THURSDAY, MAY 25, 1871

THE SMALLER LECTURESHIPS AT THE LONDON MEDICAL SCHOOLS

II.—THE TRUE FUNCTIONS OF THE SMALLER SCHOOLS

IN a recent article* we pointed out the prodigious waste of time and energy that results from the existence of no less than eleven medical schools in the metropolis, with from thirteen to twenty-one lectureships attached to each, and called attention to a scheme by which it is proposed that an amalgamation should take place between several of them.

It is maintained by those who have proposed this scheme that by its means a reduced number of central institutions would be created in which the preliminary subjects of medical education, such as natural philosophy, mechanics, rudimentary chemistry, and botany, could be taught in a much more satisfactory manner than at present, since the increased value of the lectureships would enable the lecturer to devote more time to their preparation, and to supply much greater wealth of illustration, whilst the larger number of students in attendance would correspondingly stimulate his zeal. At the same time the smaller hospitals and schools might still fulfil a very important *rôle* as supplying the means for the practical or clinical study of disease—certain lectureships still remaining attached to them.

The importance of good preliminary education in natural philosophy, taking it in its widest sense, for the medical practitioner, seems to us to be by no means sufficiently recognised. Up to a very recent time it has been almost entirely ignored. It is only within the last few years that any steps in the right direction have been taken by the great examining boards. Fifteen years ago the College of Surgeons required little more than a good knowledge of anatomy and the principles of surgery in those they admitted as members, and even now the acquaintance with preliminary subjects they demand is of a very rudimentary nature, as may be gathered from the fact that it includes only writing from dictation, arithmetic, algebra, geography, English history, the first two books of Euclid, and a little Latin translation, with one optional subject, which may be either Greek, French, German, mechanics, chemistry, botany, or zoology. We cannot but think that this programme might be advantageously extended.

Does it not stand to reason that the lad who is about to enter upon the study of Anatomy and Physiology ought to possess a competent knowledge of the principal facts of Natural Philosophy? How is he to comprehend the contraction of muscles, the action of the valves of the heart, the phenomena of respiration, the construction of the eye and ear, unless he is well grounded in Mechanics, already understands the lever and the pulley, and knows the principles of Hydraulics and Pneumatics, the laws of refraction of light, and the conduction of sound? Nor can it be said that such knowledge is of temporary value only. The surgeon and physician must daily and hourly see cases which can only be treated properly by reference to such knowledge.

If we might venture to suggest a scheme for the education of the student intended for the medical profession, we should recommend it to be commenced while he is still at school, at the age of sixteen, by passing the matriculation examination of the University of London. The following year should be devoted to the study of Natural Philosophy, rudimentary Chemistry, and Botany; and there could be no doubt that these subjects could be admirably taught at all the larger and better appointed schools through the country. But these are precisely the subjects that might be taught to large classes in a most superior manner in the four or five institutions with which it is proposed that the smaller schools should be amalgamated. The preliminary examination, in which considerable knowledge should be demanded, might take place at the age of seventeen. In the following winter session the student, now thoroughly grounded, should begin the study of Anatomy and Physiology, and the following summer might be employed in pursuing Chemistry in its application to Medicine; Botany in the same relations; and the recently introduced subject of Practical Physiology; the first embracing such subjects as the chemistry of the excretions and secretions, &c.; the second, the orders containing medicinal plants, and the composition and formation of the vegetable alkaloids, &c.; and the last, such points as the action of the valves of the heart, the processes of respiration and digestion, &c. The second winter session should be taken up in completing the knowledge of Anatomy and Physiology; and at the expiration of this session the first examination should take place, comprehending the subjects of Anatomy, Physiology, Chemistry, and Botany, the two latter points being at present almost wholly neglected. The second summer session might be occupied with the so-called Materia Medica, formerly merely consisting of the driest of all possible discourses on the composition and form of the various drugs, but with which our student is already perfectly familiar, and which might now be advantageously replaced by an account that could, in the hands of an efficient lecturer, be made deeply interesting, on the physiological action of drugs, and the effects of remedies on man and animals.

Up to the present time the whole work of the student could be conducted at one of the central institutions. From henceforward he might with great advantage be allowed to elect whether he would remain at this central institution, or go to one of the amalgamated schools. These might be made most serviceable as means of instruction in chemical medicine, surgery, and midwifery; and lectureships on these subjects, to avoid the loss of time to the students that would otherwise be involved in going to and fro, might be retained at the smaller schools. The instruction on these subjects would extend over the third and fourth winter sessions, at the end of which the final examination should take place. Thus it appears to us a vast improvement in the education of the medical student might be effected. He would enter the portals of his profession with a good general knowledge of the subjects he is about to study. The first years would be spent under circumstances in which he would obtain the best education on preliminary subjects the kingdom can afford, whilst the last two years would be spent under conditions in which the great field for clinical instruction possessed by the smaller hospitals could be

* See NATURE, vol. iv. p. 1.

utilised to the utmost. This is, indeed, the special field which we look to the smaller hospitals to occupy in the future. *Clinical instruction is pursued to a far greater* advantage with a smaller than with a larger number of pupils.

M. TAINE ON INTELLIGENCE

On Intelligence. By H. Taine. Translated from the French by T. D. Haye, and revised by the Author. Part I. (London : Reeve and Co., 1871).

IN a notice, some months ago* in these columns, of M. Ribot's clever exposition of English psychology, mention was made of M. Taine's work, *De l'Intelligence*, then newly come forth, as a striking evidence of the revival of French interest in the scientific investigation of mind. The first part of the work is now put before English readers in a translation satisfactory on the whole, and the second part is announced as soon to follow.

The first part, as readers of the original must be aware, easily admits of being published separately. This happens because M. Taine's exposition, while presenting in the detail all the best qualities of his admirable style, is in its main lines laid out with a strict regard to principles of logical method. It falls into two sharply marked divisions, an analytic and a synthetic. No explanation of the *different* heads of knowledge making up our intelligence is attempted, until, by an analysis expressly performed, the ultimate elements of human cognition are come at. Often our English works on psychology, while they pass for, or claim to be, analytic, and do contain many cases of special analysis, are, in strictness, synthetic; the foregone general analysis being kept out of sight, and its sufficiency being left to appear from the character of the explanation which its results, as brought forward, may be made to yield. Of this description are the works of Prof. Bain, and even James Mill's professed "Analysis." M. Taine, on the other hand, prefers to do his analysis not in the secret laboratory of his own mind but under the eye of the reader; and the operation takes up the whole of his first part here translated.

Obviously, when the phenomena are so complex and manifold as in the case of mind or intelligence, the analysis, if it is thus to be exhibited, and if it is to be brought to anything like a definite issue, must be of facts carefully selected for their illustrative or representative character; and this M. Taine well apprehends. Nor does he less clearly see that normal facts or events of consciousness no more suffice for psychological science than can everyday observation take the place of artificial experiment in physical science. At different stages, therefore, he looks about him for cases either of what may be called artificial mental action, as in the ingenious processes resorted to by mathematicians, or of abnormal mental action, such as the phenomena of madness, hallucination, &c., which are a sort of nature's experiments on a field where, for moral reasons, the freedom of experimenting is greatly limited. So, at the stage of the senses where experiment becomes perfectly feasible, he effectively turns to account the most advanced results got out in late years by psychologists or physiologists; and, again, at the last stage of the analytic sounding, when he strikes upon a bottom of bare physiology, he makes apt selection from the most recent experimental work.

He begins by resolving thoughts, or (in the strict philosophical sense of the term) ideas, into images, on principles of thorough-going nominalism. Ideas the least general are shown to be impossible as mental experiences, and to need representation by particular signs, and ideas the most general and abstruse are shown to come within the mental grasp still by signs or symbols. There is the difference that in the case of natural objects, like tree or dog, the substituted sign, generally a name, is the direct expression of a mental "tendency" arising under actual impressions, varied at the same time that they are similar; while to conceptions like those of mathematical science there may correspond no distinct impressions, and the sign is struck out according to an elaborate system of indirect substitution—substitutions upon substitutions. But always some definite image is present to the mind. The question, then, is to investigate the nature of particular images; and, by a very instructive muster of normal and abnormal instances, the laws of their retention out of consciousness and revival in consciousness are brought out, with the result that the image is itself seen to be a substitute of sensation below it. Must the analysis then end in a mere description of the kinds of sensation, with account taken of physical conditions? M. Taine thinks it need not, and wisely selects for special inquiry the sensations of sound—wisely, not merely because Helmholtz's classical investigations lie ready to the psychologist's hand, but also because no other set of sensations is at once so varied in character and so free from admixture with extraneous elements. The result thence obtained, confirmed more or less from the senses of sight, smell, and taste, and not contradicted by the sense of touch, is that all qualitative differences of consciousness within each sense are explicable as different compounds of an elementary sensation not conscious; such elementary sensations, different in the different senses, being further conceivable as themselves developed by composition out of a single infinitesimal "event," of course imperceptible to consciousness, the truly ultimate element of all that appears as mind. But in relation with this there will stand a molecular displacement in nerve; for, as the physiological analysis, taken up when the psychological reaches its term, finds in the sensory ganglia the seat of crude sensation, and in the cerebral lobes with their cortical layer a "repeating and multiplying organ" through which sensations are associated and revived as images, and thus become knowledge, so it may see in the reflex action of lower nerve-centres the physical correlate of the simple unconscious "events" or elements of sensation. And thus the complete analysis of intelligence discloses two worlds, the moral and the physical, in mutual correspondence down to the lowest depths of human nature, and, by analogy, to the very foot of the zoological scale.

Save that M. Taine's method of procedure is his own, and his expression is always striking, there is little thus far in which he has not been anticipated by one psychologist or another among ourselves, notably by Mr. Spencer in the resolution of sensation. Nor in breaking up, in the last chapter of this part of his work, the metaphysical entities self and matter, regarded either as substances or as systems of faculties and forces, does he do more than

* See NATURE, vol. ii. p. 331.

follow the English authorities, as they follow their great master, Hume. But in giving final expression to the relation between the two series of "events," psychical and physical, shown by the analysis to be involved in the varied phenomena of intelligence, he is more strictly original; or, at least, his view is stated with peculiar neatness and force. How shall sensation, whether in the crude form or in the intellectual condition of the image or in the elemental state, be conceived as joined to something so disparate as a molecular movement in nerve: that is the difficulty. To say that what we have united is rather an idea of sensation had by (or, in the case of the ultimate psychical element, conforming to the type had by) direct personal consciousness, and an idea of nerve got indirectly by way of external sense, though this is philosophically true, touches the difficulty without removing it; for the two ideas are still irreducible to each other. But it may then more readily be suspected that the "events" are not two, but one, with two permanently distinct faces to cognition; and this, in M. Taine's view, is the final outcome of the analytic, though as regards the duality he hints at a possible reduction in his second part. Meanwhile, taking the physical aspect as secondary and the sign of a properly mental event, he seeks to illustrate the view and to enforce his theory of universal correspondence by a remarkable analogy. He supposes an original text with an interlinear translation; the translation plain and legible at the outset, but becoming confused farther on, and before the end no longer to be made out; on the other hand, the text very clear at the last but fainter higher up, and about the beginning not to be traced at all. The writing may represent nature; clear text and undecipherable translation mark the states of full intellectual consciousness so vaguely referred, at least in detail, to the complex of the brain; faint text and translation not too plain mark the cruder mental events referred to less but still highly complicated centres; finally, visible translation and blank instead of text mark the well-ascertained physiological phenomenon of reflex action, for which it is as legitimate, if not necessary, to suppose a psychical obverse, albeit unconscious, as it is to assume for highest consciousness a physical correspondence in brain-processes eluding our finest observation.

The analogy is instructively worked out further by M. Taine; but enough for the present. Another time we may better estimate the value of parts of his analysis, when considering how, from the materials it affords, he is able to build up the edifice of human knowledge.

G. CROOM ROBERTSON

A STORM-ATLAS FOR NORWAY

Storm Atlas of the Meteorological Institute of Norway. (H. Mohn.)

A KNOWLEDGE of the laws which regulate the progress of storms would be of comparatively little practical interest without the telegraph, but, since the speed of electricity outstrips that of wind, the information by telegraph that a storm has appeared at an outpost may be of great importance to a maritime country like our own, provided we know the path which the storm is likely to pursue.

Of late years practical meteorologists have devoted a great deal of attention to this branch of their subject, and the memoir before us is not the least interesting of the various contributions which have been made. It is unnecessary to enter into the details of M. Mohn's observational system; let us rather invite attention to the general conclusions at which he arrives.

"Barometric maxima," he tells us, "often remain during a considerable period over the places where they have been formed, while, on the other hand, barometric minima are almost always in motion over the surface of the earth, transporting themselves (in Europe) almost always towards the east." He further finds that the barometric minima represented in his charts have their greatest velocity of motion before they arrive at the west coast of Europe, and a smaller velocity when they pass by Scandinavia; in Russia the velocity is again greater.

As regards the component of the movement which leads the centres towards the east, he finds a greater regularity exhibited, inasmuch as this component diminishes continuously as the minima move from the sea towards the interior of the continent. The curved paths of these minima are at north Europe sometimes very regular and sometimes very sinuous; in general they are concave towards the south. The mean movement in the direction of the meridian is towards the north in the Atlantic; towards the south, but feebly, in Scandinavia; and more strongly towards the south in Russia; in this latter country they appear to lose themselves.

Let us now invite attention to the following remarks of the author with regard to vapour:—"Vapour tension is an element of which the importance for the theory of tempests was not so evident to me until I had commenced the construction of these charts. . . . . Charts giving the relative humidity are without any value, nor do they present any trace of that continuity which shows itself so strikingly in the charts of vapour tension." Further on he says:—"I have frequently remarked in this memoir that watery vapour is one of the most important elements in studying the movement of air; it is therefore much to be desired that the publication of meteorological observations should embrace vapour tensions (which is not always the case), and if only one element can be given, let it be rather that than the relative humidity. . . . . Charts representing the distribution of the vapour of water over the surface of the earth analogous to the temperature charts of M. Dove or the isobaric charts of Mr. Buchan would be of the greatest possible utility."

It may not be out of place to make a few remarks upon these observations of M. Mohn. Meteorologists have been in the habit of discussing in two ways the state of the air with regard to vapour. They have in the first place studied the vapour tension present in the atmosphere, and secondly, they have studied the relative humidity, or what M. Mohn calls "*l'état hygrométrique.*" This latter element, representing the proportion between the vapour actually contained in the air and the full amount due to the present temperature, is an element that varies very greatly with the temperature, and is, therefore, of comparatively little use in meteorological researches.

Besides these two elements, the author of this review has suggested the *hygrometric quality* of the air as a

subject of importance in meteorological discussions. This is a very different thing from what is termed by Mohn "*l'état hygrometrique*," and denotes the chemical composition of the air, as regards moisture, or the weight of vapour contained in a hundred parts by weight of air. Now, as long as the pressure remains the same, this hygrometric quality will be represented by the tension of vapour, and, since on the surface of the earth the variations of pressure are comparatively small, the vapour tension will approximately represent the hygrometric quality. If this be borne in mind, the physical significance of Mohn's conclusions will become apparent; his remark, that the charts of vapour tension present a continuity and simplicity of distribution of that element, will now mean that the distribution of *types* or *kinds* of air is of a very simple nature.

We should, in fact, endeavour to find the distribution of air of various qualities over the surface of the earth just as we should endeavour to trace on the surface of the ocean sections of different saltness. But, while on the earth's surface vapour tension will approximately represent hygrometric quality, the case will be altered if we study strata of different elevations, and therefore of different pressures. If for instance, we ascend a mountain or take a trip in a balloon, the tension of vapour will no longer approximately represent the hygrometric quality of the air; but it will be the ratio between the pressure of aqueous vapour and that of air, which will truly represent the hygrometric quality in those regions. These considerations may, perhaps, throw some light upon the formation of clouds. If, for instance, air of the same quality extends a great way up, we shall have no cloud formed in the stratum as long as the rate of decrement of temperature does not exceed a certain limit; but when this limit is exceeded, there will be a deposition of cloud through the lowering of temperature alone, even while there is no admixture with air of another quality.

B. STEWART

OUR BOOK SHELF

Ueber Entwickelung und Bau des Gehörlabyrinths, nach Untersuchungen an Saügethieren. Von Dr. Arthur Boettcher, o. ö. Professor der allgemeinen Pathologie und pathologischen Anatomie, a. d. Universität Dorpat. Erster Theil mit zwölf Kupfer Tafeln. (Leipzig: Wilhelm Engelmann, 1871. London: Williams and Norgate.)

THE successful investigation of the structure of the internal ear must always be regarded as the crown and glory of histological research, for whilst the structures that compose the auditory organ are of extreme delicacy, they are enclosed in a bony capsule of such density as to appear to bid defiance to all attempts to exhibit them in their natural state. Yet by careful decalcification with dilute acids and by immersion in various fluids, as those of Müller Schultze's solution of chloride of palladium, Cohnheim and Gerlach's solution of chloride of gold, &c., the most delicate details have been followed out, and the structure of the ear is now almost as well known as that of the eye.

M. Boettcher's observations on the labyrinth of adult animals have been largely supplemented by his numerous examinations of the same part at various periods of fœtal life, which have led to some interesting results.

The very earliest rudiment of the labyrinth in the mammalian fœtus is not yet accurately ascertained, but in the embryo of a sheep, of which a sagittal section of the head is only a millimetre in length, it appears as a sac with a small external opening formed by an inflection of the horny layer in close contact with this and opposite the second visceral arch. The wall of the sac is formed by cylindrical cells. In a somewhat more advanced stage the vesicle becomes elongated into a tube, the upper extremity of which is divided by a fold into an internal and smaller cavity—the recessus labyrinthi, and a larger, broader cavity, the aquæductus vestibuli. The inferior extremity is pointed, and is in immediate relation with the rudiment of the cochlea.

The semi-circular canals are formed by an inflection of the wall of the labyrinth vesicle opposite to the recessus labyrinthi, the horizontal canal being the last formed. In embryoes of 2·2 cm. long, the several parts above mentioned are more fully formed, and a projection appears, the fundus of which is directed towards the brain, which is the rudiment of the sacculus rotundus, from which the utriculus or sacculus ellipticus soon becomes differentiated. The separation of a scala vestibuli from a scala tympani in the cochlea is only apparent in embryoes that have attained a length of 8·5 cm. M. Boettcher clearly shows that the recessus labyrinthi found at a very early period subsequently becomes the aquæductus vestibuli, which remains permanently in connection with the sacculus rotundus and utriculus, and contains the same fluid (endolymph) as they do. The aquæductus cochleæ, on the other hand, is a totally different formation, and is in no way connected with the interior of the labyrinth. It conducts a vein, and might more correctly be styled, as Wildberg has suggested, the canalis venosus cochleæ.

In regard to the cochlea, he shows how the canalis cochlea, or scala media, is first developed, and how the two principal scalæ (scala tympani and vestibuli) are formed by the gradual breaking down of spongy cellular tissue on either side of the scala media, and he traces out in the most interesting manner the development, chiefly from epithelium, of the complicated organ of Corti, including under this head the so-called habenula perforata, the rods, and arched fibres, &c.

He describes a remarkable ganglionic mass, the ganglion spirale, the section of which is seen in this section of the cochlea close to the attached border of the lamina spiralis. In this the cochlear nerve appears to terminate, whilst from it fresh fibres take origin, and then, having passed through the openings of the habenula perforata, join certain cells, some of which are placed outside and some inside the arcuate fibres or rows of Corti. The former kind of auditory cells are, some of them, seated with a broad base on the membrana basilaris, whilst the attenuated extremity of the cell runs upwards. Others, however, are intercalated with these, which have a broad base attached to the membrana reticularis above, and then narrow apices interposed between the broad bases of the former. The cells that point downwards are Corti's cells, and are arranged in three rows. They possess a centrically directed process. The cells that point upwards are the so-called hair-cells, which receive this name on account of their terminating at both ends in a hair. The membrana basilaris he describes as consisting of a hyaline lamella on which is a fibrous layer, both layers having a peculiar form of epithelial investment. Beneath its proximal attachment is a spiral vessel. The development of all these parts is carefully traced. A very full account is given of Corti's membrane. He denies the existence of muscular elements in Todd and Bowman's ligamentum spirale. The essay concludes with a description of the ultimate distribution of the auditory nerve. The drawings, which are upwards of sixty in number, and in some instances of large size, are very beautifully executed. On the whole, the work of Boettcher appears to be well worthy the attention of microscopists and physiologists, and to contain many facts possessing both novelty and interest.

H. P.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

Thickness of the Earth's Crust

UPON my return to London yesterday, I received the two last numbers of NATURE (May 11 and 18), in both of which I find communications on this subject. In the first of these, by Archdeacon Pratt, that gentleman inserts a quotation from a lecture delivered by me, on January 29, this year, "On the Nature of the Earth's Interior" (*vide* NATURE, February 9, 1871), to the effect that the recent experimental researches of the eminent astronomer and mathematician, M. Delaunay, had destroyed the basis upon which the late Mr. Hopkins's reasonings, as to the solidity of the earth's interior, were founded, and asks the lecturer, *i.e.*, me, "I wonder why he has taken no notice of my letter in reply to M. Delaunay, which was printed in your journal for July 1870, six months before the lecture was delivered, and which also appeared about the same time in the *Philosophical Magazine* and the *Geological Magazine*. In this I showed that M. Delaunay had evidently misconceived the problem, and that Mr. Hopkins's method is altogether unaffected by his remarks."

As Archdeacon Pratt has the candour to admit that "any one with an ordinary degree of knowledge of popular astronomy and of mechanical action is quite competent to form a good opinion on the point in dispute," I would, in answer to the question he puts to me, simply state that, after a careful study of the letter he refers to, upon its first appearance in the *Philosophical Magazine*, I *purposely* avoided referring to it in my lecture, since I failed to discover that the author had in it "showed that M. Delaunay had evidently misconceived the problem," or any reasons whatsoever which could shake my faith in the conclusions of M. Delaunay, subsequently confirmed experimentally by M. Champagneur. I would also mention that, previous to this lecture, I attended the meeting of the Royal Society on the 22nd December, 1870, expressly to hear a subsequent paper by Archdeacon Pratt "On the Constitution of the Solid Crust of the Earth," on which occasion the opinions of Professor Stokes and the experimental demonstration of Mr. Siemens, as to the untenable nature of the author's conclusions, still further confirmed me in the views I put forth subsequently in my lecture.

It is now superfluous to specify in detail the precise reasons for my rejecting the arguments of Archdeacon Pratt, as I have, in a great measure at least, been anticipated in so doing by the substance of two letters, signed respectively "A. J. M." and "A. H. Green," which appeared in my absence in the last number of NATURE; to these I may refer in support of my view, in which I may also add one of our first English mathematicians has concurred; that M. Delaunay has not changed his will be seen from the Proceedings of the Academy of Sciences at Paris, March 6, 1871.

Having always entertained the highest opinion of the scientific labours of the late Mr. Hopkins, I have taken pains to make myself acquainted with his writings as far as possible for me; but when Archdeacon Pratt states "what Mr. Hopkins did may be divided into two parts—he first *conceived an idea*, which was to be the basis of his calculation; and then he made the calculation," I regard the whole pith of the question as embodied in these words, which admit that Mr. Hopkins based his elaborate calculations upon *an idea*, now shown by M. Delaunay to be incorrect, whilst the latter gentleman, on the contrary, founds his deductions upon premises which he first proves to have stood the test of experiment. Where eminent scientific men are arrayed on each side of a question of this nature, the remarks made in the last paragraph of the archdeacon's communication seem rather out of place, and might be applied with equal force in an entirely opposite sense to that intended by their author.

May 20 DAVID FORBES

The Geographical Distribution of Insects

IN NATURE (No. 74, p. 435) was a very interesting article on geographical distribution by Mr. Wallace, combating some recently-urged views of Mr. Murray's. Mr. Wallace took, as an example, the Madeira Islands, and sustained his position upon the numerical statistics furnished by Mr. Wollaston in his books. That these conclusions are very different from those arrived at by Mr. Wollaston is evident and as a six months' residence in the more remote group of the Canary Islands confirmed to my mind Mr. Wollaston's position, while bringing into relief facts utterly incompatible with Mr. Wallace's, I have ventured to publish a few remarks on the question.

Mr. Murray's views of the distribution of beetles seem to me resolvable into saying that there are two faunas, a tropical (Brazilian and Africo-Indian) and an extra-tropical one. My own slight researches in exotic coleoptera (confined hitherto to the Coccinellidæ) strongly confirm this; and a curious instance of the connection between the northern and southern extra-tropical faunas occurred to me the other day. *Eriopis connexa*, a rather pretty little ladybird, occurs from Hudson's Bay and Vancouver's Island all the way to the Straits of Magellan; following, of course, the line of the Andes. But my object was principally to question some of Mr. Wallace's conclusions with regard to the Madeiran fauna. First of all, I was struck by the absence of any hypothesis for the origin of the very curious endemic forms which form the most important part of the fauna, and which most closely unite it to that of the Canaries and Azores. These Mr. Wollaston, myself, and apparently Mr. Murray regard as affording proof that these islands, or rather groups of islands, were once parts of a considerable continent, and I certainly am at a loss to see how else they are to be explained; for though Mr. Wallace regards the Madeira islets as possibly formerly connected, he would, I suppose, be unwilling to extend this to the other groups. Mr. Wallace appears to regard Mr. Murray's hypothesis to be that the Atlantic continent, of which Madeira is a remnant, derived its fauna from Europe; but it seems rather to be that in the Miocene period (or earlier) there was a similar continent, connected indeed with Europe, not deriving its fauna from Europe any more than Europe from it. Perhaps the best way of answering Mr. Wallace's view will be to take the case of the Canary Islands, whose fauna, resembling the Madeira as it does so closely, must have had a similar origin. Here the argument from apterous genera fails to a very great extent. Thus *Carabus* is represented by three species, while in S. Spain there is one, and in N. Africa only six or seven. *Thorictus* has three representatives, and here it may be noticed that ants'-nest beetles are decidedly not numerous in the islands, so that the "unusual means of distribution" fail on the whole to get them across the water. *Rhizotrogus* is represented by the closely allied also N. African genus *Pachydema*. Of the very numerous European *Rhizotrogi* only two Sicilian ones are apterous, so that its absence in Madeira tells either way. *Otiorhynchus* is no doubt absent, but its place is more than supplied by *Atlantis* (20 sp.) and *Laparocerus* (30 sp.). *Pimelia* again is represented in the Canaries by twelve species, and the apterous genera of Heteromera by more than fifty species, which almost demonstrates the necessity of looking for Tenebrionidæ in localities where they are likely to occur.

Tarphius it certainly is difficult to conceive carried across by winds or waves, seeing that its habits are so retired that it has escaped notice till very recently in Europe. Now, however, it is beginning to turn up in suitable mountain localities of Andalusia, Portugal, the Apennines, Sicily, and Algeria; four species are described, and I have seen two others, all agreeing *inter se* and differing in structure from any Atlantic species. Moreover, it must have been carried apparently to the Azores as well. Then of the peculiar apterous genera quoted, *Thalassophilus*, *Torneuma*, *Scoliocerus*, *Xenomma*, and *Mecognathus* occur now also in Europe, requiring only a collecting-power equal to that of Mr. Wollaston for their discovery. There remain as puzzles upon the hurricane theory twenty-two blind species in the Madeira and the Canaries, and the whole series of Euphorbia-infesting species, fifty in number, all winged, and forming for the most part special genera. Finally, with regard to the fauna of the Azores, the condition of the islands must be taken into account; if the species found round Santa Cruz, Oratava, and Funchal were enumerated, about this proportion of European species would be found. The best island, Pico, has not been worked, and in the others almost all the original vegetation has disappeared. The fact that in the scraps (as they literally were) of Euphorbias, *Tarphius* and *Acalles* occurred, shows that if any of the pristine flora could be found a fair number of species might be expected. *Elastrus dolosus* may certainly have come from Madagascar by the very ingenious route sketched out by Mr. Wallace; but the occurrence of *Urania* in Madagascar, Brazil, and the West Indies suggests a possibly shorter route, even though no *Elastrus* be known as yet to occur in America.

In conclusion I may state that I am going to spend a year or

perhaps two in the West Indian Islands, and hope there still further to investigate the theories of geographical distribution, especially endeavouring to see if they can in any way be regarded as having been connected with this submerged continent of Atlantis.

G. R. CROTCH

The Coronal Rifts

WILL Captain Tupman kindly explain what he means by "*actinic rifts*"? I should have supposed that the rifts are evidence of the absense of actinism at the places where they occur.

I am not at all surprised that anyone observing through a telescope should fail to notice the rifts. The eye would naturally be attracted by the bright light of the corona and the red prominences. It may be observed, also, that there is in the photographs a considerable amount of bright corona at the places where the rifts occur, so that Captain Tupman might have had the telescope pointed at the very places where the rifts were, and yet they would escape his notice. The rifts are *there*, unquestionably, in the two photographs taken (after the lapse of nearly an hour) at Cadiz and Syracuse, and the sketches taken in Spain also show the gaps. The evidence appears to me to be conclusive against Captain Tupman.

A. BROTHERS

Spectrum of the Aurora

THERE is one point in Mr. H. R. Procter's letter in NATURE, vol. iii. p. 468, which I do not agree with He says the bands of the auroral spectrum are seldom visible, with the exception of that whose wave-length is 557; whereas I have found two bands, doubtless Winlock's 464 and 431, to be invariably visible when the aurora is bright enough to show them. Also, I suspect the red line is always present when there is any red colour in an aurora, although our instruments do not show it unless the luminosity is considerable. Of the thirty-four auroras in whose s-ectra I have seen the line 557, fourteen showed the bands 46 and 431, and three others at least one of these, while eight showed the red line. In five auroras, all more or less red, I have seen a faint band, whose wave-length, I believe, is 500 or 510. I have never seen the line 532 (the coronal line), unless it be once; probably from want of instrumental power.

As regards the zodiacal light, I have looked at its spectrum several times when it has been at its brightest, but have never seen anything but a continuous spectrum. I am satisfied therefore that if the line 557 exists in it, it must be much fainter in proportion to the rest of its light than is the case with the aurora.

T. W. BACKHOUSE

Sunderland, May 16

Science for Farmers

As the independent and powerful advocate of scientific education, will you allow me to draw your attention to the object of the enclosed letter?

Within a short period I have seen such remarkable results attended with such an enormous saving of money arising from a limited knowledge of science amongst a committee of farmers, that I am desirous the future generation should have at least a common sense idea of some of the laws of nature which more immediately concern their business and pecuniary interests.

I have the more faith in the success of what I am advocating, because the kind and amount of scientific instruction I propose is really a business necessity. I have not forgotten the results of the Great Exhibition of 1851, how the members of each particular profession or trade were interested, especially in such stalls or departments that concerned this main object of their lives, how to make their own calling more successful or profitable.

I believe therefore in the teaching of science a much greater prospect of success exists when it can be combined with a practical business pursuit. I have read with much interest your article "The Hope of France" on the paper read by M. Deville before the Academy of Science.

The advantages arising from scientific culture, in other words, the study of nature and her laws, are beyond appreciation, and for this reason a student of science must reason and think for himself; he must do his own thinking, and not allow any other person to do this duty for him; and it is my conviction that the real power of any State is exactly in proportion to the number of independent reasoners and thinkers that go to constitute it; and I know of no means so powerful to promote this as the extension of technical teaching applied to business pursuits.

May 18 W. LITTLE

"TECHNICAL EDUCATION FOR THE SONS OF FARMERS

"*To the Members of the Lincolnshire Farmers' Association, and other Agricultural Associations in Great Britain*

"Gentlemen,—Will you allow me to ask your earnest consideration and reflection on a subject which I believe is of vital importance to the future generation of farmers? The question I would put to you is this: Do you wish your sons whom you destine to the pursuit of agriculture to be entirely ignorant of such of the simple elements of chemistry as would give them a complete knowledge of the application and properties of the various materials used in the manufacture of artificial manures, when such knowledge may be acquired with little trouble, in a short time, and at small expense?

"I cannot for a moment believe that any intelligent farmer, with the costly and bitter experience of the past few years in relation to the tricks and impostures of the artifical manure makers, can be so indifferent to the future success of his child as not to give him, by a brief course of practical scientific education, not only the power of protecting himself against fraud, but also the knowledge that will enable him to apply the gifts of science to the greatest possible advantage, and at the same time liberate himself from the large and plausible army of manure compounders.

"Why should the business and pursuit of agriculture be an exception in the rules of guidance for the successful pursuit of any other business or profession? For the practice of medicine, law, engineering, architecture, &c., a special course of study is required, and is really necessary. Agriculture as a business pursuit offers abundant occupation for the highest order of intelligence, and stands second to none in its claim to scientific skill and sound practical sense, and has therefore an equal claim with other professions, that those engaged in it should be properly qualified by a special form of education.

"What can be more embarrassing to the present generation of farmers than the reading of the reports of chemical analysts on the composition of soils and manures? What can they understand by 'water of combination' other than that it may have too near a relation to a pump; or the term 'organic matter,' which may mean flesh or bread, woody fibre, peat, sawdust, or coal dust, most likely a large proportion of the latter elements; or that very intelligible term 'soluble phosphate equal to bone earth or tribasic phosphate of lime made soluble;' or alumina, silica, alkaline, salts, &c., which generally mean clay, sand, and common salt, concluding with earthy matter as the dirty foundation upon which all the other perplexities stand.

"Is it not worth while, by a brief course of practical study, to rid one's self of the influence of all this chemical necromancy? The days of alchemy, witchcraft, and astrology have passed away, and so must the charlatanism and quackery of the inferior order of manure compounders.

"What would be the history of many of these occult persons if it could be traced? Should we find that they have at any time been diligent students under such guides as Liebig, Ville, Voelcker, and other honourable and distinguished chemists? No! I do not hesitate to say that many of them have been mere wandering vagabonds having no disposition or ability to get an honest living by ordinary industry, and as a last resource trade on the credulity of farmers as artificial manure makers. A case in point was recently reported to me. Two discharged lackeys, a butler and footman, embarked, for want of honest employment, in this trade. They are now millionaires; one is an M.P. and the other has received the honour of knighthood. Recently I was over the works of a large and respectable manufacturer of phosphatic manures, who was also a maker of sulphate of ammonia. He informed me that he mixed these two ingredients in such proportion that he could well afford to sell it for 6*l.* per ton. The mixture went in immense quantity to Liverpool, where it was christened under the name of phospho-guano, and was actually returned, more than a hundred miles, near to the original works, and sold for 12*l.* per ton. Are not such cases, and a thousand others, sufficient to make every farmer ask himself f one object of his being born into this world was to feed and fatten knaves?

"A first-class tailor, hatter, shoemaker, butcher, or baker, desires before all things that his customer should thoroughly understand the composition and quality of the goods he has for sale. Can the same be said of the manure compounders? The

remedy we have in our own hands: either mix for ourselves, or buy subject to analysis; but to properly understand the several terms of an analysis, a course of practical instruction in a laboratory is necessary.

"It is indeed surprising that in a country where the practice of agriculture is carried to such a high degree of perfection, and where it is one of the chief sources of wealth, and is besides the means of employing such an immense amount of labour and capital, so little should be done towards the scientific education of those engaged in its pursuit. As a rule, agriculture is practised almost exclusively under the guidance of a slowly-earned experience, and mere traditional principles and habitual routine, without those engaged in it having any appreciation of the phenomena and natural laws which govern the growth and production of animal and vegetable food, the first necessaries of man.

"The success we have already arrived to in agriculture is, I believe, more mechanical than scientific. Drainage, steam culture, and a liberal use of capital and labour, are amongst the chief causes; but now that chemistry in its relation to artificial manures is taking such a prominent position, it is of the first importance that the future generation of farmers should have such a general knowledge of science as will enable them to correctly appreciate the value and properties of the various compounds offered by the too numerous chemical manure makers.

"I cannot imagine a more dangerous, unfortunate, and lamentable position for any person to be in, whilst in the practice of his business, by which he hopes to gain his bread for himself and family, than being entirely dependent on the scientific skill and integrity of another man; or that his capital, time, labour, care, and hopes should be in many cases completely out of his own control. Such a state of things cannot—must not—last.

"What I propose to do to correct this state of things is this—at a very moderate cost to give to an agricultural pupil a six or twelve months' course of scientific education and practical laboratory teaching after he has left his regular school; and I will engage that any boy of average ability, at the expiration of this time, shall have such a knowledge of all the materials employed in the compounding of chemical manures as will enable him to dictate what should be used without the interested interference of the manure maker. He shall besides have such an insight into the science and laws of chemistry as to make the reading and future study of scientific agriculture not only perfectly easy, but a delightful and intellectual employment.

"To carry out this important object three conditions are necessary—a good qualified teacher, a laboratory, and pupils. The first could be had for a very moderate salary; the laboratory, with the necessary instruments and materials, would involve no serious outlay; the third condition, the pupils, gives rise to this question—Would farmers send their sons to supplement their previous education by a six or twelve months' practical scientific instruction? The want of such knowledge amongst the present generation must be so strongly felt that I believe they would be too glad to have the opportunity, especially if they knew that probably a moderate fee would more than pay the costs.

"The site of the laboratory might be anywhere—a small country village would in many respects offer advantages superior to a market town. The cost of erecting or hiring a building suitable for a laboratory, together with the instruments and materials, should be raised by subscription. The pupils' fees would, I have no doubt, pay all other charges, so that when once established it would ever after be self-supporting.

"I am aware that certain schools exist where agricultural science is professedly taught, but I consider such a combination as almost waste time, the two kinds of teaching cannot be well carried on together, and what is most important, the mind must arrive to a certain maturity before it can grasp with sufficient reasoning power the beautiful and wonderful phenomena arising out of laboratory practice.

"If the foregoing observations should be thought worthy of the serious consideration of persons interested in agriculture, I shall indeed be glad to receive any communications or suggestions in promotion of the object of this letter; and if our members will support this object by the subscription of a sum equal to only a tenth of one year's savings effected through the agency of our association, I will devote myself most earnestly to establish a school laboratory in this village that I trust may serve as a model and example to be followed by many other localities in Great Britain.

"I shall certainly not ask a single member of our Association to do that which I am not prepared to do myself. My consumption of phosphate manure—of course, I buy no mixtures or nostrums—is about twenty tons a year; and previous to the formation of our Association I paid to the most respectable makers 6*l.* 10*s.* per ton for manure, containing 25 per cent. of water. The per-centage of soluble phosphate was entirely a matter of speculation. According to an elaborate report of Anderson and Way, from an analysis of 171 samples, the average per-centage of soluble phosphate at that time was 15 per cent., and a ton of this manure was valued by these chemists at 7*l.* 5*s.* per ton, Therefore, if a 15 per cent. manure was worth 7*l.* 5*s.* a 26 per cent. manure would be worth 12*l.* 10*s.*; but our Association price for the 26 per cent. manure is now 3*l.* 18*s.* per ton in bulk, delivered free at any station in Lincolnshire, with a further advantage of a watchful system of analysis, free of any cost, to ensure quality and dry condition.

My saving on these calculations would be 8*l.* 12*s.* per ton, or a total of 172*l.* on a consumption of twenty tons yearly. I state facts just as they are recorded by the most eminent chemists, and every farmer will believe me when I say that a very large proportion of the manure sold at that time had little or no value whatever, consisting as it did of *dried mud and road scrapings*, flavoured with a little gas water just to flatter the olfactory nerves of the wise and cautious farmer of that period. A tenth of 172*l.* would be 17*l.* 4*s.* for my contribution, but my requirements are much more modest. I think, therefore, I had better leave every member of our Association to form his own estimate of what he should contribute, suffice it to say that in the first instance the only contribution I ask for is a free and unprejudiced opinion as to the necessity and desirability of what I have in view, viz., the formation of a laboratory, in which agricultural chemistry shall be taught at small cost, in a short time, and in a practical way, to pupils who have received an ordinary education.

"I have only alluded thus far to the material advantage to be derived from a brief course of scientific instruction. Allow me, in conclusion, to quote the language of one of the best and most highly gifted of our chemical philosophers as to its moral influence. The late Dr. Faraday says:—'I do think that the study of natural science is so glorious a school that with the laws impressed on all created things by the Creator, and the wonderful unity and stability of matter, there cannot be a better school for the mind.' Vain and foolish ideas, the fruit of ignorance, cannot be uprooted and destroyed by violence, the natural and more gentle method must be adopted, what in chemistry is called the law of substitution; the mind must be fertilised by knowledge, then truth and useful ideas will take the place of error and ignorant conceits. It is the absence of the exercise of the higher and intellectual faculties that leads so often to vacuity of the human mind, and the consequent indulgence in grosser and more material excitements, injurious alike to body and mind. A better form of education would eradicate the greatest of all human enemies—Ignorance and Intemperance.

"W. LITTLE

"The Hall, Heckington, Lincolnshire"

Degrees for Engineering Students at the University of London

IN one of your Notes for May 11 you refer to the failure of a motion which I brought before Convocation of the University of London at its recent meeting, to the effect that it was desirable that Greek should cease to be a compulsory subject at the matriculation examination. I have no wish to trouble your readers with a discussion of this subject, because it has been already so well ventilated in various quarters, and general opinion with regard to it has so nearly crystallised into form in other convocations than that of the University of London, that I have no doubt that the Senate of the University will ere long see the absolute necessity, if the University is to be kept *en rapport* with the scientific culture of the country as it has been hitherto, of adopting the course which I have urged, and the expediency of which has been endorsed by some of the highest educational authorities. The rejection of my motion is not the first illustration that Convocation has given of the highly conservative tendencies of many of its members, and of their incapacity to appreciate the liberal spirit in which the University was founded; and I am quite content to leave the case as it stands, with the remark made by one of old under similar circumstances—

Victrix causa Diis placuit, sed victa Catoni.

I shall, however, be glad if you can favour me with a little

space in your columns to air another subject which I also brought before Convocation, with, I am sorry to say, equal want of success, and that is the desirability of modifying the examinations for the degree of Bachelor of Science by omitting the biological subjects, so as to induce engineering students to take it. At present the biological subjects required for the degree, viz, Zoology, Botany, Physiology, and Organic Chemistry, are so entirely foreign to the studies and requirements of such students that in most cases it is scarcely practicable, even if it were desirable, for them to travel so far out of their regular line of work, for the purpose of getting them up for the Bachelor of Science examination. Such a course would be precisely analogous to that which is now prescribed for medical students proceeding to their M.B. degree, who are required to take up those subjects of the B.Sc. examination which are cognate to their routine of study, and who then branch off to those of a purely professional character.

Only two objections were urged in Convocation against this scheme which are worth consideration. The first was that it would tend to lower the standard of the degree by diminishing the comprehensiveness of the examination. In order to meet this objection I suggested that candidates not wishing to take up the biological subjects should be required to substitute for them others of a mechanical nature, such as Applied Mechanics, Engineering and Architectural Construction, and Geometric Drawing, which, as all who have had any experience in teaching them know, are quite as capable of being made efficient educational tests as those which they would replace. The second objection was, that to make such a change would be equivalent to instituting a degree in engineering. That this would be the practical result of the suggested alteration I am prepared to admit, and it is the object which I had distinctly in view in proposing it. What there was in the suggestion to provoke the unconcealed opposition of so many of the members of Convocation, I am a loss to imagine, unless it was the illusion that the profession of engineering is a less scientific one, and the education of its members less worthy of being encouraged, than that of the professions of law and medicine, to which so large a proportion of the London graduates belong.

For my own part, it seems to me a scandal of no mean gravity that, whilst the practice of that profession requires intellectual qualifications of the highest order, and a scientific training of the widest kind, no means should exist in this country whereby either the public should be provided with any guarantee that those who practise it possess either of these qualifications, or its practitioners themselves should be enabled to give evidence of the fact of their own accord. I do not know of any department of education in which the University of London could, at the present time, do more service than in this, and, I trust, there are men in its Senate, who, with more breadth of appreciation than the majority of Convocation, will give the matter their earnest attention. FRANCIS T. BOND

Hartley Institution, Southampton

Mechanical Equivalent of Heat

I AM afraid your publication, without adding the date, of my letter last week (which I only saw this morning) puts me in a false position in regard to Dr. Joule, inasmuch as it appears to ignore a correspondence of mine with him, which took place between the time that letter was written (now a long time since) and the time of your publishing it.

In that correspondence I allowed that Dr. Joule's theory remained the same in its main features, though I thought he virtually retracted one statement which I had particularly argued against. Dr. Joule, however, did not allow he had made any alteration.

He also informed me that a paper of mine had been read at the meeting of the Manchester Literary and Philosophical Society, in which I showed (as I believe) in a detailed examination that his theory was inconsistent with the results, both of his own and of M. Favre's experiments. Dr. Joule also kindly communicated to me the substance of the reply which he had made, but I have not seen either in print. Of course the question is one of facts; are facts consistent with the new laws of thermodynamics as supposed to have been established during the last twenty years? Tait, in his preface to his Thermodynamics, says: "The subject s one of vast importance, but very few indeed are yet acquainted with even its most elementary facts; and by many of these it is not yet accepted as true." These laws, therefore, can scarcely yet be put on a level with Newton's laws, even if they should be shown to be consistent with facts, which, at least in their present form, I believe to be impossible. H. HIGHTON

May 18

MR. HIGHTON'S letter in NATURE is almost identical with his communication to the *Chemical News*. My answer is similar to that which I sent to the latter publication, viz., that the object of my paper in the Proceedings of the Literary and Philosophical Society was simply to place the theory of the electro-magnetic engine in a form which might prove useful to those who had not worked on the subject, and not in any respect to withdraw the reasonings in what Mr. Highton is good enough to term my "famous paper." Mr. Highton handsomely acknowledged the justice of my note to the *Chemical News* in a letter addressed to me on the 28th ult. JAMES P. JOULE

Optical Phenomenon

IN reading over Prof. Clerk Maxwell's paper on Colour in NATURE (Vol. iv. p. 13), I was reminded of the following, to me, curious phenomenon which was seen by me on several occasions in the summer and autumn of 1859.

Whilst standing before a black board making geometrical figures in white chalk, I was struck by one side of each chalk line appearing blue, the remaining half retaining its proper white. The cause was at once evident to me, for I found that the sun shone fully upon one eye, but not upon the other. By closing the eye upon which the sun shone, the chalk marks appeared wholly white. Opening the eye again, the half blue, half white marks appeared; then closing the eye upon which the sun did *not* shine, the whole of the marks appeared a pale blue, scarcely so deep in colour as when in contrast with the white. By squinting, or forcing the eyes to see double, two sets of marks appeared, the one set all blue, the other wholly white.

Subsequently, with the sun upon both eyes, the whole of the marks were blue; whilst upon another occasion, when the sun shone very fully upon both eyes, only the white marks were evident; but shading the eyes by the hand, and allowing a ray to fall upon one eye, the usual half blue half white lines appeared.

On every occasion that I tried the experiment I met with the same results, and when I looked away a beautiful orange-coloured spot—the complementary colour of the blue, I suppose—appeared for some time wherever I looked. What is the cause why only the blue rays were visible? and why blue rather than red or yellow? THOS. WARD

Yellow Rain

THE following notice will perhaps be of some interest to the readers of NATURE. In December 1870, after a heavy rain at Rosario de Cucuta (New Granada), a great many small round specks of a yellow clayish substance were found on the leaves of plants that had been exposed to the rain. A sample of this substance was sent to Dr. A. Rójas, of this town, who forwarded it to me in order to examine it under the microscope. It proved to be composed almost entirely of a species of *Triceratium*, and another of *Cosmarium*, which must have been carried away by a violent storm from their lacustrian abodes.

Caracas (Venezuela), April 1871 A. ERNST

The Irish Fern in Cornwall

MY first impulse, on reading the note on this subject in NATURE for the 4th of May, was to apologise to Mr. Dymond for having caused him so much regret by making known a Cornish station for this fern. This first impulse was however checked by the reflection that something is due to the advancement of the study of distributive botany; and I could scarcely have expected even Mr. Dymond to place any very great degree of confidence in my bare assertion, unaided by any reference to localities.

Now that I have done the mischief and made known that the Trichomanes is a Cornish plant, and have been corroborated by Mr. Dymond, it would be interesting to know whether the writer of the note on this fern in the Cheltenham Natural History Society's report found his specimen at the same place, *i.e.* at St. Knighton's. EVERARD F. IM THURN

Force and Energy

I HAVE been under the impression that the supposed magnetising power of the more refrangible of the solar rays, as first examined by Mrs. Somerville in 1826, had been long ago disproved by the researches of Moser and Riess. This appears, however, to be a mistake, for I see from the report (in a recent number of the *Illustrated News*) of a lecture on Force and Energy lately delivered at the Royal Institution by Mr. Charles Brooke, F.R.S., that the lecturer is stated to have quoted the results of Mrs. Somerville's experiments to "show the interchange of light and magnetic energy."

Is it too much to ask that the editor of a popular treatise on natural philosophy will give us his authority for a statement so contrary to general scientific opinion? EXACTITUDE

Pangenesis

DOUBTLESS it is owing to a slight misprint in my communication in your number of May 11 that your correspondent, Mr. Meldola, has mistaken the gist of my objection to the theory of Pangenesis. I wrote, "a *seed* borne upon the graft would certainly be affected by the gemmules arising in the root and stem of the stock;" this was printed "a *bud* borne," &c. Now although it seems to me that much has been done to show that the stock will occasionally affect parts of the scion—and this my former letter does not for a moment contest—no evidence whatever has been brought to show that the sexual elements produced upon the scion have ever been affected by the stock without any intermediate change in the parts of the scion which may have borne the affected pollen grains or ovules.* And this certainly ought to be shown before it is assumed that every bud and every sexual element is formed by the aggregation of gemmules from all parts of the parents. Instead of which, in the vast majority of instances, we know that seeds borne upon the scion spring true to the scion. And if any instances to the contrary could be shown, it would then have to be proved that the part of the scion that bore the reproductive element was not a graft-hybrid. I may especially refer your readers to an interesting article by Dr. Masters, in the *Popular Science Review* for April, on "Grafting, its consequencs and effects."

A. C. RANYARD

SIR JOHN HERSCHEL

FOR nearly one hundred and fifty years Europe has not seen a more accomplished philosopher than the great and good man whose mortal remains were last week consigned to their tomb in the national mausoleum, finding there a significant resting-place close to the grave of Newton. In sorrow and friendly reverence they were followed thither by nearly all that England values as the most eminent in the various domains of those many sciences which he, through a long life, had adorned and advanced.

John Frederick William Herschel was born at Slough, in the early part of 1792, being the only son of that great philosophical astronomer, of whom it were difficult to decide, and one cares not to inquire, whether the father was or was not even more illustrious than the son. Thus the boy was nurtured within sight of that remarkable telescope, wonderful indeed for the day of its construction, which, though in reality among the least of Sir William's achievements, had probably contributed the most to render the name of Herschel famous among men. His education was conducted chiefly at home, or at all events under home influences, and mainly in the society of persons considerably advanced in years; and it is probably to this circumstance that we may attribute much of that singularly retiring, though kindly and affectionate disposition, for which he was so greatly esteemed by all who had the privilege of his acquaintance.

In 1809 he was removed to St. John's College, Cambridge, where there are still retained among a few of its oldest members some curious traditions of his scrupulous attention to the duties of his position. Certain specified selections from the "Principia" of Newton formed of course a portion of the curriculum of study; in that day they came to the student in the form of manuscripts, translated and somewhat modified from the Latin text; John Herschel, however, conceived it his duty to read the entire work just as Newton had left it. We mention this circumstance solely because it furnishes us with an early indication of that staple quality of mind without which no true greatness is ever attained, namely, thoroughness of work. It is not surprising that such a man carried off the highest honours in the University examination, and that in 1813 he graduated as Senior Wrangler of the year; the first among a little phalanx of eminent men, than whom the University of Cambridge has seen nothing superior and not much that is comparable since.

His early lot at Cambridge was cast in times of a scientific transition. To the majority of Englishmen the Continent had long been sealed, and our few men of science were for the most part unacquainted alike with the languages and with the learning of the rest of Europe; indeed, it is scarcely too much to say that the science of mathematics in England had made very little advance beyond what had been known in the later years of Newton. John Herschel, however, possessed the great advantage of living in a house where the chief languages of the Continent were understood, and in which relations with abroad were still maintained. To the late Prof. Woodhouse the honour is due of having introduced to the notice of the Cambridge mathematicians the higher methods of analysis which had long been practised on the Continent, and he was soon ably seconded in his efforts by the young mathematician. In conjunction with his friend Mr. Peacock, who afterwards became the well-known Dean of Ely, John Herschel, in the year 1816, produced a Treatise on the Differential Calculus, for the use of the University, by recasting rather than by translating a valuable work by Lacroix on that important subject, which hitherto had been studied in England solely to the most meagre extent, and encumbered by the unwieldy garb of the fluxional notation. This work was written in 1816, and before Herschel had taken his master's degree. In 1820 the translation of Lacroix was followed by another and more original work, containing a set of admirable examples and comments on almost all the more important methods of analysis by which mechanical and astronomical science had been so greatly extended by Newton's real successors, such as Euler, Lagrange, and Laplace. In this work Herschel was assisted not only by Mr. Peacock, but also by Mr. Babbage, who wrote that part of it which treated on functional equations. This admirable introduction to the higher forms of analysis is scarcely superseded even at the present day, and in some respects it remains unique. Thus John Herschel was instrumental in the promotion of that great reform in mathematical culture at Cambridge, which has never since ceased to bear most notable and excellent fruit.

It was shortly after his degree that we find the elder Herschel in one of his latest communications to the Royal Society referring with evident satisfaction to the fact that he had a son who was now capable of taking an important part in those astronomical, or rather as they may more properly be called, those cosmical researches which had formed the successful pursuit and the delight of his own life; and before his death he had the pleasure, we might not improperly call it the reward, of seeing his son in the year 1820 become one of the honorary secretaries of the newly-formed Astronomical Society. For fifty years and more he continued to be one of its most constant and loyal supporters, employing some of the last conscious moments of his life in compiling for its service a complete list, or, if we may be allowed the expression, a complete natural

* I should much like to learn if the *Bizzaria orange* can be propagated by seedlings. *Cytisus Adami* is, I believe, always sterile.

history of double stars, commencing with the father's first discoveries, and terminating only with the decease of the son.

Probably the busiest part, where all was busy, in the younger Herschel's laborious life, was passed between the time of his Cambridge degree in 1813 and the period when he quitted England in order to supplement the exploration of the heavens in the Southern regions, which his father had so ably commenced, if not completed, in the North. Those who have access to the Transactions of the various British scientific societies, and to the learned journals of the day, between 1816 and 1833, will be sure to find at brief intervals some important communication of his, enlarging the boundaries of human knowledge, and bearing the stamp of natural genius, cultivated and developed by honest labour. His fertility in this respect is truly amazing. Partly in conjunction with Sir James South, he re-observed the nebulæ and double stars the existence and the cosmical significance of which had first been brought to light by his father: at the same time adding to the list some thousands of celestial objects which had escaped even his sagacious observation. Like his father also he constructed his telescope with his own hands; an instrument which for many years remained a specimen, unique in its optical capacities and in the efficient simplicity of its mechanical arrangements. Latterly it has been surpassed among amateurs by Mr. Lassell and by Lord Rosse, and among artists by Mr. Grubb; but it was the Herschels who pointed the way and encouraged their successors to stand upon the shoulders of those who preceded them.

Nevertheless astronomy was very far from engrossing his whole attention; we doubt whether it absorbed even the half of it, for those who knew him best knew that the bias of his mind was mainly directed towards chemistry and light, and their cognate branches of physical inquiry. In 1819, when philosophical chemistry in England was perhaps at its lowest ebb, he rediscovered, and for the first time ascertained, the leading properties of the hyposulphite salts, the existence of which had, unknown to Herschel, been previously surmised, and only surmised, by Berthollet. In particular he noted the property of the hyposulphite of soda, whereby, as he says, "chloride of silver newly precipitated is dissolved in this salt almost as readily as sugar." We mention this circumstance because it was owing to this property of the hyposulphite alone, that Daguerre twenty years after was enabled practically to realise the hopes of Davy and Wedgwood, that the photographic pictures which they had already obtained might one day be fixed and preserved, even when submitted to the action of light. Thus, indirectly, John Herschel may, in a strong sense, be regarded as the father of photography; and at subsequent periods perhaps no man has entered more fully and philosophically into the actinic relations of light. It was during this most active period of his philosophical life that, attracted by the marvellous discoveries of Fresnel in connection with the undulatory theory of light, and after having studied and mastered what others had done before him, he set his own original powers to the task, and soon added to our knowledge fresh facts which they, his masters, had themselves overlooked. He discovered, for instance, that the relative positions of the optic axes in certain biaxal crystals were functions of the index of refraction; and he for the first time ascertained certain other actions of crystallised media on polarised light, which placed him at once among the first rank of experimental physicists of his day. The results of these studies he embodied in a most remarkable treatise on Light, published in the "Encyclopædia Metropolitana," which up to the present date may be advantageously consulted by the most accomplished student in this branch of physical inquiry. In the same great work will be found other treatises of his, on Sound, on Heat, and on Physical Astronomy, all of them bearing the stamp of genius and industry, and each one of them containing some specific advance beyond the condition in which he had found the subject.

In 1830 Dr. Lardner induced him to join in the composition of what he designated as the "Cabinet Cyclopædia," and to this Herschel contribute the two most celebrated volumes, viz., the "Preliminary Discourse on the Study of Natural Philosophy," and subsequently the volume on Astronomy. There were but few, if any, men of that day who could have contributed either. The first of them has probably formed the delight, the instruction, and the encouragement of every person who has since pursued or admired a scientific career. In dignity, purity, and pregnancy of language; in profundity of thought, in copiousness of apposite illustration, in a certain indefinable sweetness of persuasion, it, even at this day, captivates every mind that applies itself to its perusal. Here and there indeed its author gives rein to certain metaphysical speculations on Causes and Force, which are now found not exactly to square with the conceptions of later psychological writers. But on such questions as Causation and Force, a man whose mind, like John Herschel's, had been for half a century steeped in the difficult philosophy which embraces and pursues them both, may surely be more safely trusted than other minds, however subtle, whose extent of opportunity and of practical exercise have necessarily been inferior to his. We entertain a strong conviction that when metaphysical science shall, "by taking thought," have arrived at the first cubit of its stature, the deliberate conceptions of Herschel will be found to be in the main correct. A mind like his could have no sympathy with a philosophy which logically admits the thought, that, under some possible state of things, two and two can be equivalent to five. Speculative, he was by nature constrained to be such, but the practical side of his disciplined intellect sufficed to adjust the balance, and to prevent him from going deliberately wrong in his philosophy.

We now reluctantly but necessarily pass over much that is interesting and instructive in the career of the younger Herschel, and approach that crucial period of his life, when, accompanied by his wife and family, he left England for the Cape of Good Hope in 1834. To most of us John Herschel is known chiefly as the most eminent of modern philosophical astronomers; but the pursuit of astronomy was not the voluntary choice nor the chief bias of his intellectual life, it was rather the recollections and the impressions of the happy home of his youthful years, and reverence for the illustrious head of it, which determined him to complete what his father had commenced with such imperturbable diligence, and such wonderful success. He became a great astronomer rather through filial piety than through the promptings of a natural taste. As in the case of many other great men, some of whom still survive among us, his life-long career was determined by uncontrollable circumstances, while the inborn aptitude has lain in another direction. But passing over such thoughts, suffice it to say that Herschel quitted England for a long sojourn at the Cape of Good Hope, in order to survey those portions of the sidereal heavens which were beyond the reach of his own and his father's instruments. This he did, and wisely and generously did at his own personal expense; for happily, the possession of a moderate fortune enabled him to follow his own bent, and placed him beyond the necessity of the aid and the interference of a patron. How wisely, sedulously, and successfully his time was spent in this happiest of voluntary exiles, may be gathered from the perusal of perhaps the most remarkable volume on philosophical astronomy that has yet appeared.

The publication of this volume was, however, long delayed; he therein unconsciously followed the advice of the Roman poet, "nonum prematur in annum," inasmuch as it was not given to the world as a whole until the year

1847. The truth is that the numerical calculations necessarily entailed for the reduction and the discussion of the observations, occasioned an amount of labour inconceivable to those who are strangers to the requirements of exact astronomical research, and upon all this labour he personally entered. To explain what he required, to such a mind as his, would have been more troublesome and distasteful than to do it himself. As he had done before, so he did now, and so he did again and again while consciousness was accorded to him, he laboured with his own hands. But the book itself, ultimately published by the noble and well-judged munificence of the Duke of Northumberland, is by no means a monument of industry alone; it abounds, in almost every page of its many notes and appendices, with original discoveries, suggestions, speculations, grand and comprehensive conceptions of the distribution of the celestial universe, which will require many a long year to elapse before their significance is exhausted. We may take as an illustration the first instance that occurs to us, in a suggestion, made in a note of Herschel's which might, and for a long time did, escape the reader's notice. He suggests that the main difficulty which occurs in the observation of the sun's photosphere might be removed by viewing its light when reflected from the first surface of a glass prism, which, at the same time, permits the greater part of the heat to escape away from the observer's eye. This simple contrivance, thus rapidly suggested by the way, lies at the bottom of more than one discovery which has since been made relative to the constitution of the solar photosphere; but similar instances abound.

It is hardly necessary to refer to the multiplied and well-earned honours which awaited John Herschel on his return from the Cape of Good Hope. He might have been elected to the Presidency of the Royal Society, but he retired in favour of the Duke of Sussex; and shortly afterwards, not alone for his own sake but for the substantial recognition of an illustrious name among the worthy families of his country, he was made a Baronet of the United Kingdom. Like his great predecessor Sir Isaac Newton, he might have been returned as the representative in Parliament of that noble University where his intellect was nurtured and grew, until it became its brightest and fondest ornament; this honour he declined. Subsequently he was appointed, again like Newton, to the lucrative post of the Mastership of the Mint; but his gentle and unsophisticated nature was ill adapted to cope with the occasional unrealities and difficulties of an official life; it affected his health, and he retired after a tenure of a few years.

Our space forbids us, in this place, to enter upon the more recent portions of this illustrious man's public and scientific career; indeed it cannot fail to be sufficiently known to the great majority of our readers. His true place in the philosophy, and among the great lights of his age, cannot be accurately fixed, until his own generation shall have entirely passed away; for the feelings, the partialities, the prejudices of contemporaneous life, unavoidably warp and incapacitate the judgment, just as too close a proximity to a mass or a multitude is unfavourable to a correct appreciation of its true proportions. Some time after the death of Laplace, the writer of this notice, while travelling on the Continent in company with the celebrated French *savant* Biot, ventured to put to him the question, not altogether a wise one—"And whom of all the philosophers of Europe do you regard as the most worthy successor of Laplace?" Probably no man was better able than Biot to form a correct conclusion, and the reply was more judicious than the question. It was this,—"If I did not love him so much, I should unhesitatingly say, John Herschel." It is from a loving reverence for the memory of a great philosopher and a good man that we now venture to say no more.

Out of the large number of mourning friends who last week in Westminster Abbey gazed with reverential regret at the sorrowful procession which followed the mortal remains of John Herschel, till they were deposited among the best loved and most highly honoured of the worthies of past time, not a few must have recalled to their memories how in their scientific difficulties, or anticipations, or successes, they had betaken themselves to the aged philosopher of Collingwood, and had never failed to meet with the ready aid of a kindly and courteous sympathy.

C. P.

SIR J. HERSCHEL ON OCEAN CURRENTS

WE are permitted to publish the following letter (probably one of the last written by Sir John Herschel on scientific subjects) which was addressed by him to Dr. Carpenter, with reference to his paper in the Proceedings of the Royal Geographical Society, "On the Gibraltar Current, the Gulf Stream, and the General Oceanic Circulation," a copy of which had been forwarded to him by Dr. Carpenter on its publication, with a request that he would reconsider the opinions he had formerly expressed as to the inadequacy of differences of temperature and specific gravity to produce great movements of ocean water :—

"Collingwood, April 19, 1871

"MY DEAR SIR,—Many thanks for your paper on the Gibraltar Current and Gulf Stream.

"Assuredly, after well considering all you say, as well as the common sense of the matter, and the experience of our hot-water circulation-pipes in our green-houses, &c., there is no refusing to admit that an oceanic circulation of some sort must arise from mere heat, cold, and evaporation as *veræ causæ*, and you have brought forward with singular emphasis the more powerful action of the polar cold, or rather the more intense action, as its maximum effect is limited to a much smaller area than that of the maximum of equatorial heat.

"The action of the trade and counter-trade winds in like manner cannot be ignored; and henceforwards the question of ocean-currents will have to be studied under a two-fold point of view. The wind-currents, however, are of easier investigation. All the causes lie on the surface; none of the agencies escape our notice; the configuration of coasts, which mainly determines their direction, is patent to sight. It is otherwise with the other class of movements. They take place in the depths of the ocean; and their movements and directions and channels of concentration are limited by the configuration of the sea-bottom, which has to be studied over its whole extent by the very imperfect method of sounding.

"I am glad you succeeded in getting specimens of Mediterranean water near the place of the presumed 'salt spring of' Smyth and Wollaston, making it clear that the whole affair must have arisen from some accidental substitution of one bottle for another, or from evaporation. I never put any hearty faith in it.

"So, after all, there *is* an under-current setting outwards in the Straits of Gibraltar.

"Repeating my thanks for this interesting memoir, believe me, Dear Sir,

"Yours very truly,

"J. F. W. HERSCHEL

"Dr. W. B. Carpenter."

We congratulate Dr. Carpenter on having obtained from so eminent an authority, as one of the last acts of his honoured life, this cordial and well-considered acceptance of the doctrine he had previously opposed; and this distinct recognition of the new aspect in which Dr. Carpenter's own observations and reasonings had placed it. The success of his appeal shows that he did not underrate the noble candour of the great philosopher, to whom, more than thirty years previously, he had dedicated his first scientific treatise, as an expression of his gratitude for the moral and intellectual benefit he had derived from the "Preliminary Discourse on the Study of Natural Philosophy." We shall return to this subject next week.

PALÆOZOIC CRINOIDS

AT the seventh and last of the ordinary monthly meetings of the Montreal Natural History Society for the season 1870-71 a communication on a Mineral Silicate injecting Palæozoic Crinoids was made by Dr. T. Sterry Hunt. The author described a gray granular palæozoic limestone from New Brunswick, which had been examined by Dr. Dawson, and found to consist almost entirely of the comminuted remains of brachiopod and gasteropod shells, crustacea, and the joints and plates of crinoids, cemented with a little calcareous spar. The crinoidal remains were, however, found to have their pores filled with a peculiar silicate, which is exposed in relief when the surface of the limestone is attacked by an acid, and then appears as a congeries of small cylindrical rods or bars, anastomosing and forming a beautiful network which, under a magnifying glass, exhibits a frosted crystalline surface, and resembles the variety of aragonite known as *flos ferri*. This silicate, which also fills small interstices among the other calcacereous fragments making up the limestone, is greenish in colour and forms about 5 per cent. of the rock. Though insoluble in dilute acids, it is completely decomposed by strong acids, and is found to be a hydrous silicate of ferrous oxide and alumina, with some magnesia and a little alkali, closely allied to fahlunite and to jollyte. The results of its analysis will appear in *Silliman's Journal* for May. Dr. Hunt remarked that this process of infiltration, by which the minute structure of these palæozoic crinoids has been preserved, was precisely similar to that seen in the glauconite casts of more modern foraminifera, and in the Eozöon of older times. This ancient calcacerous rhizopod, though most frequently preserved by serpentine, had been shown, both by himself in Canada and by Hoffmann in Bohemia, to be in some cases injected by silicate related in composition to that of these crinoids. The great class of silicates of which serpentine, loganite, pyrosclerite, fahlunite, and jollyte are members, are generally described as the results of pseudomorphic changes of pre-existing silicates or carbonates; but Dr. Hunt maintains them to be original aqueous depositions, similar in their origin to the related mineral glauconite; a view now adopted by such investigators as Naumann, Scheerer, Gümbel, and Credner. These facts have an important bearing on the Eozöon Canadense of Dawson, the organic nature of which, though almost universally admitted by zoologists and mineralogists, is nevertheless still questioned by Messrs. King and Rowney. These gentlemen object that the ancient rocks in which Eozöon is found are what are called metamorphic strata, which have been, according to them, subjected to pseudo morphic changes, and therefore the Eozöon may be the result of some unexplained plastic force, which has fashioned the serpentine and other mineral silicates into forms so like those of foraminiferal organisms as to deceive the most practised observer. This was going back to the notions of those who, rather than admit that mountains had been formed beneath the sea, imagined that the fossil shells which they often contain were not the real shells of animals, but the result of some freak of nature. The argument of Messrs. King and Rowney that the Eozöon rock is a result of pseudomorphic alteration because it contains serpentine, is a begging of the question at issue, by asking us to admit that the presence of serpentine is an evidence of metamorphic change, which is denied. The specimens of this organic limestone, with its injected crinoids, differs from Eozöonal rock only in containing at the same time recognisable fragments of other organic remains, and in presenting in its injected portions the differences which distinguish the minute structure of a crinoid from that of a calcareous rhizopod.

Principal Dawson has verified the observations of Dr. Hunt by microscopic examinations. Crinoids in the fossil state are generally filled with carbonate of lime so as to obliterate their pores. The infiltrating silicate in the present case, however, shows, especially in decalcified specimens, that these ancient crinoids closely resembled in their minute structure the modern forms lately studied by Dr. W. B. Carpenter and Prof. Wyville Thomson, especially *Comatula*. The process of filling up the porous calcareous skeleton of the crinoids has been clearly shown to be prior to the cementing and consolidation of fragmentary limestone.

To this we may add that fragments of the calcareous skeleton of Echinoderms infiltrated with silicates have been detected by Dr. Carpenter, together with *Polystomellæ* and many other foraminifera similarly infiltrated, in Capt. Spratt's dredgings from the Ægean. On placing these fragments in dilute acid, the calcareous network of which Dr. Carpenter nearly thirty years ago showed the skeletons of all Echinoderms to be made up, is dissolved away; and a perfect model is left in green or ochreous silicates, of the sarcodic network, with which, in the living state, the interspaces of the calcareous network are occupied. Dr. Carpenter, however, objects to the term "infiltration" as expressive of the process by which the replacement of the sarcodic substance by silicates has taken place. As this process is going on at the present time on the ordinary sea-bottom, he thinks that it can only be attributed to a process of "substitution," in which the decomposition of the sarcodic substance performs an essential part. Whatever may be regarded as chemically the most probable explanation of the replacement, it will be obviously the same for the ancient as for the modern examples of the process.

NOTES

AT the Anniversary Meeting of the Royal Geographical Society held on Monday last, the address of the retiring president, Sir R. I. Murchison, was read by the secretary, Mr. Clements Markham, Sir Roderick thus closing an occupancy of the presidential chair extending over sixteen years. He is succeeded by Sir Henry Rawlinson. The Founder's Medal was on the same occasion awarded to Sir R. Murchison in recognition of the eminent services he had rendered to geography during his long connection with the society, in the course of which he had been associated with every exploring expedition for the last thirty years. The Patron's or Victoria Medal was presented to Dr. A. Keith Johnston for his long-continued and successful services in advancing geography. We regret to find that the retiring president found it necessary to send a letter to the secretary forbidding any hope that he would be able very soon to take an active part in the proceedings of the society, his progress towards complete recovery being slow. At the annual dinner which followed, the Dean of Westminster expressed a hope that we might yet see the foundation of a professorship of geography at each of the universities.

AT the Anniversary Meeting of the Linnean Society, held yesterday, Mr. Bentham delivered his annual address, which we hope to have an early opportunity of giving to our readers. Mr. Bentham was re-elected to the office of President, Mr. Wilson Saunders of Treasurer, and Messrs. F. Currey and H. T. Stainton of Secretaries, and the following gentlemen, in addition, were elected members of the Council for the ensuing year: Mr. John Ball, F.R.S., Mr. Alfred W. Bennett, Mr. J. J. Bennett, F.R.S., Mr. George Busk, F.R.S., Mr. F. Ducane Godman, Dr. J. D. Hooker, F.R.S., Prof. M. A. Lawson, Mr. Henry Lee, Mr. S. J. A. Salter, F.R.S., Dr. J. Lindsay Stewart, and the Rev. Thomas Wiltshire.

THE Board of Natural Science Studies for the Natural Science Tripos of the University of Cambridge has issued a set of schedules indicating the subjects to which the examination in 1872

and following years will be confined, and also those subjects which are suitable for the questions of the first six papers in the examination, as follows:—(1) Chemistry and certain other branches of Physic; (2) Mineralogy; (3) Geology; (4) Botany, Comparative Anatomy, Physiology, and Zoology, including (A) Morphology; (B) Physiology; and (C) Distribution.

THE Slade Professorship of the Fine Arts referred to in our last number has been established in connection with University College, London.

THE University of London has decided on the appointment of two assistant examiners in Experimental Philosophy at an annual salary of 25*l.* each; and a salary of 30*l.* in place of 25*l.* to each of the assistant examiners in Chemistry; as it is thought expedient to charge them with the superintendence of the practical and laboratory examinations at the preliminary scientific and first M.B. examinations.

DR. C. R. A. WRIGHT has been appointed Lecturer on Chemistry and Practical Chemistry at St. Mary's Hospital, *vice* Dr. Russell, who is now the Professor of Chemistry at St. Bartholomew's Hospital.

A LECTURE was delivered on May 17 by Dr. W. B. Carpenter, F.R.S., in the Comparative Anatomy Lecture Room of the New Museum, Cambridge, on the results of the Deep Sea Explorations during the last summer. After a brief *résumé* of the results of the deep-sea dredging up to the end of 1869, the lecturer gave an account of the configuration of the Mediterranean basin, of the singular difference in the laws of temperature at various depths in it and in the neighbouring Atlantic, of the proof of an outward current flowing beneath the surface in-current in the Straits of Gibraltar, of the additional proof of a great oceanic circulation between the waters of Polar and Equatorial regions, which he considered to have a far greater effect on climate than the Gulf Stream, and upon the fauna of the deeper parts of the Lusitanian seas, concluding with some remarks upon the comparatively azoic condition of the Mediterranean basin and the bearing of this upon some geological questions. The lecture was most attentively listened to by a crowded audience, and at the conclusion a vote of thanks, proposed by the Vice-Chancellor and seconded by the venerable Prof. Sedgewick, was carried by acclamation.

THE number of the members of the French Academy of Sciences is fast diminishing. The late Sir John Herschel was a foreign associate member, which is a very rare honour, as there can only be five such members created. Profs. Faraday and Graham were amongst the foreign associates.

THE distinguished members of the medical profession have mostly deserted Paris, although there are many thousand sick and wounded to be taken care of within the walls of the unhappy city. But there are also sick and wounded by scores of thousands outside. Amongst the distinguished practitioners who are in Paris we see the names of M. Broca, the celebrated anthropologist, Lassergue, Maison Neuve, and Axenfeld. But although some professors of the École de Médecine are to be found amongst these medical gentlemen, the School of Medicine is closed. It appears, however, that an irregular course of lectures is kept up open at Hospital Beaujon, which hospital does not belong to the Government.

M. ELISÉE RECLUS, the newly-appointed director of the National Library, asked from his subordinates to give their adhesion to the Commune. Almost everyone refused, and were instantly dismissed.

THE Annual Conversazione given by the President of the Institution of Civil Engineers will be held on Tuesday evening, June 6th. A collection of Models of Engineering Construction, of small and light pieces of Mechanism, and of Scientific Instruments, as well as of Works of Art, by ancient and modern masters of eminence, depicting some engineering work, object, or matter of interest, as "a bridge, lighthouse, aqueduct, or harbour, &c., set in its appropriate landscape," will be exhibited.

THE following Excursions have been arranged by the Geologists' Association for the ensuing month:—Excursion to Yeovil: Monday, May 29, and three following days, under the leadership of Prof. Buckman and Mr. Lobley, including the following points of interest: Yeovil Junction (Fine Section of Upper Lias Sands); Closeworth (Rectory), inspection of large collection of Mesozoic fossils, belonging to Rev. E. Bower, M.A.; Babylon Hill (Inferior Oolite); Halfway House (Inferior Oolite, very fossiliferous); Sherborne (Inferior Oolite, very fossiliferous); Bradford Abbas (Inferior Oolite); inspection of Prof. Buckman's collection; Handford Hill (Upper Lias Sands); Ham Hill (Inferior Oolite, very large quarries, ancient encampment); South Petherton (Middle and Upper Lias, very fossiliferous); Chard (Chloritic Marl, base of Chalk series). Should time permit, Crewkerne (Inferior Oolite) will be visited on return. Excursion to Ilford: Saturday, June 17, under Mr. Henry Woodward.—On arriving at Ilford, the Mammalian beds in the Newer Pliocene deposits at this place will be inspected, and subsequently a visit will be paid to the residence of Sir Antonio Brady, who has kindly invited the Association to inspect his fine collection of stone implements and mammalian remains. Excursion to Caterham: Saturday, July 1, under the management of Mr. Lobley. Fine Sections of the Upper Chalk are exposed in the neighbourhood of Caterham. Excursion to Warwick: Monday and Tuesday, July 10 and 11, under the Rev. P. B. Brodie.—On arriving at Warwick the party will visit the Museum, in which will be found the finest collection of Triassic fossils in England. The Keuper sections near the town will then be inspected. At Wilmcote very interesting seetions of the Insect Bed of the Lower Lias are exposed. Should time permit, visits will be paid to the Permian sections at Kenilworth, and to the fine Lower Lias section at Harbury.

WE learn from the *British Medical Journal* that the Committee of the College of Physicians has produced a scheme of amalgamated examination for consideration by the Joint Committee. Under this scheme, the examination would be a minimum examination, and essential for all the universities and licensing bodies of Great Britain. It would be carried out by examiners appointed by a Joint Committee, with a sole view to the fitness of such examiners. The fee for the joint examination would be one calculated only to cover the expenses—about fifteen guineas. The licensing bodies would not confer any licence except upon those who had passed the examination, and each would fix the fee for its licence. If the College of Surgeons will on its part accept this scheme, it will establish its claim to be considered sincere in the cause of medical reform.

WE have received the first four fasciculi of a new Italian Journal of Chemistry, edited by Prof. Cannizarro, of the University of Palermo. It contains a number of original articles by the editor, Dr. U. Schiff, Profs. Lieben and Rossi, and other well-known chemists, translations of important foreign papers, and an abstract of the proceedings of the chemical societies of Italy, Germany, and England.

THE Scottish Arboricultural Society has just issued its volume of Transactions for the past year, edited by Mr. James Sadler. The objects of the society are the promotion of the Science of Arboriculture in all its branches by periodical meetings of the members for the reading of papers, by offering prizes and reports on the practical operations of forestry, and publication of the same; and by such other means as may be found advisable; and it numbers among its members most of the botanists, arbori-

culturists, and practical foresters of Scotland. In the present volume are a number of practical essays on various points of tree cultivation, and for the current year no fewer than nineteen prizes are offered, the competition for some being limited to working foresters and woodmen.

REFERRING to the statement of the disappearance of Aurora Island (one of the New Hebrides group), recently printed in the American newspapers, Mr. Tryon exhibited to the Conchological Section of the Academy of Natural Sciences of Philadelphia, at their meeting on January 5th, two species of shells from the collection, supposed to be peculiar to this island, remarking that in the event of the reported submergence of the island being confirmed, these must be classed among the lost species. In his report on the mollusca collected by Wilkes's U.S. Exploring Expedition, we learn from the *American Naturalist*, Dr. Gould gives the following account of Aurora Island :—"The little island of Metia, or Aurora Island, to the northeastward of Tahiti, is one of peculiar interest. It is a coral island which has been elevated two hundred and fifty feet or more, and has no other high island near it. On it were found four small land shells belonging to three genera, viz., *Helix pertenuis*, *Helix Dædalea*, *Partula pusilla*, and *Helicina trochlea*. None of these were found upon any other island. They seem to have originated there, after the elevation of the island, and have a significant bearing upon the question of local and periodical creations in comparatively modern times."

IN these high-pressure days, it is astonishing what a saving in money and temper results from an exact punctuality. One would have thought that in every town which possesses a railway station, precise London time would be kept by the public clocks. This, however, appears to be by no means the case. To remedy this inconvenience, we notice that the Rev. H. Cooper Key is urging on the authorities of Hereford the importance of a daily time signal, preferring a time-gun to the dropping of a ball, as more certain to arrest attention. Certainly every town of the size of Hereford ought to have some means of keeping correct time.

A SLIGHT shock of earthquake was felt in Salvador in Central America on the 24th March, $1^h\ 45^m$. On the night of the 30th there were two shocks, with the sky clear and the moon bright. The Salvador earthquake very nearly coincides with two very severe shocks felt all over the Republic of Chile on the 25th March. Since then other shocks have been felt. In Valparaiso the first earthquake occurred at 11.5 A.M. and lasted about a minute, there being no previous noise. A little after 12 a slight shock was experienced, another shortly after 1, and at 5.30 P.M., a shock as strong as that of the morning ; walls were cracked.

ON the 26th March there were slight shocks of earthquake at Arequipa, in Peru.

WE have been favoured by the president of the Halifax (Nova Scotia) Institute of Natural Science with a report of their most recent meetings, which will be found in another column. We congratulate the Institute on the good work done by its members in illustrating the natural history, past and present, of the colony.

THE *Pioneer* of Allahabad contains a communication on snake bites. The writer is inclined to believe there is no antidote, but he thinks it useful to put on record an experiment. About three years ago he saw a bullock which had been bitten by a snake and was lying prostrate on the ground retching. Having heard from an old Brahmin that aniseed soonf was a remedy, he was induced to try it. He mixed aniseed 2 chittacks, pepper ½, aniseed leaves 1, aniseed bark 1. This was administered internally with great difficulty down the bullock's throat and externally. In a few minutes the bullock lifted his head, in an hour he stood up and began to chew, and in two hours was all right.

*PROF. WYVILLE THOMSON'S INTRODUCTORY LECTURE AT EDINBURGH UNIVERSITY**

IT is too often the first duty of a professor on taking office, to lament the loss of a predecessor who has lately left a blank in the ranks of literature or of science. I am happily relieved from this sad task, for although my friend, Dr. Allman, has found it necessary to retire from the active duties which he has performed so well for many years, his retirement may be looked upon as in a certain sense a gain to science, since he now enjoys a greater amount of leisure to carry on those admirable researches in one of the most difficult and obscure provinces of biology, which have already placed his name high on the roll of those who have added to the store of human knowledge. Although I sincerely trust it may be long before the inevitable time arrives for summing up the labours of George Allman, I believe I may be pardoned if I say a few words about the nature and method of his work, for there is no sounder example which I can cite for your emulation and my own. While keeping pace with the rapid advance of knowledge, and contributing to the general literature of biology the intelligent commentaries and criticisms of an accomplished teacher, Dr. Allman has steadily pursued for many years one special line of research. Whatever he takes up he works out thoroughly and well. His results are fearlessly quoted in all languages as entirely reliable. His straightforward statements and exact descriptions are warped by no preconceived theories, and need no revision or corroboration, and his beautiful drawings are as true to nature as the objects themselves.

No one appreciates more than I do the value of well-founded generalisations. They are the silken threads on which the pearls of truth are strung, and without them we could never realise the full beauty of the gems, their relative value, and their subtle harmonies in form and lustre and tone of colouring ; but the first thing is to dive for the pearls, and a good pearl-diver is immortal !

There is another matter to which I wish to refer, and I do so with unmixed pleasure—the appointment of my friend Prof. Geikie to a separate Chair of Physical Geology and Mineralogy in the University. You are all aware that it is to the munificence of Sir Roderick Murchison that this most valuable addition to our teaching staff is due. Sir Roderick Murchison is a Scotchman who has done more to advance the knowledge of geological and geographical science than any other man living. It is needless for me to speak in terms of eulogy of this last benefit which he has conferred upon the cause of scientific instruction in his native country, but I could not from feelings of personal gratitude allow this opportunity to pass of saying that it is to Sir Roderick Murchison that I owe my first encouragement and assistance in Natural Science ; and, like all who have received favours at his hands, I have found him a kind and steady friend through life.

We have now in the University three distinct departments of Natural Science, and as it taxes any man's energies to the utmost to keep up with the rapid advance of any one of them, it is of incalculable advantage that their teaching should be in different hands. Broadly speaking, Prof. Geikie now takes the inorganic kingdom of Nature, while Dr. Balfour and I divide biological science between us—Dr. Balfour taking the vegetable kingdom, and I the animal kingdom chiefly. The three subjects, however, meet and inosculate at every point, and the more one branch derives illustration from the other the better. This is especially the case with reference to Physical Geology, and the two departments of biology go between them, and demand full illustration from each. A mass of facts has of late years been developed, which group themselves into a special science of boundless interest—the Science of Palæontology. Still there can be no doubt that Palæontology is simply the biology of the present carried back continuously into the past. I will accordingly, with Prof. Geikie's full concurrence, incorporate pure Palæozoology with my Zoology course, and my colleague, Prof. Balfour, will doubtless do the same by Palæophytology ; and we shall both materially trespass upon the domain of Prof. Geikie for the necessary illustration which his special subject affords, fully aware that he must make even heavier requisitions upon us.

Gentlemen, I have already alluded to the division of the Natural Science group of subjects into three—the study of inorganic nature from a natural history point of view, and the study

* Introductory Lecture to the Natural History Class. By Prof. Wyville Thomson, LL D., D.Sc., F.R.S.

of the two organic kingdoms. As a certain amount of latitude is allowed in a first lecture, I will crave your indulgence while I direct your attention for a few minutes to a group of forms which are said to belong to none of these kingdoms, and to form a kind of Bohemia of their own.

Prof. Ernst Haeckel of Jena, one of the most profoundly learned naturalists and one of the most sensible thinkers of the day, advocates the separation into a distinct kingdom of an immense series of simple organisms, some of which had been hitherto regarded as plants and others as animals.

Prof. Haeckel's opinion on a matter of this kind is of the highest value, not because he has made a bold and certainly premature attempt to rearrange the universe on Darwinian principles, but because he has been a most sagacious and careful student of the lower forms of life. He has raised for himself a monument in his wonderful monograph of the Radiolaria, which will endure along with Darwin's researches on coral reefs and on the Cirripeds, when the Darwinian theory of modification through Natural Selection may possibly be remembered only as one of the most brilliant of those broken lights which have been shed from time to time by gifted men on the plan of the Divine Creator.

According to Professor Haeckel, the material universe, so far as we at present know it, resolves itself into minerals, protista, plants, and animals. I may say at starting that, along with most of my brother naturalists in Britain, I regard the introduction of this new "kingdom," the Protista, as a mistake; but as the proposal even involves most interesting questions as to the relations between the three recognised kingdoms, it is well worthy of careful consideration. Haeckel ranges among the Protista the Monera, a group of peculiar forms, of which he himself has been the most successful student, and these may be taken as the type of the "Protistenreich;" the protoplasta, containing amœba, difflugia and their allies; the diatoms, the flagellate infusoria; the fungi; the noctiluca; and the rhizopoda.

It is foreign to my present purpose to trace in detail the various steps by which our views of the ultimate process of organisation have been modified during the last few years; how after the publication of the brilliant observations of Schleiden and Schwann, the nucleated cell was almost universally regarded as the physiological unit; how the researches of Max Schultze, Leydig, Beale, and Hofmeister gradually shook our faith in the earlier conceptions of this cell-unit, and did away at all events with the necessity of a cell-wall, proving such a wall, when it existed, to be an excretion, and showing that the vital activity of the cell resided solely in the nucleated spherule of contractile sarcode which forms the cell-contents of every living cell—and how finally Cohn, Max Schultze, Huxley, and Haeckel cast doubts upon the value of the nucleus and upon the necessity of any cell-like limitation, and seemed to render the view highly probable that the vital activity of all organisms, even of the most highly organised, resides essentially and ultimately in a diffused homogeneous "germinal matter," or "protoplasm," of which all formed tissues are modifications or excretions.

It is impossible in the present state of knowledge to subject any view as to the ultimate mechanism of the formation of tissue through the means of protoplasm to direct proof. It seems now to be a very generally received opinion, supported by Huxley, Max Schultze, Hofmeister, Beale, and many others, and notably by Oscar Schmidt, who would seem to bring it almost to demonstration in his beautiful researches on the sponges of the Adriatic, that protoplasm is simply converted, with a certain change of composition, into tissue or "formed material." There are, however, almost insuperable objections to this view. The secondary products of organisation (formed material) are most various in their chemical constitutions, and it involves the admission that protoplasm may change in its chemical composition till it is *almost* carbonate of lime, or silica, or starch, or horn, or cellulose; the last stage of the metamorphosis being its absolute separation as one or other of these bodies. Another view which I have always regarded as more probable is that protoplasm, the substance which is endowed with the peculiar vital property, has always the same composition, and that it acts simply by catalysis, inducing, under certain known laws, decomposition and recombination in compounds which are subjected to its influence, without itself undergoing any change, absorbing the nascent products of combination and decomposition, and recombining them and reserving them with reference to the development or maintenance of the organ to which it gives its life.

The researches of Prof. Haeckel on the Monera have perhaps been of higher value in support of the protoplasm view than any others, for they have given abundant proof that independent beings may exist and may show all the essential phenomena of life without the slightest trace of differentiation of any part of their substance into investing wall or nucleus or distinguishable part of any kind, simply as masses of contractile jelly, particles of albumin endowed with the faculties of nutrition and reproduction.

The positive character to which Prof. Haeckel trusts for the definition of his protista kingdom is the entire absence in all the groups which it contains of sexual reproduction. He contends that all protista are monogenetic, reproducing by gemmation or fission alone. This character he conceives separates them definitely from true animals and true plants. Before passing to the consideration of the general relations of the animal and vegetable kingdoms and the position of these questionable forms, I wish to say that I do not attach much importance to this negative character. Of late years enormous advances have been made in our knowledge of the process of reproduction in lower organisms, and we find that multiplication by gemmation in various forms is infinitely more common than was supposed; that in some cases multitudes of individuals and apparently several generations are reproduced by gemmation alone, without the intervention of sexual reproduction; but at the same time I believe that the tendency of modern research is to make it more and more probable that in all cases conjugation or some other form of sexual reproduction comes in at some part of a definite or indefinite series of broods, and starts as it were an entirely new stock. I am inclined to think that in those cases where we find only monogeny, it is probably from a want of knowledge of the life history, not of an individual, but of a complete cycle of individuals. Besides, the reproductive process in some of these lower forms is very obscure. Not many years ago, accepting Prof. Haeckel's test, all the orders of cryptogamic plants would have belonged to the protista. Who could have anticipated the obscure and beautiful process of fertilisation in ferns? It seems scarcely possible that there should be no equivalent process in fungi, if we could only find it out.

Let us now consider for a moment the characters on which the older kingdoms have been founded, and see how they have stood the test of advancing knowledge. We shall thus be the beter able to judge of the stability or otherwise of the proposed new kingdom.

The consideration of the inorganic kingdom need not, I think, detain us long. Any two groups of things conceivable must have some analogies or resemblances; but it seems to me that any essential relations which have been founded on the resemblances between inorganic substances and organised beings are purely fanciful. Of course, it is impossible to say that a point of continuity may not be discovered, but as yet the boundary line seems sufficiently trenchant.

Inorganic substances never *live*, they are either simple (according to our present state of knowledge) or they may originate from the combination of two or more substances which unite in definite proportions; they may exist in any physical condition from solid to gaseous, but they are homogeneous, that is to say, any portion which may be detached exactly resembles the remainder in composition and in properties; they increase by the addition of like particles from without to the external surface; they may be indefinite in external form or amorphous, but almost universally they tend to assume the form of regular geometric solids bounded by planes, which have a definite relation to one another in position—to crystallise. Internally inorganic substances are at rest, unless their atoms be set in motion, or unless they be otherwise affected by forces acting from without; they initiate no motion nor change. If one could imagine a quartz crystal absolutely isolated from all external influences, it might remain unchanged for ever.

An organised being, on the other hand, either *lives* or has lived during some part of its existence; if living, every part of it is in constant motion and change; it increases by the imbibition of heterogeneous matter from without, by its assimilation, and by the intercalation of the particles of the assimilated food among the particles of the substance already laid down, by molecular intussusception; and old molecules which have undergone change are constantly being removed and replaced by new ones. An organised being always contains a mixture of solids, liquids, and gases; it is never homogeneous nor uniform in structure, but consists of structural elements which are distinct in character, and each of which has its part to play in the production and regulation of the movements

and changes which are unceasing; it always contains certain substances in what is called "unstable equilibrium," which become decomposed and reduced to more stable compounds the moment the peculiar vital property is lost. An organised being is not produced by the direct union of definite proportions of two or more simple substances; it arises by the growth of a germ, a portion separated from the body of a pre-existing organised being of the same kind. Finally, organised beings never assume accurate geometrical forms, but under the influence of life each kind of organised being assumes a characteristic, though not absolutely definite shape, which is the resultant of the sum of the shapes of all its structural elements, which has a very close relation to the shape of the organised being from which it was derived as a germ, though it is not identical with it, and which is called its individual form.

I have thus far contrasted inert matter with organised beings possessing life. That the term life indicates a very special property there can be no doubt, but, as yet, an impenetrable veil seems to shroud its ultimate processes. I believe, however, that the veil is at the far end of the labyrinth in which we are now wandering, and that patient observation and guarded generalisation may yet enable us greatly to narrow the limits of the unknown—to approach some steps nearer to the veil. I must premise that, as I am now looking at the subject from a purely physiological point of view, I regard life simply as a condition capable of producing certain perceptible phenomena, and can take no cognizance whatever of that mysterious union between spirit and matter which is broken in passing through "the valley of the shadow of death." Material processes and material changes only are subject to the material instruments of biological research. Those inner mysteries are now and must probably ever remain—in our present condition of existence—beyond the veil.

It becomes daily more manifest with the advance of knowledge that the action of known physical laws—such as chemical affinity and capillarity as manifested by porous media and by colloids—are most intimately interwoven with all organic processes, and it is, as yet, impossible to say how far life may influence, in the sense of modifying or directing, the action of these laws. Life has been called the vital force, and it has been suggested that it may be found to belong to the same category as the convertible forces heat and light. Life seems, however, to be more a property of matter in a certain state of combination than a force. It does no work in the ordinary sense. If a man lift a weight a couple of feet off the ground, many of the so-called vital actions are called into play, but yet every part of the work done can be accounted for by the action of the ordinary physical forces. The act of the will, in regal phrase the "mere motion," which induced the lifting of the weight, can be referred, we can scarcely doubt, to the mechanical action of some part of a large and complicated apparatus, the cerebral hemispheres, and was accompanied by a waste of its substance.

The telegraphic communication to the muscles involved which harmonised their several acts and signalled the contraction of their fibres, was conveyed through a cord whose molecules were set in vibration by a force very probably convertible with the physical forces, generated by chemical change and the waste of tissue; and in the muscle, the organ by which the weight was actually raised, an amount of waste took place—that is to say, an amount of carbon was combined with oxygen precisely equivalent theoretically to the quantity of coal which must have been burned in a perfectly constructed engine to do the same work.

Chemical forces act in living beings under very special circumstances. For a series of years a mass of substances are held undergoing constant change and throughout in the most unstable state of chemical combination. The instant the condition of life is removed, decomposition commences, and the complex constituents of the body are resolved into more simple and stable combinations. But yet it may be fairly questioned whether the chemical relations of the component elements of an organised body are in any way directly affected or controlled by life. It has become quite conceivable, especially through the researches of the late Master of the Mint, that a constant adjustment and re-adjustment of membranous and colloid diaphragms in the presence of powerful catalytic agents may possibly explain the maintenance of almost any chemical conditions however complicated.

The one function of living beings whose explanation it seems at present impossible to imagine except by regarding it as the manifestation of a special property, is what has been called the "moulding of specific form;" the building up of a heterogeneous and complicated organism, which shall repeat, not rigidly but with a certain flexibility, the characters which have been transmitted to it through a germ from a parent, every molecule of every part having thus a direct relation in form, in position, and in composition, to every other molecule of the body. At present, regarding it from a purely material point of view, we are scarcely justified in regarding life as more than that condition of an organised being in which the products of chemical and physical changes taking place within it are stamped with a specific organic form.

(*To be continued.*)

SCIENTIFIC SERIALS

Journal of the Ethnological Society of London (January 1871). A paper by Mr. E. B. Tylor on "The Philosophy of Religion among the lower Races of Mankind" gives in a condensed form his views on the development of "Animism," *i.e.* the doctrine of the soul, and of spirit and deity in general, a subject which is treated at length in his recently published work on "Primitive Culture."—Prof. Huxley's address on the "Geographical Distribution of the Chief Modifications of Mankind" is accompanied by an ethnological map, which curators and lecturers will do well to adopt as a wall-map. The principal races of mankind are defined as the Australioid, Negroid, Mongoloid, and the Xanthochroic and Melanochroic (fair and dark whites.) Among the special features in Prof. Huxley's scheme of the races of mankind, the following are prominent. The indigenous non-Aryan tribes of Central and Southern India, and less closely the ancient Egyptians and their descendants, the modern Fellahs, are referred to the Australioid type. The Negroid type of Africa is divided between the Negroes proper and the Bushmen of the extreme south, the Hottentots being considered a cross-breed between these two races. The Mongoloid type is made to include not only the brachycephalic Tatar races, but classification by skulls is set aside, and the group is arranged to include the Chinese and Japanese. The "absurd denomination" of "Caucasian" is abandoned, and the nations thus described by ethnologists come under the titles of Xanthochroi, fair whites, who are classed as of special type, and Melanochroi, dark whites, which latter Prof. Huxley is disposed to consider as sprung from intermixture of Xanthochroi and Australioids. In this classification of human types or races, Prof. Huxley rests on physical characteristics, treating language as subordinate. In his remarks on "The Ethnology of Britain" he again states his views as to the great division of European men between the fair whites of the centre and west, and the dark whites of the south. Both types occur in the early population of our islands, the use of Celtic language not corresponding with a racial distinction.—Dr. Nicholas's paper on the "Influence of the Norman Conquest on the Ethnology of Britain" is in strong antagonism to the view that Englishmen are ethnologically "Low Dutch." In his view, the old British race, in great measure, kept its early type, the Saxon, Danish, and Norman invasions affecting language, government, &c., rather than replacing the population itself.—Among the papers on Prehistoric Archæology are Sir John Lubbock's description of the Park Cwm Tumulus, and an account of remains of "Platycnemic Men in Denbighshire," by Mr. W. Boyd Dawkins and Prof. Busk.—Canon Greenwell's paper on "The Opening of Grime's Graves in Norfolk," gives full particulars as to the site of a Stone Age manufactory of implements from the excellent flint of the district. The chalk was systematically mined for the flint, and the so-called "Grime's Graves" are ancient pit-workings of this class. Colonel Lane Fox is disposed to explain in the same way the "Danes' Holes" in Kent, long a puzzle to antiquaries.—Looking at the number of the journal of the Ethnological Society, it is to be hoped that the journal of the new Anthropological Institute will maintain its very high standard of succinctness, solidity, and general interest.

THE *Geological Magazine* for the present month (No. 83) contains only four original articles, of which the first is an account by the editor, Mr. H. Woodward, of the objects which more particularly attracted his attention during a recent visit to the Brussels Museum. He notices especially the fossils of the Antwerp crag, and a fine example of the mammoth found at Lierre, in the province of Antwerp, in a sufficiently perfect state to be mounted as a skeleton. Two figures of this interesting specimen are given. Mr. Woodward also refers to

a fine series of skulls of *Ursus spelæus* from the Belgian caves contained in the Museum at Brussels.—Mr. Whitaker describes the chalk of the cliffs from Seaford to Eastbourne in Sussex, which he illustrates by a section, and compares with that of the Kentish cliffs.—In a paper (illustrated with a map) on the Denudation of the Coalbrook Dale coal-field, Mr. Daniel Jones endeavours to explain the puzzling arrangement of the coal measures in that locality by demonstrating that the southern portion of it has been largely denuded, and subsequently overlain by coal measures of younger age, so that the deposits are not uniform and persistent.—Mr. W. Davies gives us an alphabetical catalogue of type specimens of fossil fishes in the British Museum, in continuation of the similar lists already published by Sir Philip Egerton and Lord Enniskillen of the type specimens in their collections.—The remainder of this number is occupied as usual by notices, reviews, reports and correspondence.

THE *Proceedings of the Royal Irish Academy*, Series II. No. 2 of vol. i. has just been presented to the members. This Part contains Mr. Andrews's notice of the capture of *Ziphius Sowerbi*. The President's Annual Address. W. Archer "On some new or little-known Freshwater Rhizopods (Plates 12 and 13). Mr. R. C. Tichborne, Laboratory notes. G. J. Stoney "On the Cause of the Interrupted Spectra of Gases." Prof. R. Ball "On the Motion of Vortex Rings in Air." C. E. Burton "On Results obtained by the *Agosta* Expedition to observe the Recent Solar Eclipse." Principal Dawson, Note on *Eozöon Canadense*. Prof. T. S. Hunt, Notes on Messrs. King and Rowney on *Eozöon Canadense*. Prof. Macalister, "On Human Muscular Anomalies." The Appendix contains the minutes of the Proceedings of the Academy, and the Correspondence relative to the Bombardment of Paris.

IN the *Journal of Botany* for May, Mr. C. E. Broome describes a new British fungus *Scleroderma Geaster*, with a lithograph. The contributions to local botany are a continuation of Mr. More's Supplement to the "Flora Vectensis," and Notes of plants of the neighbourhood of Oxford, by Prof. Thistleton-Dyer. We have also a further instalment of Dr. Hance's "Sertulum Chinense," and the usual short notes, reports, reviews, and proceedings of societies.

SOCIETIES AND ACADEMIES

LONDON

Zoological Society, May 16.—Prof. Flower in the chair.—The Secretary read a report on the additions that had been made to the society's menagerie during the month of April 1871; and called particular attention to a female of the lately-described Prince Alfred's deer (*Cervus alfredi*), which had been received in exchange, and was stated to have been originally brought from the Philippines.—An extract was read from a letter addressed to the secretary by Dr. R. A. Philippi, Director of the National Museum at Santiago, stating that no species of the tortoise was known to occur in Chili, and that the specimens upon which the so-called *Testudo chilensis* had been based had been received from Mendoza, in the Argentine Republic.—Prof. T. H. Huxley communicated a paper by Dr. P. Martin-Duncan, F.R.S, containing descriptions of the Madreporaria (stony corals) dredged up during the expedition of H.M.S. *Porcupine* in 1869-1870.—Sir Victor Brooke, Bart., F.Z.S., read a paper on Speke's Antelope (*Tragelaphus spekii*) and the allied species of the genus *Tragelaphus*, in which the distinguishing characters of these animals were pointed out, and their synonymy and distribution given.—Mr. P. L. Sclater communicated some notes on a collection of birds made in the vicinity of Lima, Peru, by Prof. W. Nation, of that place, with notes on their habits by the collector.—A second communication from Mr. Sclater contained a continuation of his notes on rare or little-known animals now or lately living in the society's gardens. Mr. Sclater also gave the description of a new parrot, now living in the society's gardens, which he proposed to call *Lorius tibialis*.—Mr. R. B. Sharpe read a note on *Macheirhamphus anderssoni*, a very rare Accipitrine bird from Damara Land, and gave a history of the two species of *Macheirhamphus* now known to science.—Mr. J. Gould exhibited and pointed out the characters of a new humming bird, lately discovered by Mr. H. Whitely in Peru, which he proposed to call *Helianthea osculans*; and likewise characterised five other new species of the same family of birds.

Geological Society, May 10.—Prof. Morris, vice-president, in the chair. Dr. Henry Nyst, of Brussels, was elected a foreign member, and Prof. G. Dewalque, of Liège, a foreign correspondent of the Society. The following communications were read:—1. On the Ancient Rocks of the St. David's Promontory, South Wales, and their Fossil contents, by Prof. R. Harkness, F.R.S., and Mr. Henry Hicks. In the Promontory of St. David's the rocks upon which the conglomerates and purple and greenish sandstone, forming the series usually called the "Longmynd" and "Harlech Groups," repose, are highly quartziferous, and in many spots so nearly resemble syenite that it is at first difficult to make out their true nature. The apparent crystals are, however, for the most part angular fragments of quartz, not possessing the true crystalline form of the mineral. The matrix does not exhibit a crystalline arrangement, and contains a very large proportion of silica, much exceeding that which is obtained from rocks of a syenitic nature. These quartziferous rocks form an E.N.E and W.S.W. course. The arrangement of these rocks, which seem to be quartziferous breccias, is somewhat indistinct. In the immediate neighbourhood of St. David's they have associated with them irregular bands of hard, greenish, ashy-looking shales, much altered in character, but often presenting distinct traces of foliation. In a ridge running from the S.E. of Ramsey Sound in a north-easterly direction, the greenish shales are more compact, and resemble earthy greenstones. The quartziferous breccias and their associated shales form two anticlinal axes, contiguous to each other, and have on their S.S.E. and N.N.W. sides purple and green rocks. The order of the rocks from the quartziferous breccias upwards, when not disturbed by faults, is as follows:—

Lower Cambrian.

		feet.
1.	Greenish hornstones on the S.E., and earthy Greenstones on the N.W., forming the outermost portions of the so-called Syenitic and Greenstone ridges.	
2.	Conglomerates composed chiefly of well-rounded masses of quartz imbedded in a purple matrix . .	60
3.	Greenish flaggy sandstones	460
4.	Red flaggy or shaly beds, affording the earliest traces of organic remains in the St. David's Promontory, namely, *Lingulella ferruginea* and *Leperditia cambrensis*	50
5.	Purple (sometimes greenish) sandstones . . .	1000
6.	Yellowish-grey sandstones, shales, and flags containing the genera *Plutonia*, *Conocoryphe*, *Microdiscus*, *Agnostus*, *Theca*, *Protospongia*	150
7.	Grey, purple, and red flaggy sandstones, containing, with some of the above-mentioned genera, the genus *Paradoxides*	1500
8.	Grey flaggy beds	150
9.	The true beds of the "Menevian Group," richly fossiliferous, and the probable equivalents of the lowest portions of the Primordial Zone of M. Barrande .	550

The discovery of a fauna specially rich in trilobites, among these rocks of the St. David's Promontory, affords very important information concerning the earlier forms of life of the British Isles. Until the discovery of this fauna, these rocks and their equivalents in North Wales were looked upon as all but barren of fossils. We have now, scattered through about 3000 feet of purple and green strata, a well-marked series of fossils, such as have nowhere else been obtained in the British Isles. In the Longmynds of Shropshire the only evidence of the existence of life during the period of their deposition is in the form of worm-burrows, and in the somewhat indistinct impressions, which Mr. Salter regards as trilobitic, and to which he has given the name of *Palæopyge Ramsayi*. If we assume the purple and green shales and sandstones, with their associated quartz rocks of Bray Head and the drab shales of Carrick M'Reily, county Wicklow, to represent the old rocks of St. David's, they afford only very meagre evidence of the occurrence of life during the period of their deposition in the form of worm-burrows and tracks, and in the very indeterminate fossils which have been referred to the genus *Oldhamia*. One very prominent feature about the palæontology of the ancient rocks of St. David's is the occurrence of four distinct species of the genus *Paradoxides*; and this is in strong contrast with the entire absence of the genus *Olenus*. On a comparison of the palæontology of the St. David's rocks with those of the continent of Europe and of America, which seem to occupy nearly the same horizon, we have like features to a very great extent presenting themselves. With reference to

the distribution in time of some of the earlier genera of trilobites, it would appear that the genus *Olenus* is represented in Britain and Europe by twenty-two species, confined to the Lingula-flags and Tremadoc rocks, and not occurring so low as the Menevian group. The absence of this genus from the Menevian group, and its occurrence throughout the whole of the Lingula-flags, and in the Tremadoc rocks, along with the fact that so far as present observations go, no species of *Paradoxides* ranges higher than the Menevian group, have afforded good palæontological grounds for placing the line of demarcation between Upper and Lower Cambrian at this spot, and for including the Menevian group in the Lower Cambrian, to the bulk of which it is intimately united palæontologically. Mr. Hughes bore testimony to the admirable work done by Mr. Hicks, who had, almost unaided, worked out the geology of that district. Allowing that many subdivisions and new specific names had with great advantage been introduced into petrology, he defended the Survey nomenclature by reference to the then received definition of syenite and greenstone, terms still perfectly understood and applicable to the main mass of the rocks in question, though possibly subsequent closer examination and new sections may have rendered some modification of the boundary lines desirable. He was prepared to allow the metamorphic origin of all rocks of the classes under consideration, but did not think there was sufficient evidence to show that the divisional planes in the syenite and greenstones of St. David's were due to original stratification, but might correspond rather to the great joints of most granites. Mr. Hughes pointed out that the conglomerate contained fragments of the hornstone and quartz of this older series, which he considered was probably part of an old ridge or shoal, possibly of Laurentian, but certainly of Pre-Cambrian age, and thought that there were slight differences in the lithological character of the beds on either side, such as might be explained on this supposition. He agreed with Prof. Ramsay in thinking that there was evidence of the proximity of land in early Cambrian times, but was not prepared to refer these red rocks to inland seas or lakes as opposed to open sea; the whole seemed rather the deposit of an open sea encroaching during submergence. He did not attach very much importance to the restriction of genera to limited horizons in these older rocks of St. David's. For, as it was reserved for Dr. Hicks to discover these fossils after so many other observers had examined the district, he anticipated that further researches must certainly result in finding links which will connect together more closely beds, the stratigraphical relations of which seem to indicate so clearly an unbroken though varying series. Mr. Gwyn Jeffreys had been struck by the intercalation of non-fossiliferous beds from time to time among the fossiliferous beds described in the paper. This was the case in beds now in course of formation, and appeared to arise from the great deposits of mud brought down by rivers and redeposited in certain positions in the sea-bed. That this was the case had been proved by recent dredging operations both in the Atlantic, off Spain, and in the Mediterranean. Mr. Boyd Dawkins called attention to the gap which had been filled by the discoveries recorded in the paper, inasmuch as the Molluscan, Annelid, and Crustacean forms were now carried back far into the Cambrian period, and yet without any trace of their convergence, so that the origin of life might be as far removed from that period as was the Cambrian from the present time. The difference in the colours of the rocks he was inclined to refer to the different degrees of oxidisation of the iron they contained, which might supervene in a comparatively short time. The Rev. W. S. Symonds had, in visiting the spot, been much struck by the rocks, at that time termed syenite, which he believed might be an extension of those on the Carnarvonshire peninsula, and which he thought supported the whole series of the Cambrian rocks, so that they might after all be the Laurentian, the same as those of Sutherlandshire and Assynt. If this were the case the nomenclature of the Geological Survey would have to be altered, and the rocks of Pistyl and Holyhead no longer termed metamorphosed Cambrian rocks, but Laurentian. Mr. Hicks, in reply, stated that the quartziferous breccias forming the central ridge contained so many rolled pebbles, and were, moreover, in places so distinctly bedded, that there could be no doubt of their being sedimentary. Other beds, described as greenstone in the maps of the Geological Survey, were also distinctly laminated. The non-occurrence of fossils in the more sandy beds he attributed to their having been deposited in very shallow water. The fossils occurred principally in fine-grained beds of a flaggy nature.

"On the Age of the Nubian Sandstone," by Mr. Ralph Tate, F.G.S. The author remarked that the sandstone strata underlying the Cretaceous limestones, and resting upon the granitic and schistose rocks of Sinai, had been identified with the "Nubian Sandstone" described by Russegger as occurring in Egypt, Nubia, and Arabia Petræa. In the absence of palæontological evidence, this sandstone has been referred to the Mesozoic group, having been regarded by Russegger as Lower Cretaceous, and by Mr. Bauerman and Figari-Bey as Triassic, the latter considering an intercalated limestone bed to be the equivalent of the Muschelkalk. The author has detected *Orthis Michelini* in a block of this limestone from Wady-Nasb, which leads him to refer it to the Carboniferous epoch, as had already been done by the late Mr. Salter from his interpretation of certain encrinite-stems obtained from it. The author mentioned other fossils obtained from this limestone, and also referred to the species of *Lepidodendron* and *Sigillaria* derived from the sandstone of the same locality. He regarded the Adigrat Sandstone of Mr. Blanford as identical with the Nubian Sandstone.—3. "On the Discovery of the Glutton (*Gulo luscus*) in Britain," by Mr. W. Boyd Dawkins, M.A., F.R.S. The author in this paper described a lower jaw of the Glutton, which had been obtained by Messrs. Hughes and Heaton from a cave at Plâs Heaton, where it was associated with remains of the wolf, bison, reindeer, horse, and cave-bear. He remarked that he could detect no specific difference between the *Gulo spelæus* Goldfuss, from Germany, and the living *Gulo luscus*, except that the fossil Carnivore was larger than the living, probably from the comparative leniency of the competition for life in postglacial times. He referred to the distribution of the Glutton in a fossil state, and argued that its association with the reindeer, the marmot, and the musk-sheep would imply that the postglacial winters were of Arctic severity, whilst the presence of remains of the hippopotamus, associated with the same group of animals, would indicate a hot summer, such as prevails on the Lower Volga. Mr. Hughes indicated the exact position in which the jaw of the glutton was found, but pointed out that, owing to the excavations of keepers, badgers, rabbits, &c., the earth was so much disturbed in that part that it was impossible to be sure of the original relative position of the bones. He showed that the Plâs Heaton Cave was on a hill rising from the top of the plateau, while the Cefn, Brysgill, and Galltfænan Caves were in the gorge cut through that plateau, and therefore that the Plâs Heaton Cave was probably formed, and might possibly have been first occupied, at a much earlier period than the others. As it appeared to pass under that part of the hill which is overlapped by heavy drift, he thought it quite possible that this may have been a preglacial cave, and that by and by we may find evidence of preglacial fauna in it. The Rev. W. S. Symonds mentioned that in some of the pot holes in the roof of the Cefn Cave he had procured silt containing remains of shells determined by Mr. Jeffreys to be marine. Mr. Hughes explained that these shells had probably been washed in from the superficial drift of the district. Mr. Dawkins, in reply, expressed his belief that though the excavation of the caves in question might have taken place at different periods, yet that their occupation was, geologically speaking, contemporaneous.

Mathematical Society, May 11.—Mr. W. Spottiswoode, president, in the chair. Mr. C. J. Monro, B.A., late Fellow of Trinity College, Cambridge, was elected a member; and Mr. J. Griffiths, M.A., Fellow of Jesus College, Oxford, was proposed for election. The Hon. J. W. Strutt, fellow of Trinity College, Cambridge, was admitted into the Society. Prof. Henrici indicated the method of treatment he had employed in his paper "On the Singularities of the Envelopes of a non-unicursal Series of Curves." Mr. Strutt then read his paper "On the Resultant of a large Number of Vibrations of irregular phase, as applied to the explanation of Coronas." Sir W. Thomson, Prof. Clerk Maxwell, and Mr. Strutt made some further remarks on the subject of the paper. Mr. Maxwell then gave a description of two solar halos he had recently seen, and Prof. W. G. Adams gave some additional particulars in the case of one of the phenomena which had also been noticed by himself. Prof. Cayley then communicated an account of a paper by Mr. J. Griffiths "On the problem of finding the circle which cuts three given circles at given angles." The president next requested assistance in the solution of a "Question on the Mathematical Theory of Vibrating Strings," which he had been unsuccessful in solving. Mr. Strutt mentioned some results he had arrived at in reference to the subject of inquiry. A communication from Prof. Cayley

respecting the extension of the Society's sphere of action was laid before the meeting by the president; it was determined that the matter should be discussed at the Society's next meeting. Prof. Maxwell asked for information as to the convention established among mathematicians with respect to the relation between the positive direction of motion along any axis, and the positive direction of rotation round it. In Sir W. Hamilton's Lectures on Quaternions the coordinate axes are drawn, x to South, y to West, and z upwards. The same system is adopted in Prof. Tait's Quaternions, and in Listing's Vorstudien zur Topologie. The positive directions of translation and of rotation are thus connected as in a left-handed screw or the tendril of the hop. On the other hand, in Thomson and Tait's "Natural Philosophy," p. 234, the relations are defined with reference to a watch, and lead to the opposite system, symbolised by an ordinary or right-handed screw, or the tendril of the vine. If the actual rotation of the earth from west to east be taken positive, the direction of the earth's axis from south to north is positive in this system. In pure mathematics little inconvenience is felt from this want of uniformity, but in astronomy, electro-magnetics, and all physical sciences, it is of the greatest importance that one or the other system should be specified and persevered in. The relation between the one system and the other is the same as that between an object and its reflected image, and the operation of passing from one to the other has been called by Listing *Perversion*. Sir W. Thomson and Dr. Hirst stated the arguments in favour of the right-handed system, derived from the motion of the earth and planets, and the convention that north is to be reckoned positive. The right-handed system, symbolised by a corkscrew or the tendril of the vine, was adopted by the society.

Halifax, Nova Scotia

Institute of Natural Science, March 13.—Mr. J. M. Jones, F.L.S., president, in the chair. D. J. B. Gilpin read a paper on the Mammalia of Nova Scotia, being the ninth part of a series on that subject delivered before the institute. The present paper included the common hare (*Lepus americanus*) and the cariboo (*Rangifer cariboo*) or reindeer of the province. The author stated that whilst Newfoundland and the country around Hudson's Bay were represented by the polar hare (*L. glacialis*) which varied in colour even to pure white, and New England on the south by the wood hare (*L. sylvestris*) which never varied, Nova Scotia had the American hare (*L. americanus*) which varied to a soiled rusty-white, and which had been confounded with both the other species. A specimen of this last species taken early in November, and which might be considered as in summer pelage, was sepia-brown with a yellow wash and coarse black hairs on the back, breast, belly, and inside the legs white, tips of ears black, and pads light rusty. One taken in December of the same year and which may be taken as a winter specimen, was soiled white with rusty streaks on the back and sides; nose and circlet around the eyes rusty; under parts, pure white; a rusty streak on fore arm always, and often upon the thigh. The only parts which remained unchanged were the white of the belly, the black ear tips and the rusty pads, and that all the hair, both, summer and winter, had a lead coloured base. The change of colour takes place during the month of December, and is the result of the summer coat being shed and replaced by the winter one. The American hare abounds in the province, keeps close covert, and is nocturnal. In concluding his remarks upon this the last of the list of rodents found in Nova Scotia, Dr. Gilpin stated that although the equator produced no arctic forms, yet we find equatorial forms side by side with boreal ones at the north; and that although the furry foot of the lynx and ermine, and the feathery one of the day owl, the winter falcon, the ptarmigan, and grouse, are the true livery of the north, yet the shrews with satin coats and naked needle-like legs brave cold 20° below zero, and the red squirrel sports with naked palms on snow of similar temperature. Passing by the three orders *Edentata*, *Solidungula*, and *Pachydermata*, one of which, Solidungula, was represented by the horse, an introduced species on Sable Island, and there allowed to assume the feral state, the author arrived at the *Ruminantia*, two genera of which only exist in Nova Scotia—the cariboo or reindeer (*Rangifer cariboo*) and the moose (*Alces americanus*). He stated that the cariboo attain in Nova Scotias the enormous height of four feet ten inches; that the horns differs in every individual, but agrees in certain typical marks. In summer they are in colour rich brown, with white necks and shoulders; in winter, all soiled white; legs brownish, with white fringe on he hoofs extending to the back hoofs. They are seen in droves of seven or eight usually, and now and then of a hundred, but are fast diminishing; not, however, by the hand of man or teeth of wild beasts, but in that noiseless way wild creatures disappear as their range is contracted by new settlements; the does producing fewer fawns, and the males becoming early barren. Nova Scotia is the most southern latitude in which the cariboo is found on the American continent, but there is a "permanent variety," according to Richardson, one third the size of the southern form, with larger horns and no gall bladder, inhabiting the polar region. The President read a paper on the Diurnal Lepidoptera of Nova Scotia, being the second part of a series in process of delivery before the Institute. He remarked how visibly insect faunas differed according to the geological and botanical character of the districts visited by the entomologist, and more particularly alluded to the smaller size of certain insects inhabiting the extreme north-eastern portions of the American continent, compared with individuals of the same species taken farther south. This fact was first brought to his notice by the Rev. C. J. S. Bethune, secretary of the Entomological Society of Canada, three years ago, who while identifying a small collection of *Heterocera* taken in Nova Scotia, observed the smaller size of Nova Scotian forms when compared with those of Western Canada. Since that date the author has compared species of other orders with British types, and found a similar peculiarity, the British being larger than the Nova Scotian. This specific change is probably owing to the difference existing in the botanical character of these separate districts, which is not far removed from each other; but he hopes to be able to pay a second and longer visit to the valley of Annapolis and the slopes of the North Mountain during the coming summer.

Vienna

Imperial Academy of Sciences, March 9.—Several memoirs were communicated, of which the titles only are given, namely, "On the conversion of formic acid into methylic alcohol," by MM. A. Lieben and A. Rossi, of Turin; "On the structure and development of the earliest plumage observed in the chicken," by Dr. E. Pernitza; "On the solution of algebraic equations of any degrees, even with complex co-efficients, by means of Gauss's scheme for complex magnitudes," by M. A. Raabe; and "On the heat equilibrium between polyatomic gaseous molecules," by Prof. L. Boltzmann. Two sealed papers were also deposited.—Dr. L. Fitzinger presented the sixth section of his critical revision of the family of the Bats (*Vespertiliones*), embracing the genera *Vespertilio* and *Myotis*.—Prof. R. Maly communicated the results of some investigations made in the chemical laboratory of the medical faculty at Innsbruck, including an analysis of the fluid from an ovarian cyst, made by himself, with investigations of the constituents of its ash, by Prof. E. Hofmann; a notice of Trommer's sugar-reaction in the urine, and of a simple mode of preparing muriate of creatinine from that fluid, by himself; and researches upon the bodies containing sulphur in the urine, by Dr. W. Löbisch.—Prof. von Hochstetter communicated some microscopic investigations on opals, by Dr. H. Behrens, in which the author states that most opals are mixtures of various minerals, including a colourless fundamental mass, containing (microscopically discoverable) hydrophane, cacholong, quartz, hydrated and anhydrous oxide of iron, ferriferous silicates, metallic sulphurets and carbonates, and organic substances:—fire-opal, glass-opal, noble-opal, and hyalite are free from admixture, and the first two are structureless. The colours of the noble-opal are interference-colours, caused by their lamellæ, which, however, are not tabular crystals. The double refraction discovered by Schultze in hyalite is caused by differences of elasticity such as occur in dextrin, amber, and compressed glass. The author also noticed the spheroidal structure which frequently occurs in opals.—A memoir on the circum-anal glands of man, by Dr. Gay, of Kasan, was presented by Prof. Brücke. The author describes these glands as having the greatest similarity to the large sudorific glands of the axillary cavity.—Dr. Tschermak presented three memoirs, namely, an analysis of the meteoric iron from the desert of Atacama, by Prof. E. Ludwig, as a further demonstration of its similarity to the meteoric iron of Jewell Hill; a notice of the microscopic constitution of the Lavas of Aden, by M. J. Niedzwiedski, who distinguished three species of rocks:—an obsidian containing sanidine, a trachytic lava containing plagioclase and algite, and a felspathic basalt; and a contribution of his own to the knowledge of salt-deposits, in which he refers especially to the deposit at Stassfurt, which consists of two stages (rock-salt and kieserite-carmallite), the upper of which appears to

be wanting in other salt-deposits. The author notices the minerals sylvine, and kainite, which occur scattered in this upper stage at Stassfurt, and mentions their occurrence in the salt-deposit at Kalusy, in Galicia, and partially at Hallstadt, as indications of the upper stages. He also notices the crystalline forms of the kainite and sylvine of Kalusy, and of the kieserite of Hallstadt.—Prof. L. Ditscheiner presented a memoir on some new Talbotian phenomena of interference, describing the phenomena manifested in the spectrum when the object-glass of the telescope is half-covered with crystalline plates of various thickness, whilst two Nicol's prisms are placed before the fissure and before the eye-glass.—The same gentleman also communicated a paper on a simple apparatus for the production of complementary pairs of colours with Brücke's schistoscope, and a notice supplementary to his determinations of wave-lengths, published some years ago.—M. Franz presented a memoir on the theory of simultaneous substitutions in double and triple integrals; and M. Oskar Simony noticed three mathematical problems, one belonging to the integral calculus and the two others to algebraic analysis.—Prof. A. Bauer presented a memoir on some compounds of lead with other metals, in which he showed that lead combines both with palladium and with mercury to form definite chemical compounds, having the formulæ Pd^3Pb and Hg^3Pb^2. The same gentleman communicated a paper by M. J. Stingl, an analysis of rocks and spring deposits of the Teplitz thermal district.

PARIS

Academie des Sciences, Morales et Politiques, April 29.—The French Institute is divided into five branches, of which the Académie des Sciences is considered the senior. All the branches meet in the same hall on different days of the week; the meetings of the Académie des Sciences take place on the Monday, and those of the Académie des Sciences Morales on the Saturday; the other sittings are not public, and the three other sections do not issue a special periodical, although they keep regular records. The Académie des Sciences Morales was not less determined than its elder brother to maintain its sittings, and they were not interrupted up to April 29. But the number of the members, which had been five for the sittings of the 15th and the 22nd, had diminished again to only three, which is the smallest for making a quorum. The presidency was given to M. Naudet, the senior member by age, who is close to his 88th year. The Académie des Sciences Morales et Politiques, which had been suppressed by Napoleon I. as being tainted with "ideology," was restored by Louis Philippe after the revolution of 1830, and M. Naudet is one of the original members, and was during many years perpetual secretary, resigning five years ago as being unable to fulfil the duties of his post. M. Leveque, one of the younger members, acted as perpetual secretary, and read over a short account of the proceedings of the last sitting. M. Pellat, the only third member present, sat on the benches, and held up his hand to approve the record. Then the reading of memoirs was proceeded with. A member of the Académie des Beaux Arts, whose name is not given to us, availed himself of the privilege granted to the academicians of every section, and took his seat by his colleague Pellat. The general public was represented by three persons. One of them was M. Mangin, a literary gentleman attached for years to the editorial staff of the *Patrie*. The *Journal Officiel* of the Commune took no notice of the proceedings, which were reported in the Versailles *Officiel*. It is very likely that the Académie des Sciences Morales et Politiques will be extinguished for the time by the Communist rule, and there is only a faint hope that the Académie des Sciences itself will be able to find the three members required for a quorum. But some academicians propose to advise the five academies to hold a general sitting every week, so that the chance may be increased.

BOOKS RECEIVED

ENGLISH.—The Sub-Tropical Garden: W. Robinson (Murray).—Horses: their National Treatment, &c., by Amateur (Ballière, Tindall, and Cox).—The Builders of Babel: D. McCausland (R. Bentley).—The Meteoric Theory of Saturn's Rings: A. M. Davies (Longmans).—The Physiological Anatomy and Physiology of Man, vol. i. pt. 2: Todd, Bowman, and Beale (Longmans).

PAMPHLETS RECEIVED

ENGLISH.—Report of the Observing Astronomical Society, Bristol.—Brown on the Throne.—Biology *v.* Theology, No. 2, by Julian.—Transactions of the Society of Engineers of Scotland.—Memoirs of the Geological Survey of Ireland, Nos. 104, 113, by G. H. Kinahan.—Report of the Rugby School Natural History Society for 1870.—First Annual Report of the Natural History Society of Derry.—A First Catechism of Botany, by John Gibbs.—On the Physics of Arctic Ice, by R. Brown.—Descriptions of some New Oaks, by R. Brown.—On Double Spectra, by W. M. Watts.—Proceedings of the Bath Natural History Field Club, vol. ii., No. 2.—The Gold Fields of Nova Scotia, by A. Heatherington.—Report of the Palestine Exploration Fund.—Science and Revelation, by R. P. Smith.—Materialistic Theories, by the Archbishop of York.—Transactions of the Clifton College Scientific Society.—Address delivered at the Anniversary Meeting of the Geological Society, by J. Prestwich.—On the Physiology and Pathology of the Lower Animals, by Dr. Lauder Lindsay.—The Historical Difficulties of the Old and New Testament, by Rev. G. Rawlinson.—Positivism: a Lecture by Rev. W. Jackson.—Transactions of the Scottish Arboricultural Society for 1870.

AMERICAN AND COLONIAL.—Third Annual Report of the Noxious and Beneficial Insects of the State of Missouri, by C. V. Riley.—Report of the Fruit-Growers' Association of Ontario.—On the Solar Corona, by Prof. C. A. Young.—On a Method of Fixing Photography, and Exhibiting the Magnetic Spectra, by Dr. A. M. Mayer.

FOREIGN.—Plaidoyer en faveur de Paris: W. de Fonvielle.

DIARY

THURSDAY, MAY 25.

ROYAL SOCIETY, at 8.30.—On the Temperature of the Earth as Indicated by Observations made during the Construction of the great Tunnel through the Alps: D. T. Ansted, F.R.S.—Some Remarks on the Mechanism of Respiration: F. Le Gros Clark.—On a New Instrument for Recording Minute Variations of Atmospheric Pressure: W. Whitehouse.—Note on the Spectrum of Uranus, and of Comet I., 1871: W. Huggins, F.R.S.
SOCIETY OF ANTIQUARIES, at 8.30.—Ballot for the Election of Fellows.
ROYAL INSTITUTION, at 3.—On Sound: Prof. Tyndall, F.R.S.

FRIDAY, MAY 26.

QUEKETT MICROSCOPICAL CLUB, at 8.
ROYAL INSTITUTION, at 9.—On Bishop Berkeley and the Metaphysics of Sensation: Prof. Huxley, F.R.S.

SATURDAY, MAY 27.

ROYAL SCHOOL OF MINES, at 8.—Geology: Dr. Cobbold.
ROYAL INSTITUTION, at 3.—On the Instruments Used in Modern Astronomy: J. N. Lockyer, F.R.S.

MONDAY, MAY 29.

ANTHROPOLOGICAL INSTITUTE, at 8.—On the Quissama Tribe of Angola: F. G. H. Price.—On the Races of Patagonia: Capt. Musters.—On Chinese Burials: Dr. Eatwell.

TUESDAY, MAY 30.

ROYAL INSTITUTION, at 3.—On the Principle of Least Action in Nature: Rev. Prof. Haughton.

WEDNESDAY, MAY 31.

SOCIETY OF ARTS, at 8.—On the Employment of Women: Mrs Grey.

THURSDAY, JUNE 1.

LINNEAN SOCIETY, at 3.
CHEMICAL SOCIETY, at 8.—On Ozone: Dr. Debus, F.R.S.
ROYAL INSTITUTION, at 3.—On Sound: Prof. Tyndall, F.R.S.

CONTENTS

ERRATA.—Vol. iv. p. 40, in Table of Contents, for "Lieut. S. P. Oliver, R.N." read "Lieut. S. P. Oliver, R.A."; p. 45, 2nd column, line 16, for "slow enough to exceed" read "slow enough not to exceed"; p. 47, 1st column, line 28, for "December 29" read "December 15"; same column, 2nd line of footnotes, for "1871" read "1870."