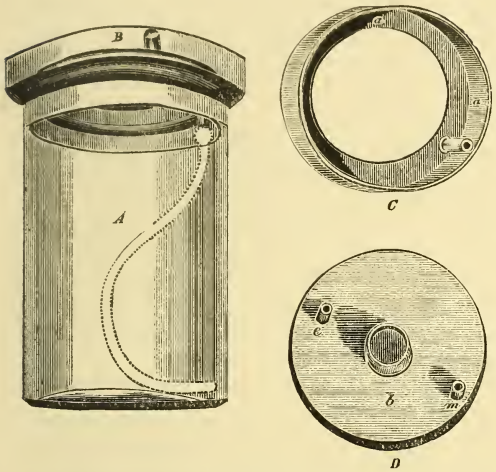
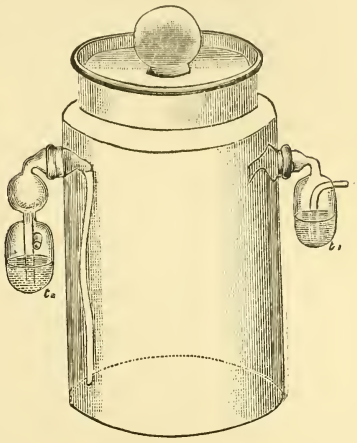


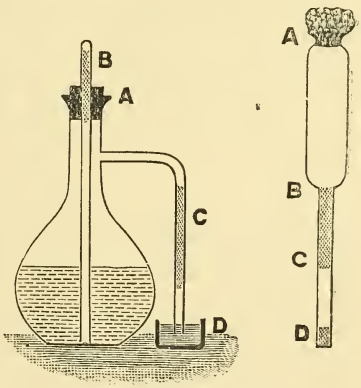
Fig. 72.



The author also describes his application of the methods of Liborius and Buchner to the cultivation of anaerobes.

Bacteriological Examination of Air.* — Dr. R. T. Hewlett finds that Sedgwick's method is the best for the bacteriological examination of air. A glass tube of special form is employed. This consists of an expanded portion A B (fig. 73) about 15 cm. long and 4·5 cm. in diameter; one end of this is contracted so as to form a neck A, 2·5 cm. in diameter and in length; to the other end is fused a glass tube B D, 15 cm. long and 0·5 cm. in diameter. The neck of the tube is plugged with cotton-wool, and two wool plugs are inserted in the narrow tube, one at its open end D, the other about 6–8 cm. from the wide part C. The whole is then sterilized. When cool the narrow part of the tube, from its origin at the wide part down to the first plug B C, is filled with powdered cane sugar (No. 50, B.P. gauge), which has been carefully dried and sterilized at 120°–130° C. The tube is again sterilized at 120° to 130° for two or three hours, the greatest care being taken not to melt the sugar. After sterilization the tube is ready for use. The wool plug is removed from the mouth A, and a measured volume of air is aspirated through the layer of powdered sugar by

Fig. 73.



* Lancet, July 14, 1894, p. 74 (1 fig.).

means of a small hand air-pump, the volume of air being measured by the displacement of water in a flask. Having taken the sample (5–20 litres), the wool plug is replaced in the neck A. The powdered sugar is then shaken down into the wide part of the tube A B, and 15 ccm. of melted sterile nutrient gelatin are poured in. The powdered sugar readily dissolves in the melted gelatin, and when solution is complete a roll-culture is made in the tube, just as in Esmarch's method. The tube is then placed in an incubator at 20° C., and the colonies are allowed to develop.

Cultivation of Tetanus Bacillus.*—Dr. R. T. Hewlett cultivates tetanus bacillus in yeast flasks of about 90 ccm. capacity, three parts filled with 2 per cent. grape sugar bouillon. The neck is plugged with a perforated rubber stopper through which a glass tube passes to the bottom of the flask. The upper end of this, and the side tube also, are stuffed with cotton wool. The apparatus is first sterilized and then inoculated. After this the vertical tube is connected with a hydrogen generating apparatus, and when the whole flask is filled, the end of the side tube is plunged in a vessel filled with mercury, and the free end of the vertical tube sealed off in the blowpipe flame.

Cultivating Anaerobes in Agar.†—Dr. R. T. Hewlett cultivates anaerobes in narrow test-tubes, three parts filled with 2 per cent. sugar-agar. The tubes are steamed for a few minutes in a sterilizer to get rid of dissolved oxygen, and then cooled in water. When the agar has set, the inoculations are made well into the depth of the medium. The inoculation puncture is then sealed up by heating the tube in a flame, so as to melt the superficial layer of the agar. The upper part of the tube is heated, and a well-fitting rubber cap applied while the tube is still hot.

Heating Arrangement of the Microscope for Bacteriological Purposes.‡—Herr P. Friedrich describes a new heating arrangement for the Microscope. An air-bath, in which the Microscope stands, is the chief feature of the arrangement. This air-bath is closed in front by a glass plate, and is kept at a temperature of 37° by a water-jacket, heated from below. The temperature is regulated by means of a Meyer-Reichert regulator.

(2) Preparing Objects.

Simple Method for Producing two or more Embryos from one Egg.§—Herr J. Loeb experimented with eggs of *Arbacia* which were artificially fertilized in normal sea-water. Ten minutes after fertilization they were removed to sea-water and distilled water in equal volumes; the membrane was destroyed by endosmosis, and part of the protoplasm escaped. The egg now consisted of two connected spheres of protoplasm which contained one nucleus between them. If, after some time, the eggs were returned to normal sea-water, each of the two spheres developed into a completely normal and perfect embryo. His experiments show that an embryo can arise simultaneously from each part of

* Lancet, July 14, 1894, p. 73 (1 fig.). † P. cit.

‡ Internat. Med.-photogr. Monatschrift, i. (1894) p. 30. See Arb. d. Kais. Gesundheitsamtes, viii. (1892).

§ Arch. f. ges. Physiol., lv. (1894) pp. 525-30. See Zool. Centralbl., i. (1894) p. 346.

the protoplasm, and of the nucleus, if these parts are isolated to a certain extent, and can assume a spherical or ellipsoidal form.

Newt Ova.*—Prof. G. Born gives a full account of his methods. For the larger ova he used chromacetic acid, and that plus sublimate; the smaller ova he placed in hot 1/3 per cent. chromic acid solution (80°–90° C.) which fixed the ova instantaneously; the solution was allowed to cool, and the objects were left in it for two days. Strasser's collodium-castor-oil mixture is most effective for fixing the sections on the slide. Böhmer's hæmatoxylin is the sovereign stain for these objects.

Study of Living Fish-Embryos.†—Mr. C. Hill twisted a piece of fine copper wire into a loop, the diameter of which was a little less than that of the yolk-sac of the embryo. The ends of the wire were then bent in such a way that they formed a support for the loop, of such a length that, when placed in a flat dish filled with water, the loop was raised 1 or 2 mm. from the bottom of the dish. The embryo was taken into a wide-mouthed pipette, held in a vertical position, and forced into the loop tail foremost in such a way that the loop, by constricting the yolk-sac, held the embryo firmly in position. By bending the wire supporting the loop, the embryo could be brought into any desired position.

Examination of Nervous System of Myxine glutinosa.‡—Mr. A. Sanders found it very difficult to make the nervous tissue hard enough to be sectioned; a year in bichromate of potash was not too long, and Erlicki's fluid had to be used to get it hard enough to make fairly fine sections. Soluble blue was found to show as much, if not more than, any other stain.

Embryology of Gebia littoralis.§—Mr. P. Butschinsky fixed the ova of this Crustacean with Perenyi's and Kleinenberg's fluid, or with alcoholic sublimate. Borax-carmine, hæmatoxylin, and hæmatein-alum were the best staining reagents. Embryos saturated with photoxylin were imbedded in a mixture of chloroform and paraffin at 40°–45°, and then in pure paraffin.

Examination of Starfishes.‖—Mr. H. C. Chadwick has given up the use of osmic acid, as it penetrates slowly and makes the tissues brittle. In nearly every case he fixed his specimens with saturated solution of corrosive sublimate, taking care to expose well the parts required for sectioning. Decalcification was effected by immersion in 10 per cent. nitric acid for about a day. If a living starfish, after the separation of the rays from the disc, be put into nitric acid solution and afterwards hardened with alcohol, there will be but little contraction.

Preserving Larvæ of Balanoglossus.¶—Mr. T. H. Morgan found that the only method that gave satisfactory results was to put the larvæ for a few minutes into an extremely dilute solution of lactic acid; they

* Arch. f. Mikr. Anat., xliii. (1894) pp. 1–79 (4 pls.).
† Journ. Morphol., ix. (1894) p. 238.
‡ 'Researches in the Nervous System of *Myxine glutinosa*,' London, 4to, 1894, p. 3.
§ Zool. Anzeig., xvii. (1894) p. 353.
‖ Trans. Liverpool Biol. Soc., vii. (1893) p. 232.
¶ Journal of Morphology, ix. (1894) p. 6.

were then hardened in picrosulphuric acid or picrosalt solution; the dead and hardened worms retained the shape of the living worm almost perfectly. Lactic acid acts too slowly on adults to be of use for them.

Study of Endoglobular Parasites.*—M. A. Labbé prepared a convenient staining reagent by putting on the slide a drop of methylen-blue 1 part, water 100 parts, and chloride of sodium 0·75, which was drawn under the cover-glass by blotting-paper. One per cent. solutions of acetic carmine and of methylen-green also gave good results. For fixing Gymnosporidia the following method was used:—Flemming's fluid, then five minutes in distilled water; after drying, a solution of one drop of acetic acid in 20 ccm. water; then in picric solution (picric acid, 30 parts of concentrated aqueous solution, 30 parts distilled water, and 1 part glacial acetic acid); after being in this for a day, the preparation was washed in absolute alcohol.

Various staining reagents were used; a triple coloration was effected with Delafield's hæmatoxylin, acid fuchsin or Bengal rose, and aurantia; several methods of staining must be tried to find the key to the structure of these organisms.

Botanical Microtechnique.†—Herr F. Rosen after pointing out that the contraction of vegetable tissue during imbedding is by the ordinary method often unavoidable, advises the following procedure. The objects, thoroughly dehydrated in absolute alcohol, are successively transferred (1) to a mixture of equal parts of absolute alcohol and bergamot oil; (2) to pure bergamot oil; (3) to a mixture of equal parts of bergamot oil and paraffin; (4) to paraffin with melting-point 45°; (5) to paraffin with melting-point 56°–58° for 24 hours. In stages (3) and (4) the fluids should be kept at 48°, in stage (5) at 60°. In order to make the sections adhere to the slide they are placed while still in paraffin on a drop of fluid which can be evaporated completely. The fluids suitable for this purpose are distilled water or 50 per cent. pure alcohol. Evaporation at room temperature is slow, but can be rapidly and safely accomplished at 32°–36°. When the fluid has completely evaporated the section adheres firmly and there is no damage to the finer structures. The paraffin is then dissolved out with xylol. The three temperatures 32°–36°, 45° and 60° are obtained in a tripartite paraffin oven devised by the author. In this apparatus sections 5–10 μ thick are made to adhere in about 12 hours. Of course the alcohol must be completely evaporated before the sections are treated with xylol, otherwise they will get free.

Preparing Megaspore and Female Prothallium of Selaginella.‡—The great delicacy of these objects makes imbedding difficult. As a fixing process Herr E. Heinsen recommends the action, for ten minutes, of a mixture of 1 gr. chromic acid, 0·4 gr. osmic acid, and 0·4 gr. acetic acid in 200 gr. water; or a three minutes' treatment with a 1 per cent. solution of sublimate. The collapsing of the protoplasm of the spore was avoided by this method.

* Arch. Zool. expér. et gen., ii. (1894) pp. 57–61.

† Schlesische Gesellsch. f. Vaterländ. Cultur, Jahresbericht, 1893 (Bot. Sec.) pp. 8–11.

‡ Flora, lxxviii. (1894) pp. 468–9.

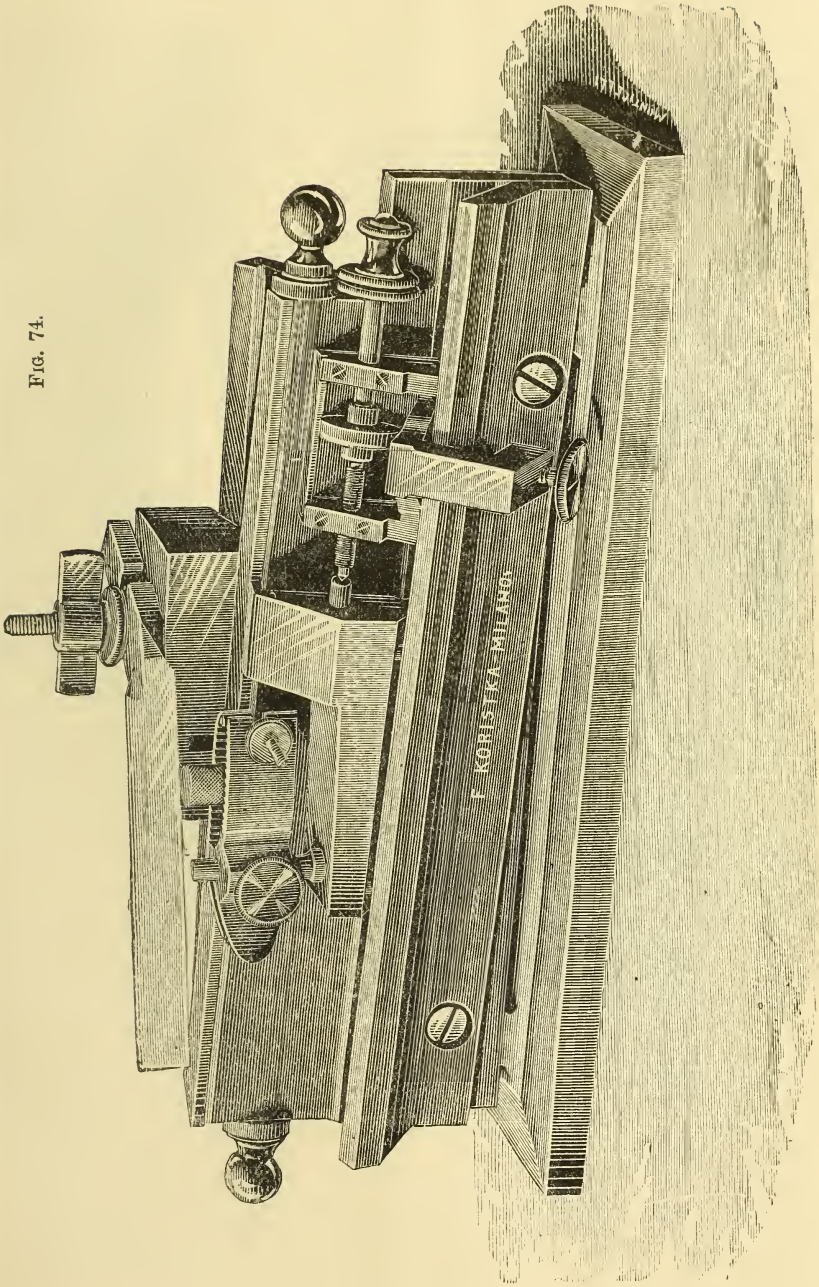


Fig. 74.

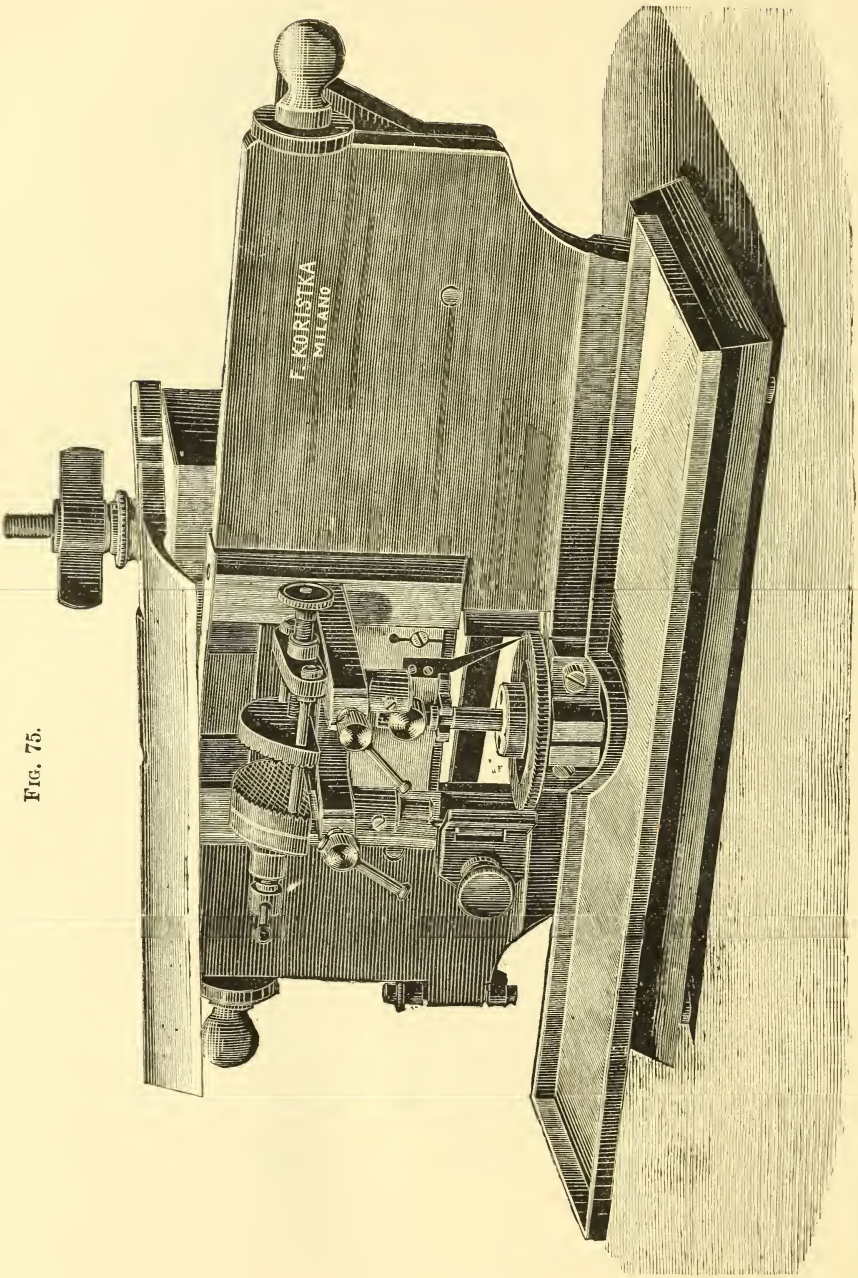
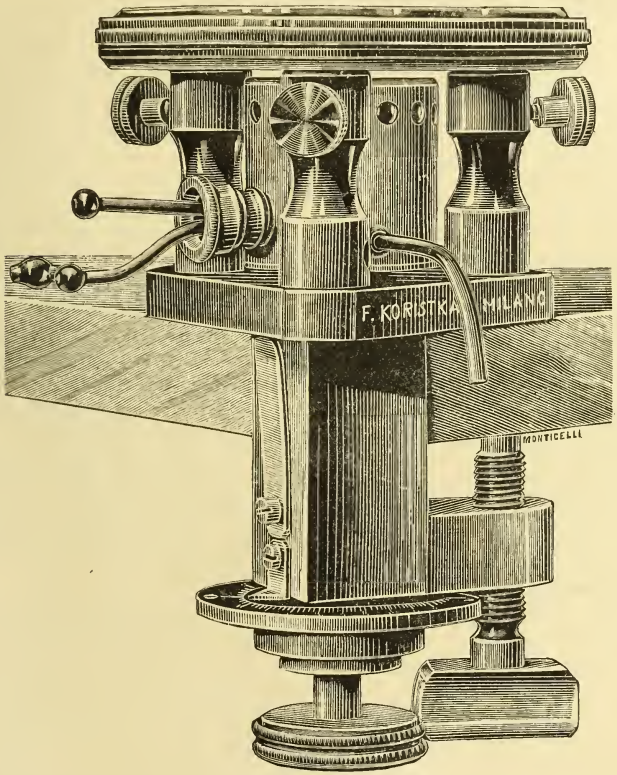


Fig. 75.

(3) Cutting, including Imbedding and Microtomes.

Koristka's Microtomes.*—The instrument with double slide represented in fig. 74 is of cast iron nickeled. The razor runs on a horizontal slide-way, and the object-holder on a slide inclined at 1/20. The motion of the object-holder is by means of a micrometer screw with a divided head, which allows of the measurement of displacement of the object to be sectioned of 1/1000 mm. The micrometer screw can be displaced along the slide. The length of the slides is 26 cm.

Fig. 76.



The automatic microtome shown in fig. 75 has a stand of cast iron nickeled interiorly. The slide has a length of 25 cm., with a free course of the knife of 17 cm. The raising of the object is effected automatically by means of a micrometer screw and an escapement. The thinness of the sections can be regulated by a screw from 0·005 to 0·03 mm. The slide on which the knife is fixed rests on five points of tempered steel and moves with very slight friction.

The freezing microtome (fig. 76) is of new construction. By means

* F. Koristka, Catalogo Illustrato Descrittivo, N. 7, Milan, 1894.

of a screw-clamp it can be fixed to any table having a projecting edge. The glass plate allows of cutting in any direction. It can be readily removed for cleaning, and replaced by a hollow cylinder for sectioning by the ordinary methods of imbedding. The screw for the displacement of the preparation has a disc divided in hundredths of a millimetre and is provided with a catch which marks each displacement of a division. For the sectioning the razor is moved by hand.

Large Microtome for Brain-sections.*—Dr. J. Pal describes a new microtome made by C. Reichert according to his design, with which he has succeeded in easily obtaining sections of both hemispheres of the human brain.

The instrument (fig. 77) is mainly constructed on the same principle as that described in Zeitsch. f. wiss. Mikr., i. (1884) p. 241, but differs from it by special arrangements which allow of sections being made through a whole brain under water. It is also double the size and of stronger make. The length of the slide is 50 cm., so that knives with a cutting edge of 36 to 38 cm. can be used. Objects with a diameter of from 12 to 13 cm. and a height of 10 cm. have been cut with the instrument. For cutting under water the tank W is provided; the deep central portion of this is formed of a stout leather bag V. At the bottom of this bag there is a box through which the rod of the clamp passes. The tank can be emptied by means of the cocks *v v'* at both ends. The rod of the clamp is received by the clamp-holder, which is adjustable in all directions. The holder is connected with a very strong slide which is raised by a micrometer screw having a diameter of about 18 mm. and pitch of 0·6 mm. By this screw the object can be raised 15 mm., and consequently from 250 to 300 sections may be cut in a continuous series without further adjustment of the object.

As soon as the micrometer screw has reached its highest position, the pawl *s p* (fig. 78) and the spiral spring at the back of the microtome are disengaged, the micrometer screw is screwed down, the object-carriage pressed outwards, and the object again raised up to the knife-edge, so that the operator can resume cutting without change of the plane of the sections.

On the back stroke of the knife, the object is automatically raised by a certain amount within the limits of 0·005 mm. and 0·055 mm. To obtain thicker sections the automatic arrangement must be set in motion twice, when sections of a thickness up to 0·11 mm. may be cut.

The knife-carriage, which is of specially heavy construction and slides on five points as in Reichert's smaller microtomes, has, to prevent tilting, a double groove, and is pressed on the slide by a spring counter-plate.

For moving the slide the driving belt arrangement seen in fig. 78 is chosen. The crank shown in fig. 77 has been lately replaced by a fly-wheel (fig. 78).

The knife is attached to the knife-carrier T (fig. 77) by the two screws *s* and *s'*, and is fixed by the nut *m*. It is prevented from springing by the support *s t*. The microtome can be used without the tank, as seen in fig. 78.

* Zeitschr. f. wiss. Mikr., x. (1893) pp. 300–4.

Fig. 77.

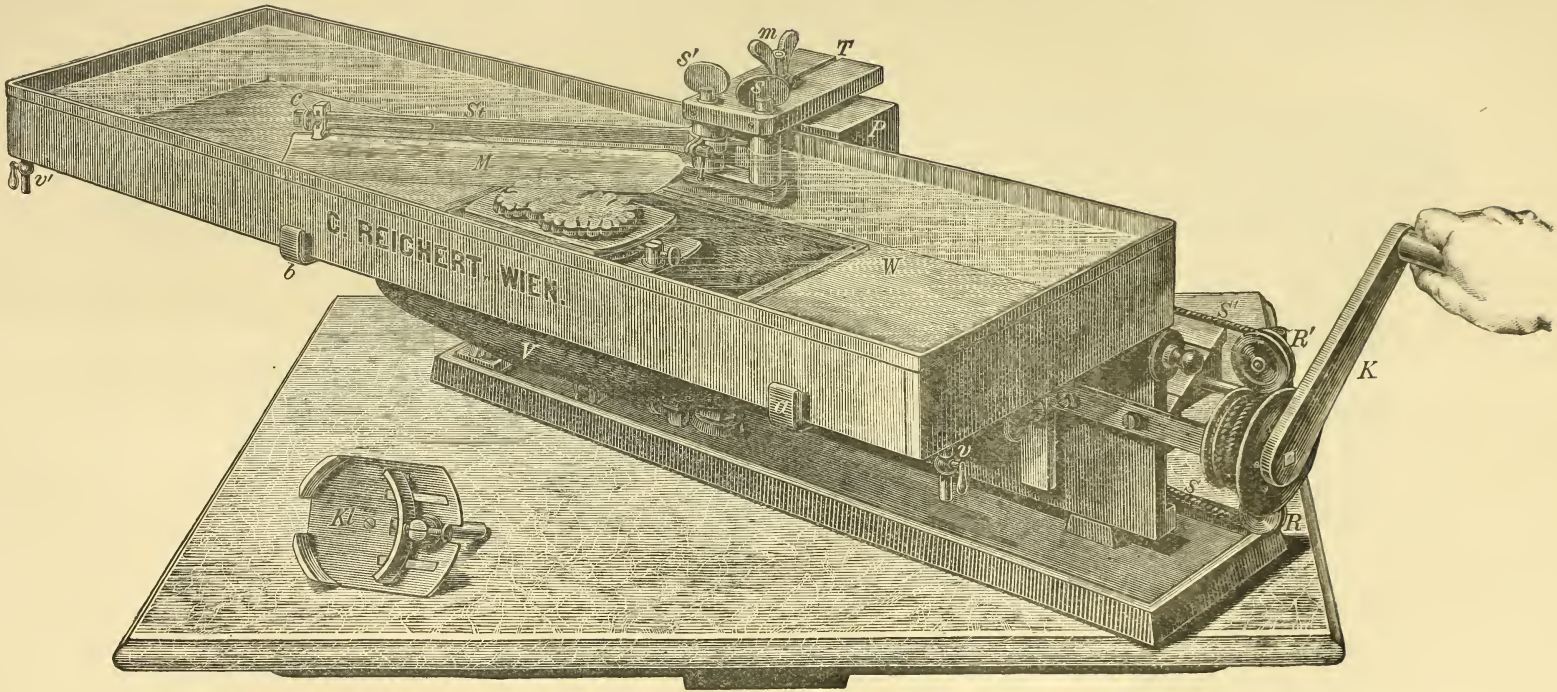
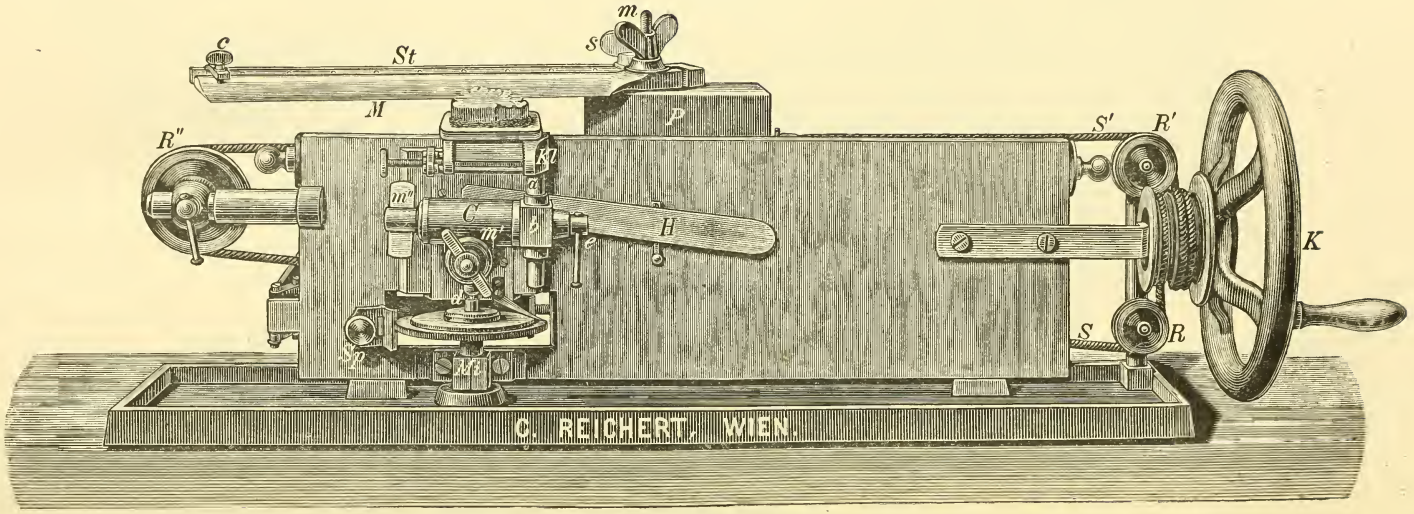


Fig. 78.



In the treatment of the brains and sections the author uses the following process:—After previous injection with Müller's liquid, to which one-quarter of its volume of a 5 per cent. solution of lysol has been added, the brain is hardened and kept in a dark cupboard at the ordinary temperature of the room. Hardening in the hatching oven is to be avoided.

The pieces are dried with blotting-paper, and *without* washing are, after a short stay in absolute alcohol, immersed in photoxylin. They are then glued to a metal plate which is attached to a smaller piece of wood fitting into the object-clamp. The use of a metal plate is indispensable, as wooden plates would warp in consequence of the prolonged immersion in the bath.

In the sectioning, the sections sink in the water and are caught on a sheet of paper with the help of a fine brush.

For staining the sections the author has resorted to the principle described by Oregia,* which consists in bringing the section on to a glass plate coated with a mixture of candied sugar and dextrin. The section adheres to the layer of sugar and the paper can be removed. The preparation is then dried with fine blotting-paper and afterwards covered with a thin layer of photoxylin, which on drying is pressed against the section by means of a roller. The plate is then placed in water, when the sugar dissolves, setting free the section with its adhering photoxylin backing; such sections can then be easily stained with hæmatoxylin, since they can be passed through the various liquids without injury.

Quick Double-staining Method for Examination of Blood and Tissues.†—Dr. Inghilleri's method of double-staining depends on the mordant and fixative properties possessed by absolute alcohol, ether, and chloroform. The preparations are to remain for just 30 minutes in any of these fluids, but not longer, otherwise their sensitiveness to staining reagents is diminished. The procedure is as follows:—The cover-glass or section is first placed in chloroform for 30 minutes, and then in a mixture of 40 parts 1 per cent. eosin in 70° alcohol and 60 parts of a saturated aqueous solution of methylen-blue. The solution should be warmed for 2 or 3 minutes.

The method is very suitable for the study of phagocytosis and of malaria parasites.

Demonstrating Nucleated Red Corpuscles.‡—M. Timofeyewski has found that by injecting a solution of sodium chloride into animals large numbers of nucleated red corpuscles appear in the blood soon after the injection. These nucleated globules are about the same size as the ordinary red corpuscle, but they contain a round, well-defined nucleus 4–5 μ in diameter, often placed excentrically. When stained by the Ehrlich mixture they are either black or assume a blue or greenish hue. The investing membrane of the nucleus is always quite distinct. Sometimes the nuclei are freed and devoid of protoplasm.

The solution injected consisted of sodium chloride exposed to the air

* See Neurol. Centralbl., 1890.

† Centralbl. f. Bakteriol. u. Parasitenk., xv. (1894) pp. 820–1.

‡ Wratsch, 1894, No. 2. See Ann. de Micrographie, vi. (1894) pp84–6.

and allowed to putrefy for 30 days. It was then filtered and sterilized twice over, and kept in hermetically sealed tubes. When required for injection it was heated to 31°–38°, 10–11 ccm. per kilogram being injected into the saphenous or femoral vein. The blood examined was obtained from an artery in the ear.

Staining Tubercle Bacilli.*—M. Letulle advises the following procedure for staining tubercle bacilli under any condition of tissue or fixation method:—The preparations are to be immersed for 1 to 24 hours in carbol-rubin and then transferred to a 1½ per cent. solution of permanganate of potash. This is followed by immersion in a saturated aqueous freshly prepared solution of sulphurous acid. The preparations must then be washed freely in water, after which they may, if so desired, be double-stained by means of a saturated aqueous solution of methyl-blue. The sections should then be washed until they are almost decolorized, after which they are dehydrated in alcohol, passed through xylol, and mounted in balsam.

Staining Flagella of Bacteria.†—Dr. R. Bunge uses as a mordant a mixture of aqueous solution of tannin and liquor ferri sesquichlor., the latter with water in the proportion of 1 to 20 aq. dest. Three parts of the tannin solution and one part of the dilute iron solution are then mixed, and to 10 ccm. of the mixture 1 ccm. of a saturated aqueous solution of fuchsin is added. The mordant is not to be used fresh, for it works better after having been exposed to the air for some days or weeks. The author obtained good results without any addition of acid or alkali with *Proteus*, *Bact. coli*, typhus, and cholera. After carefully fixing the film on the cover glass, the filtered mordant and the preparation are to be kept in contact for about five minutes. The preparation is then washed, dried, and stained with phenol-fuchsin in the usual way.

Demonstration of Influenza Bacillus.‡—Dr. M. Borchardt found Pfeiffer's influenza bacillus in thirty-five out of fifty cases examined. In order to be successful Pfeiffer's directions must be strictly observed. The sputum must be quite fresh and the lump washed in a sterile water. Cover-glass preparations are then made from the centre of the mass and stained with dilute Ziehl's fuchsin (1–10 or 20) after which they are washed in water or decolorized in dilute acetic acid. Sometimes the preparations show other bacteria as well as influenza bacilli, sometimes the latter are impure cultivations. The bacilli should be fairly evenly distributed over the field; they are usually free, though sometimes inside cells or, when mixed with mucous flakes, in little clumps or swarms.

The influenza bacilli may be demonstrated in the sputum for at least a week. Microscopical examination is not always sufficient for the recognition of the bacilli, for the staining differences are sometimes considerable, especially when from polar staining they resemble diplococci. Even cultivation is sometimes unsatisfactory. For this purpose a washed sputum mass is immersed in bouillon, and when thoroughly

* Bull. Soc. Belge de Microscopie, xx. (1893–4) pp. 184–5.

† Fortschritte d. Med., xii. (1894) No. 12. Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 217.

‡ Berlin Klin. Wochenschr., 1894, No. 2. See Centralbl. f. Bakteriol. u. Parasitenk, xvi. (1894) pp. 78–9.

disseminated is inoculated on oblique agar which has been treated with blood, or the agar may be inoculated directly. In the first case colonies appear in 24 hours, in the latter in 12–15 hours, though these are often mixed with other bacteria. The author also cultivated on agar plates mixed with a few loopfuls of human or rabbit's blood. On such plates the small homogeneous structureless influenza colonies are easily distinguishable from other bacterial growths.

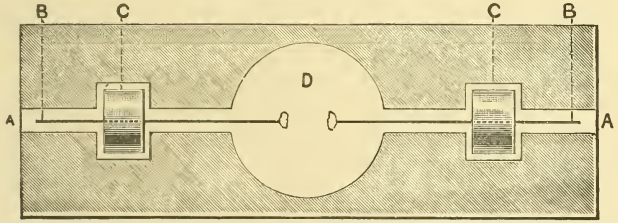
Natural Injection.* — Dr. E. Retterer has a note on Herr K. Zellner's † method of "natural injection," which is similar to one which he has himself used.‡ Portions of a body whose blood has been retained are cut into fragments about 3 cm. in diameter, placed in Müller's fluid for at least 24 hours, washed for 2 hours in a current of water, gradually saturated with alcohol, cut in paraffin, stained for 24 hours in Biondi-Heidenhain's mixture, washed and dehydrated as usual. Then it is seen that the red blood-corpuscles have a golden yellow colour, which beautifully marks the course of the blood-vessels.

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

Method for Mounting Opaque Objects. — At the meeting of the Society in June last Mr. J. J. Harvey read the following note on his method of mounting opaque objects, which allows of the object being rotated when examined under the Microscope.

"One of the many objections to the present system of mounting opaque objects is that it is necessary to permanently hide one side of the specimen, and in the case of aberrant or rare forms this may greatly lessen the value and interest of the slide. The method here advocated allows of the revolution of the object under the Microscope, and permits

Fig. 79.



of its examination with as much ease as a hand specimen. It is at the same time as permanent and as compact as the older system. Another important advantage is the differential lighting which this rotation brings into play, and which the inventor has found of special service in the study of the Foraminifera for which this method was originally designed. The slides used are the wooden slips recommended for this class of objects by Carpenter and others. The specimen is attached by means of a suitable medium to the end of a needle (fig. 79, B) which has been thrust through the centre of a plug of india-rubber cord C.

* Journ. de l'Anat. et de la Physiol., xxx. (1894) p. 336.
† Archiv f. Pathol. Anat. u. Physiol., cxxxv. p. 147.
‡ Journ. de l'Anat. et de la Physiol., 1888, p. 324.

This is laid, with the specimen projecting into the central cell D, in a shallow longitudinal groove A cut just deep enough to enable the specimen to revolve without touching the cover-glass, a hole having also been cut for the reception of the rubber plug. The projection of this plug above the surface allows the whole arrangement to revolve by the mere movement of the finger. When the cover-glass has been placed in position the whole can be finished off with paper in the usual way. A neater appearance is obtained by mounting two specimens in each slip, one on either side of the cell."

Cleaning Cover-glasses.*—Herr E. Funck says that cover-glasses are most advantageously cleaned by uniting chemical and mechanical action. The dirty cover-glasses are soaked for some time in turpentine oil and then removed to a vessel containing some 30 ccm. of hydrochloric acid to which two or three pinches of potassium chlorate have been added. They are then heated in a water-bath until all colour has disappeared. The glasses are then washed with hot water and next placed in a mixture of equal parts of powdered soda, talc, and fine sawdust made into a thick soft paste with water. The mixture and the glasses are then heated for half an hour in a water-bath. After this the cover-glasses are again washed with hot water, to which a few centimetres of weak hydrochloric or acetic acid have been added. Lastly the glasses are washed with hot water or ether alcohol and dried with a soft cloth. They are now perfectly clean, and there is no necessity for heating them on the iron plate.

Uses of Formaldehyd.†—Herr F. Cohn's experiments with formaldehyd are confirmatory of previous observations showing that in weak aqueous solution and in vapour it kills bacteria, both in the vegetative and spore conditions. Hence it is extremely useful for sterilizing, disinfecting, &c., and is suitable for the preservation of preparations. Against mould fungi its action is not invariable, and requires occasionally to be used in somewhat large quantity.

Changes caused in Nervous Tissue by Hardening Reagents.‡—Prof. H. H. Donaldson has made a number of experiments and observations with the object of determining what changes are induced by the hardening reagents generally employed. He finds that a sheep's brain under the influence of solutions of bichromate of potash increases in weight and volume; this is due to the taking up of the solution, and it is made greater by freshness, absence of pressure, and low percentage of salts in the solution; it is made less by a temperature of 38°. The general action of alcohol is to decrease the weight and volume of the sheep's brain, and the higher the percentage of alcohol the more rapid and great is the loss in weight; this loss is due to the decrease in the volume of the specimen by shrinkage, extraction of solids, and replacement of water by the alcohol of a less specific gravity.

Alcohol of 50 per cent., a saturated solution of sodium chloride, or a mixture of bichromate of potash and alcohol disturb the normal weight but slightly.

* Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 113–4.

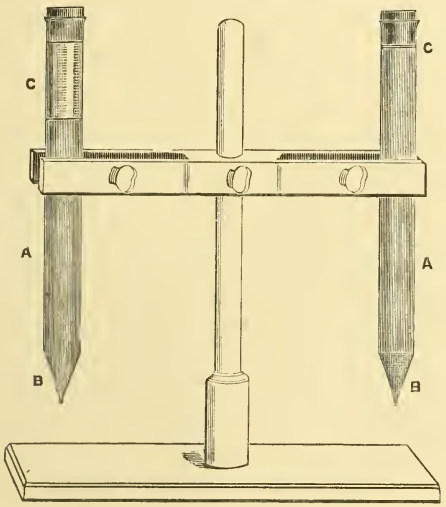
† Jahresbericht d. Schles. Gesellsch. f. Vaterl. Cultur, ii. Abth. Bot. Section, (1893) pp. 23–31.

‡ Journal of Morphology, ix. (1894) pp. 123–66.

Collecting and Preserving Urinary Sediment.—Dr. Bohland * first collects casts, cells, and other solid particles occurring in urine by sedimentation or by centrifuging. The deposit is washed with saline solution and then treated with Müller's fluid renewed every three or four days for a fortnight, after which it is hardened with absolute alcohol. Epithelium, leucocytes, and casts are readily recognizable. The sediment may also be stained by placing a drop of the deposit in alcohol on a cover-glass and evaporating slowly so as to get a thin film and then colouring this with Ehrlich's neutrophile mixture. Specimens prepared in this way last for a few weeks.

Dr. T. Harris † pipettes off some of the deposit from the bottom of an ordinary conical urine glass (1–2 ccm.) and then places this in a sort of test-tube containing a preservative fluid composed of potassium acetate

Fig. 80.



60 grm., chloroform 10 ccm., H_2O 1000 ccm. The tube is a piece of ordinary glass tubing about 5/8 in. diam., and drawn out to a point so that the lower opening is about 1/8 in. diam., the length being about 13 in. and the capacity about 60 ccm. The upper end is closed by a rubber plug $1\frac{1}{4}$ in. long.

The tube is to be filled with preservative fluid to within an inch of the top, and while doing this the lower aperture should be stopped with the finger. When the sediment has subsided, a sufficient quantity may be obtained by holding a slide underneath and just pressing on the rubber plug above.

Dr. B. Bramwell ‡ proceeds by mixing equal quantities of urine and aqueous solution of boracic acid. The deposit is pipetted off into a

* Centralbl. f. wiss. Med., May 19, 1894, pp. 449–51.
† Brit. Med. Journ., June 23, 1894, p. 1356 (1 fig.).
‡ Op. cit., July 7, 1894, p. 8.

solution of picrocarmine, and after having been allowed to stain for 24 hours or so is examined. In case of suspected amyloid disease methyl-violet may be used instead of picrocarmine. Permanent preparations may be made by mixing the stained deposit with Farrants' medium and allowing the mixture to stand for three or four days, and then mounting a specimen from the deposit.

(6) Miscellaneous.

Microchemical Reaction of Vegetable Albumen.*—Dr. A. De Wévre studied the microchemical reactions of vegetable proteids in specimens rich in reserve-albumen, such as the pea, castor-oil plant, maize, and wheat; also in *Cucurbita pepo*, *Carica Cundinamarcensis*, and some other plants. The reagents in their action are considered under three divisions—coagulating, precipitating, and colouring. The author arrives at the following conclusions:—

(1) Albuminoids cannot be localized by means of a single reagent; several are needed.

(2) Before testing, sections must be boiled in water, then in absolute alcohol, or be immersed in tartaric acid alcohol.

(3) The most sensitive reagents are, in order of sensitiveness:—*a*. Iodopotassic iodide, or a solution of eosin. *b*. Millon's reagent. *c*. Picric acid, xanthoproteic acid, phosphomolybdic acid: Guezda's test (saturated ammoniacal solution of sulphate of nickel gives blue colour turning to orange-yellow with KHO). *d*. Pietrowski's test (biuret reaction). *e*. Reichel and Mikosch's test (alcoholic solution of benzaldehyde plus H_2SO_4, containing a trace of ferric sulphate). If all the tests give a reaction, the presence of albumen is assured.

(4) Absolute alcohol is the best coagulating reagent.

(5) The xanthoproteic reaction answers best for the examination of porous tissue, "tubes criblés," &c., and the same may be said for eosin.

(6) The reactions from porous tissue are frequently not very marked.

(7) At the growing ends of roots and in the laticiferous vessels of various plants is a great quantity of proteid substances.

* Bull. Soc. Belge de Microscopie, xx. (1893–94) pp. 91–121.

MICROSCOPY.

a. Instruments, Accessories, &c.*

(1) Stands.

Messrs. Ross & Co.'s "Eclipse" Bacteriological Microscope.—In its main features this stand is similar to that described on p. 507 of the

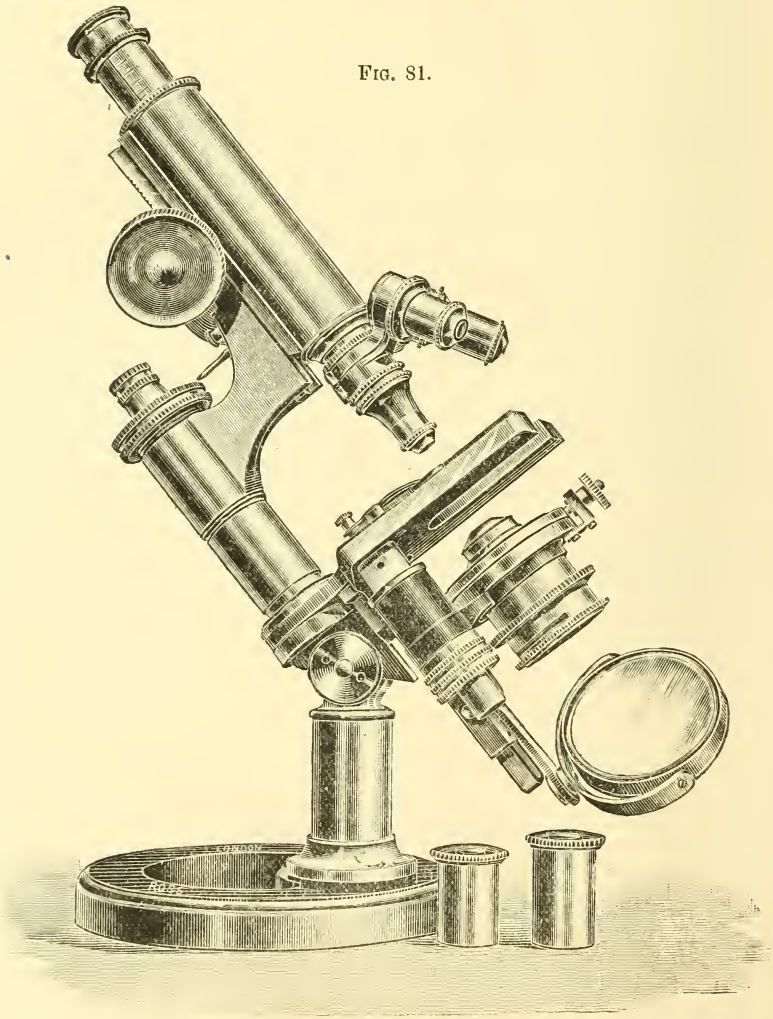
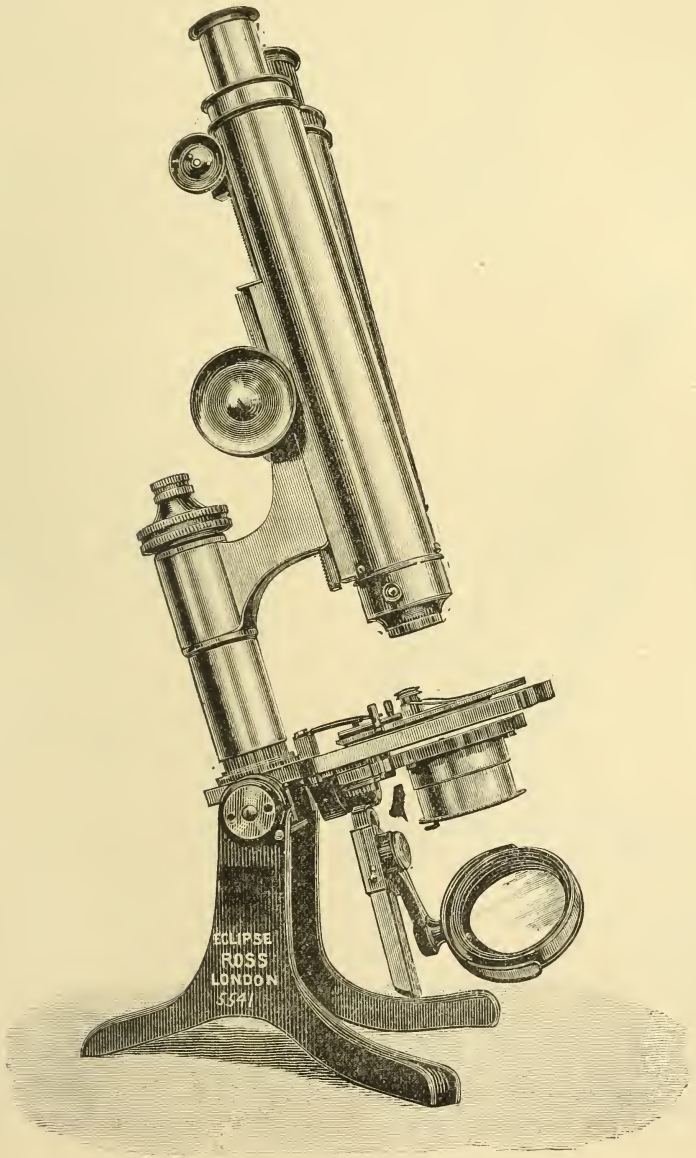


Fig. 81.

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

August number of this Journal. In the present form (fig. 81) the draw-tube is graduated in millimetres and the stage has been replaced by one

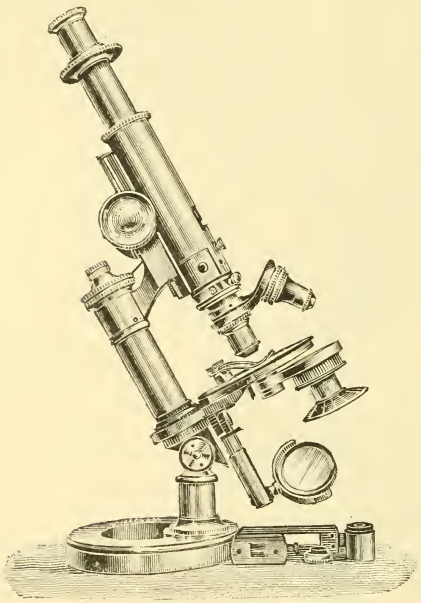
Fig. 82.



of horse-shoe form. The sub-stage, which has centering-screws, is carried on a bar pivoted to the stage-plate; the coarse-adjustment is effected by a spiral movement in the body of the sub-stage, and the fine-adjustment is by a micrometer-screw actuated by a milled head at the bottom of the bar; the condenser supplied is an Abbe achromatic of either N.A. 1·40 or N.A. 1·20. The sub-stage is attached to the side of the stage, and can be turned in or out of position as desired. The triple nose-piece on this stand is so adapted that the objectives focus in the same plane. The slotted tail-piece carrying the mirror can be swung round to allow of the mirror being used for super-stage illumination.

Messrs. Ross & Co.'s "Eclipse" Binocular Microscope.—This stand (fig. 82) differs from the other examples of the "Eclipse" class in having a "bent claw" foot instead of a circular ring. The sub-stage apparatus is attached to the under side of the stage-plate, and can be turned in or out of position as desired. The adjustments and the method of fixing the mirror are the same as in the preceding stand.

FIG. 83.



Messrs. Ross & Co.'s "Eclipse" Petrological Microscope.—A description of this Microscope (fig. 83) appears on p. 509 of the August number of this Journal.

Support for the Microscope.*—Mr. R. B. Coutant has devised a support intended for the use of large or small Microscopes in either an upright or inclined position. It consists of two triangular wooden boxes, one sliding in the other. When closed, the height of the boxes is 29½ in., but the movable one can be drawn out and fixed in any position so as to increase the height up to 10 in. more. The inner box has a double top, between the layers of which a lamp-carrier swings horizontally through an arc of 90°. The upper and lower layers are each made up of three triangular pieces of wood (fig. 84) with the grain parallel with the outer edge so as to prevent warping. Three pieces of wood (the unshaded parts of fig. 85) serve to keep the layers apart. The lamp-carrier, as shown in fig. 85, has a slot in which a screw passing through the top of the support engages so as to fix it in any position. The projecting end of the carrier has a slot, in which the upright rod of the lamp fits, as seen in fig. 86. The outer box is 18½ in. high. In the

* English Mechanic, lx. (1894) pp. 108–9.

right-hand panel, 5 in. from the top, is fixed a large set-screw, which works through a slot in the corresponding side of the inner box into a

Fig. 84.

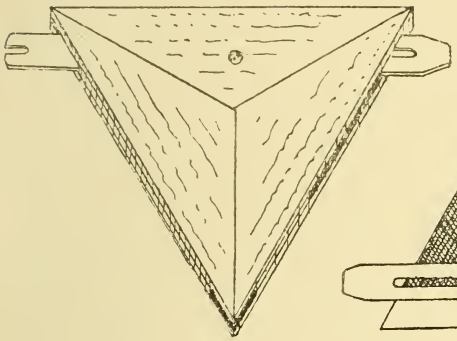
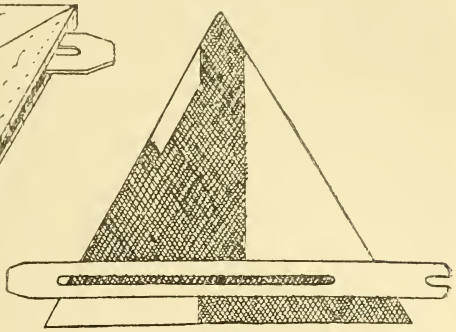


Fig. 85.



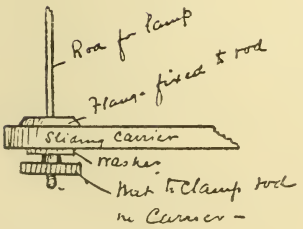


Fig. 86.

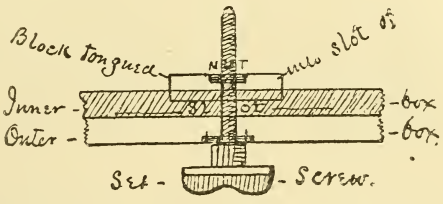


Fig. 87.

nut (fig. 87), so that when the screw is released the inner box may be raised or lowered, and when tightened the two boxes are securely clamped together and fixed at any elevation.

(2) Eye-pieces and Objectives.

New 1/5 Objective.*—Mr. J. Michels states that he possesses a 1/5 objective of 50° air angle which was constructed for him by Spencer and Smith, of Buffalo. The lens has fine definition and is specially adapted for work with covers 1/10 in. thick. The writer thinks that a lens of this sort, one that can be used in conjunction with a compressor having a screw-adjustment at each end, and with a cover-glass 1/10 in. thick, will be found very useful to those making biological researches.

Koristka Semi-Apochromatic 1/15 Objective.†—Herr J. Amann gives the results of the tests which he has applied to this objective. According to the catalogue of the firm, the composition of the system is similar to that of the apochromatic, except that the fluor-spar is replaced

* Amer. Mon. Micr. Journ., xv. (1894) pp. 156–7.
† Zeitschr. f. wiss. Micr., xi. (1894) pp. 145–8.

by a suitable glass. The aperture is said to be 1·30. The objective is to be used with compensation eye-pieces, and for the tube-length of 160 mm. should give magnifications respectively of 600, 900, 1200, 1800, 2700 with the eye-pieces 4, 6, 8, 12 and 18.

As the result of his examination of the system, the author determines the focal length as 1·8 mm., and the numerical aperture measured with the apertometer as 1·32.

When used as eye-piece with the front lens turned towards the eye, the system shows no large spots and not too many small ones.

The objective stood the Abbe test very well. With central illumination, when an immersion condenser of 1·40 N.A., and the compensation eye-piece 6 were used, the edges of the slit of the test-plate in the central parts of the field of view were very sharp and perfectly free from colour-fringes and mistiness, while on the periphery small colour-fringes were visible, and, quite on the edge, a slight mistiness. With the slightest changes in the adjustment the colour-fringes of the secondary spectrum make their appearance. The image is sharp and free from colour up to the extreme edge of the field. With the compensation eye-piece 12, the edge of the eye-piece diaphragm has a light orange-yellow fringe.

With oblique illumination including rays inclined 60° to the axis, the colour-fringes of the secondary spectrum are very distinct, but no mistiness is observed. By blocking out the most oblique rays and diminishing the effective aperture to about 1·20, the colour-fringes are reduced to a minimum, and the two edges of the slit appear very sharply defined up to the extreme edge of the field. A test of the objective by means of a scale of *Pleurosigma* and also of tubercle-bacilli gave very good results.

The resolving power corresponds perfectly to the aperture 1·32. With central illumination the cross-striations of *Surirella gemma* are very distinct. With intense lamp-light and oblique illumination the objective showed the cross-striation of *Amphipleura pellucida*. With oblique monochromatic illumination by means of sunlight and a CS_2-prism these striations appear in the limit between the green and blue ($\lambda = 0{\cdot}48\ \mu$) of the spectrum; in blue light ($\lambda = 0{\cdot}45\ \mu$) they are very distinct, and in the blue-violet ($\lambda = 0{\cdot}42\ \mu$) indications of the pearl-structure are visible. In order to test the optic homogeneity and elasticity relations of the material of the lenses, the behaviour of the objective in polarized light was examined. The lenses were found to be perfectly homogeneous and isotropic, for no signs of double-refraction were noted either with parallel or with convergent polarized light.

(3) Illuminating and other Apparatus.

Clay Wick for Microscope Lamps.*—The indestructible clay wicks give 25 per cent. more light than cotton wick. They are made in any desired shape or size and have been used for high-power work in some laboratories for months. They require no trimming or attention and the wicks do not clog. These wicks are made by arranging vegetable fibres in the unbaked clay, so that when fired a series of longitudinal pores are left through which the oil is raised by capillary attraction. Owing to

* Amer. Mon. Micr. Journ., xv. (1894) pp. 30-1.

the perfect combustion, the flame is perfectly white, smokeless, and devoid of odour.

Magnifier for Reading Small Print.*—This magnifier, which is now being offered for sale in the shops of Parisian opticians, consists, not of an ordinary lens, but of a thin-walled glass-tube filled with water and closed at both ends. This tube, which is in length about that of the lines of a book, is held at both ends in a piece of bent wire which is provided in the middle with a handle so that the instrument can be rolled over the lines of the print.

The New Photometry.†—Prof. Crova is the inventor of new and improved methods of photometric work. The use of the electric light has been the means of exposing the many imperfections of the old photometric processes. The standard sources of light, as candles, Carcel lamp, Hefner-Alteneck lamp, &c., have all great faults, and the various photometric apparatus are so imperfect that the simple law of the square of the distances in practice becomes a source of error.

Prof. Crova finds that the Carcel lamp is the most reliable of all known standard sources of light, if the instructions of Dumas and Regnault for its use are rigorously followed. When, however, the Carcel lamp is used for measuring the intensity of an arc or incandescent light, it loses a great part of its value owing to the fact that the illuminated surfaces of the screen of the photometer have no longer the same colour. In the laboratory this difficulty might be overcome by isolating with the spectrophotometer the rays of 582 wave-lengths, and from the ratio of their respective intensities determining the total intensities of the two sources of light. Such a method requires expensive instruments and special knowledge.

Prof. Crova therefore recommends a simple means for obviating the difficulty, which consists in observing the screen through a glass vessel with parallel walls filled with a solution of nickel and ferric chlorides. The proportion of the two salts is so chosen that the solution only transmits rays which have a wave-length of 582.

The whiteness of the different sources of light, Crova defines as follows:—It is the ratio of the intensities of the rays whose wave-lengths are about 582 μ and 650 μ. The intensity for the latter wave-length is obtained by observing the screen through a glass coloured red with cuprous oxide. Experiment has shown that this ratio is unity for sources of light of the same colour as the Carcel lamp, that it varies from 1·05–1·23 with the electric incandescent light, and from 1·5 to 1·7 with the arc-light.

In photometric work the great differences of intensity of the sources of light offer a serious difficulty, since for direct working, a room 20–30 m. long would be necessary. This difficulty is overcome by placing the intense source of light in a small side room, separated from the photometric room by a wall in which is an opening covered with a ground glass. This glass is covered with a screen in which is a hole of exactly a square centimetre, and the source of light is exactly a metre from the glass. The square centimetre of the ground glass gives in the photometric room a light whose intensity is a certain fraction easily

* Central-Ztg. f. Optik u. Mechanik, xv. (1894) p. 189. † Tom. cit., pp. 194–5.

determined of the incident light. Glasses can thus be graduated and named, e. g. a ground glass of 100 Carcels is one which, brought into a field of this intensity, transmits an amount of light exactly equal to one Carcel at the unit of distance.

In making a photometric determination by comparison with a Carcel lamp, instead of the distances being changed, the aperture in the screen is made variable and its size can be measured by a micrometer screw.

Colorimeter with Lummer-Brodhun Prism Pair.*— Dr. H. Krüss points out the advantages of the use of four prisms in the colorimeter

FIG. 88.

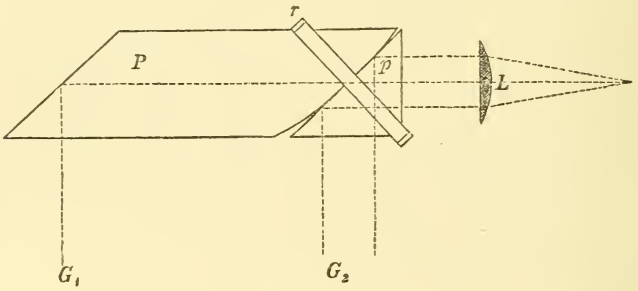
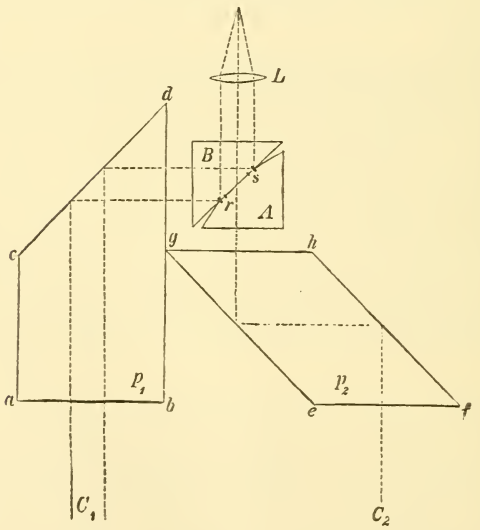


FIG. 89.



devised by himself over the arrangement of only two prisms which has been more recently proposed by Dr. C. Pulfrich.

* Zeitschr. f. Instrumentenk., xiv. (1894) pp. 283-5.

The arrangement of Pulfrich is shown in fig. 88, that of the author in fig. 89.

Against the arrangement in fig. 88, the author raises the objection that the rays coming from the liquid G_1 have a much longer path to travel through the prism P than those from the liquid G_2 which only pass through the reflecting prism *p*. This difference of path amounts to 4 cm. if the distance between the centres of the liquid columns G_1 and G_2 is 5 cm.

The advantage, on the other hand, of the author's arrangement, which at first sight appears so unsymmetrical, is that it is really optically perfectly symmetrical, since the lengths of path of the rays in the prisms P_1 and P_2 are the same, and the number of reflections is the same.

Photometric experiments made by the author on Jena flint glass (No. 36) showed that the coefficient of absorption for 1 cm. thickness was 0·982, and for 4 cm. 0·930. Thus if this glass were used in the Pulfrich colorimeter with the centres of the two glass vessels 5 cm. apart, there would be an error of about 7 per cent. owing to the strong absorption in the prism P.

The absorption also varies throughout the spectrum; there is a considerable increase in the loss of light from the red to the violet end. In the Pulfrich arrangement, therefore, for different coloured solutions a different factor of correction would be necessary. The author suggests that the equality of path of the rays coming from the two liquids might be easily effected in the Pulfrich arrangement by increasing the length of the prism *p* downwards.

(4) Photomicrography.

Photomicrograms of Ice and Snow Crystals.* — Herr Neuhauss describes the method adopted by Redner for taking photomicrograms of ice and snow crystals. The apparatus was set up out of doors. The source of light was a small petroleum lamp and the objective a projection-system of 31 mm. focal length (Hartnack). The linear magnification varied between twelve and twenty times. A concentrated alum solution, kept from freezing by the addition of rock-salt, served to absorb the heat-rays. Altogether twenty pictures were taken at −5 to −10° R., five of ice and the other fifteen of snow crystals. Single pictures showed up to ten different forms of crystals.

The Optics of Photography.†—This second part of Dr. Vogel's handbook runs to 367 pages and has numerous figures with a coloured frontispiece illustrating the Vogel-Kurtz process of printing in three superposed colours. The subjects of photographic optics, viz. the methods of forming images, faults of lenses, intensity of illumination, &c., is dealt with in seven chapters forming an appendix to the work. The main portion of the book, consisting of 31 chapters extending over 266 pages, treats of such subjects as:—Intensity of light and Lambert's law, photometry, standards of light, Methe and Michalke's law of photographic reciprocity in developed films, sources of artificial light for photography,

* SB. Gesell. Naturforsch. Freunde, 1893. pp. 18–9.

† 'Handbuch der Photographie, II. Theil: Das Licht im Dienste der Photographie und die neuesten Fortschritte der Photographischen Optik,' by Prof. Dr. H. W. Vogel, Berlin, 1894. See Nature, l. (1894) pp. 589–91.

properties of optical sensitizers, colour screens, spectrographs, direct photography in natural colours, &c. As regards standards of light, the author gives the preference to the amyl-acetate lamp of Hefner-Alteneck. The so-called law of photographic reciprocity is very fully discussed. The greater portion of the book, however, is devoted to the action of special sensitizers and kindred subjects.

(5) Microscopical Optics and Manipulation.

Experiments with a Right-angled Prism.*—Herr W. G. Röntgen finds that a right-angled prism may be used in order to demonstrate the fact, originally discovered by Helmholtz, that the line of sight of the eye does not coincide with the axis of the eye.

On looking with one eye through the hypothenuse face of a right-angled prism with vertical prism edge, an image of the head is seen which, unlike that from a mirror, is congruent with the object. The author discovered that for any position of the head the line of sight of the image from the back prism edge to the pupil in the image always passed through the same part, but not through the middle of the pupil; it was always directed to a point from the middle towards the side of the nose.

Further experiments were made by the author with a right-angled prism by mounting it on a goniometer with the prism edge parallel to the axis of the instrument. When the telescope is directed upon the hypothenuse face a sharp image of the cross-wires is seen which only coincide with the cross-wires seen directly if the vertical cross wire and the prism edge lie in one plane. By rotating the prism the image of the cross-wires does not change its position in the least. These observations may be made use of in order to set the vertical cross-wire parallel to the axis of rotation of the instrument, and also to determine whether the prism is exactly right-angled or not. In the latter case, instead of one image only of the vertical cross-wire, two are seen which lie so much farther to the right and left of the wire seen directly, the greater the error of the prism. Since all these experiments succeed equally well with mirrors set at right-angles, this observation affords a simple means of adjusting two mirrors exactly at right-angles to one another.

When the vertical cross-wire was rotated through a certain angle the image was turned through the same angle, only in the opposite direction. When, therefore, the vertical cross-wire was turned through an angle α, a rotation of the prism about an incident ray as axis through the angle $\frac{\alpha}{2}$ in the same direction brought the image into its original position again.

(6) Miscellaneous.

The late Mr. G. E. Blenkins, F.R.C.S.—As announced at the October meeting of the Society, we have lost one of our oldest and most honoured Fellows by the death of this gentleman. He joined the Society in 1848, and was active in its service, being Secretary from 1858–67. We learn some details from the British Medical Journal.†

* SB. Physikal-medicin. Gesell. Würzburg, 1894, pp. 53–6.
† Brit. Med. Journ., No. 1762, 1894, p. 789.

He was a Deputy Inspector-General. "He entered the Grenadier Guards in April 1838, and served in the Crimean campaign, receiving the gold medal with clasp, the fifth class of Medjidie, and the Turkish medal. After serving more than thirty years in the regiment he retired in December 1868. Mr. Blenkins has so long retired from active work that the younger generation will hardly recognize his name as one of the most active and valued workers in the metropolis some thirty years ago. He was one of that distinguished class of army surgeons, then by no means too numerous, who to a thorough knowledge of his profession and departmental duties, added a great love of scientific research in the active study of its most difficult departments. He was a practical and skilful histologist, when to be so was a rare distinction in the schools in civil life.

"We incline to believe that he was the first amongst the teachers of histology in the metropolitan medical schools who instituted classes of practical microscopic work and demonstration. He lectured and taught at Lane's School of Anatomy and Medicine adjoining St. George's Hospital, and as far back as 1851 he carried on a class of practical histology, in which every student was provided with a Microscope, and was taught himself to make, prepare, and put up the specimens. This class Mr. Blenkins conducted while a surgeon in the Guards, and it had, at that time at least, few if any parallels in this country, for what is now an every-day rule of teaching was then a rare and brilliant exception."

The writer of the notice adds:—"This brief tribute is due to the memory of one of the most lovable and accomplished surgeons of his day, for to a handsome presence, great dignity and refinement of manners, of which the only fault perhaps was a somewhat marked reserve, Mr. Blenkins joined singular modesty, unfailing kindness of heart, and an interest in the personal welfare of his pupils, which lasted throughout his and their lives."

To the Society's Transactions he contributed in 1858 a note "On an early Human Ovum." *

The late Mr. F. R. Cheshire.—We regret to learn that Mr. F. R. Cheshire, who was some years a Fellow of this Society, died on the 17th of September last, aged 61. Mr. Cheshire was greatly interested in Bees, and in 1885 he made us two interesting communications, which will be found in the Journal for that year. One was by himself on "The Apparatus for Differentiating the Sexes in Bees and Wasps," the other, in conjunction with Mr. W. Watson Cheyne, dealt with "The Pathogenic History and History under Cultivation of a new Bacillus (*B. alvei*), the Cause of a Disease of the Hive Bees hitherto known as Foul Brood."

Removal of Rust from Instruments.†—Herr Säuger recommends the following method for removing rust from instruments:—The instruments are placed for the night in a saturated solution of chloride of tin, when the layer of rust will disappear by reduction. After taking them out of the solution, the instruments are washed with water, brought

* Cf. Trans. Micr. Soc., vi. (1858), pp. 5-9, pl. ii.

† Central-Ztg. f. Optik u. Mechanik, xv. (1894) pp. 237-8.

into a hot solution of soda-soap, and then dried. A further cleaning with absolute alcohol and whiting is also advisable. Ordinary petroleum may also be used with advantage for removing rust. Paraffin oil is recommended as the best means of protecting steel instruments from rust. To avoid using excess of oil, the best method of procedure is to take a solution of 1 part paraffin oil in 200 parts benzine, to immerse the instruments in this solution, and afterwards place them on a plate in a dry room where the benzine may evaporate.

B. Technique.*

(1) Collecting Objects, including Culture Processes.

Aseptic Protozoa Cultures.†—Dr. C. O. Miller says that in the preparation of Protozoa cultures it is necessary to be extremely careful to prevent contamination of the media, and greater precautions are required for liquid than for solid media. For direct examination of the appearances occurring in the cultures he used sterilized moist chambers, hanging drops, Petri's capsules and ordinary tumblers. The most trustworthy cultures were made in Erlenmeyer's flasks holding 100–200 ccm. Discontinuous sterilization was usually employed, the media being steam sterilized for 15 minutes on three successive days. For some experiments an autoclave was used for 15 minutes at a pressure of two atmospheres. Inoculations or transplantations may be made with a platinum loop, but it is better to use a pipette. A couple of dozen pipettes (from 18–20 cm. long) may be sterilized together. The author adds many cautions and precautions too minute to give in full, but these may be easily apprehended. The infusions used were neutralized bouillon 2–4 parts to 100 of water; 1/2 per cent. glycerin in which is placed a little bit of tendon 1 mm. square; linseed decoction diluted down to the colour of white wine; dilute hay infusion with 1/2 per cent. grape sugar or 1/5 per cent. milk. These dilute solutions give better results than thicker ones. After filtration, 1–1½ ccm. were placed in the glass vessels. One of the greatest difficulties in these cultivations is the presence of fungi, though most of these are got rid of at a temperature of 37·0°, which is unsuitable to them and favourable to Amœbæ, Plasmodia, and many other Protozoa.

Apparatus for Pure Cultivation of Algæ.‡—Herr P. Kossowitsch adopted the following arrangement for the pure cultivation of Algæ. On the bottom of an Erlenmeyer's flask (fig. 90) having a diameter of 15·5 ccm. is placed a thin layer of sand. The neck of the flask is plugged with a triply perforated caoutchouc stopper. Through one of the holes passes the glass tube *d*, which reaches nearly to the bottom of the flask.

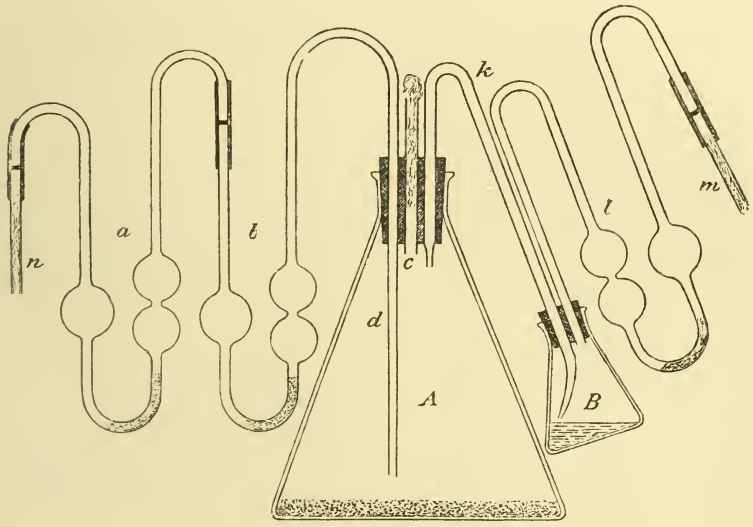
* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 273–80.

‡ Botanische Zeitung, Jahrg. 52 (1894) pp. 101–3 (2 figs.).

The outer end of the tube is connected with two U-shaped tubes *a* and *b*, joined by rubber tubing. In their course are six bulbs, and their bend holds some strong sulphuric acid for drying and sterilizing the air. Dust and other impurities are prevented from entering by means of the short tube *n*, which is filled with cotton-wool. Through the second hole in the caoutchouc plug passes the tube *c*. Through this the Algæ are introduced after the apparatus has been sterilized; this done it is closed with sealing-wax. Through the third hole passes the tube *k*. This is the exit air tube; the bottle end is narrowed, and the end of the long arm which passes into the small Erlenmeyer's flask *b* containing nutrient solution is curved. From the flask *b* passes the bulbed U-shaped tube *l*.

Fig. 90.



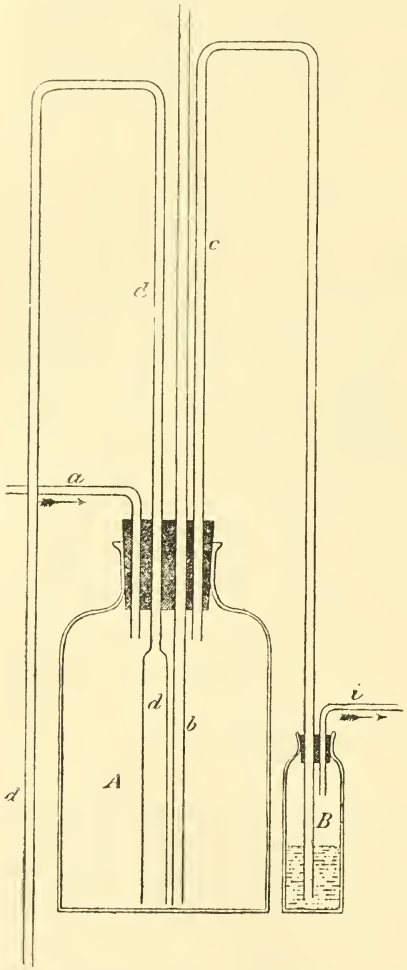
This also holds some sulphuric acid and is closed with cotton-wool at *m*. The long arm of tube *k* which unites the large and small flasks is bent away from the short arm, and is of such length that its extremity would not touch the nutrient medium if the apparatus were in the horizontal position.

The air was introduced and a current maintained by a modification of A. Koch's apparatus, which consists of a flask holding 5 litres, A, fig. 91, closed with a caoutchouc stopper with four perforations for the passage of four tubes. Water is introduced through *a*, and the air is driven out through *i*, having previously passed through *c* and the flask B filled with fluid. When the bottle A is quite full and the water run up into the siphon *d*, the bottle A is emptied in a few minutes. Then the

fluid in the bottle B runs up the tube *c*, and thus the air is prevented from escaping backwards. The bottle A is meanwhile filled with air through the tube *b*.

When the bottle A is almost empty the water in the siphon *d* falls, provided the lower end inside the flask be sufficiently broad, and the water flowing back without interruption again drives on the air into the cultivation vessel. There is no other outlet for the air as the siphon *d* and the tube *b* are closed by water. The amount of pressure with which the air is forced out depends on the height of the tubes *b*, *c*, *d*: the longer they are the greater the pressure.

Fig. 91.



If the water runs into the bottle A too quickly, the air pressure rises too high in the bottle, the water is forced into the siphon *d*, so that the bottle A is emptied too soon and before it has become properly filled, but if the water inflow be regulated the apparatus will be found to work with great regularity.

Cultivation Capsule for Fungi.*—Dr. J. H. Wakker describes an apparatus which he has devised for cultivating fungi in the tropics, where it is necessary to use agar as the nutrient medium. It is a simple glass capsule in the middle of the top of which is an opening *o*, with the funnel-shaped piece *h* above (fig. 92). The free edge of the funnel has a thick lip *r*. The top *a a* forms a movable lid for the capsule, which can be securely closed. The funnel is stopped with cotton-wool *w*, and protected against dust by a rubber cap *f*. When a layer of the medium has been poured in the capsule is

* Centralbl. f. Bakteriol. n. Parasitenk., xvi. (1894) pp. 348–9 (2 figs.).

sterilized, and several may be sterilized at once by placing them in a tin box with a number of shelves (fig. 93).

Fig. 92.

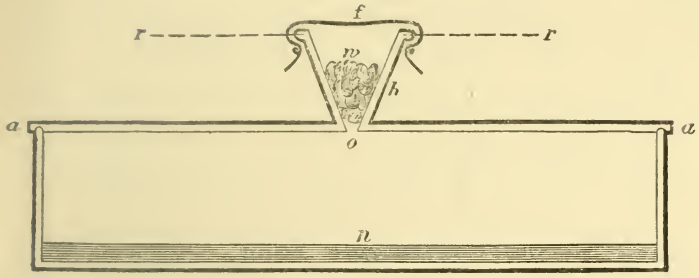
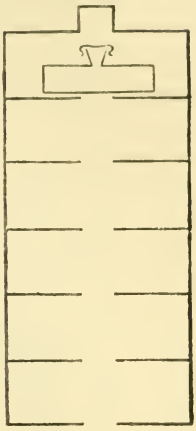


Fig. 93.



Air Filter.*—Herr J. J. van Hest describes at considerable length a simple apparatus which he has devised for filtering air and thus freeing it from bacteria, fungi, &c. The principle of the filter depends on the fact that these organisms are not devoid of weight, and hence if a current

Fig. 94.

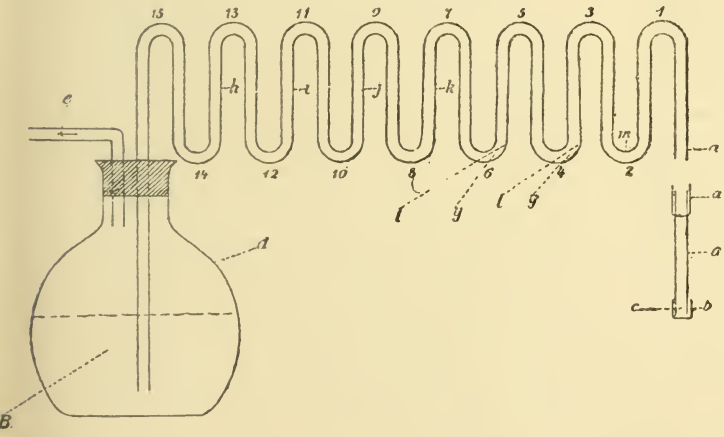
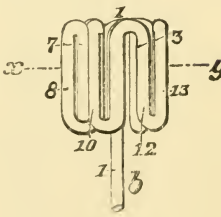


Fig. 95.

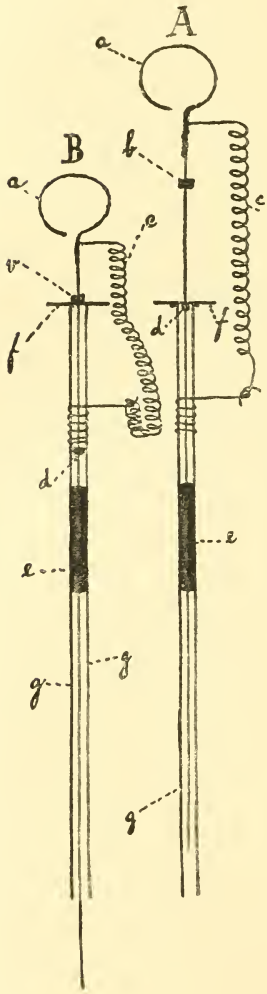


of air be passed through a fine tube with a perfectly smooth interior and numerous coils or turns in its circuit, organisms will be deposited inside. The rapidity with which the air may be driven through is 1·5–2 m.

* Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 435–47, 495–99 (11 figs.).

per second or 1 litre per minute. The tubes, which are made of tin or are tin-lined, are 3–6 mm. thick, with a bore of 1–4 mm. in diameter. To the filter there are fifteen turns up and down, each of them 2 cm. long. The filter may be used either extended as in fig. 94 or in the more compact form seen in fig. 95.

Fig. 96.



Infection Needle.*—Mr. J. C. Bay describes a needle used by him in the study of the lower cryptogams. The needle itself, made of brass or copper wire, passes through the centre of a metal disc *f*, and its lower part is surrounded by a glass tube *g* (fig. 96). The disc can move between two stoppers *b* and *d*. The upper end of the needle is bent round to form a grip *a*, while just below this is the spring *c*, the other end of which is attached to the glass tube *g*. Inside the tube is a cotton stopper *e*. When used, the upper part of the glass tube is charged with cotton, and this outside wrapper should be of the same size as the opening of the flasks, so that when the plug of the flask is removed for inoculation, the needle case exactly fills the neck. Fig. A shows the needle guarded, fig. B when pressed down for removing a sample from a culture.

Setting Cultivations on Solid Media.†—Dr. P. Miquel fixes all kinds of cultivations by exposing them to the vapour of trioxymethylen. In the dry condition this substance gives off but little methylic aldehyde, to which its fixative property is due. It must therefore be moistened with water, or better, dissolved in a saturated solution of calcium chloride. It is only necessary to put the substance and the cultures under a bell-jar for twenty-four hours to about three days. The media are quite unaffected, the growths are all killed, and it is only necessary to hermetically seal up the culture vessel to prevent evaporation. The appearance of the cultures is unaltered as a rule, though occasionally chromogenic bacteria and some moulds lose a little colour.

Parasitic Cell-inclusions and their Cultivation.‡—Dr. O. Busse has successfully inoculated cell-inclusions on animals, in which they have multiplied; has obtained pure cultivations on various nutrient

* Amer. Mon. Micr. Journ., xv. (1894) pp. 44–5 (2 figs).
† Ann. de Micrographie, vi. (1894) pp. 422–3.
‡ Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 175–80 (4 figs.).

media, and has successfully reinoculated these latter on animals. The material was obtained from a chronic inflammatory growth of the tibia, the alternative diagnosis being softened sarcoma. From teased out fresh material were obtained bright circular or oval bodies, varying in size from a nucleus to a liver cell, lying within, and also without giant cells. The bodies have a distinct double contour and frequently contain one or more corpuscles. Sometimes appearances were seen recalling a capsule. This capsule remained unstained when cover-glass preparations were treated with methylen-blue, carbol fuchsin, logwood, or by Gram's method, though the inner doubly contoured portions were strongly coloured. The only successful method of preparation was to treat with caustic soda and examine in water. The material was inoculated on three animals (dogs and rabbits) and with most successful results, it being noted in one case at least, that the parasite was present in the lymphatic glands. Pure cultivations on agar, glycerin-agar, gelatin, blood-serum, potato-gelatin, and potato were obtained. On gelatin and agar the growth is white, and the gelatin is not liquefied. Potato was the best medium, the growth at first being dirty white, changing afterwards to a grey brown. The cultivation appearances differ somewhat from the original; the double contour being for the most part absent.

When reinoculated on animals, there was reversion to the original type. The author showed the specimens and preparations to Prof. Loeffler who decided that the parasite was a pathogenic yeast. In favour of this view are the growth on plum decoction and the development of carbonic acid in grape-sugar bouillon.

Cultivating Gonococcus.—Dr. Král * has obtained with the three following media for cultivating gonococcus very good results:— (1) 20 grm. of agar, after soaking for 24 hours, are placed in a steamer and dissolved at a temperature of 100° C. in 650 ccm. of bouillon made without salt. After cooling down to 55° C., 5 grm. of saccharose, 2·5 grm. of salt, and 350 ccm. of blood-serum are added; it is then steamed again for half an hour at 100°. The coagulated portions are removed, and the clear fluid transferred to test-tubes after filtration. (2) 2 per cent. agar, which has been cleared with the white of one hen's egg per litre, and after cooling down to 55°, is mixed with half its volume of blood-serum, and then treated as in No. 1. (3) This formula contains the further addition of 5 per cent. glycerin and 1 per cent. saccharose, which are mixed in at the same time as the blood-serum. One or two loopfuls of the pus are placed in 4 ccm. bouillon, and after shaking 2 loopfuls are distributed over the surface of the medium.

Drs. Ghon and Schlagenhaufer † have used with very successful results ordinary pepton-agar smeared with human sterile blood for the isolation and continued cultivation of gonococcus. Inoculation with these blood-agar cultures on men gave positive results.

By cultivating in cattle-serum-agar the authors obtained even better results when acid phosphate of soda was added to the medium. They also tried whether an acid medium were better suited to the coccus, and found that a useful substratum was a mixture of 2 parts

* Arch. f. Dermat. u. Syphil., xxviii. (1894) No. 1.

† Wien. Klin. Wochenschr., 1893, p. 619. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 467–9.

2 per cent. agar and 1 part acid urine, either taken or made sterile. Further cultivations on this medium were difficult, but inoculations with two days old cultures of the first generation excited a suppurative urethritis in 48 hours.

Rapid Method for making Nutrient Agar.*—Dr. J. L. Schutz prepares agar in the following expeditious way :— 1500 ccm. of water and 18 grm. of agar are boiled together in an open vessel. While boiling, 2 grm. of Liebig's meat extract are added. After boiling for half an hour, the solution is removed from the fire and cooled down to 60° C. To it are then added 10 grm. of dry pepton, 5 grm. of salt, and a hen's egg, in as much water as has been lost by evaporation. The strongly alkaline reaction is now reduced to a slightly alkaline or neutral one by the addition of HCl. The mixture is then boiled again for 5–10 minutes, after which it is filtered through a white filter paper. The filtration of a litre of this fluid does not take longer than 3–5 minutes. If the filtrate be not perfectly clear, the white of another egg must be added, and the whole reboiled until the albumen has coagulated. When the solution is transparent and thin it is easily filtered; if not, the reaction is too alkaline. To this agar, 4 per cent. glycerin may be added, so as to render it suitable for Esmarch's roll tubes.

Instead of meat extract fresh meat may be used; if so, 1/2 kilo of finely chopped meat is digested in 1500 ccm. of water for 30 minutes at 50° C.; the mass is squeezed in a linen cloth, and having been boiled for 5 minutes, the whole is filtered. To the filtrate the agar is added, and the further treatment is as before.

As the reaction is usually markedly acid, the mixture must be alkalinized or neutralized with a saturated solution of sodium carbonate.

Nutrient Media containing Alkali Albuminates.†—Herr Deycke recommends a medium composed of 1 per cent. veal alkali albuminate, 1 per cent. peptone, 1/2 per cent. salt, 2 per cent. agar, 5 per cent. glycerin, and 1/2 per cent. soda for cultivating the cholera vibrio, and the bacilli of anthrax, diphtheria, and tubercle. The author has found it extremely useful for the rapid diagnosis of cholera and diphtheria.

(2) Preparing Objects.

Preparation and Preservation of Embryos of Chelonia.‡—Prof. K. Mitsukuri preserved nearly all his young embryos in Kleinenberg's picro-sulphuric acid; very advanced embryos were placed in the same, or in corrosive sublimate. The spot where the blastoderm was to be found was generally marked with a hair, as the thin layer of white which was necessarily left over it, coagulates in the preserving fluid, and hides it entirely from view. After three or four hours incisions at right angles were made with a sharp knife on three sides of the blastoderm. A little manipulation with forceps or scalpel easily separated the superficial coagulated white from the blastoderm beneath; the

* Johns Hopkins Hospital Bull., iii. (1894) p. 92.

† Deutsche Med. Wochenschr., 1894, No. 25. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) p. 542.

‡ Journ. Coll. Sci. Imp. Univ. Japan, vi. (1894) pp. 229–31 (1 fig.).

latter can be easily removed. After removal, the blastoderm was generally left in a relatively large quantity of the preserving fluid for some hours longer.

When the embryo was very much advanced, and the allantois had spread itself entirely beneath the shell, the removal of the shell was found to be a matter of some difficulty, as it is leathery and not brittle. The author says that he carefully scrapes the shell at one small spot with a knife until it becomes quite thin; picrosulphuric acid is applied to the spot, which is again scraped, and acid again applied. This process must be repeated, with great care, until enough of the shell is worn off to expose a very small patch of the allantoic surface. However small the opening may be, the acid is able to penetrate and harden the tissues for some space around it. The opening may then be with safety gradually enlarged, until at last the entire shell can be removed without injury to the membranes.

Preserving Ostracoda.*—Dr. G. W. Müller finds that preservation in 70 per cent. alcohol is sufficient for the examination of the shells and appendages of Ostracoda. With some, especially the Halocrypidæ, the shell is too soft for this method, and it is well to place such in Canada balsam, to preserve the form of the shell.

Preservation for histological purposes presents some difficulties, as the highly calcified shell is an obstacle to the entrance of the preservative fluid. The best results were obtained with a mixture of 5 parts ether and 1 part absolute alcohol, from which, after a minute, the specimens were removed to 70 per cent. spirit. Useful preparations may be made by destroying the shell of living animals, and placing them quickly in 70 per cent. alcohol.

Study of Mitosis.†—In his study of the variations of mitosis in *Ascaris megalocephala* M. V. Heda found that Prof. Van Beneden's method was the best for fixing the eggs; he used, that is, a mixture of 1 part glacial acetic acid with 5 parts of absolute alcohol; this mixture kills rapidly, while the achromatic elements remain very distinct. The best staining reagent appears to be vesuvin 0·25, malachite-green 0·25, distilled water 100, and glycerin 10 parts. The eggs, on removal from the fixing reagent, are at once placed in a drop of the staining fluid on a slide, and in this they are moved about. The preparation is then placed in a damp chamber for a day; a cover-glass is then put on, and at each of its four sides a drop of glycerin (with 1/3 water) is allowed to fall. If, on examination, the preparation appears worthy of a detailed study, it must be decolorized. This is done by putting a drop of aqueous solution of glycerin at one edge of the cover-glass, and drawing it through till there are only traces of the stain. The solution of glycerin should be 10 per cent. if the preparation has just been stained, 30 per cent. if it was stained a short time previously, and 50 per cent. if the preparation is old; this last solution may be employed for eggs set up some years since. It is well to have the worms as fresh as possible.

* Fauna u. Flora des Golfes von Neapel, xxi. Ostracoda (1894) pp. 8 and 9.
† Arch. de Biol., xiii. ("1893") [1894] pp. 424 and 5.

(3) Cutting, including Imbedding and Microtomes.

Small Auxiliary Apparatus for the Plate Modelling Method.*—Prof. F. Keibel describes a small graving tool which can be attached to a microtome in order to mark the straight lines in the plate-modelling method. The apparatus consists of a stout brass hoop B (fig. 97), which fits over the knife of the microtome and is fixed by the screw S. To this hoop is fastened by means of two screws (of which only one *s* is shown in the figure) a steel plate *p*, bent at right angles, with its free end pointing downwards. On the free end small teeth are cut, which are arranged in groups and are sharpened on both sides, so that their section is as in fig. 98.

Fig. 97.

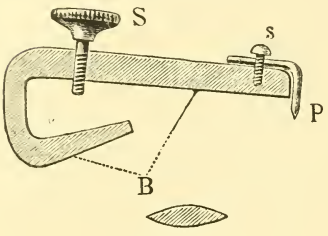


Fig. 98.

Plate Models of Embryonic Livers.†—Herr J. A. Hammer has studied the development of the liver in some Vertebrata by the method of plastic reconstruction of the object. The author followed the procedure as laid down by Born,‡ though some departures were made in details, perhaps the most important being the use of brown modelling wax, which is more plastic than the ordinary uncoloured plates. The material was fixed in saturated solution of sublimate and afterwards hardened in spirit to which a little iodine has been added. The sections varied from 10–20 μ in thickness. The objects were drawn under magnifications of 130–150, so that the epithelial cells of the liver, bile-duct, &c., were well seen.

Methods for Examining Embryological Material.§—Prof. C. Rabl recommends the following procedures for examining the vertebrate embryo:—

Fixing.—(1) Saturated aqueous solution of sublimate 1 vol., saturated aqueous solution of picric acid 1 vol., distilled water 2 vols. As a rule they are kept in this for about 12 hours; they are then washed for a couple of hours, and next transferred to weak spirit. The spirit is gradually increased in strength until it becomes absolute alcohol, to which a trace of tincture of iodine should be added. (2) Another fixative which gives even better results is 1 per cent. platinum chloride solution 1 vol., saturated aqueous solution of sublimate 1 vol., distilled water 2 vols. (3) Another mixture, the results of which are sometimes brilliant and sometimes doubtful, is 1 per cent. platinum chloride solution 1 vol., saturated aqueous solution of picric acid 2 vols., distilled water 7 vols. Any fixative which contains platinum chloride must be used in large quantity and often renewed. With other fixatives the author has not obtained such good results, e. g. pure sublimate and Flemming's fluid. Embryos of osseous fishes require to be plunged in hot fixative to prevent crumpling of the chorda and rupture of the muscles.

* Zeitschr. f. wiss. Mikr., xi. (1894) pp. 162–3.
† Nova Acta R. S. Sci. Upsaliensis, xvi. (1893) p. 34 (2 pls.).
‡ See this Journal, 1884. § Zeitschr. f. wiss. Mikr., xi. (1894) pp. 164–72.

Staining.—Czokor's cochineal-alum is the best all-round stain for embryos and embryonic areas, but Delafield's hæmatoxylin, borax-carmine, safranin, &c., are very clear nuclear stains. The author makes his alum-cochineal by mixing about 25 grm. of powdered cochineal and an equal quantity of powdered alum in about 800 grm. of distilled water and evaporating down to 600 grm. The mixture must be constantly stirred. A small piece of thymol is added to the solution in order to prevent fungi growing, and when cold the solution is filtered. It stains better when fresh, and is therefore the reverse in this respect of Delafield's hæmatoxylin. According to size, the embryos remain in the stain for an hour to a day; they are then washed in water as long as any colour comes out. Embryos which have been hardened in a solution containing platinum chloride should be stained as soon as possible (within a week), otherwise they stain badly or not at all. Before staining all the alcohol must be removed.

Imbedding and Cutting.—Embryos are imbedded from chloroform or from bergamot oil. It is advisable to make the change from absolute alcohol to bergamot oil or chloroform a gradual one. The objects are first soaked in paraffin with a melting-point of 45°, and are then placed in paraffin of 56° melting-point heated in a water-bath to 80°–90°. It is of importance that all the chloroform or bergamot oil should have been driven off, otherwise the sections crumble. In dealing with fragile or brittle objects (e. g. lens, or if air has got into the preparation) it is advisable to brush over the surface of the paraffin block a layer of paraffin heated in a water-bath. By this device the section may be lifted off the knife with safety, and it does not curl itself up.

Adhesion of Sections.—Schällibaum's solution is used by the author for sticking the sections to the slide, and they are made to adhere firmly by treating them with the following mixture, which must be freshly made every four or five days:—new clear oil of cloves 3 parts and 2 parts of perfectly clear collodion. When stuck on with this mixture the sections adhere so firmly that they may be immersed in absolute alcohol for a whole day, and may be stained and decolorized as desired.

This adhesion-method has the further advantage of allowing a series of sections to be examined a few minutes after they have been cut, for supposing no further after treatment is required, the paraffin is soon melted off over a Bunsen burner, and then the slide can be at once transferred to xylol. As a mounting medium the author uses xylol-dammar, and always warms the cover-glass before imposing it.

Use of Stabilite for Celloidin Preparations.*—Herr O. Jelinek recommends the use of the new insulating material stabilite in preference to wood or cork on which to fasten the celloidin block. The disadvantage of the use of wood or cork for this purpose is that colouring matter and tannic acid are extracted from them by immersion in alcohol. In seeking for some material to replace them the author was guided by the following considerations. The substance must be perfectly insoluble in water and alcohol; it must be possible to easily cut from it blocks of different size and shape with the knife or saw, and these blocks must be hard and not alter their shape by clamping; the celloidin must adhere

* Zeitschr. f. wiss. Mikr., xi. (1894) pp. 237-42.

firmly to it; it must be possible to write on the blocks without danger of the writing being easily effaced; and finally the substance must not be costly. According to the author, stabilite, the insulating material supplied by the Electricitäts-Gesellschaft of Berlin, answers all these requirements very satisfactorily. It has a specific gravity of 1·6, so that it sinks in alcohol; it is not hygroscopic, is insoluble in water and alcohol, and is not attacked even by hydrochloric and dilute sulphuric acids. It can be easily cut with a saw, and takes a good polish, and it is possible to easily write upon it either with a pencil or with ink.

Glass Receptacle for Series of Sections.*—Prof. J. Schaffer describes a new form of receptacle for series of sections, in which the object-holders can be placed with their long-diameter vertical, so that a considerable saving in liquid (alcohol, xylol, &c.) is effected. The

Fig. 99. Fig. 100.

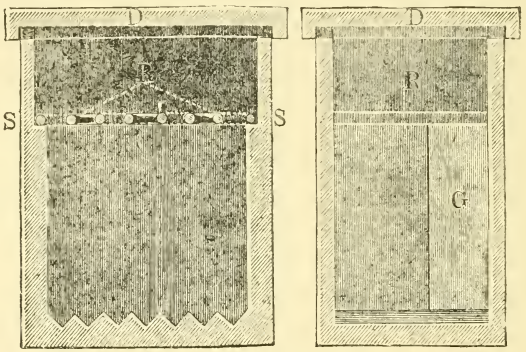
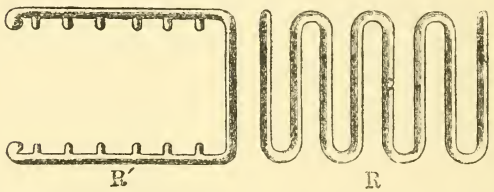


Fig. 101.



vessel is of strong glass, and has cubic contents of 8·3 × 6·2 × 4·4 cm.; at the bottom are seven grooves (fig. 99), which receive the lower ends of the object-holders, while the upper ends are held by the glass grating R resting upon the two projections S S. The cover D fits on tightly by means of a deep rim. The grating is either a bent glass rod with parallel folds (fig. 101, R), or has the form shown at R′. The latter is intended for the large paraffin size, 36 × 76 cm., the former for the smaller size. The amount of liquid required for seven wide object-holders is 100 ccm. When the small (25 mm.) object-holders are used the amount of liquid may be diminished to 80 ccm. by placing a glass block (fig. 100 at G) in the vessel.

* Zeitschr. f. wiss. Mier., xi. (1894) pp. 150–3.

(4) Staining and Injecting.

Modification of Golgi Silver Stain.*—Dr. H. J. Berkley has chiefly followed, in the investigation of the nerves of the liver, the rapid Golgi method, but he did not always get with it the finest details. He recommends, therefore, the following modifications:—The tissue is cut into slices not more than 1·5 mm. thick, and while warm is immersed in a saturated solution of picric acid diluted with an equal volume of warm water. After being in it for from 15 to 30 minutes it is immersed, without washing, in the hardening fluid, where it remains for forty-eight hours or longer. This fluid should consist of aqueous solution bichromate of potash 100 parts (saturated in the sunlight), and solution of 2 per cent. osmic acid, 16 parts. The solution is to be exposed to full sunlight to age, but all specimens are to be hardened in absolute darkness at a temperature not lower than 25° C.

After the expiration of the 48 hours the specimens are treated with the silver solutions of 0·25 and 0·75 per cent. in the usual manner, and allowed to remain in them five or six days. After very rapid washing in running water they are rapidly dehydrated, immersed for a few minutes in celloidin, placed on a cork, and the celloidin hardened in 75 per cent. alcohol in a closed jar; this jar is cooled so as to harden the celloidin as rapidly as possible. The sections are cut under 95 per cent. alcohol, rapidly dehydrated, cleared in oil of bergamot, and mounted in xylol-balsam without cover-slip.

The osmium-copper-hæmatoxylin method and various gold methods were tried, but the results do not appear to have been very satisfactory.

Staining Intrinsic Pulmonary Nerves of Mammalia.†—For these nerves Dr. H. J. Berkley found that the picrid-acid-osmium-bichromate modification gave incomparably better results than the rapid Golgi method, the latter allowing no definite distinction to be made between medullated and non-medullated nerves.

Nerve-Supply of Cardiac Ventricles.‡—The same author reports that very considerable differences are found in the staining by the silver methods of the nerve elements in the muscular tissue of the cardiac ventricle. These variations in the staining action of the silver salt account in large measure for the discrepancies that exist between different observers that have used Golgi's method.

Staining Living Cells.§—Dr. G. Galeotti finds, from numerous experiments on animals and plants, that living cells never stain altogether, owing to their vital energy, which prevents the colouring matters from becoming diffused in their protoplasm. It is, however, possible to stain some elements of living cells, and those are they which do not take any active part in the functions of the cells; such are the supposed nutritive substances of the cytoplasm and secretory products destined to be expelled. It cannot therefore be admitted that there is a vital staining reaction for the nervous system in the sense of Ehrlich, or in that of Schultze and Mitrophanow for the cytoplasmic granules, for the staining

* Johns Hopkins Hospital Reports, iv. (1894) pp. 216–9.
† Tom. cit., p. 241. ‡ Tom. cit., p. 250.
§ Zeitschr. f. wiss. Mikr., xi. (1894) pp. 172–207.

of the whole anatomical element is the sign of its death. Partial staining of a living cell indicates that the coloured part no longer possesses any activity. In discussing partial staining the author demands the following postulates:—The colouring matter must not be toxic to the cellular protoplasm; there must be an elective relation between the cell-elements and the stain; the stain must be stable and capable of resisting the reducing power of the living cell.

For his experiments the author used the salamander, the frog, and the iris, and these were treated with twenty-four pigments. The salamanders received an intraperitoneal injection of a solution of the dye in sodium chloride. From the frogs a piece of mucosa was removed from the palate and then placed in the staining solution. The iris flowers were immersed in an aqueous solution of the pigment.

Artificial Colouring of Wine with Vegetable Substances.*—Sig. A. Scala finds that nitrite of potassium or formaldehyde added to a natural red wine will precipitate the colouring matter, leaving a liquid golden-yellow in the first case, cherry-red in the second. Extrinsic vegetable colouring matters from the fruits of elder, Phytolacca, &c., are not precipitated, and may thus be detected. Some anilin-reds behave in the same way. The first reagent mentioned is more trustworthy than the second.

Rapid Staining of Blood Corpuscles.†—Dr. H. Seelmann points out that Ehrlich's method of differentiating red from white blood-corpuscles demands too much time and apparatus to be suitable for the busy physician. His method is as follows:—A drop of blood is placed on a slightly warmed cover-glass, dried, and fixed for five minutes in absolute alcohol; the preparation is then placed in a saturated alcoholic solution of eosin with the addition of a quarter the volume of water; it remains there half a minute and is then transferred to an aqueous alcoholic solution of methylen-blue (1:85 of water, 15 of absolute alcohol) for about 2–2·5 minutes; thereafter it is put on the slide and examined wet, or dried and covered with balsam. The red corpuscles become brown-red; the nuclei of the white corpuscles dark blue; the protoplasm a delicate bright blue; and eosinophilous cells are similarly stained. The preparations cannot be compared with Ehrlich's, but they are sufficiently clear for an estimate of the proportions of red and white corpuscles, and they are made rapidly.

Flagella-Staining without a Mordant.‡—Dr. W. Hessert stains flagella, using no mordant, in the following way:—A young agar culture is suspended in distilled water, and a film made on a cover-glass. When dry, the film is fixed either by passing the cover-glass through the flame or by treating it with a saturated alcoholic solution of sublimate. In the latter case it must afterwards be washed. When fixed, the preparations are treated for 30 to 40 minutes with the staining solution, which is frequently heated. The cover-glass is then washed, dried, and mounted in Canada balsam. The staining solution recommended is a 10 per cent. aqueous dilution of a saturated alcoholic solution of fuchsin.

* Ann. Ist. d'Igiene Sper. Univ. Roma, iv. (1894) pp. 167–76.
† Biol. Centralbl., xiv. (1894) pp. 687–8.
‡ Centralbl. f. Bakteriol. u. Parsasitenk., xvi. (1894) pp. 346–7.

In this simple way the flagella of many bacteria may be effectively stained, though the pictures are perhaps not so striking as by Loeffler's method.

Spore-staining after Maceration.*—Prof. P. Ernst reports some researches made by Dr. Kinscherf on the staining of spores after macerating the preparations. The basis of the method presupposes that the difficulty of staining spores depends on the thickness and impenetrability of the spore membrane and not on any special characters of the spore plasma. By maceration this resistance may be overcome. The methods adopted are given very curtly, e. g. *Bac. subtilis* 13–15 minutes in 5 per cent. chromic acid, water, 18 hours in gentian-violet-anilin-water, 2–3 minutes in Lugol's solution. Günther's acid alcohol, 96 per cent. alcohol, water, Bismarck brown. An excellent contrast stain. Potato bacillus, 18 minutes in 5 per cent. chromic acid, 18 hours in Ehrlich's solution, &c. Root bacillus, 15 minutes in 5 per cent. chromic acid, &c. *Mesentericus vulgaris*, 30 minutes in 5 per cent. chromic acid, &c. Anthrax, 23 minutes 5 per cent. chromic acid, 18 hours Ehrlich's solution, 33 per cent. HNO_3 (= tubercle stain). Also by Günther-Gram and thirdly by Lustgarten, 5 seconds in 5 per cent. permanganate of potash, 3 seconds in aqueous solution of sulphurous acid. Anthrax cultivations showing many free spores, were macerated from 18 to 20 hours in chromic acid, and afterwards treated with aqueous fuchsin solution, or with Bismarck brown. In such preparations the spores were stained in a short time.

Staining Micro-organisms in the Blood.†—M. H. Vincent adopts the following procedure for staining micro-organisms in blood preparations. The blood-film is prepared in the usual way, and then the cover-glass is treated for 1/2–2 minutes with the following mixture :—5 per cent. carbolic acid 6·0; saturated salt solution 30·0; glycerin 30·0. The solution is to be filtered. This fluid dissolves the hæmoglobin, does not alter the shape of the red corpuscles and causes no precipitate. The fluid is drained off, and the preparation after having been washed in distilled water is stained with carbol-methylen-blue plus 1–2 per cent. aqueous methyl-violet solution.

This method is also useful for showing the malaria plasmodia.

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

Production of Artefacts by certain Fixatives.‡—Dr. A. P. Ohlmacher in a critique of the Sporozoan theory of malignant neoplasms from a micro-technical standpoint, records his experience of different fixatives, followed by different stains, on the Myxosporidia found in the kidney tubules of toads. These Sporozoa are only found in the spore form, exist in great numbers in the renal tubules, and are excellently adapted for controlling the results obtained from cancerous tumours. The author found that solutions containing chromic acid or osmic acid are unsuited for the preservation of Myxosporidia, while absolute alcohol and Carnoy's chloroform-acetic alcohol gave excellent results. Corrosive sublimate, while fixing and hardening well, is a little inconvenient

* Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 182–4.
† Gaz. Méd. de Paris, 1894, p. 296. ‡ Journ. Amer. Med. Assoc., June 30, 1894.

as the crystals are sometimes very difficult to remove. The author condemns the inferences drawn by many investigators of carcinomata in organs, chiefly on the ground that their results have been obtained by using fixatives which do not preserve spores well, and which produce curious artefacts in the stained spores, distorted by the fixing fluids.

Zenker's Fixative.*—Dr. K. Zenker recommends as a fixative the following solution:—Distilled water 100·0, sublimate 5·0, bichromate of potash 2·5, sulphate of soda 1·0, acetic acid 5·0. Though the solution keeps well, it is better to add the acetic acid shortly before using it. Pieces 1 cm. thick are perfectly hard in less than 24 hours. The after treatment consists in washing well in running water, and then dehydrating in alcohols of increasing strength. If any sublimate remain it may be removed either from the piece or from the sections by means of iodine alcohol. No distortion occurs during the after-hardening in spirit. The sections stain well.

Formol as a Preservative Fluid.†—Herr J. Blum is strongly impressed with the value of formol as a preservative fluid. Formol is a 40 per cent. solution of formaldehyde, and comparatively recently has come much into vogue for preserving museum specimens for microscopical and also for bacteriological work. Animals hardened in formol preserve to a great extent their natural form and colour; their eyes are clearer than in spirit. Mucin is not coagulated, and retains its transparency. Blood colouring matter of tissues and organs placed in formol apparently disappears, but on immersing the object in not too weak spirit (60–90 per cent.) the characteristic colour is restored. Vegetable tissues and structures are also well preserved in formol. Chlorophyll is not extracted, though it appears to undergo some change, which varies with the plant. Microscopical sections of plants preserved in formol give excellent pictures. Diluted formol does not burn, and is cheaper than alcohol.

Pacini's Preserving Fluid.‡—Prof. A. Lustig has examined cholera dejecta which had been kept in Pacini's fluid since 1831. The fluid consists of mercury chloride 1, sodium chloride 2, distilled water 200. The composition of the mixture was in Pacini's own writing.

Microscopical examination of the yellowish-white sticky mass at the bottom of the vessel showed that the organisms were well preserved, the predominating form being a curved bacillus, with thin rounded ends, about the length and thickness of the comma bacillus. Stained cover-glass preparations were also very good. The author points out that this fluid must be an excellent medium for preserving material for microscopical examination.

Fixing Methods and the Granula.§—Dr. A. Fischer has some criticism of fixing methods. Chromic acid (·5 per cent.), osmium acid (1 per cent.), Altmann's mixture of 1 per cent. osmic acid and 2·5 per cent. bichromate of potassium and other fixatives cause solutions of

* Münchener Med. Wochenschr., 1894, No. 27. See Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 542-3.

† Bericht Senkenbergische Naturf. Gesell., 1894, pp. 195-204.

‡ Centralbl. f. Bakteriol. u. Parasitenk., xvi. (1894) pp. 326-8.

§ Anat. Anzeig., ix. (1894) pp. 678-80.

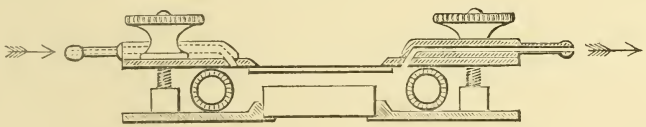
peptones to assume a granula form. The granules may be soluble or insoluble; they may be stained with acid fuchsin and picric alcohol; they are not distinguishable from Altmann's granula. These facts suggest the question whether Altmann's granula is not an artificial product due to peptone or propeptone in the animal cells. Peptone solution injected into empty pith cells, and then fixed with osmic acid or Altmann's mixture, gave rise to a strikingly close imitation of vegetable cell-structure.

Preserving Tow-net Material.*—Mr. J. Rattray never adopted pure alcohol *ab initio* for the preservation of tow-net material, but 70 or 80 per cent. alcohol, with a small addition of pure hydrochloric acid and a trace of picric. After washing with strong spirit to remove the acid, the specimens were preserved in spirit. Alger's adaptation of Kleinenberg's formula was often used, because of its reported high degree of penetrability for chitinized structures; the fixing agent was simply added to the sea water, and was succeeded by increasing strengths of spirit. Mayer's picro-hydrochloric method was only employed a few times. Corrosive sublimate was extensively used, Lang's methods being simplified and accelerated by adding a little of the solid salt to the sea water. In a few cases, following Carnoy, a trace of acetic acid was added to the corrosive solution.

New Compressorium.†—Prof. H. E. Ziegler has devised a small apparatus by means of which a well-regulated pressure can be applied to the object, while at the same time a stream of fresh water or any other liquid can be drawn through it.

The apparatus (fig. 102) consists of two metal plates, of which the lower serves as object-holder, while the upper carries the cover-glass.

Fig. 102.



In each plate there is an aperture in the centre. On the opening of the lower plate a round piece of thick glass is fixed, while below the opening of the upper the cover-glass is cemented. The two plates are kept apart by a hollow caoutchouc ring, and can be pressed together by three pressure-screws. A constant stream of water can be passed through the space between the caoutchouc ring and the plates by means of the two tubes in the upper plate. The stream of water is regulated by a stop-cock. A small U-tube is attached to the exit-tube to prevent any effect of suction on the water in the apparatus.

The brass parts of the apparatus are protected from the injurious effect of reagents by lacquer, but it is advisable to have two apparatus, one of which should be kept free from reagents.

* Trans. Linn. Soc. London, Zool., vi. (1894) pp. 4 and 5.
† Zool. Anzeig., xvii. (1894) pp. 330–2 and 345–7.

The author has made use of the apparatus for observations of different marine larvæ and small worms, of Rotatoria and Infusoria, and also of the eggs of *Crenilabrus pavo*.

(6) Miscellaneous.

Collection of Microscopic Preparations.*—Dr. Beneke pleads for the institution of more systematic collections of microscopic preparations, not only in the seats of learning, but in central stations or museums. He points out, as a little consideration makes quite evident, that the lack of system, centralization, and availability involves a serious waste of energy. He pleads, in other words, for the institution of libraries for the real documents of histology.

Mr. A. Sedgwick, F.R.S., informs us that there are at Cambridge—

(1) Fairly complete series of sections of embryos of Cape *Peripatus*. A few series of *Peripatus* embryos of West Indian and New Zealand species.

(2) Sections of Elasmobranch embryos; fairly complete series of *Pristiurus*, less complete of *Scyllium* and *Acanthias*; a few series of *Raja*—in the possession of Mr. A. Sedgwick.

(3) Series of sections of embryos and larvæ of many Polyzoa, and of adult *Cephalodiscus* in the possession of Mr. E. F. Harmer.

(4) Series of *Petromyzon* embryos and larvæ in the possession of Mr. A. E. Shipley.

Fixing-board for Experiments on Animals.†—M. A. Latapie describes an apparatus for fixing animals securely during experiments in the laboratory, a feature of which is that the animal can be turned over from front to back without untying the hind legs. It consists of a board 0·3 m. long and 0·14 m. broad; at each end there is an arrangement, one for fixing the head, the other the neck or head. The hind piece is a metal plate, which slips along a fixing screw and has in front a slightly curved metal rod. This can turn round a vertical axis. At each end of the rod is a sort of loop which can be turned right or left. When the hind legs have been stretched by the cross-piece the rings are made to embrace the projecting angle formed by the leg on the thigh. A spring keeps them in position, and thus the hind legs are held tight.

The head is fixed by stretching the head or throat over the block and fastening it down with a rod. A muzzle serves to complete the fixation of the head. For pigeons or fowls a couple of hooks like those used by Malassez are supplied. When both head and hind-legs have been fixed, the proper extension is given by drawing apart the head and tail pieces. The front legs are secured by a couple of rings and a chain.

The board carries two hind leg pieces, the second one being for small animals.

* Biol. Centralbl., xiv. (1894) pp. 718–20.

† Ann. Inst. Pasteur, viii. (1894) pp. 668–78 (1 fig.).

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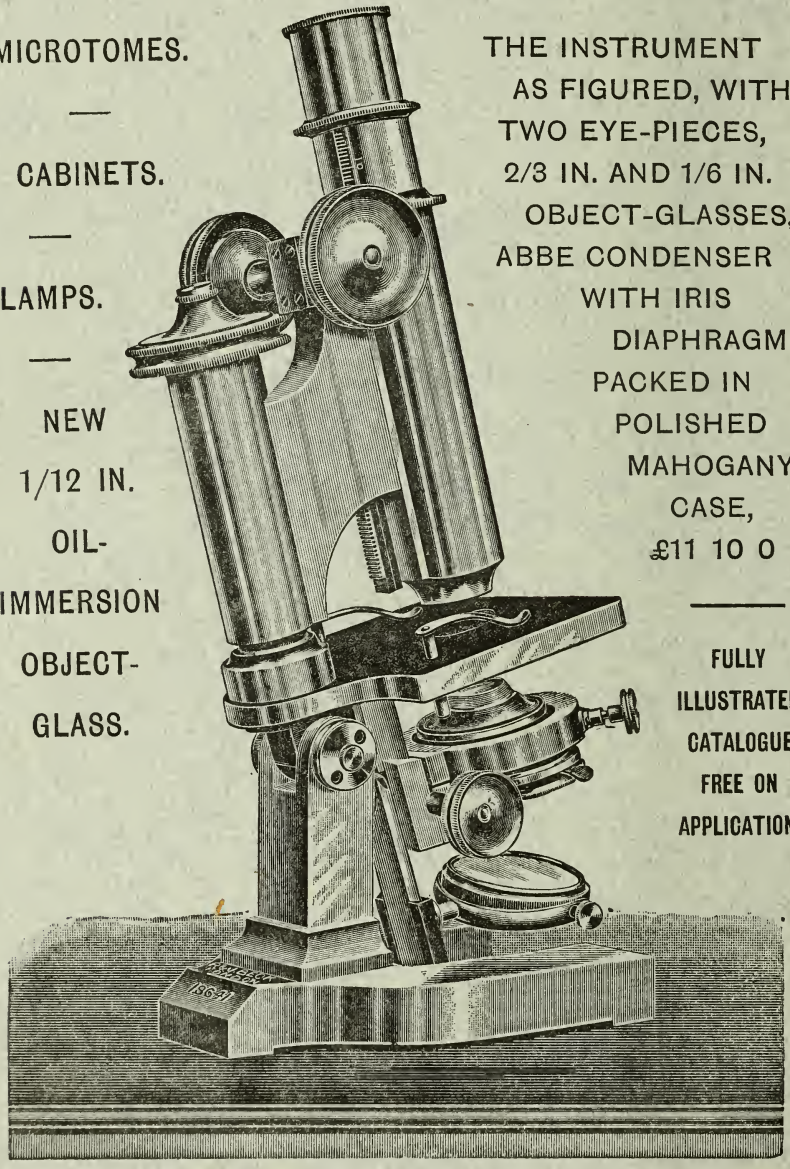

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