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When mixed in the culture liquids the bacteria and the new vibrions develop side by side. When animals are inoculated with them (taking care to have only a very small quantity of the latter) the two parasites are developed simultaneously, and on a microscopic examination are found associated in the blood. But on the second inoculation the bacteria are still localized at the point of inoculation, whilst death has already taken place in consequence of the much more active multiplication of the vibrions.

In a foot-note the author adds that he has found Ranvier's warm chamber extremely convenient for studying all the lower beings, and particularly bacteria. Their elongation can be followed minute by minute, and the transformation into spores as well as the elongation of the spores to re-form the bacteria. He was thus able recently to determine that the bacteria cultivated in certain liquids, especially in the serum of the blood of the dog, give sometimes true sporangia, globular or in "calabashes" filled with spores.*

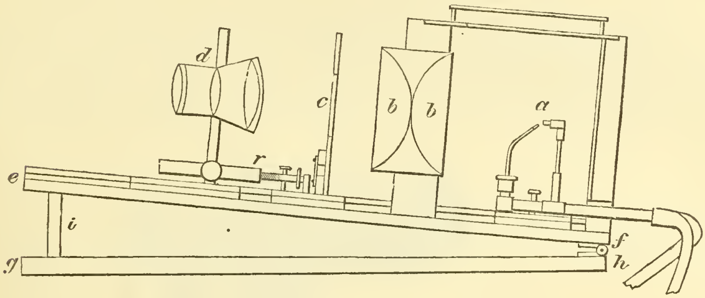
"*The Projection of Microscope Photographs.*"—Dr. J. C. Draper, Professor of Natural History in the College of the City of New York, contributes an article under this heading to the 'American Journal of Science and Arts.' In the lanterns that are constructed for the projection of photographic or other images on a screen, the support or stage on which the photographic slide is placed is close to and at an invariable distance from the condensing lens. So long as the objects to be projected are nearly equal in size to the diameter of the condenser, this is the only adjustment that can be made to illuminate the whole surface of the object, but when the diameter of the field occupied by the object is only one-half or one-quarter of the diameter of the condensing lens, the brilliancy of the result obtained upon the screen may be greatly increased by removing the supporting stage or object carrier to a greater distance from the condenser, so that a convergent beam of light may fall on the object to be projected. To accomplish this I have constructed the following form of lantern.

In the figure, *a* is a zirconia light mounted on an adjustable base,† which may be used with a condensing lens of very short focus, since the zirconia is not burrowed into cavities where the oxyhydrogen flame impinges, as happens with lime cylinders, and causes the flame to be reflected on the condensing lens, and thereby destroys it. In the jet employed, the gases are mixed just before they are ignited. *b*, *b* is a short-focus condensing lens; *c*, the stage or support carrying the photographic or other design to be projected; *d*, the projection lens formed of three sets of lenses, and giving a perfectly flat rectilinear field; *a*, *c*, *d* are mounted on a base board *e*, *f*, to the end of which the lantern box *a*, *b* is attached, and which is freely opened above and below to permit perfect ventilation. The base carries lateral grooves in which *a*, *c*, *d* slide, allowing them to be placed at varying distances from *b*, and fixed by suitable binding screws; *c* and *d* are also connected together by a rod *r*, carrying an adjustment screw at *r*, by

* 'Comptes Rendus,' vol. lxxxvii. p. 69.

† See 'American Journal of Science and Arts,' Sept. 1877, p. 208.

which the change of distance between *a* and *c*, required in giving the correct focus, may be obtained. The base *e*, *f* is attached to a second or under base *g*, *h* by a hinge at *h*, which allows the end *e* of the movable base *e*, *f* to be raised to any required angle, at which it may be maintained by the block at *i*. So convenient and compact is this lantern, that it may easily be stowed away in a small trunk.

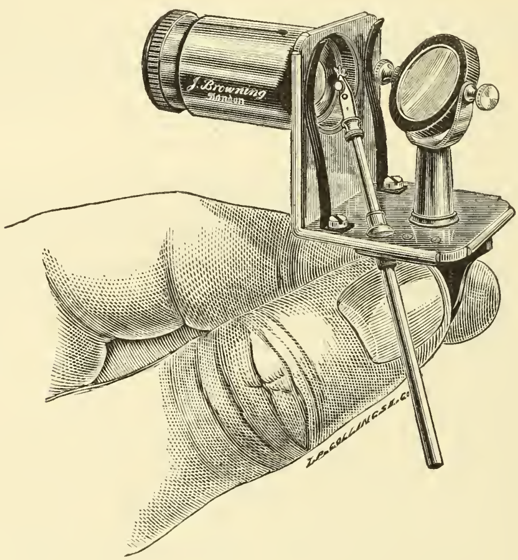


When a series of objects of different sizes is to be projected, as is the case with microscopic photographs taken under the same adjustments, it is, as we have said, a great gain in the projection of small objects if the circle of light used for illumination is reduced, and at the same time increased in brilliancy. This is accomplished in the above arrangement as rapidly as can be desired by removing *d*, *c* together along the slide of the base *e*, *f* to a sufficient distance from the face of the condenser *h* to allow the convergent rays of the latter just to cover a circle which will include the object to be projected. The greater intensity of the illumination thus obtained renders the definition of fine markings or other peculiarities on small objects as clearly visible at considerable distances as are the coarser markings on large objects under a weaker light.

In closing this brief communication, I desire to add that I made photographs of *Frustulia Saxonica* under a power of 7000 diameters. The photographs in question were made in the City College building, by a $\frac{1}{20}$-inch immersion Beck lens. The light was from the sun, reflected by a heliostat through ammonio-sulphate of copper solution and condensed on the object at an angle of 30° to 40°. The photograph in question was direct, by which I mean that there was no intermediate or secondary enlargement of a first photograph. With this photograph and the lantern described I have shown *Frustulia Saxonica* magnified more than half a million diameters, a result which must be seen to be appreciated.

Cleaning Slides and Cover-glasses.—Mr. C. E. Hanaman, of the Troy (U.S.) Scientific Association, recommends as being as efficacious as the nitric acid bath, and wholly free from its disagreeable odours, a cold saturated solution of bichromate of potash in water, to which about one-eighth of its bulk of strong sulphuric acid is added, the mixture being made in a porcelain or thin glass vessel, as the heat evolved would be likely to break a bottle, and the vessel placed outside the window until cool, when no more injurious vapour will be given off. A gross or two of slides may be cleaned in an incredibly short time by sliding them one by one into a vessel containing the liquid, tilting the vessel about a few moments to cause the liquid to flow through the mass, then pouring it off, and placing the vessel under the stream of a tap. The solution is well known to photographers.*

Miniature Microscope.—A diminutive instrument, small enough to be carried in the waistcoat pocket, and available for viewing objects mounted on the ordinary slides, has just been brought out by Mr. John Browning. It is made in nickel silver, and has two achromatic



powers, magnifying respectively 15 and 35 diameters (the latter with a Lieberkuhn), as well as a movable mirror and forceps. The accompanying woodcut of the instrument is full size.

Notommata Werneckii—a Parasite of Vaucheria.—Besides the well-known *Notommata parasita* which inhabits *Volvox globator*, there is another species of the genus living in an Alga which has hitherto been little observed. M. Balbiani having obtained some specimens from M. Cornu, has made an extended investigation, not only of the animal, but of the so-called "galls" of the *Vaucheria* which they inhabit. The article appears in the 'Annales des Sciences Naturelles,' but, though published so long ago as 20th March, the plate has not yet (October 15) reached London. When this is done it is proposed

* 'American Naturalist,' vol. xii. p. 573.

to print here a translation of the article *in extenso* with the plates, but meantime the following summary of M. Balbiani's observations will show the general conclusions at which he arrived.

In the existence of *N. Werneckii* there are two periods, the one of freedom, the other of parasitism in the tubes of *Vaucheria*. In each of these two phases of its existence it assumes a very different form. In the first it is elongated, vermiform, and divided exteriorly into very distinct segments. In the second, when it attains the age of maturity, it is dilated, very contractile, and without any trace of segmentation.

To these exterior changes correspond important modifications in the internal organs, characterized particularly by the enormous development of the ovary and the atrophy of the salivary and gastric glands.

As with many other Rotatoria, it lays two kinds of eggs, called summer eggs and winter eggs, which are distinguished from one another by their structure no less than their mode of development.

The same female may produce either summer or winter eggs exclusively, or the two kinds mixed in the same gall.

The winter eggs are produced as early as the spring; their laying commences later and is prolonged longer than that of the summer eggs — the latter are developed immediately, whilst the former hybernate, and are only hatched in the following year.

Males were not observed, and on the other hand spermatozooids were never found in the females; whence it is concluded that the winter eggs, like the summer eggs, develope without previous fecundation.

The galls of *Vaucheria*, in which the animal lives and is reproduced, are due to a hypertrophy of the branches of the plant which bear the organs of fructification. They differ from the galls, properly so-called, of the higher plants, in that they are pre-existing parts, which have simply undergone an increase of volume under the action of the parasite. This exaggeration of the vegetative functions is also often manifested by the formation of adventitious branches on different points of the surface of the gall.

The exit of the young born in the galls, and their re-entry into the tubes of the *Vaucheria* to form new galls, is effected by openings which are produced spontaneously at the summit of the adventitious branches. They also sometimes make use, for the same object, of the male organ of reproduction, which persists at the base of the capsule in the form of a tube open at its two extremities.

"Bismarck Brown" as a Staining Material.—In the 'Archiv für Mik. Anat.,' vol. xv. part 2, is an article by Dr. C. Weigert on the superiority of this pigment over those hitherto used. The requirements in a good staining matter are, he says:—(1) It must stain with perfect certainty, so that nothing is left to accidental circumstances or the ability of the histologist. This condition is not fulfilled by carmine, picrocarmine, or eosin. (2) The stain must take quickly. In this respect, too, the two first-named pigments are defective. (3) Overstaining must not take place too readily, or must be capable of cor-

rection without having recourse to very different materials, as e. g. strong acetic acid. (4) On the other hand, a proper time must be allowed for the necessary operation of washing, so that the colour does not disappear if the washing is prolonged somewhat. The aniline colours hitherto employed do not permit this. (5) The preparations must be capable of being viewed and preserved in a medium of small refractive power. This is not possible in the case of hæmatoxylin staining, and where aniline colours are used. (6) The stain must be a fixed colour. All these conditions are satisfied in the pigment which is called Bismarck brown. The application of it is very simple. A concentrated solution of it in water or weak alcohol is used. To obtain the former quickly, the pigment must be boiled in distilled water, which serves at the same time to prevent the formation of the white film to which it is subject. The solution is then filtered (the filtration requires to be repeated from time to time). Sections of alcohol or chromic acid preparations are stained immediately on being put into such a solution, which is of a dark brown colour; if the solution is weaker, but still strong, the sections become deeply stained in a few minutes. The differentiation of the staining is effected in a few minutes by washing in absolute alcohol, and then the preparations (cleared by oil of cloves, &c.), may either be kept in Canada balsam, or put up direct in glycerine. In the latter case, care must be paid to the washing in alcohol, and it is as well to put the preparation previously in distilled water again. No harm at all is done if the section is left a day or two in the staining fluid, or allowed to lie for hours in alcohol or days in oil of cloves, provided the stain is not too weak in the first instance.

The nuclei are stained brown by it, and, as with all good stains, more or less dark according to their size. Many protoplasms and connective tissues stain a more or less light yellow. Amyloid is not plainly differentiated, but plasma-cells and many bacterian forms are, which resist hæmatoxylin and carmine stains. Double staining, &c., can be applied, of course, as well as with other pigments for nucleus staining. From an æsthetic point of view, the colour will not perhaps give satisfaction. This, however, is a matter of taste, and the tint has the advantage that preparations thus stained can be photographed. Our blue and red stains are badly adapted for photographing.

Thin Covering Glass.—A complaint is made in the 'Zeitsch. f. Mikroskopie' that the covering glass supplied from England in recent years is of bad quality, not only being of excessive thickness, but containing bubbles and a number of microscopic points which cannot be removed by any chemical means, so that a great part is unsuitable for any delicate investigations. Complaints addressed to the manufacturers have, it is said, met with no success.

Improved Form of Frog-plate.—With the common brass frog-plate generally used it is almost impossible, after the frog has been properly secured, to move the plate under the clips which in the cheaper microscopes serve to retain the object in place on the stage. A very simple addition, however, serves to remedy this defect, and makes the most convenient frog-plate we have ever used. A plain under-plate is riveted to the ordinary notched (upper) plate at one end with a strip between them, which holds them a little more than an eighth of an inch apart. The lower plate (which has a hole which corresponds with that in the upper one) passes under the clips of the stage, which retain it securely, but allow proper freedom of motion.*

Variation in Spongilla fluviatilis.—Mr. J. G. Waller details, in No. 37 of the 'Quekett Club Journal,' the result of examinations which he has made on various specimens of Spongilla, principally from different parts of the Thames. He shows that it is subject to considerable variation, but from the easy manner in which the changes seem to pass through a series of gradations to a complete development of parts, and notwithstanding the remarkable differences between the two extremes (the smooth spicule of the type yielding place to the spinous one and becoming practically obsolete), he considers that, undoubtedly, *S. Meyeni* and *S. Parfitti* should be treated as varieties only, and not as distinct species. Mr. Waller considers that *S. fluviatilis* may be divided into two natural divisions, one having the spicule smooth and the other spinous.

Borax in Vegetable Physiology.—If we immerse in a cold aqueous solution of borax (from 5 to 6 per cent.) vegetable organs containing different colouring matters, the red, blue, purple, or violet liquid matters diffuse themselves rapidly in the solution, whilst the green pigment of the grains of chlorophyll is not diffused. We can in this manner show the presence of chlorophyll in plants in which it is completely masked by other colouring matters, for example, in the red variety of *Atriplex hortensis*, in *Simodurum abortivum*, in certain red and yellow Algæ, &c. A little unicellular Alga, which produces blood-coloured stains on damp vaults, the *Porphyridium cruentum*, Naeg., has been placed by Rabenhorst among the *Phodophyceæ*, Algæ which are distinguished from others by the absence of chlorophyll, and by the presence of a generally red colouring matter. But it is sufficient to immerse this little Alga for a few hours only in a solution of borax, in order to see the whole of the red matter disappear; the plant then becomes completely green under the influence of the true finely-divided chlorophyll. †

The Vernier applied to the Microscope.—American opticians have recently applied the vernier to the body of the microscope (in which they are being followed by English makers), and some controversy has taken place in the States as to who was the "first and true inventor." *A propos* of this controversy M. Bauwens, the Treasurer of the Belgian Society of Microscopy, communicated a paper to the Society on the subject, from which the following extracts are made:—

"It is about ten years since I applied the vernier to my Jackson-Lister instrument, the scale being applied to the movable body, and

* 'American Journal of Microscopy,' vol. iii. p. 158.

† M. Schnetzler, in 'Comptes Rendus,' vol. lxxxvii. p. 381.

the vernier to the support in which the body slides. I can affirm that it is of real utility—

1. When one desires to know the 'frontal distance' (that is the distance between the anterior surface of the front lens and the point where the object ought to be placed) of each of the combinations of eye-pieces and objectives which are used.

2. To measure easily and rapidly the thickness of the covering glass—a very important matter in many circumstances.

3. To find the thickness of the objects examined, &c., and for many other cases, too long to be enumerated.

The vernier which I use is composed of two distinct pieces, sliding one against the other; the one forming the scale is divided into millimetres; the other is the vernier, that is, a piece on which a length of nineteen millimetres is divided into twenty equal parts. As an example, suppose we want to know the thickness of a covering glass. Make a line in ink on one of the faces of the glass, and a line on the other side of it. Find under the microscope the visual point of one of the sides, and note the reading of the scale. In the same way take the visual point of the other line, and the difference between the two measures is the thickness."

M. Bauwens also describes the way in which he applied a second vernier and scale to the draw-tube and body, so as to determine the exact distance between the eye-piece and objective.

Micro-photograph.—Mr. Langenheim, of the United States, has photographed the Lord's Prayer on the ten-thousandth of a square inch, and "so fine that it will bear inspection with a good $\frac{1}{8}$th and B eye-piece."