NOTES AND MEMORANDA.

DR. WILHELM KÜHNE, Professor of Physiology at Amsterdam, well known for his researches in histology as well as in physiological chemistry, has been appointed Professor of Physiology in the University of Heidelberg, as the successor of Professor Helmholtz, who has been called to a similar post at Berlin.

Improvements in the Lenses of Microscopes.—For some time people in England have been content to let the improvement of the optical powers of the microscope remain entirely in the hands of the makers, believing, apparently, that Mr. Lister had effected all in his suggestions and improvements that could be desired. Dr. Royston Pigott, an able mathematician, formerly Fellow of St. Peter's College, Cambridge, and a Doctor of Medicine of that University, was not, however, inclined to look at the matter in this way, and for many years has been working and experimenting with a view, first, to test the accuracy of our best object-glasses, and, secondly, to suggest means for their improvement. It should be remembered that Oberhaüser, Nachet, and especially Hartnack, on the Continent, not satisfied with the old system of combinations for object-glasses, and not having the benefit of Lister's researches, have made excellent objectives on a totally different system, and during the last few years the last-named maker has carried his system of "immersion lenses" to such a point of excellence as really to surpass the best glasses on Lister's system, in definition, penetration, working distance, and illumination. Those who do not admit the excellence of these objectives, which are now used by nearly all German histologists, have probably seen older glasses, made at a time when Hartnack had not reached his best. It is worth stating, now that the Parisian opticians are inaccessible, that Gundlach, of Berlin, has succeeded in making excellent glasses of high power at astonishingly small prices, some of his 1-12ths and 1-16ths immersion 1-16ths (so-called) being admirable in their performance. They are not, however, equal to Hartnack's glasses, which, though costing far less than what similar English glasses cost, yet are more expensive than Gundlach's. It is only fair to all parties concerned to state that the terms 1-8th, 1-12th, 1-16th, &c., as now applied to an object-glass, appear to have no definite meaning, but depend on the caprice of the maker, since the magnifying power of glasses, with the same fraction assigned to them, differs enormously.

To return to Dr. Royston Pigott. He found the usual means of testing an object-glass by trying if it gave some particular appearance with a "test object," such as the Podura-scale, very unsatisfactory, since we have no certainty to begin with as to what is the true appearance of such an object. He therefore examined minute images of objects of which he knew the true form, such as a watch-face or thermometer-scale, forming these images by aid of mercurial globules and the condenser properly adjusted below the microscope-field. By this means he has found that object-glasses corrected so as to show dark, sharply marked spines (like ! ! !) on the Podura-scale—a favourite test-object with our microscope-makers—give false, blurred, and distorted appearances with his known images, and on making such corrections of the objective as to show the known images in their true form, he finds that the Podura-scale, examined with the corrected objective, is not really marked at all as supposed, but is beset with a series of bead-markings, which by intersection, when improperly defined, give the curious appearance like notes of exclamation.* This important discovery of the falsity of our high powers (1-8th to 1-16th), has led Dr. Royston Pigott to pay more attention to the lower powers, and he finds that, though you may not get so much actual amplification, you yet get a truer effect, and greater clearness of detail, by employing very carefully made low powers (1-2nd to 1-5th), and increasing the magnifying power at the other end of the microscope, *i. e.* the eye-piece. We have in this way seen the beaded structure of the scales of Podura more satisfactorily than with very high objectives, even when corrected so far as they would admit, and we may say the same of some Diatom-valves, *e. g.*, *Pl. formosum.* It would be most important to know how far such a change of combination would be useful in histological work.

The general upshot of Dr. Royston Pigott's investigations appears to be that it is desirable to shift the burthen hitherto cast almost wholly upon the objective to the other parts of the instrument. We should be content with an objective as high as a fifth, or even less. A very deep eye-piece is to be

* See Plate VIII of this number.

used; and to correct residuary aberrations of the objective, and at the same time amplify, Dr. Pigott has introduced an important adjustable combination *between the eye-piece and the object-glass.* There seems to be considerable reason for the step proposed by Dr. Royston Pigott. Just as great results were obtained in passing from the single lens or combination to the compound microscope of eye-piece and objective, so by adding distinct integral factors to these two, such as Dr. Pigott's "aplanatic searcher," we may obtain excellences quite impossible by any amount of attention bestowed on the objective alone, or only with difficulty reached by long labour, leading to very high price for high powers.

Dr. Pigott has, during the past year, published some account of his researches in the 'Quarterly Journal of Microscopical Science,' and has communicated papers to the Royal Society, one of which is about to appear in the 'Philosophical Transactions.'[1]

Naturally at first the makers in London and the Microscopical Society were sorely tried by Dr. Pigott's exposure of the Podura-scale, but we hear, as one good result already obtained, that Messrs. Powell and Lealand have constructed a new 1-8th, both dry and immersion, with great care, which is declared to be the best glass yet made. It has been proposed to form a committee for the purpose of examining carefully as to penetration, definition, and angular aperture, the best glasses of our English makers, the best American glasses, and the best of Hartnack's, Gundlach's, and others, the glasses being mounted similarly, with private marks only for recognition, so as to prevent all possibility of prejudice on the part of the committee. Were this done, the result, whichever way it tended, would be eminently satisfactory. Of this the writer is sure, that many persons—even eminent microscopists—have made up their minds about the qualities of foreign objectives, without having seen any, or only very poor examples, and then when a really fair specimen of such a glass is placed before them, they exclaim with astonishment, "Why, this is the finest glass I have ever seen." We shall be glad to receive suggestions or assistance in carrying out the proposed comparison of objectives. Dr. Royston Pigott has expressed his willingness to aid in such an undertaking.

E. R. L. [*Nature.*]

The Microscope in the Study of Rocks.—Professor Archibald Geikie contributes to 'Nature' (February 9th and 16th) two elaborate reviews of "Recent Petrographical

[1] See p. 166 of the present number of this Journal.

Literature," from which we extract the following passages bearing on the use of the microscope:

"English petrography does not exist; what we have in its stead is an indefinite obsolete grouping of rocks patched up with occasional borrowings from the Continent. And yet, strange to say, it is in England that the most important steps in modern petrography has originated. Sorby's application of the microscope to the study of rocks has opened a new era in the science, and our good friend Sorby himself is regarded as a kind of demi-god in the eyes of our German brethren of the hammer.

"The great paper of Mr. Sorby published here thirteen years ago has done much to quicken research by showing that the older methods were in many respects untrustworthy. These methods were based primarily upon chemical analysis. But such analysis, while it reveals the ultimate chemical constitution of the rock, may not explain its mineralogical composition. The various stages of the metamorphism of the component minerals are thereby often lost sight of. Hence two rocks, having by analysis approximately the same chemical composition, may differ materially from each other in mineralogical composition. It is here that, as Sorby showed, the microscope comes in to our aid, and shows what the different mineral ingredients of the rock are, how far they have respectively undergone alteration, how they are built into each other so as to form the rock-mass, and under what conditions they may originally have been formed. This important addition to the methods of research has so powerfully affected petrography, that this branch of science must be regarded as at present in a transition state.

"Among the Continental petrographers who have led the way in the recent reform and extension of this branch of science, none can claim a more prominent place than Dr. Zirkel. Although still a young man, he has held professorships successively at Lemberg and at Kiel, and we rejoice to hear from him that he has been selected to succeed the venerable Dr. Naumann at Leipzig. He is the author of many excellent mineralogical and petrographical papers, and of the best text-book of petrography which has yet been published. Especially has he distinguished himself by the zeal with which he has followed out the ideas first broadly sketched by Mr. Sorby, and has shown how absolutely indispensable is the application of the microscope to the study of the composition and history of rocks. His researches, while extending over the length and breadth of Germany, have not been confined to the Continent, but have been carried with characteristic enthusiasm even as far as the peaks of Arran, and the cliffs and glens of our north-western isles.

"A few years ago he resolved to devote himself to a comprehensive study of the rocks to which the general name of basalt had been given. Though abundant chemical analyses had been made the ultimate chemical constitution of these rocks well known, the mineralogical composition of them still remained rather vaguely defined. Men were still speculating about the mineralogical nature of that part of basalt which is soluble in acid, when Dr. Zirkel set to work to collect specimens of basalt from every available locality, and to prepare thin transparent sections of them for examination with transmitted light under the microscope. The result of these investigations appears in the little volume now before us, which is appropriately dedicated to Mr. Sorby. In a brief introduction the author recounts the state of the question when he took it up. Having collected and prepared upwards of 300 sections of basalt from the most varied localities, he believes that he has obtained samples of at least the chief types of composition and structure among the basalts, and he now gives us this first instalment of his labour.

"That Professor Zirkel is still busy with his researches is shown by the paper (second in the list at the end of this article) which appeared in a recent part of the 'Neues Jahrbüch,' and in which he investigates the peculiarities in the minute structure of rock-forming minerals, and also of artificially-fused basalt and syenite.

"Herr Vogelsang is another ardent student of the microscopic structure of rocks. A few years ago he published a little work containing the most beautiful coloured illustrations of that structure which have yet appeared. In the present paper he describes under the name of *crystallites* the non-crystallised, but yet more or less regularly grouped inorganic bodies which are found in crystals and rocks.

"Professor Fischer's little pamphlet is a modest production, but one which could not have been prepared without a great deal of hard work. Finding that minerals which to all outward appearance are simple and homogeneous, can yet be resolved by microscopic examination into as many as sometimes four distinct minerals, he has analysed by this method some sixty minerals, and publishes his results in the present paper, which should be in the hands of every petrographer.

"Professor Tschermak's essay shows how by microscopical examination with polarised light it is possible to distinguish augite and hornblende, even when minutely diffused through a rock.

The following are the titles of the works referred to:

Untersuchungen über die Mikroskopische Zusammensetzung und Structur der Basalt-Gesteine. Von Dr. F. Zirkel. (Bonn, 1870.)

Mikromineralogische Mittheilungen. Von Dr. F. Zirkel. Pp. 801. ('Neues Jahrbuch für Mineralogie,' 1870.)

Sur les Crystallites, études crystallogeniques. Par H. Vogelsang. ('Archives Néerlandaises,' 1870.)

Kritische Mikroskopisch-mineralogische Studien. Von H. Fischer. (Freiburg.)

Mikroskopische Unterscheidung der Mineralien aus der Augit, Amphibole und Biotit-gruppe. Von G. Tschermak. (Proceedings of the Vienna Academy of Sciences, 1869.)

Spontaneous Generation.—The controversies on this subject have not ceased. Professor Frankland has repeated for himself the experiments which he formerly carried on for Dr. Bastian, on the supposed development of organisms in saline solutions within closed tubes, but "taking additional and much more stringent precautions against the subsequent admission of atmospheric germs into the tubes."

For this purpose four tubes of hard Bohemian glass were about half filled with a solution of carbonate of ammonia and phosphate of soda in distilled water. No care was taken to exclude living germs from these ingredients. These tubes were carefully exhausted by the Sprengel air-pump and hermetically sealed, and then exposed for four hours to a temperature varying from 155° to 160° C. in a Papin's digester. When cool the tubes were removed from the digester and immediately plunged, two of them into colourless concentrated oil of vitriol, and the remaining two into a nearly colourless saturated solution of carbolic acid in water. These precautions were taken in order to avoid the possible admission of atmospheric germs through invisible cracks in the glass; such cracks, entirely invisible to the naked eye, being sometimes known to exist. On examining the tubes when they came out of the digester, it was evident that their interior walls had become corroded by the enclosed liquid.

The cylinders containing the immersed tubes were now maintained at a temperature from 60° to 75° F., and were exposed to bright diffused daylight, and sometimes to sunlight, for more than five months. The liquid in all the tubes became more or less turbid, and in some cases a small quantity of a light flocculent precipitate subsided to the bottom.

Two of the tubes which exhibited the greatest turbidity were selected for examination, and were opened in the presence of Professor Huxley and Mr. Busk, who, with Dr. Frankland, submitted their contents to a searching microscopical examination. So far as the optical appearances of the sediment went they might be appropriately described in the terms applied by Dr. Bastian to the matter found by him in a solution of like composition and similarly treated (see 'Nature,' July 7th, 1870, p. 200). "A number of little figure-of-eight particles, $\frac{1}{20000}$th in diameter, were seen in active movement. The portions of the pellicle were made up of large irregular and highly refractive particles, imbedded in a transparent jelly-like material," &c.

But the movement of the particles which was observed was obviously mere Brownian motion, and many of the particles were evidently minute splinters of glass; there was not the slightest evidence of life in any of the particles. When they were treated with hot concentrated sulphuric acid there was no blackening, and the rounded and dendritic bodies were as unaltered as the glass splinters. Indeed, some of the larger spheroidal bodies were evidently rounded particles of glass which had become detached from the tube by the corrosive action of the enclosed liquid at the high temperature to which it had been exposed in the digester.

Dr. Bastian, in his reply, contends that the experiments described by Dr. Frankland are in reality different from those of his own, to which they were supposed to be similar. The walls of the tubes in his experiments were not in the least corroded, and that there was no flocculent sediment, except in one instance, in which a tube of English glass was used instead of one of Bohemian; that his observations were made not on a sediment but on a *pellicle*, in which alone were found the *spherical* or *ovoid spores* on which he relied as indicative of the presence of living things. He also suggests that Dr. Frankland's tubes should have been subsequently exposed to a somewhat higher temperature, and that the fluids in which the tubes were immersed may possibly have been impervious to the chemical rays of light. — *Nature*, Jan. 19th and 26th.)

The 'Journal of the Quekett Microscopical Club' for January, 1871, also contains an article on so-called spontaneous generation, by Benjamin T. Lowne, M.R.C.S. Mr. Lowne has repeated and varied some of Dr. Bastian's experiments. He placed spores of Pericillium glaucum in a solution of acetate of ammonia, and, after boiling the fluid, enclosed some in capillary glass tubes, when, after remaining twenty-four hours in a warm place, numerous mycelial filaments were seen to protrude from the spores. Other experiments confirmed the conclusion that the vitality of these spores is not destroyed by simple boiling. Some of Dr. Bastian's results are explained by Mr. Lowne as due to the accidental presence of foreign substances; for instance, certain "spiral organisms" described by Dr. Bastian are believed by Mr. Lowne to be filaments of spider's silk, which are, by the action of alkaline solutions, caused to twist into a spiral form.

Striated Muscular Fibre in Gasteropods.—W. H. Dall ('American Journal of Science and Arts,' February, 1871, p. 123) has observed striated muscular fibre in a species of *Acmæa;* and believes "that this is the first instance in which it has been shown to exist in the class Gasteropoda."

Fungus as a cause of Whooping-cough.—The germ theory of disease, which some pathologists seek to extend so widely, has been applied by Dr. Letzerich ('Virchow's Archiv,' vol. xlix, p. 530, 1870) to explain the extremely infectious disease whooping-cough. He thinks he has discovered a form of fungoid growth which vegetates in the epithelium of the air-passages, and by its irritation causes the convulsive attacks of coughing. The expectorated mucus in patients suffering from this disease is said to contain masses of brownish-red spores with occasional threads of mycelium, which in later stages of the disease becomes very abundant. The spores are coloured blue by iodine and sulphuric acid. These observations were controlled first by cultivation of the spores on pieces of bread soaked in milk, and further by introducing masses of the fungus growth thus obtained into the trachea of young rabbits. This was effected by tracheotomy, but the animals rapidly recovered from the effects of the operation, and in a short time became affected with a cough of a very violent and noisy character; in fact, a genuine whooping-cough. The rabbits thus affected were killed, and their air-passages and lungs found to contain an enormous quantity of the same fungus as that met with in the sputa from human whooping-cough; and, in fact, the mucus expectorated by the rabbits showed precisely the same appearance. Dr. Letzerich had already published very similar observations on a supposed fungus causing diphtheria; but neither set of observations seems, as yet, to have been confirmed by any other investigator.