diameter, which on introduction into urine reproduced the moving Spirillum, now of very large size, and sometimes remarkably branched, but as time passed gradually growing a smaller and smaller progeny as the liquid became vitiated, till at length it lost in the urine its spiral shape, and returned to the appearance of the minute ordinary Bacterium first seen in the milk. These may serve as samples of this class of observations, which proved on the one hand how utterly fallacious are any descriptions hitherto given of Bacteria according to form, size or movement, yet, on the other hand, showing that the different Bacteria, like the different Oidia, retained amid all their variations their distinct specific characters.

The fermentative changes induced in the media by the introduction of the various organisms were next alluded to. The test-tubes of the experiment with unboiled milk were shown, and it was pointed out that each different organism was accompanied by a different appearance of the milk, implying that each was associated with a special chemical change in the fluid in which it grew. An enlarged sketch was also exhibited of the boiled milk glasses as they were seen some weeks after they had been inoculated with the various Bacteria, showing that no two of those glasses were alike. In that containing the Bacteria derived from a drop of tap-water introduced into urine the milk had changed to a beautiful green colour; that with the kind which formed the Spirillum in urine was a pure white curdy mass, sharply acid to test-paper, while a third, inoculated with a curious irregular form of Bacterium from another of the milk-flasks, was of umber brown colour. This glass was brought to the meeting because it was of especial interest, not only on account of its peculiar tint, but because it was an instance of a primary alkaline fermentation of milk. Another milk glass had been inoculated with the same organism, and had undergone the same change, assuming in a few days the same umber brown colour, accompanied by powerful alkaline reaction. This particular Bacterium was in some forms undistinguishable from pairs of granules of a form of "Granuligera," which occurred in one of the milk glasses associated with the large Bacteria above mentioned; but the Granuligera having been obtained unmixed by introducing it successively into liquids which permitted its growth, but not that of the Bacterium, it proved to be a feeble acid ferment of milk, not producing any effect upon its colour. One of the glasses sketched was of peculiar interest, because it contained a large motionless Bacterium, which had been the sole product of exposure of a glass of the boiled milk for an hour in a sitting room, the fungus spores that in all probability entered with it having been prevented from developing by the growth of the Bacterium. It happened that the Bacterium thus derived from the air refused to grow in Pasteur's solution, urine, or turnip infusion, so that if the experiment had been performed with either of those fluids, it would have afforded negative results as regards the Bacterium, though fungi would probably have appeared; and this might have been quoted as a good illustration of absence of Bacteric development after atmospheric exposure.

The Oidium, which, as before mentioned, was a powerful putrefactive ferment of urine, produced scarcely any effect on milk, which had remained unchanged in flavour for seven weeks, although converted into a thick mass, not by coagulation of the casein, but simply by the dense jungle of the fungus filaments, while test paper indicated merely a very faint increase of alkaline reaction. The fluid remaining thus unimpaired in quality, explained the luxuriant growth and healthy appearance of the fungus in it, contrasting strikingly with its characters in urine, in which it rapidly occasioned putrefaction, and then formed merely a scum of toruloid rounded cells.

In describing these facts, the author did not affect the circumlocution that would be necessary in order to avoid using the language of the germ theory. As stated at the outset, his original object in the investigation had not been to prove that theory, but to throw light upon the nature and habits of the fermenting organisms. Nevertheless, for the sake of any who might still entertain doubt upon the question, it might be well to point out that the facts which had been adduced were irreconcilable with any other view. It was plain that they utterly disproved the oxygen theory, while they indicated with sufficient distinctness that all instances of so-called spontaneous generation had been due simply to imperfect experimentation. It remained to consider shortly the only other rival theory, the somewhat specious one of chemical ferments. After pointing out some of the inconsistencies of that theory with the facts observed, and how its difficulties became increased with the discovery of every new organism with its corresponding chemical change, requiring the assumption of a new and purely hypothetical chemical ferment, the author reminded the Society that in truth there was not a fact in chemistry to favour the belief that any substance destitute of vitality possessed the one faculty which distinguished all true fermentation, viz. the property of self-propagation of the ferment. Perhaps the most remarkable instance of a chemical ferment was the resolution of the amygdalin of the bitter almond into the essential oil of bitter almonds, hydrocyanic acid, formic acid and glucose under the influence of emulsin. The amygdalin neither gained nor lost a single atom, but was simply broken up into new compounds under the influence of the peculiar albuminous principle emulsin. But did the emulsin undergo multiplication as in the true fermentations? On the contrary, it had been shown by Liebig and Wöhler in their original paper * that a certain weight of emulsin would only break up a limited quantity of amygdalin, and that the emulsin when afterwards separated no longer affected amygdalin. So far from having the property of self-propagation, it lost its catalytic power in the act of catalysis. Thus the chemical ferment theory was in truth utterly destitute of scientific basis as explaining true fermentation.

Such being the case it was contended that the germ theory must now be regarded as demonstrated; viz. that putrefaction and other true fermentations characterised by indefinite multiplication of the ferment are caused by the growth of living organisms, which, while capable of great variations according to the circumstances in which they are placed, retain their specific characters like larger plants, and like them spring only from pre-existing similar organisms.

Nevertheless the so-called chemical ferments had a high degree of interest in this question, as very likely playing an important part in bringing about the chemical changes. For just as it was proved that a peculiar albuminous principle, emulsin, existing in the sweet as well as in the bitter almond, but absent from the pea, or bean, or other leguminous plants examined by Liebig and Wöhle, could break up as much as ten times its weight of a stable crystallisable substance like amygdalin, so it seemed probable that other peculiar albuminous principles might exist in other plants, such as the fungi, and in like manner break up larger or smaller quantities of other stable organic compounds. In this sense, then, as intervening between the growth of the organisms and the resulting decompositions, the theory of chemical ferments might be welcomed as a valuable hypothesis.

Lastly, the author showed some blood obtained from a horse between three and four weeks previously, in the hope that by exposing the carotid artery antiseptically, and receiving the blood from it into a "heated" vessel, and protecting it from dust, he might, after the clot had contracted, decant off the clear serum, and inoculating or exposing the uncontaminated fluid, observe organisms and fermentations corresponding to those which occur in the practice of surgery.

But to his great surprise day after day passed without the clot showing any sign of shrinking, and it remained still uncontracted. In the flask shown, the buffy coat was seen to be present on the upper part of the still tremulous jelly-like coagulum, but instead of being powerfully pinched together into a comparatively small bulk bathed with serum, that part like the rest of the clot was everywhere in contact with the sides of the glass, and not a drop of serum was to be seen. At the same time there was no smell whatever about the cotton that covered the neck of the flask, showing that putrefaction had been avoided. Somehow or other the exclusion of living organisms, while it had not interfered with coagulation, had prevented the fibrine from acquiring a tendency to shrink. This fact, while entirely new, and opening up a wide field of inquiry, was seen to tally with phenomena met with in surgical practice, such as the absence of shrinking of the plug of clot near a ligature placed upon an artery. It was an illustration of how little we are often able to predict what may arise when even the most familiar objects are placed in new circumstances.

SCIENTIFIC SERIALS

THE *Journal of Mental Science*, July.—We have heard or read of a rather impressionable gentleman who, as he perused Dr. Buchan's "Domestic Medicine," fancied himself afflicted with

* *See* "Annales de Chimie et de Physique," 1837, p. 185.

every disorder therein described, not even excepting the pains of pregnancy. Bearing this in mind, we would recommend that none save those well assured of their own sanity should read the *Journal of Mental Science*. There is so much about morbid psychology, madness, and idiocy, that weak readers are in some real danger of being taken possession of by an uncomfortable suspicion that they may be a little touched themselves. The place of honour is given to an address on idiocy by Dr. J. C. Bucknill. This is a piece of special pleading (justified, perhaps, by its occasion) for the education of idiots. Now, as these miserable abortions must be kept in life because of the *indirect* evil effects of any system of extinguishing them, we certainly desire that they should be kept in asylums and made comfortable. But we cannot even grant that they are "more worthy of our efforts than those races of animals which men strive to bring to perfection." Except in so far as Science may be advanced by such work, it seems very much of a waste of time for such a man as Séguin to labour for four months to fix the eye of an idiot as the first step in the education of sight. We cannot go into ecstacy on hearing that idiots are actually taught to use knives and forks, when so many rational beings around us have neither knives nor forks to use, nor any use for them. By all means let the charitable support asylums for idiots; but at the same time it should not be forgotten that these poor creatures can never be educated into anything useful or lovely, and that a point is soon reached beyond which further education is misspent labour.—A valuable paper on "The Use of Digitalis in Maniacal Excitement" is contributed by Dr. W. J. Mickle. Next follows, under the title of "Consciousness and Unconscious Cerebration," a rather muddled attempt, on the part of W. G. Davies, B.D., to upset Dr. Carpenter's doctrine of "unconscious cerebration." From this article one might suppose that the views combated were peculiar to Dr. Carpenter and his so-called disciples Dr. Bastian and Miss Cobbe, whereas in truth the writer has against him not these only, but also the most distinguished of living psychologists. His writing is a good deal in the bad old style, the language serving at times, as it seems to us, to obscure rather than express thought. Dr. Carpenter is accused of imagining a nervous anatomy to suit his theory. But Mr. Davies does not himself seem to be up with the latest scientific surmises. For example, in laying the groundwork of one of his own arguments, he says: "The very same cells in the visual sense-centre cannot, at one and the same moment, see brown and yellow." He does not seem to be aware that it is highly probable that the cells that see one colour never do see another. There are over a dozen other papers, all of more or less, some of them of considerable interest.

THE *Monthly Microscopical Journal* for this month commences with an article by Mr. J. W. Stephenson on the optical appearances presented by the inner and outer layers of Coscinodiscus when examined in bisulphide of carbon and in air, in which the importance of considering the refractive index of the medium in which calcareous and silicious structures are examined, is fully discussed. This is followed by a paper on some new diatoms from the harbours of Peru and Bolivia, by Mr. F. Kitton, in which *Aulacodiscus formosus* and *Omphalopelta versicolor* are the most important.—Mr. F. Wenham, in a very temperate manner, rebuffs the unjustifiable statements of the American microscopists, who, not realising the high scientific position he holds in this country, accuse him of acting unfairly to Mr. Tolles, and insinuate that he has acted from mercenary motives. He ends by saying, "I trust that Colonel Woodward, having affirmed that 'the position taken by me is certainly true for objectives, as ordinarily constructed,' will allow that this additional lens embodies a deviation from the ordinary question, which was to the effect that there would be no loss of angle aperture of ordinary objectives by the immersion of the front surface in fluids."—Dr. Braithwaite continues his observations on the bog-mosses.—Dr. Royston-Piggott considers the high-power definition of minute organic particles, in which he divides his subject into five parts, including the nature of the least circle of confusion, the nature of mixed shadows, and the nature of perfect definition.—The preparation of the brain and spinal cord for microscopic examination, forms the subject of a paper by Mr. H. S. Atkinson, in which he explains in detail the methods employed by Professor Rutherford, and the means of staining sections adopted by himself.

Petermann's Geographische Mittheilungen, No. VI.—An account of Dr. Nachtigal's travels in Northern Africa, which appears in this number, we have already noticed in the advanced sheets One of the longest and most valuable papers is by Dr. C. E. Meinicke on Dr. Bernstein's explorations in the Northern Moluccas, accompanied by a map. An important article is the second part of an account by Freiherr F. von Richthofen, of some of the results of his journey from Pekin southwestwards through China, embracing valuable details on the geology, topography, and natural history of the little known interior of that country. Another important article is on the Aurora Borealis, by M. E. Pechuel-Loesche, who for the purpose of ascertaining the real nature of the phenomenon, brings together the results of the observations of those who have carefully observed it in the Polar regions. This is to be followed by another paper in the same direction.—Dr. H. Wagner contributes an article on the Development of the German Railway System, accompanied by a well-constructed map.

A VERY interesting number of the *Bulletin Mensuel de la Société d'Acclimatation de Paris* has been published for May. One of the principal papers is a long article by the Abbé Desgodins, missionary at Yer-ka-lo, on the zoology of Thibet. The varied temperatures of its different levels are such that the country contains a great variety of animals, the fauna of both tropical and cold climates being found there. A description is given by M. Robert of his patent artificial incubators for hatching eggs, which seem to be more perfect in all their details than any of those appliances we have seen. As a proof of the usefulness of such a Society, the secretary calls attention to the increased price of certain animal and vegetable products of foreign countries, which, if the principle of acclimatisation were more fully developed, could be produced much cheaper in France. Experiments on sericulture have shown that silk of varied colour can be produced by feeding the silkworm on different leaves. Worms fed on vine leaves produce a silk of a magnificent red colour. Lettuce has been found to produce an emerald-green coloured silk. During April, 51 animals and 886 birds were received at the Gardens of the Society, while 51 animals, and 1,333 birds were distributed. Among interesting items of intelligence we may mention that the ostriches have begun to lay, and it is hoped that kangaroos may be so freely bred in France as to justify their being turned loose in suitable parts of the country. Three Trumpeter Swans were received from America.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, June 19.—"On a tendency observed in Sun-spots to change alternately from the one Solar Hemisphere to the other." By Warren De La Rue, D.C.L., F.R.S., Balfour Stewart, LL.D., F.R.S., and Benjamin Loewy, F.R.A.S.

1. Hitherto in our reductions we have summed up the spotted areas of the various groups occurring on the sun's surface on any day, and have regarded their sum as a representation of the spot-activity for that day. It has occurred to us to see what result we should obtain by taking instead for each day the excess of the spotted area in the one solar hemisphere above that in the other.

2. On adopting this method, it soon became evident that during periods of great disturbance there is a tendency in spots to change alternately from the north or positive to the south or negative hemisphere, and *vice versâ*, the period of such change being about 25 days. When, on the other hand, the solar disturbance is inconsiderable, the spots do not present any such systematic oscillation.

3. We have graphically represented on a diagram the results derived from this method during three of the most considerable periods of solar disturbance.

In this diagram the observed values of hemispherical excess are marked with an asterisk, and a curve is drawn so as to equalise their smaller irregularities. The northern hemisphere is reckoned positive, and the southern negative. The unit of area is, as before, the one millionth of the sun's visible hemisphere.

4. The first of these three periods extends from the beginning of August to the end of December, 1859. We derive from our diagram the following Table, exhibiting the maximum amounts of hemispherical excess, with their respective dates:—