THURSDAY, JUNE 13, 1872

THE BRITISH MUSEUM

THE Return published by order of the House of Commons on April 19, 1872, of the progress made in the arrangement of the collections, and of the objects which have been added during the past year to the National Museum, is a document which, although only seen by a very few persons, cannot fail to be of interest to a very large proportion of English people, and also to those engaged in scientific pursuits all over the world.

Confining our attention to the Natural History Department, and commencing with Prof. Owen's general report, we find that, although every care has been taken on the part of Heads of Departments to limit in all possible ways by declining or postponing all acquisitions not absolutely and immediately pressing, the annual tide of new specimens still flows in, and during the past year 15,879 specimens have been added to and incorporated with the present crowded series.

Everywhere throughout Prof. Owen's report the old grief of "want of space" is introduced and persistently pressed upon the attention of the Legislature; but at the same time allusion is also constantly made to the time when the requirements for increased exhibition-space, and more adequate store-rooms and cabinets, will have all been met by the galleries of the new Museum.

We are glad to see that Prof. Owen puts forward other very good and sound reasons, besides the mere overcrowding, in favour of a speedy release from the too-restricted galleries and studies to which the collections under his care are at present restricted. "Inadequacy of space," writes the Superintendent, "is associated with loss of time." Thus: "To meet the wishes and expectations of scientific visitors and students in regard to opportunities of study and inspection of specimens relating to the latest advances in natural history, the well-filled or crowded exhibition-galleries and cases have to undergo more or less of re-arrangement with removal and interchange of specimens, in order to allow place and access to the novelties."

Again, in the case of the delicate and brittle specimens, the risk which is now incurred in frequently shifting these will then be reduced to its minimum, and, consequently, the chances of preserving such treasures will be greatly increased. It now not unfrequently happens that an entire series of objects have to be removed and rearranged to gain a few feet or even inches of space in some cases.

All this labour and care in the re-adjustment of series, which would be needless if there were abundance of exhibition space, will be removed in the new Museum, and the same amount of labour can be devoted to the more satisfactory task of classification and the true advancement of Natural Science.

Prof. Owen gives in a tabulated form the annual additions made to each Department during the twelve years from 1859-70. The total increase for each is as under:—

	Zoology	Geology	Mineralogy	Botany	TOTAL
Total increase for 12 years..	435,492	78,434	24,945	123,409	662,280*

* The total numbers are wrongly cast in the printed return.

Of course, in certain years the increase in one or other of these Departments has been specially large; thus in 1863 98,754 specimens were added to the Zoological Department, whilst in the following year only 7,688 specimens were acquired. After all, numbers only convey a very imperfect idea of increase, so much depends upon the size of objects themselves. Thus, for instance, a collection of Coleopterous insects, comprising many thousands of examples, may all be contained in a small cabinet of twenty drawers; whilst a tapir, antelope, or other quadruped may when stuffed need a case all to itself, or a whale may require an entire gallery 90ft. long for its proper display. We are glad to hear that the birds and shells are better off for room than the other Natural History divisions; we have always felt when passing through this gallery with its fine series of table-cases, and the birds occupying the wall-cases, that these two groups were specially favoured; whilst the adjoining mammalian-saloon but very inadequately represented the actual exhibition needs of the higher animals. All this Prof. Owen tells us will be set right in the new Museum.

The use of methylated spirit for the preservation of Reptilia and fishes has produced in some cases injurious results to some of these specimens. Dr. Günther will, no doubt, speedily remedy this mischief, and the purer medium must in future alone be used. All the other collections are reported as in good preservation.

There is a long list as usual of additions to each of the Departments. Dr. Gray reports a fine series of Lemurs from Madagascar; a *Grampus Rissoanus*, and a Pike whale (*Balænoptera rostrata*), from the English coast. Various Mammals from Abyssinia, chiefly of the Antilope family. Among the Birds we find Pheasants, Hornbills, and Pigeons, and many lesser members of the feathered tribe. Fishes, Reptiles, Mollusca, and tribes of Insects, have also been added, likewise specimens of the "Glass-rope-*sponge*" (called a "Coral" in the Report), the *Hyalonema* from Japan, and the beautiful vitreous sponge, the *Pheronema Grayi*, from the coast of Portugal. Making a total in all of 10,577 specimens added during the past year to the Zoological Department.

Of Fossils there seems to be a goodly supply. From the La Plata come bones of the *Toxodon*, *Mylodon*, and *Macrauchenia*, the *Drepanodon*, and the *Glyptodon*; from Australia remains of the *Thylacoleo* (that queer marsupial which Prof. Owen demonstrates to be a carnivore, and Prof. Flower essayed to make out to be only a great root-feeding Wombat), the *Diprotodon* (a gigantic kangaroo, which probably did not hop, like the modern kangaroo, but went on all-fours), the *Nototherium*, *Macropus*, and many others. The most important acquisition during the past year is that of the Van Breda collection from Haarlem. This well-known collection, commenced by Dr. Peter Camper, the celebrated Dutch anatomist, more than 100 years ago, has since been largely increased by his grandson, the late Prof. Van Breda, secretary for more than fifty years to the Royal Dutch Society in Haarlem, who inherited Camper's original collection.

The series of specimens is particulary rich in remains of the great Meuse lizard, the *Mosasaurus hofmani*, and of a giant tortoise, the *Chelone hofmani*, and many fine remains of fishes and reptilia from the Maestricht chalk,

the Solenhofen stone, the Brown Coal of Bonn, the Miocene limestone of Oeningen, and the Trias and Keuper of Germany.

Of English fossils the finest addition is that of the Wetherell collection, the author of which was for more than fifty years a diligent collector of London clay fossils at Highgate and its vicinity. This collection is a truly Metropolitan series, and will, when the new Museum is prepared, doubtless have, as it deserves, a suitable exhibition case. Altogether there have been added to the Department of Geology a total of 4,789 specimens.

Mineralogical science is well cared for by Prof. Maskelyne. Only 513 specimens have been added, but these are each one a valuable addition to the cases. Among the most important may be mentioned the Chlorides and Iodides of Silver, in distinct crystals, from Chili, and a series of remarkable crystals and masses of Iceland spar.

In the Laboratory new minerals of the Dufrenite class have been examined, to which the name "Andrewsite" has been given; a blue mineral from South Africa proves on analysis to be "Percylite," only known hitherto in the specimen preserved in the British Museum. The Cranbourne Meteorite is still being investigated.

In the Botanical Department, Mr. Carruthers reports a long series of important acquisitions during the past year. Among other interesting additions to the exhibited series may be named a series of microscopic preparations of fossil plants, selected partly from the collection bequeathed by Robert Brown, and partly from the specimens subsequently acquired by the trustees, and exhibited so as to show their minute structure by the help of light reflected from mirrors.

It will be seen that the key-note of the Report is the hope of better times coming, not only for the National Collection, but for its Officers, in the New Museum. In this hope we most heartily concur, and trust that not the least reform which will then be inaugurated will be the entire modification of the present system, by which the actual amount of instruction gained by the public appears to be in inverse proportion to the vast resources of this great establishment if well and ably administered. This is not as it should be. There is no reason why the British Museum should not become, under its new management, one of the first educational establishments of the country.

NEW WORKS ON GEOMETRY

Solid Geometry and Conic Sections, with Appendices on Transversals and Harmonic Division; for the Use of Schools. By J. M. Wilson, M.A. (Macmillan and Co. 1872.)

Geometrical Note-Book, containing Easy Problems in Geometrical Drawing preparatory to the Study of Geometry; for the Use of Schools. By F. E. Kitchener, M.A. 2nd edition, revised. (Macmillan and Co.)

THESE works are by mathematical masters at Rugby School. Their united aim (in connection with Mr. Wilson's two previous parts) is to provide a complete course of geometrical teaching, and so to meet a crying want of our schools, which has of late led to so much agitation. It is now nearly four years since Mr. Wilson's first part and Mr. Kitchener's first edition appeared, at which date an eminent reviewer, in his notice of the "Elementary Geometry," remarked that the forces were mustering for the battle. Since that time considerable progress has been made in the agitation, and, thanks to the Association for the Improvement of Geometrical Teaching, which owes its origin in part to a correspondence commenced in this journal, there seems to be a fair prospect, if not of perfect success, yet of the whole subject of geometrical teaching being placed on a more satisfactory basis.

The very first resolution put forward by this Association in its second Annual Report is, "That some practical familiarity with geometrical construction should precede theoretical study; and that the teaching of geometry would gain by the free introduction of easy exercises and numerical examples or illustrations." We presume that a main object of Mr. Kitchener's book is to meet this suggestion; and from the fact of a second edition being called for we may fairly suppose that it has met a felt want. It will be barely necessary to do more here than point out wherein this edition differs from its predecessor. Without going into details, we may state that the size of the page has been materially enlarged; that instead of blank spaces being left for figures to be drawn by pupils on the printed pages, there are now inserted between every two pages of type two sheets of admirable blank paper. The paging is continued on these blank sheets. There are three parts in the place of two; the use of the protractor is relegated to part ii.; on p. 37 a return has been made to Euclid's definition of parallels (this is doubtless in consequence of the agreement come to and embodied in the seventh resolution of the above cited Report); the third part contains a few simple constructions connected with tangency and the circumscription of figures. There are apparently no typographical errors in this well got-up work, and we take leave of it commending it to all teachers engaged in the arduous task of instilling geometrical notions into junior students' heads.

It appears to us that the following are the only oversights to point out:—Should not 7 precede 6 on p. 49? Exercise 30, p. 25, should be expunged; it is given on p. 61, 4, where a definition is given which is wanting in the former place. In Exercise 14, p. 62, the case of parallel lines has been overlooked; and on p. 50, for 514 we get 534 nearly =.

To turn now to Mr. Wilson's book. This is characterised by his usual clearness and ability. The selections and the grouping are, in the main, all that we desire in a school treatise; we would, however, have preferred a somewhat more extended treatment of the sphere and cylinder. Some properties of the former are cited on p. 79 which have not been given in the work itself. A little fuller notice of these solids would fit the book to meet the requirements of candidates for the B.A. London Examination; as by a recent extension of the University scheme students are expected to be acquainted with the proofs of the properties of these figures, which are assumed in treatises on mensuration of solids. As indicated in the title, the work consists of three parts; the first part covers the ground occupied by Euclid xi. 1—21, and further treats of polyhedra and stereometry, the whole presented in a clear and satisfactory manner, certainly in a form not hard to be

understood by an average schoolboy who has mastered any ordinary treatise on Plane Geometry. We have found our own pupils to read it with interest, partly for a reason put forward by the author, that "the geometrical imagination is exercised." We notice for the first time, we believe, in a text-book, the term "disposition," in the following connection:—"Parallel planes are those which have the same disposition in space:" the discussion raised in these columns in connection with Mr. Wilson's application for a suitable term will be within the recollection of most readers, and if we mistake not we are indebted to Dr. Hirst for the suggestion of this appropriate word. We note on this page (9) a curious oversight, which, however, the student can readily correct.* On p. 45, for $\frac{1}{2}\pi$ read 2π. In the short and handy notice of transversals we observe the use of the term "sense," as equivalent to direction. On p. 64, last line but one, read $\frac{DA}{CA} = -\frac{BD}{BC}$; and on p. 67, third line, read $\frac{AB.CD}{BC.AD} =$ &c. Other slight typographical mistakes will give the reader no trouble. The last of the three parts contains a capital summary of the chief properties of the conic sections—just sufficient, we think, for class use; for, with the limited time at our disposal now-a-days, it is almost useless attempting to take up such extended treatises as the admirable ones by Drew and Besant. The figure on p. 128 is not quite correctly lettered in accordance with the proof that accompanies it.

We have examined and used this book with much satisfaction, and hope to see it pass through several editions, as we think it calculated to raise the study of solid geometry "to a more prominent position in geometrical instruction," and to put the subject of geometrical conic sections in a more satisfactory state than it at present occupies.

R. T.

OUR BOOK SHELF

The Year-Book of Facts in Science and Art. By John Timbs. (London: Lockwood and Co. 1872.)

MR. TIMBS'S books always produce upon us the effect of an ill-assorted dinner. There is plenty of solid food, but along with it some that is anything but wholesome; and the concatenation is badly managed, and the cooking none of the best. To take the concatenation first: The paragraphs in this volume are arranged under a variety of headings, but on what principle the assortment is made we have failed to discover. Thus we have paragraphs on Surface Movements of the Earth and on the Secular Cooling and Figure of the Earth, under Natural Philosophy; on Earthquakes and Volcanoes, under Geology and Mineralogy; on Protuberances of the Sun, under Natural Philosophy; and on Vast Sun Spots, under Astronomy and Meteorology; while two long accounts of the Gun-Cotton Explosion at Stowmarket are given, one under Mechanical and Useful Arts; the other under Chemical Science. Next, as to the cooking, in other words, editing. Very little pains appear to have been taken to go to the best authorities on each subject, or to trace statements to their original source. For instance, admirable papers as are the *Spectator* and *Pall Mall Gazette*, we hardly care to know what the one thinks as to the chance of men ever being able to fly, or the other about the sensitiveness of frogs during vivisection; and some more authoritative judgment on Prof. Tyndall's experiments on the purity of water might have been found than that of an anonymous writer in the *Times*. It is surely the result of careless editing to find on the same page two descriptions of the same bone-cave in Pennsylvania, although in one instance it is described, by a slight geographical confusion, as being situated "in Philadelphia." Very familiar proper names are constantly misspelt or misquoted. Thus we hardly recognise Padre Secchi under the disguise of "Seeche;" or the admirable Genevan Society which has published so many valuable contributions to science, under the name of "The Society of Physics and Natural History of Ginevra." As to the unwholesome and absolutely indigestible food, we will refer only to a single actual error. Canon Kingsley will be surprised to be made responsible, on the authority of our excellent contemporary the *Builder*, for the statement that "lime is a metal called by chemists 'calcium;' but it is never found in that state in nature. It is found in a rocky or chalk form." Other blunders almost as gross could be quoted. The book gives us the impression that the compiler was under the necessity of filling a certain number of pages, and that for this purpose the scissors and paste were freely used on the material that came the readiest to hand. The worst is that by the non-scientific public such books are taken as an authoritative record of the progress of science during the year, and of the most important inventions and discoveries, and the most striking new applications of old principles.

Righthandedness. By Daniel Wilson, LL.D., Professor of History and English Literature in University College, Toronto. Pp. 40. (Toronto, 1872.)

THIS pamphlet contains some useful facts bearing on the question why some people are left-handed, and the antecedent question why more are right-handed. Prof. Wilson takes a sufficiently comprehensive view of the subject. He admits that the problem does not concern the hand alone, but the foot, the eye, and the whole body. He admits that a similar preference for one side may be found among the lower animals; and he re-states with some fresh illustrations the grounds which have led previous writers on the subject to conclude that right-handedness is the normal condition of all the existing tribes of man, and has been so as far back as history, tradition, or language extend. He raises the question whether, in some cases, we have not translated the ancient terms inversely, so that the favourite and stronger hand may have been with certain of the ancient nations the left; but has no difficulty in showing, from the described relations to the points of the compass, from the form of weapons, and from many other sources, that what we call the right hand has always been the one chiefly used. In another passage Dr. Wilson refutes the idea that the Egyptians were a left-handed race, and shows that it has arisen from the greater convenience of drawing the figure left-handed in certain cases. The evidence from language is discussed, and the etymology of the words *dexter*, *decem*, *quinque*, *sinister* is accepted, as given by Grimm, Donaldson, and other philologists, who long ago pointed out the connection in various languages between the words which express the number ten and those for the right hand, the fingers of which complete the tale of ten.

The learned Canadian Professor does not offer any new theory of the reason for the general preference of the right hand, or the occasional preference of the left. He discusses the hypotheses advanced by Barclay, Hyrtl, Gratiolet, and Buchannan; and rightly rejects them all, as insufficient or contradicted by anatomical facts. Besides these writers, and Prof. Humphry, of Cambridge, who is also quoted, Dr. William Ogle has lately published, in the "Medico-Chirurgical Transactions," an interesting paper on "Dextral Pre-eminence," in which several new facts and observations are recorded.

Prof. Wilson's paper is a valuable contribution to the literature of the subject. It seems, however, to have been

* There is a similar oversight in the proof of Cor. i., Theorem 27, p. 35.

hastily revised. Thus, in four lines quoted from Ovid, there are two bad misprints, besides a doubtful reading.

At present the results obtained in this inquiry are the accumulation of facts and the refutation of untenable explanations. One may also, perhaps, affirm (1) that the primitive condition of man and other vertebrates was, as their early fœtal condition still is, one of complete bilateral symmetry of structure, and also of functional symmetry; (2) that this primitive ambidextrous use of the limbs is occasionally superseded in animals, and constantly in all races of men of which we have any knowledge, by a preferential use of one side; and that this is a necessary step in development as soon as the more delicate operations performed by a single hand take the place of those of digging, climbing, &c., in which both take part. It is, in fact, a differentiation produced by the same causes which have led to the specialisation of the fore and hind limbs in frogs, birds, or kangaroos, compared with their uniformity of structure and function in fishes, crocodiles, and horses; (3) the prevalent choice of the right hand when differentiation was established, must have depended on some slight advantage, at present unascertained, by which dexterity at last suppressed *gaucherie;* (4) The occasional preference for the left hand, which is often partial and sometimes hereditary, does not depend on any "coarse" structional abnormality, but is an instance of atavism—of reversion to the primitive and universal ambidextrous, or to a subsequent and partial lefthanded condition.

P. H. PYE SMITH

LETTERS TO THE EDITOR

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

Ocean Currents

IF a free body on the earth's surface should be moved from a lower to a higher latitude without friction by a force in the direction of the meridian, it would acquire a certain amount of relative eastward velocity, which would be the same whether the body moved toward the pole with a very slow uniform velocity arising from a single impulse, or whether it moved with a continual accelerated velocity down a gradient by the force of gravity. If a particle of atmosphere or of the ocean is moved in the same way by a similar force, and does not acquire the same amount of relative eastward velocity, the difference between the velocities in the two cases is the true measure of the effect of friction. But from the amount of work done, or velocity generated or destroyed, nothing can be inferred with regard to the acting force, unless we take into account the length of time during which it acts. The velocity of the interchanging motion of the water between the equator and the pole, discovered by Dr. Carpenter, is extremely small, perhaps not as much as a mile per day, and less than tidal velocities in the open ocean. If a great amount of eastward velocity, therefore, is destroyed by friction in the case of a particle of the ocean in moving from a lower to a higher latitude, it is not because the friction is great, but because it acts during a very long time.

If the velocity in the direction of the meridian were one mile per day, the deflecting force, at the parallel of 45°, arising from the earth's rotation, would be about equal to the force of gravity along a regular gradient of 6ft. between the equator and the pole. Both the velocities north or south and east or west, and the amount of friction belonging to any given velocity, are unknown quantities. The force down the gradient of 6 ft. between the equator and the pole, which Mr. Croll allows to be the measure of the force due to the difference of temperature or density between the equator and the pole, would soon give the particles of water without friction the velocity of one mile per day, and the question now is, whether the force would then be sufficient to overcome the friction belonging to this small velocity; for the inertia of the water being once overcome, all that would be required of the force would be to overcome the friction.

The velocity of motion between the equator and the pole being probably of the same order only as tidal velocities, we may suppose the friction in the two cases to be somewhat of the same order. Now the friction in tidal velocities in the open sea, when not regarded as entirely insensible, has always been regarded as a quantity of a second order in comparison with the disturbing forces producing the tides, or at least as being much less. But the force producing the tides is about equal to the force of gravity along a gradient of two feet between the equator and the poles. If we therefore suppose the force necessary to overcome the friction of tidal velocities to be one-fourth of that producing the tides, then the force of gravity on a gradient of 6 in. between the equator and the poles, would be sufficient to overcome the friction belonging to the slow velocities of the motion discovered by Dr. Carpenter, if we suppose, as above, that the amount of friction in the two cases is of the same order. But this is only one-twelfth part of what Mr. Croll allows to be the available force for this purpose. According to the preceding view, therefore, the difficulty is not in finding a sufficient force for overcoming the friction of Dr. Carpenter's slow velocities, but in disposing of the abundance of force we have on hand for that purpose.

Washington, May 24 WM. FERREL

The Wanderings of the Esquimaux

I AM much obliged to Dr. Rae for his courteous letter upon a subject in which he is so deservedly an authority, while I am only a student. The question upon which he joins issue with me, namely, the southerly migration of the Esquimax, is one upon which I ought to bow to his authority; but there are some difficulties attending the solution he offers which deserve, I think, consideration. If the Greenland Esquimaux came from the north, as both of us are agreed, it is probable that the stock from which they sprung are the so-called Arctic Highlanders of Smith's Sound, about whom Mr. C. Markham has written both in the *Ethnological Journal* and the *Journal of the Geographical Society*. They are broadly distinguished from the Esquimaux of America by the use of stone igloos instead of snow huts, and by their ignorance of boats, either kayaks or omenaks. These Arctic Highlanders are a diminishing race. M'Clintock tells us "that they have become alarmed by the rapid diminution of their numbers through famine and disease" (Travels, 137). Along the shores of Smith's Sound are the ruins of many deserted huts, moss-grown, and of considerable antiquity. The skulls of musk oxen without their lower jaws, a proof that they had been killed by Esquimaux, are also found scattered along the same coast (id. 76). These facts show that the Esquimaux were formerly abundant in very high latitudes, where they have now become very few in number. What is true of Smith's Sound is also true of the great Archipelago of the Arctic circle known as the Parry Islands. These also are dotted with the moss-grown ruins of ancient and deserted huts, the remains of a once numerous race in an area now, I believe, entirely deserted by the Esquimaux. These two places are in the highest latitudes yet reached by navigators.

Dr. Rae would make these Northern Esquimaux to be wanderers from the American Continent; but, putting aside the difference of customs, which seem to show that the American Esquimaux are not the primitive stock of the race, but have been sophisticated by contact with the Indians, I may quote the following passage from Mr. Markham, who has studied the question with some care:—"The American Esquimaux never go from their own hunting range for any distance to the inhospitable north. Except in the case of the Pond's Bay natives who followed up the whalers for a specific reason, there is no instance of their having gone north, and it is unreasonable to suppose that they would do so" (*Journal of Ethnological Society*, 4, new series, 135).

When I quoted the traditions about the migration of the Esquimaux having been southerly, I had the passage especially in my mind where Sir John Franklin describes the Chippewyan legend about the discovery of copper, beginning with the words, "The Chippewyans suppose the Esquimaux originally inhabited some land to the northward, which is separated by the sea from this country; and that in the earliest ages of the world a party of these men came over and stole a woman from their tribe, whom they carried to this distant country, and kept in a state of slavery, &c." (Franklin's Narrative, 146).

Dr. Rae, on the contrary, thinks they came from the west. Now Mackenzie, who certainly knew the country well, says:—"The progress of the Esquimaux, who possess the sea-coast from the Atlantic through Hudson's Straits and Bay, round to Mackenzie River, and, I believe, further, is *known to be westward. They never quit the coast*" (Mackenzie's Travels, 406).

The Asiatic origin of the Esquimaux seems to me to be a very problematical solution of the difficulty. There are Esquimaux in Asia undoubtedly. The so-called Tchuktchi of Tchuktchi Ness are Esquimaux, but they are a very small fragment, and are apparently emigrants from the opposite shores of Behring Straits. Between them and the American Esquimaux there is a considerable intercourse, which has led to the products of Russian manufacture being found along the shores of the Arctic Ocean; and the American Esquimaux constantly pass the Straits for purposes of barter. Beyond the fragment of this people found at the extreme north-eastern part of Asia, and a few of the Kamskatkans, I know of no Asiatic race whose language, or custom, or physique, favours the opinion that they are connected with the Esquimaux. The course of migration has rather been westerly and easterly. The Tchuktchi proper and the Koriaks, who are a very different race from the Tchuktchi of Tchuktchi Ness, have been pressing to the west, and have uprooted numerous tribes, such as the Omoki, &c. These latter were portions of a widely-spread race now represented by the fast-diminishing Jukagiri, whose language, so far as I have examined it, is very different from the Esquimaux (a copious vocabulary may be seen in Billing's travels). Again, between the travels of Cooke and those of Whymper, the language of the inhabitants of Kotzebue Sound has changed considerably, and become more Esquimaux, which seems to show that the Esquimaux have quite recently been pressing in this direction also.

All these facts point to apparently only one conclusion, that the original home of the Esquimaux was in the regions near the Pole, from which they have migrated to a more temperate climate; and I can see no good cause for such migration, except the increasing rigour of the climate. The question is one of great interest, both to ethnology and physical geography, and I hope Dr. Rae will favour your readers with some more facts on the other side.

While the evidence seems to be overpowering that the climate has been gradually growing more severe in the highest latitudes, there is a good deal of evidence which points to a corresponding decrease of severity elsewhere. We cannot read the descriptions of Gaul and Germany in Roman times and reconcile them to the state of things that at present exists there, without believing that the climate has very much improved. It is rash to take isolated seasons, but we may compare with profit the accounts of the terrible winters of Roman days, during which the Rhine and Danube were frequently frozen over, with the comparative mildness of modern times. The reindeer and the elk then ranged far to south of their present habitat. Ovid's lamentations over the fearful severity of his place of exile on the coast of Thrace are matched by the accounts of white foxes, &c., which then lived there, and by the proverbial rigour of the winters on the coasts of the Black Sea; while the diminution in the energy and vigour of the races that inhabit the Mediterranean border-land can best be accounted for by the theory which makes them to have in some measure succumbed to a more enervating climate. If this be true, we have a very remarkable fact hitherto ignored, so far as I know, by scientific men, namely, that it is possible that circumpolar climate may have been very temperate when the climate of more southern latitudes was very severe. This paradox, upon which I should very much like to have the opinion of some of your correspondents, is favoured by the following fact:—"It is a common remark of those who frequent the Polar seas, that they find always the least obstruction from ice when the preceding winter has been very severe in more southern latitudes. In the year 1766, though the frost had proved most intense through the rest of Europe, the whalers reached a high latitude; and not to multiply instances, the three last seasons (*i.e.* 1815, 16, and 17), which have been reckoned very open, have succeeded to winters notoriously cold and protracted," *Edinburgh Review*, 30, 34). We have only to extend the analogy of a season to a number of seasons, and we at once get a similar result to the one above named, *i.e.*, that an increase of severity of climate in low latitudes is balanced by a diminution of severity in high ones. I need hardly point the moral in the present letter of the value of such a result in speculations on the existence of the mammoth in Siberia and Northern Russia during the Glacial epoch, &c.

Derby House, Eccles, June 4 HENRY H. HOWORTH

Origin of Cyclones

IN NATURE of August 17, 1871, Mr. J. J. Murphy calls attention to a paper by Mr. Meldrum on the origin of storms in the Bay of Bengal, &c. This paper advocates the theory of their origin "in the meeting of the trade-winds in the northern and southern hemispheres, at some distance north or south of the equator."

Mr. Murphy says:—"Over the greater part of the Pacific cyclones do not appear to be found. The reason of this probably is that, in consequence of the temperature of the sea changing but little with the seasons, the two trade-winds over the Pacific meet each other nearly on the equator all the year round; though I do not know how far this is confirmed by observations on the winds of that ocean."

Very little is known about the meteorology of this part of the Pacific, and my object in writing is to communicate to Mr. Murphy and others who may be interested in the subject the following facts:—

1. There is rarely a year without at least one cyclone passing through, or in the neighbourhood of, one of the following groups of islands, viz., Fiji, Samoa, or Hervey.

2. The cyclone season extends over a greater part of the period during which the sun is south of the equator; consequently, when the trade-winds from the north reach farthest south. Cyclones are most prevalent about the middle of the season, or rather later than the middle. They rarely visit us earlier than December or January.

3. They are usually preceded for a few days by strong northerly winds. During such winds we watch the barometer very carefully, as a sudden fall is a sure indication of a cyclone near at hand.

I may add that a strong northerly wind is blowing in this group at the present time. It was indicated by the barometer thirty-six hours before it reached us, and was preceded by a day's calm. It then burst upon us suddenly with fury, but after a few hours moderated to about the force of the S.E. trade-wind.

S. J. WHITMEE

Leulumoega, Samoa, South Pacific, Jan. 8

P.S.—Since the date of my last note we have had two earthquakes—Nov. 13, at 5.5 P.M., vertical, with a great rumbling preceding and accompanying it; Dec. 15, at 12 noon: double shock, with an interval of thirty seconds: slight.

Rain after Fire

SOME old settlers believe that great bush fires cause rain. During this summer exceptionally dry weather has prevailed over the greater part of New Zealand, more especially along the eastern coast; in several of the towns prayers for rain have been offered up in the churches. I beg to send some notes of recent date extracted from our home diary. It should be stated that this district, adjoining Banks' Peninsula, has been suffering from extensive bush fires since the 18th of last month.

"Feb. 1. Strong N.-Wester; very hot; 92° in the shade under the back verandah. Heavy bush fire on the hill still burning; showers in the evening."

On the coast here it is very unusual to have rain with a N.W. wind, which is dry and parching.

"Feb. 3. Strong N.-Easter; showers in the evening."

The bush fire was still burning, and continued to do so till the 7th. On the 5th most of the neighbours turned out to save some property in great danger of being destroyed by the fire. N.E. is a cool dry wind from the sea.

"Feb. 16. Strong N.E. Heavy bush fire under Omauhate and about Cass Peak. Slight showers from the S.W. in the morning; wind veered round to N.E."

Our rainy quarter is S.W. with a low temperature; less frequently we experience thick weather from S.E., accompanied by fine rain. These fires have been traversing a range of hills (more or less timbered in the gullies), their heights from eleven to about four hundred feet above the level of the sea. I believe the showers noted to have been as local as the fires; the direction of the wind is given as prevalent on the dates mentioned, with some indication as to its strength, but we have no memoranda as to its force during the actual fall of rain. Opportunities of watching the gradual formation of cumulus cloud above dense volumes of smoke are by no means rare in this part of New Zealand, where the occupiers of Crown land have periodical burnings of their run, or great portions thereof, in early spring. These notes are forwarded in the hope of helping to illustrate the question of whether fires cause rain, no opinion is ventured on the subject, but this curious phenomenon should be further investigated. THOMAS H. POTTS

Ohinitahi, New Zealand, Feb. 19

On Adhesion Figures

A DROP of crude carbolic acid placed on the surface of cold water exhibits the most surprising and beautiful "cohesion figures." I am not aware that Mr. Tomlinson has described the behaviour of this substance. So lively and unpredicted are the movements of the drop that its action resembles that of a living creature. At first it pulsates, then its edge breaks up into crispations, and a motion begins like the waving tentacles of a sea-anemone. Sometimes the drop will sail about in a crescent shape, or shoot out independent little rings, which gyrate and rush about like a rotifer, until at last they burst into a myriad of intensely active little specks. Warm water destroys all action, by lessening, I suppose, the adhesion of the liquids.

To your readers it is trite and useless to remark upon the interest that attaches to the careful and continued observation of the most familiar things. But I wish the leisure classes could understand this. How many pleasant and instructive hours might some of them spend in examining such common things as essential oil dropped on water, even drops of ink falling through water, or puffs of smoke through air or a candle flame, or a hydrogen flame, or iron filings sprinkled on paper over a magnet, or, among other simple things, best of all a block of ice in a sunbeam. From the contemplation of such phenomena one rises with an increasing joy, and not a little humbled at one's own ignorance before the orderly mystery that pervades everything.

24, Elgin Road, W. J. H. SPALDING

A Suggestion to Opticians

THERE is a method of mounting self-registering meteorological thermometers very commonly employed, and one which for some purposes, as, for instance, for determining the temperature immediately over the surface of the ground, is an excellent plan.

I allude to the placing of the divided thermometer stem in a larger tube forming a jacket to it, and fixing it with india-rubber packing, which makes an air-tight stopper round the neck.

Now it is frequently observed that when thermometers fitted in this manner are exposed to cold, a copious deposition of dew takes place, both on the stem and in the interior of the jacket, rendering the accurate reading of the instrument a matter of some difficulty. I would therefore suggest to makers of this class of instrument whether it would not be advisable for them to *dry*, I do not mean merely heat, the air in the tubes, or else enclose some water-absorbing substance, as calcium-chloride, in the tube before finally inserting the india-rubber stopper.

It is extremely probable my suggestion is not a new one. I have no recollection, however, of having heard of such a plan being employed by any maker. G. MATHUS WHIPPLE

Kew Observatory, June 10

The Ferrara Floods

MAY I ask for space to draw the attention of engineers to the question whether the beds of embanked rivers rise or not? The affirmative is argued (and in reference to Ferrara) in the last chapter of "Rain and Rivers," against the negative of the eminent American engineer Ellet. The title of the chapter is "Ellet on the Mississippi." GEORGE GREENWOOD

Brookwood Park, Alresford, June 8

FORCE AND ENERGY

THE CONSERVATION OF ENERGY A FACT, NOT A HERESY OF SCIENCE

IN an article entitled "The Heresies of Science," published in a recent number of the *London Quarterly Review*, two widely different principles are oddly linked together as heretical dogmas, the doctrine of Evolution, and the Conservation of Energy.

On the doctrine of *Evolution* the writer has nothing to say.

Before discussing with the "Reviewer" the validity of the *Conservation of Energy*, it is quite necessary to define the terms which may be employed, such as Force, Energy, Potential, Sound, Light, Heat.

It is much to be regretted that a far greater degree of logical accuracy in the use of terms than is usually met with, does not exist amongst even the ablest writers on physics, for many of the arguments adduced against physical principles lie not against the principles themselves, but against the indefinite language in which they have from time to time been expressed. There is probably no term employed in physics that has been more misapplied, and in its misuse has led to greater confusion of ideas, than "force."

Force has been thus defined by our ablest modern physicist.* "What I mean by the word force is the source or sources of all possible actions of the particles or materials of the universe."

This definition of force is substantially the same as the writer's definition† to which the reviewer takes exception, but which may perhaps with advantage be thus amplified: Force is a mutual action between the atoms or molecules of matter, by which they are either attracted towards, or repelled from, each other; and by this action energy is imparted to the matter put in motion. It may be further remarked that force is essentially either attractive or repulsive.

The writer sees no reason to amend his definition of "Energy"—namely, that it is *the power of doing work*. It may, however, be remarked that the existence of energy in matter implies the existence of motion, and *vice versâ;* but it by no means follows that motion and energy are convertible terms, for motion means only the act of moving, or changing the position occupied in space.

The term "Potential" applied to force or energy means inactive, but capable of being called into action. Thus, if a weight be raised, a certain amount of energy is expended in raising it, and so long as the body is supported the energy expended in raising it remains potential in it, but when allowed to fall freely *in vacuo* to the level from which it was raised, the body acquires exactly the amount of energy that was expended in raising it. In the same manner the repulsive force of the molecules of the highly ignited gases into which gunpowder is resolved by ignition may with equal propriety be said to be potential in the unignited powder.

The remarks with which the writer's interpretation of the terms "force" and "energy" have been met by the reviewer may here be appropriately noticed. Quoting the introductory chapter already referred to, he adds: "his doctrine regarding the nature of force has thus no connection with sound philosophy; by force Mr. Brooke evidently means what other advocates of conservation mean by potential energy." Does then sound philosophy consist in the impossible task of agreeing as to the meaning of terms with those who do not agree amongst themselves? Or is sound philosophy monopolised by, and crystallised in the opinions of the reviewer? Sound philosophy would seem to consist rather in assigning appropriate meanings, involving no inconsistency or contradiction, to terms of frequent occurrence in all works on physics.

If the above definitions of force and energy be accepted, it is obvious that the term "force," as used by Grove, Tyndall, and many others, means sometimes force and sometimes energy. Thus, for example, "the conservation of force" becomes a simple truism, for its exercise being a function of matter, force must necessarily be coeval with matter. The reviewer (p. 22) thus quaintly expresses the relations of force, energy, and motion:—"A given motion viewed as a cause is force, while the very same motion thought as an effect is energy." Motion, it is presumed, can mean nothing else than the act of moving; but how the act of moving, whichever way we look at or

* Faraday, MSS. Croonian Lectures on Matter and Force, by H. Bence Jones, M.D. p. 35.

† Introductory chapter to the Sixth Edition of "The Elements of Natural Philosophy."

think of it, can either produce energy or do work, it is difficult to conceive; has this "any connection with sound philosophy"? and does not the reviewer here himself "forget that each thing is itself, and not something else" (p. 22, l. 89).

The writer would commend to the serious attention of his brother-physicists the above definitions; he would also submit the following definitions of sound, light, and heat, the former of which has, however, been elsewhere declared to be incapable of definition,* as well as by the reviewer (p. 22). Sound may be defined to be the impression produced by certain vibratory movements of matter upon appropriate sensuous organs, including both the receptive and perceptive apparatus. Whether the tympanum be incapable of receiving sonorous vibrations, or whether it vibrate sympathetically while the structures of the internal ear are incapable of appreciating its vibrations, there can be no sound.

And why may not the same definition apply to light and heat? It is, in fact, far from improbable that the perceptions of light and heat may result from the impressions produced by the same identical vibrations on different receptive organs; that of light on the eye and its nervous appendages, that of heat on the organs of common sensation. In common parlance, the terms sound, light, heat, will doubtless continue to be applied indiscriminately to the vibratory motion producing, and to the impressions produced; and to this there can be no objection, provided no advantage be taken of the misnomer to found thereon an assumption of the identity of the proximate cause and the resulting effect.

The reviewer has sought to kill two birds with one stone, and has made a vigorous onslaught against the conservation of energy in general, and the writer in particular, regarding the theory of latent heat; but it may reasonably be questioned how far "sound philosophy" is shown in attempting to convict an author of admitting an insuperable difficulty in the adoption of a given principle by quoting his statement of the difficulty, and coolly suppressing his immediately subsequent explanation of it. He thus quotes the writer† :—"Latent heat has ever been held up as the great stumbling-block of the dynamic theory, because it is impossible to conceive motion to be reduced to a state of quiescence, but remaining still ready to start again into action."

But instead of continuing the quotation thus :—"This, however, is merely a confusion of ideas, the fact being that when any substance passes from the solid to the liquid, or from the liquid to the gaseous form, a certain portion of the impressed heat-force is continuously occupied in overcoming molecular attraction, and thereby effecting the change of form; and this heat cannot be imparted to other bodies so long as it is occupied in maintaining that change," he ventures to state :—"In this we quite agree, and hence we think it unnecessary to give Mr. Brooke's reasons for believing a doctrine which he allows to be inconceivable"!!! Whether "sound philosophy" or not, is this common literary honesty? What Mr. Brooke allows to be inconceivable is obviously not the doctrine itself, but the conclusion drawn from fallacious arguments adduced in opposition to it; for to assign reasons for believing what one allows to be inconceivable would be nothing less than pure and simple evidence of mental alienation.

The fact is that the term "latent heat" is an unfortunate one, and has mystified the reviewer, as well as many others. It ought long ago to have been consigned to the limbo of discarded hypotheses, together with the material or corpuscular theory of heat from which it arose. If heat consisted of material particles, it might be supposed to become latent among the molecules of grosser matter, just as a handful of shot, if dropped into a box full of marbles, would lie hid amongst them, and be lost to sense, and would so remain until shaken out again; but mere vibratory motion cannot be theoretically dealt with in this fashion.

A much better term would be *engaged* or *occupied* heat, for the so-called latent heat is wholly engaged or occupied in maintaining the change—first from the solid to the fluid state, and secondly from the fluid to the gaseous. The facts are very plain; a pound of water at the temperature of 0° C., or the freezing point, mixed with a pound of water at 79° yields two pounds at the mean temperature of 39·5°; but a pound of ice or dry snow at the temperature of 0° mixed a pound of water at 79° yields two pounds of water at 0°, because the 79° of sensible heat in the water are now employed or occupied in maintaining such an amount of vibratory motion in the molecules of the ice, that they are no longer able to obey that polar attraction by which they were previously aggregated together in given directions so as to form crystals (for though not so evident in ice, the crystalline character of snow is notorious), and the heat-energy, being thus occupied in doing work, is incapable of doing any other work, as for example on the organs of sensation, at the same time; on the principle that you cannot "eat your cake, and have it too." The same reasoning applies to the change from the fluid to the gaseous state; but in this case a much larger amount of thermic energy is employed in so far removing the molecules from the sphere of each other's attractions that the balance of their mutual forces is repulsive, and so long as that repulsion is maintained, the dry steam manifests all the properties common to the fixed gases. "Latent" heat, then, when properly understood, ceases to be a "stumbling-block to the dynamic theory of heat."

One finds oneself occasionally brought by circumstances into an unwelcome generalisation. Thus the reviewer, speaking of the supporters of "conservation" in the lump, says (p. 21) "they take it for granted that force is motion and nothing but motion." This the writer entirely and absolutely denies. The reviewer, then immediately preceding his observations on the writer's views, quotes from Prof. Bain that "Inert matter in motion is force under every manifestation." This is plainly an abuse of language, in which the writer, as one of the "they," declines to participate; inertness and force are hardly concomitant ideas, and matter, whether in motion or at rest, is assuredly not force. The term heat-potential adopted by Mr. Rankine is admissible only in relation to heat as previously defined; the thermic energy can hardly be termed potential while it is employed in doing work.

The reviewer (p. 19) quotes, and objects to, the explanation of latent heat offered by Prof. Tait: that while sensible heat is *motion*, latent heat is *position*. The writer must acknowledge his inability to derive any definite idea from this statement of Prof. Tait; he cannot therefore express either assent or dissent.

The writer must plead guilty to having made use in the treatise above referred to, in common with many others, of a phrase which is not strictly accurate, viz., that sound, light, heat, and electricity are modes of motion. It would be more exact to state that they are so many forms of energy, or effects due to matter affected by certain modes of motion.

It is rather surprising that the reviewer should have ventured to dogmatise on the very slender knowledge either of physical facts or hypotheses that he evidently possesses. Thus he states (p. 33, note) regarding the investigations of Dr. Joule :—

"By means of machinery a weight of 772 lbs. is made to turn a small paddle-wheel placed in one pound of water. Dr. Joule found that the descent of the weight with a given velocity through one foot raised the temperature of the water exactly 1° F." Now this small sentence contains

* "A logical definition of sound is impossible." Dr. M'Cann on "Force and its Manifestations," a paper lately read before the Victoria Institute.
† Elements of Natural Philosophy (p. 786).

a curious concatenation of errors. Dr. Joule never employed a weight of 772 lbs., for the weights he employed were all under 30 lbs.; he never employed the energy acquired by his descending weights in stirring an exact pound of water, for the stirring vessel was not constructed to hold that particular quantity ; neither did he find that the descent of the weight with a given velocity raised the water exactly 1° F., for the velocity of descent has nothing whatever to do with the result ; since precisely the same amount of energy is acquired by a body in descending through the space of one foot by the action of gravitation, whether one minute or one month were occupied in the descent. For the sake of convenience, and in order to avoid a source of error, it was desirable only that the weights should descend slowly, and with a tolerably uniform velocity.

So much for the reviewer's knowledge of facts ; now as to his knowledge of theories. He writes (p. 31) :—

"The supporters of the doctrine of the indestructibility (? conservation) of energy have adopted a method the reverse of scientific. They start with the assumption of perpetual motion by means of transformation. In order to make facts fit their hypothesis, they take for granted that heat, light, electricity, and magnetism, are modes of motion, but not requiring a material basis to account for their phenomena. Some, however, seem to be aware that motion of necessity implies something moving, and that this something must be matter in some of its forms, and that consequently it is a great mistake to suppose that the dynamical theory is inconsistent with the materiality of heat. Finding that they have been a little too hasty in getting rid of the old imponderables, they are now quietly bringing them back under a new name, hoping, doubtless, that their few remaining friends may not be able to recognise them. Instead of the 'imponderables' we now have the 'luminiferous ether' which fills stellar space, and even permeates all the grosser forms of material existence."

This sentence expresses a gross misrepresentation of the course of philosophic thought. Can the reviewer point out a single physicist who for a moment doubts that "motion of necessity implies something moving, and that this something must be matter in some of its forms ;" it is an axiom that not "some" but all must obviously admit. When it was supposed that light and heat consisted of material particles projected with immense velocity from their radiant sources, and that electricity and magnetism were "fluids" travelling with similar velocity, it might be assumed that inter-stellar space is an absolute vacuum ; but when the progress of physical knowledge developed phenomena which were partially or wholly incapable of explanation on this hypothesis (such as diffraction and interference, and subsequently those of the polarisation of light and heat) ; but which became perfectly intelligble on the hypothesis that these forms of energy consisted in vibratory molecular motion transmitted with the same great velocity, the existence of a highly attentuated and elastic medium as the denizen of infinite space, became a necessary part of the theory ; and this, in unavoidable ignorance of its precise nature, was termed "ether." Hence, in direct opposition to the reviewer's statement, physicists take for granted that "light, heat, electricity, and magnetism" do require a "material basis" (that is, matter as a means of their transmission) "to account for their phenomena ;" and his dictum about physicists getting rid of the old imponderables, and now bringing them back again, is unmitigated nonsense.

The attribute of imponderability has been ascribed to the hypothetical substance "ether" by many physicists who hold that it monopolises the property of transmitting the waves of light and heat, and is therefore interstitially deposited in all kinds of matter. The writer is, however, more inclined to believe, with Mr. Justice Grove, that all kinds of matter are susceptible of these vibratory motions, and hence that the hypothesis of *interstitial* ether is gratuitous ; his reasons for such opinion being elsewhere in print, need not be here repeated.*

It may be further suggested that for all that is positively known to the contrary, all kinds of matter may possibly be susceptible of a fourth state or condition, which may be termed the "ethereal," and which in tenuity and elasticity may be as far beyond the gaseous, as the gaseous is beyond the fluid state ; possessing also the mechanical properties of a jelly, rather than those of a gas.

The writer can hardly be expected to take up the cudgels for others against the reviewer ; but in concluding the remarks on this point, it may be observed regarding the reviewer's emphatic denunciation of an alleged descrepancy between Grove and Tyndall, that the discrepancy exists only in his own misunderstanding the quotation from the "Correlation of Physical Forces," viz., that "it requires no great stretch of imagination to conceive light and electricity as motions, and not as things moving," in which the writer clearly contrasts the undulatory and corpuscular theories, as commonly understood. Enough has now been advanced to show that the reviewer need not look very far from home for a conspicuous example of that which he has so freely attributed to the unhappy physicists, namely that they do but "darken counsel by words without knowledge" (p. 23).

The equivalence of dynamic and thermic energy is the only one that has as yet been determined quantitatively. He must be a bold man who denies that the sun shines at noonday ; and scarcely less audacious is the assertion of the reviewer that the experiments of Dr. Joule do not confirm this equivalence. Dr. Joule conducted four distinct series of experiments, three series on the amount of thermic energy produced by molecular friction in stirring respectively water, oil, and mercury ; the fourth, on that produced by the friction of two iron surfaces against each other. The four numerical results accorded very nearly, and after assigning to each result its weight, according to its estimated liability to error, he deduced the mean value of 772 foot-pounds as the dynamic equivalent of thermic energy.† In the metrical system, in which the units of quantity are one kilogramme, one metre, and one degree in the centigrade scale, the above equivalent is represented by 424 dynamic units, which, for brevity's sake, we may as well agree with the French in calling "dynams."

The reviewer, in ignorance probably of the amount of labour bestowed on this subject, seems to imagine that by ignoring Dr. Joule's results, he has demolished the basis of thermodynamics ; but if so, he is grievously mistaken. It is a remarkable and unprecedented confirmation of this theory, that the numerical results arrived at by three distinct methods of investigation, in the hands of as many independent physicists, should be found to agree within very narrow limits of error.

It has been found by experiment that a less amount of heat is required to raise a gas maintained at a constant *volume* one degree of temperature, than when the gas is allowed to expand under a constant *pressure*. Suppose, for example, that the gas be enclosed in a vertical cylinder under a piston of 100 square inches area, the atmospheric pressure on this piston will be 1,500 lbs., and the raising this piston is equivalent to raising a weight of that amount. Dr. J. R. Mayer, assuming that the difference in the quantities of heat in the two cases above mentioned is equivalent to the work done by the expanding gas, proceeds to determine the numerical value of these equivalent quanti-

* Lecture on Force and Energy, delivered at the Royal Institution, *Medical Times and Gazette*, July 8, 1871.

† For the sake of those readers who are not already familiar with this subject, we may state that a foot-pound is the amount of energy acquired by a weight of one pound in descending through the vertical space of one foot, or, in other words, the amount necessary to raise one pound one foot; and the numerical equivalent here given means that 772 dynamic units are equivalent to the amount of thermic energy required to raise the temperature of one pound of pure water, at or about the mean temperature of the air, one degree of Fahrenheit's scale.

ties. Taking the specific heat of air to be 0·267, as at that time determined by the observations of De la Roche and Berard, he found the dynamic equivalent of an unit of thermic energy to be 367 dynams. But if, in the calculation of this number, the more careful and accurate subsequent determination of the specific heat of air by Regnault be substituted, namely, 0·2375, the result gives as the equivalent 426 dynams; a result almost identical with that of Dr. Joule, but based on purely theoretical considerations.

Subsequently M. G. A. Hirn* pursued a course of observations exactly the reverse of that of Dr. Joule, namely, to determine the amount of heat converted into work in the steam-engine. Taking it as an axiom, which he showed to be in strict accordance with analytical investigations, that the difference between the heat existing in the steam as it enters the cylinder and that remaining in it after its exit, must be the thermic equivalent of the work done in and by the engine (which difference in the best constructed engines amounts to about 5 per cent. of the total heat due to the combustion of the fuel), he determined the value of one thermic unit to be 425 dynams; a remarkable result, and intermediate between those previously obtained by Mayer and Joule. In the face of such overwhelming concurrent evidence will even the reviewer be still bold enough to assert that the conservation of energy is a myth?

The principle of the dissipation of energy, as a corollary to that of its conservation, is of course equally ignored by the reviewer; but as his remarks on that point have no relation to anything beyond his own inner consciousness, it must here suffice to give a familiar illustration both of the conservation and the dissipation of energy, in the action of the rifle-ball. This reaches the target with less velocity, and consequently with less energy, that it possessed on leaving the muzzle; a portion of its energy has been expended in producing heat by friction against the particles of air between which it passes, which is dispersed through the surrounding atmosphere, and thus becomes *dissipated*. On reaching the target the progressive motion of the mass is arrested, and converted into molecular motion, which is cognisable only as heat, by which the mass is reduced to the fluid state, and splashes of molten metal are scattered in all directions. These again impart their heat partly to the air through which they pass, partly by radiation into space, and partly to the ground on which they fall; and thus the whole energy of the ball becomes dissipated. An analogous explanation will apply to all other cases of the dissipation of energy; thus the principle may be indefinitely illustrated, but it is hoped that it has now been sufficiently established that the conservation of energy is a fact, not a "heresy of science," the reviewer's opinions to the contrary notwithstanding, for

> A man convinced against his will
> Is of the same opinion still.

Want of space forbids the consideration of the larger cosmical relations of the conservation of energy to both organic and inorganic existence; one proposition only shall be alluded to as having been by some writers rather overstrained, viz., that the amount of energy in the world is unchangeable, the sum of the actual or kinetic and potential energies being a constant quantity. This may be taken as a postulate, and is probably true, but it is a proposition that is equally incapable of proof or of disproof, because the amount of potential energy in a body can be determined only by its development into actual energy, and cannot therefore be predicated. For example, two stones of equal weight lie one at the bottom of a well, the other on the ground at its edge; both are raised and placed side by side on the top of the windlass frame, much more work has been done on one than on the other, but can any one predicate in which of the two the greater amount of potential energy resides? Or is there any conceivable difference in the amount of energy acquired by either, otherwise than as dependent on its descending through the greater or the lesser distance?

It may, in conclusion, be remarked with much regret that the principle of the conservation of energy has by some been misapplied in a fruitless endeavour to supersede the necessity of a creative intelligence. To the mind of the writer, and, it is earnestly hoped, to that of most of his readers, the indisputable establishment of this principle conveys only a more exalted idea of that infinite wisdom by which the perpetually recurring transformations and interchanges, not only of the materials, but also of the powers, of Nature are rendered subservient to predetermined laws, which govern the comfort and welfare of all created beings.

CHARLES BROOKE

* Cosmos, v. 22, 1863.

SPECTROSCOPIC NOTES *

ALTHOUGH P. Secchi and others have recently published descriptions of the different varieties of solar prominences which have been observed, well illustrating the many forms in which these outbursts from the sun's chromosphere occur, a careful record of such disturbances as may be out of the more common order may in the end assist us to a further knowledge on this subject.

While looking for bright lines near F in the spectrum of a low prominence situated 25° north of east, at 11.35 A.M. (April 2), my attention was called to what appeared to me a sudden displacement of the F line toward the violet end of the spectrum.

I immediately brought the C line into the field of view, in order to discover if any change was taking place in the form of the prominence, but was wholly unprepared for the spectacle which met my eye. Upon widening the slit I found that where only twenty minutes before there had been a comparatively low mass of prominence matter not exceeding 50″ in height, and remarkable only for the brightness of a jet issuing from the southern portion which was but slightly raised above the chromosphere, there had been an eruption of matter on a grand scale.

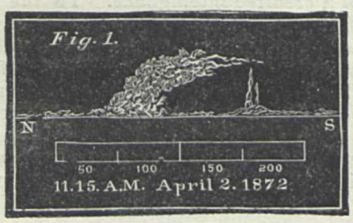
Fig. 1 represents the prominence as first seen at 11.15 A.M. At 11.35 A.M. the northern portion had entirely disappeared, and from the low mound, at the point where the jet mentioned above had been seen, an eruption had taken place far exceeding anything I have ever witnessed. Far above the chromosphere the air was filled with long wisps of glowing hydrogen, ranging from 20″ to 50″ in length, with the appearance of having been ejected in quick succession. Above them floated detached masses, in the form of thin fleecy clouds, and the highest point reached by these was fully five minutes of arc, or about 135,000 miles above the sun. In the mound appeared a low, sharp horn, exceeding in brightness any other portion of the prominence. The grandeur of the eruption lasted but a few minutes, gradually fading in brightness and diminishing in size.

Fig. 2 gives a correct idea of the general form and extent of the prominence as seen at 12 M.

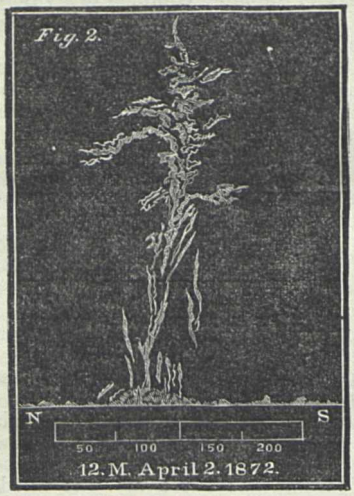
When next observed at 1.40 P.M., nothing was left but a small cloud mass of about the height of the prominence when first seen, at 11.15 A.M. To the north of this, however, were two very small horns, of great brightness. It has generally been noticed that the appearance of these bright points in the chromosphere is a forerunner of increased activity. The forces at work beneath were only gathering strength for a final outburst, which, if not so great in extent, proved to be equally magnificent. I had not long to wait; for after a few minutes spent in examining the F line, just as the clock was striking the hour, I again brought C into the field, and found myself only in

* Reprinted from advance sheets of the Journal of the Franklin Institute furnished by the Editor.

season for the grand *finale*. The chromosphere had again belched forth, and far above the sun could be seen the ejected matter, reaching to the height of 94,500 miles. The *débris* was in the form of jets or wisps, which appeared to be falling toward the chromosphere, here and there fretted with sharp horns or bristles. The remains of the first eruption existed unchanged since last seen, at



1.40 P.M., but the changes in the form of the new one were rapid; at one point the filaments were so interlaced as to resemble close network. In the more elevated portions the jets soon lost their brilliancy, and in less than

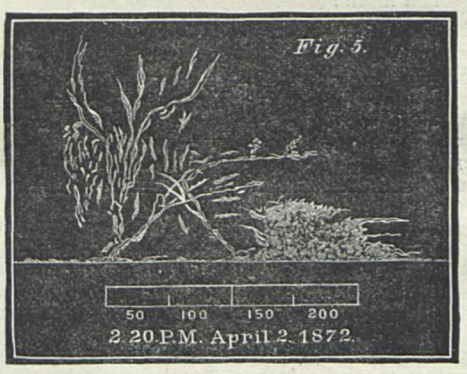


an hour scarcely anything remained but a few stray wisps floating low down near the chromosphere.

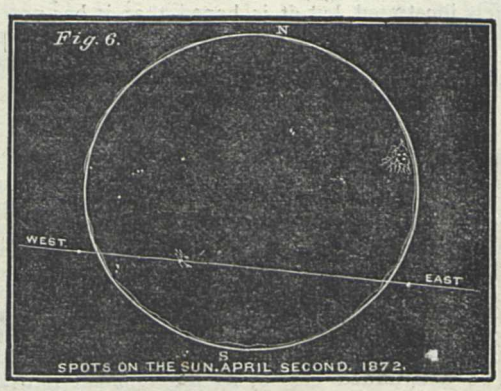
Fig. 5 exhibits the change which the last outburst had undergone at 2.20 P.M.

During the phenomena the C and F lines were completely broken up, being displaced toward both the red and violet ends of the spectrum, the greatest displacement being toward the violet, in the F line extending to the iron line above F numbered 2082 in Kirchhoff's map. The D_3 line also suffered a sensible displacement. I examined the magnetic needle during the outbursts and an hour afterwards, but could detect no unusual disturbance. In the evening there was a slight auroral display.

The portion of the chromosphere in which the eruptions took place was in the neighbourhood of a group of spots which were just making their appearance upon the eastern



limb of the sun. The spots were completely surrounded by faculæ which radiated from the spots themselves, and could be traced to the sun's edge. Fig. 6 shows the po-



sition of the spots upon the sun at the time of the eruptions. The sketches were made at the time of observation, and are as correct as the duration of the phenomena would allow, the general form and most of the details being preserved.

JOHN H. LEACH

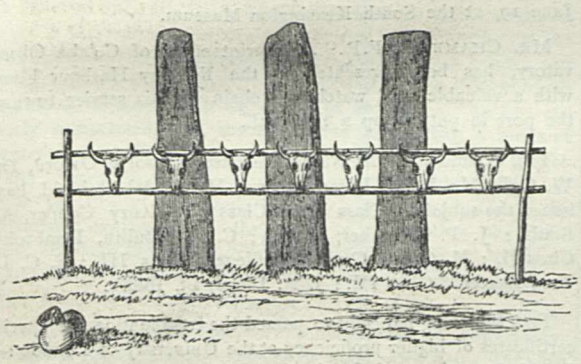
ANCIENT AND RECENT STONE MONUMENTS

IN Mr. Fergusson's new book on Ancient Stone Monuments, mention is made of the Menhirs and Dolmens, both ancient and modern, which are found in the Khasia Hills, North-Eastern Bengal.

Having been for some time engaged in the survey of these hills, I can furnish a few particulars concerning these monuments which may be of interest. On one occasion, returning to my camp after a day's work, I was startled by hearing a loud shouting as of a number of men exerting their strength together and getting the time by shouting in chorus, much as sailors do on board ship.

I found that the sound proceeded from an assembly of Khasias, who were putting up three of these menhirs to the memory of a deceased villager. They were at a considerable distance from me, so that I could not clearly see their mode of procedure, and as on occasions of funerals and the ceremonies connected with them the Khasias are invariably more or less drunk and unruly, it would have been inexpedient to have gone amongst them. I was therefore compelled to wait until the next morning, when I went and inspected the scene of operations.

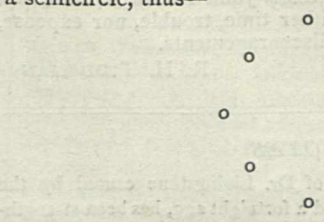
I found that three menhirs of no very great size had been put up, and that the stones had been raised in a very simple way by the use of long levers formed of young trees and ropes made of an exceedingly tough kind of creeper found in abundance all over these hills. The whole affair had been made the occasion of a feast on a very large scale; bones of slaughtered cattle, and empty grog jars lay around in numbers; the skulls of the oxen (some fourteen or fifteen in number) being arranged in a very fantastic way before the menhirs. As the arrangement of these skulls at once suggested to my mind the probable origin of a well-known architectural ornamentation, I attach a sketch showing how they were placed, viz.,



in a row at even distances apart on two horizontal poles, which were themselves supported on two upright poles. I was at some pains to inquire the meaning of these menhirs, but could only gather that they were intended to perpetuate the memory of some local celebrity.

In the case of the dolmens, so often found put up in front of the menhirs, I was informed that they served to give a kind of rough shelter to the ashes of the deceased, these ashes being kept for a year or two in the house and then brought out and scattered under the broad flat stone of the dolmen.

Moreover, the Khasias use these dolmens in their extraordinary form of divination by the breaking of eggs. This divination, which may be said to form their nearest approach to a religious worship, and which is on that account of peculiar interest, is conducted as follows:—On the top of the dolmen the Khasia who officiates puts five little pellets of clay and chewed betel nut, in the form of a semicircle, thus—



Then he stands upon the stone, and commences a wild kind of chant, having a rhythm and intonation utterly different from that of their ordinary songs. At a certain period in this chant he draws an egg from his pouch, and dashes it down on to the stone, as near the centre of the semicircle as he can. If the mass of the yolk scatters towards and over the pellets the omens are propitious, each pellet of the five having its meaning; but if the yolk scatters away from the semicircle of pellets the prognostication is unfavourable.

In his book Mr. Fergusson seems to suppose that the Menhirs and Dolmens mark places of assembly; but this is not the case, for near almost every large and old-established village there is found a place of assembly provided with stone seats, often prepared with much labour, and well adapted to the purpose for which it is intended.

I would also demur to Mr. Fergusson's inference that the Khasias are a physically inferior race; on the contrary they are a race possessing muscular strength to a singular and exceptional degree, as witness the fact that it is a very ordinary feat with them for one Coolie to carry a full-grown man in a kind of chair strapped on his back, along a road more than eight miles long, and ascending upwards of 4,000 feet.

M. T. SALE

DISCOVERY OF EXTINCT MAMMALS IN THE VICTORIA CAVES, SETTLE

THE scientific public will be pleased to hear that the Committee who have been exploring the Settle caves for two or three years past, have at length met with a great success. Till within the last fortnight we had discovered only remains of different ages from the Neolithic period to the present. These, though of great interest as throwing light on the vicissitudes and succession of later races, had to a certain extent been forestalled by the previous researches in this district of Mr. James Farrer, of Ingleborough, and by Mr. Jackson, the original discoverer of the Victoria Cave, and present superintendent of the work carried on in it by the Committee. Those remains were all in comparatively recent deposits. Beneath them was a great thickness of barren ground, consisting of a laminated clay in some places twelve feet thick, and below that again a great accumulation of angular fragments of limestone in a matrix of clay.

At a depth of about twenty feet in this we have now found elephant, rhinoceros, hyæna, a crushed canine of a much larger carnivore, &c. The elephant's teeth found belong to a young individual, and the number of gnawed bones and other indications of the cave having been a den of some large carnivores render it probable that the elephant was dragged into it by them.

The facts have a special interest, from this older group of mammals not having been previously met with in this district. It is to be hoped that when we can investigate these important beds more thoroughly we may get some light thrown upon the relation of man to these extinct animals, and of both to the Glacial period, undoubted deposits of which occur in other caves hard by.

Great credit is due, amongst others, to Mr. Walter Morrison, M.P., and to Messrs. John Birkbeck, Sen. and Jun., who have spared neither time, trouble, nor expense, and that in face of many discouragements.

R. H. TIDDEMAN

NOTES

THE belief in the safety of Dr. Livingstone caused by the telegrams which we published a fortnight ago, has been strengthened by further intelligence received since our last issue. The following telegram was to hand in London on Saturday last by the Falmouth, Gibraltar, and Malta Telegraph Company :—"Kirk reports from Zanzibar Livingstone safe at Unyanyembe. Visited north end of Tanganyika. Rivers said to flow into Lake Tanganyika. Stanley near the coast with letters. —GOVERNOR." No date is attached to the telegram ; but at the meeting of the Royal Geographical Society on Monday evening, Sir Henry Rawlinson stated that he considered all doubt now to be removed, and that the intelligence now in hand is really authentic. He laid great stress on the well-known cautiousness of Dr. Kirk in receiving and communicating information respecting Dr. Livingstone. The following despatch from the Sultan of Zanzibar to Sir H. Rawlinson was read at the meeting :—"In the name of the Most Merciful God.—To our esteemed friend, Sir Henry Rawlinson. May the Almighty preserve him in health and happiness.—Your friend is quite well, and the object of our letter is to inform you that at the auspicious moment of our safe return from performing the pilgrimage to the holy cities of Mecca and Medina, my friend the Consul called on me and presented to me Lieutenant Dawson and his companion, and at the same time he delivered to me the letter from Her Majesty's Secretary of State for Foreign Affairs, Earl Granville, and also the gift presented by the Royal Geographical Society, through the President. And it has pleased me much to do that which is considered advisable, and that I am enabled to aid the people in their search for my friend Dr. Livingstone, and I pray God that certain information regarding him may soon be received, and I will give my aid to those gentlemen whom you have sent in attaining their object. And the Consul having requested me to grant the use of my steamer to the above gentlemen to convey them to Mombassa to procure men to accompany their expedition, I have done so, and, please God, I will continue to render assistance to those whom you have sent in your endeavour to explore the mysterious regions of the unknown country, because their object is praiseworthy, and tends to increase our knowledge of what the Almighty has created in these our countries.—From your friend, BURFASH BIN SAYYID.—Dated Zanzibar, the 5th day of Safr, year 1289 of Hejira, corresponding with the 14th April, 1872." Further telegraphic intelligence may be expected at any moment, and should this arrive we purpose next week to resume the present state of our knowledge respecting Dr. Livingstone's safety.

WE learn with great regret, from the scientific editor of *Harper's Weekly*, of the death of Dr. William Stimpson, late Secretary of the Academy of Sciences of Chicago. Dr. Stimpson's health has been quite precarious for several years past, making it necessary for him to proceed every winter to the warmer climate of Florida, and the past winter was spent by him in the same region. He was engaged in the earlier part of the season on board the United States Coast Survey steamer *Bache*, in superintending a series of dredgings, which, however, he was compelled to abandon through increasing ill-health, and returning not long since to the residence of his father-in-law, near Baltimore, he became gradually worse, and died there on the 26th of May. For a time a pupil of Prof. Agassiz at Cambridge, Dr. Stimpson made his first mark as a scientific author in 1851, in a work on the shells of New England, which was soon followed by a paper on the marine invertebrates of Grand Manan, published by the Smithsonian Institution in 1853, and which is still a standard work on the zoology of the mouth of the Bay of Fundy. Shortly afterwards he was appointed zoologist to the North Pacific Exploring Expedition, in which he was occupied for several years. When the late Mr. Robert Kennicott went to Alaska, in 1865, in the service of the Russian Telegraph Expedition, Dr. Stimpson moved to Chicago to take charge of the general affairs of the Chicago Academy of Sciences, and maintained that connection until his death. As a scientific investigator Dr. Stimpson occupied a very high rank for the thoroughness of his researches and the clearness and accuracy of his descriptions, in these respects leaving nothing to be desired. No one, with the exception, perhaps, of Prof. Dana, has described so many new species of marine animals as he. The detailed accounts of his new species, forming a large number of valuable zoological monographs, with large numbers of illustrations, and nearly ready for publication, were unfortunately all destroyed by the Chicago fire, together with most of the types of his species—a calamity which of course affected him severely, and in all probability materially influenced the state of his health. Among these works were synopses of the mollusca of the East coast of North America, and of the crustacea of both coasts, to be published by the Smithsonian Institution.

IT is rumoured that the dignity of K.C.B. is about to be conferred upon Mr. G. B. Airy, Astronomer Royal, and President of the Royal Society.

THE Albert medal of the Society of Arts has been awarded by the Council this year to Mr. Henry Bessemer, "for the eminent services rendered by him to Arts, Manufactures, and Commerce, in developing the manufacture of steel." The Conversazione of the Society will be held on Wednesday, June 19, at the South Kensington Museum.

MR. CHAMBERS, F.R.S., Superintendent of Colaba Observatory, has been presented by the Bombay Harbour Board with a valuable gold watch and chain for his service towards the port in putting up a time ball.

THE examiners in the Natural Science School at Oxford, Dr. W. Ogle, Mr. R. H. Bosanquet, and Mr. A. W. Reinold, have issued the subjoined Class list :—Class I. : Henry Cooper, All Souls' ; J. P. Earwaker, Merton ; C. J. Moullin, Pembroke. Class II. : H. Green, Queen's College. Class III. : E. C. D. Fox, Exeter. Class IV. : J. A. Lloyd, St. John's.

THE following ladies have passed the examination for special certificates of higher proficiency at the University of London :—In Mathematics and Mechanical Philosophy, Mary Stewart Kilgour, Ladies' College, Cheltenham ; in Geology and Palæontology, Laura Gertrude Eaton, Ladies' College, Cheltenham ; in Political Economy, Jane Ellen Harrison, Ladies' College, Cheltenham ; and in Harmony and Counterpoint, Mary Amelia Bennett, North London Collegiate School for Ladies.

PROF. HUMPHRY, F.R.S., will commence his Course of Three Lectures on Human Myology at the Royal College of Surgeons on Monday, June 17, at 4 P.M. They will be continued on Wednesday and Friday at the same hour. The lectures will discuss the morphology and teleology of the muscular system of man.

A TELEGRAM from Madras, printed in the *Times*, states that a court of inquiry is being held, with closed doors, on the conduct of Mr. Pogson, the Government Astronomer, who seems to be held responsible for the damage done by the late disastrous cy-

clone. Whether it is thought that he could have prevented the cyclone does not appear.

REPORTS have been received from Prof. Agassiz and his party on the *Hassler* up to the 18th of March, at which time they had reached the coast of Patagonia. They were busily engaged in dredging and carrying on explorations along the shore, with a very fair measure of success. The details have not yet been announced, but we trust we shall have an opportunity before long of presenting these to our readers.

THE Annual Report of the Trustees of the Museum of Comparative Zoology at Cambridge, U.S.A., for 1871, has made its appearance, and presents the usual satisfactory account of progress in the preceding twelve months. No institution of the kind in America, and few anywhere, has so extensive and thoroughly organised a corps of scientific assistants (amounting to between thirty and forty) as that at Cambridge; and, with the immense amount of material constantly coming in, the result in greater part of Prof. Agassiz's indefatigable personal labours, supplemented by purchases of entire collections, it is not to be wondered at that the museum is rapidly occupying the foremost rank among such establishments. Prof. Agassiz, the director, calls attention to his expected absence from the country in the expedition of the *Hassler*, gives an account of the arrangements made temporarily to supply his place, and presents the special reports of the various assistants upon the work accomplished in 1871, and to be continued during the year 1872.

AMONG the more interesting collections lately received by the Smithsonian Institution at Washington, in the department of ethnology, is a mummied human head, retaining all the form and features of life, including hair, lips, &c., but reduced by some peculiar process so as not to exceed the size of an ordinary fist. These heads are found among the Javaro tribes in the province of Chimborazo, in Peru, and are said to be of great antiquity, there being no indication of recent preparation. They are believed to be the heads of enemies slain in battle, and preserved in this way as trophies of victory. The interior of the head has been entirely emptied of flesh, bones, and brain; and the skin, which alone remains, by its contraction is thickened to the amount of more than an eighth of an inch. The lips are closely compressed, and through them are strung a series of knotted cords, which in their character call to mind the guipos of the ancient Peruvians. There is also a cord which is knotted inside the top of the head, by which it is suspended. No satisfactory explanation of the mode of preparation has been given, although there is a tradition that it is effected by introducing heated stones or sand into the cavity after the removal of the portions of the head referred to.

THE Transactions of the Norfolk and Norwich Naturalists' Society for 1871–72 show evidence of good work being done by its members. The president, in his address, speaks of the satisfactory progress made in the important task which the Society has in hand, of compiling well-authenticated, and, as far as possible, complete lists of the fauna and flora of the county; and the following papers are printed in the Report—some of them, although referring to local subjects, of more than local interest:—"On the Occurrence of the Ringed or Marbled Seal (*Phoca hispida*) on the Norfolk Coast," by T. Southwell; "Scoulton Gullery," by H. Stevenson; "The Norfolk Broads and Meres Geologically Considered," by J. E. Taylor; "Further Notes on Coast Insects found at Brandon," by C. G. Barrett; "The Marine Mollusca of the Norfolk Coast," by F. W. Harmer; "A List of Land and Freshwater Shells found in Norfolk," by J. B. Bridgman; and "On the Spongeous Origin of Flints," by F. Kitton.

WE have received from the Royal Cornwall Polytechnic Society, Falmouth, a list of a large number of subjects in which prizes and premiums will be awarded in the course of the present season. The fortieth Annual Exhibition of this Society will open on Wednesday, August 21. Medals and prizes in money will be awarded in the following Departments:—Mechanics—Machinery and Models; Mechanical and other Scientific Inventions and Improvements; Specimens of Naval Architecture; Essays and Scientific Papers, &c. Fine Arts—Pictures and Drawings by Professional Artists and Amateurs, Sculpture, Architectural Drawings and Models, and Specimens of Ornamental Art. Photography—Photographs by Professionals and Amateurs. Natural History—Essays, Local Observations, Collections of Specimens, &c. School Productions—Mechanical and Freehand Drawings, Specimens of Penmanship, &c. Plain Needlework, &c., British Lace, and all objects of interest connected with Science and the Fine and Industrial Arts, which may be considered deserving by the Judges. List of Prizes and Premiums, and all further information, may be obtained from the Secretary, J. H. Collins, F.G.S., Polytechnic Hall, Falmouth.

SCIENCE and Art teaching seems to be flourishing in Plymouth, if we may judge from the number of papers worked at this year's examinations (just concluded) by the students of the Charles Science and Art Schools. Three hundred and thirty papers have been sent up in the various subjects, being an increase over 1871 of fifty-six papers, or 20 per cent. Owing to the Department holding the examinations in several subjects in one evening, students are prevented from being examined in more than one of these, which will, in most cases, account for the falling off in those few cases where there is a decrease.

MR. N. VON MACLAY, who is in charge of a Russian scientific exploration of the Atlantic and Pacific oceans, reports to the Academy of Sciences of St. Petersburg that on the passage of the *Witjas* from the Cape de Verde Islands to Rio he made an experiment on the 3rd of February for the purpose of determining the temperature of the sea at a depth of 1,000 fathoms in the region of calms, about 3° north latitude and 24° west longitude. The temperature of the water at this depth was 38·30° F., that of the surface water being 81·68° F. It is interesting to compare this with the temperature obtained during the past winter by the Coast Survey steamer *Bache*, at about the same depth, in the deep water between Cuba and Yucatan, in the latter case the temperature amounting to about 39·50° F.

IT seems almost impossible to exhaust the richness of the deposits of vertebrate fossils of the Western territories of the United States, Prof. Leidy having lately added to the number by the description of two extinct tapir-like animals, one about the size of a raccoon, and the other about the size of a rabbit, and an insectivorous animal of the dimensions of the hedgehog. The are from the tertiary formation of Wyoming Territory.

Harper's Weekly notes that a remarkable fact connected with the interchange of animal species between Europe and America is seen in the frequency with which North American birds occur in England, and the scarcity of European birds in America. Nearly seventy species of the birds characteristic of the American fauna have so far been detected in Great Britain, the latest announcement of this kind being that of the black-billed cuckoo, which was taken at the end of September 1871 in Antrim, ten miles from Belfast. Very few of the European land birds have been found in North America, with the exception of a few species that are really Arctic in their distribution, although less frequently seen in the New World than in the Old. The water-birds of Europe are more common as stragglers. Among them we may mention the English green-winged teal, the widgeon, the woodcock, &c. The entire list, however, does not amount to a dozen species. The causes of this difference are doubtless to be met with in the comparative prevalence of certain winds. Most of

the captures of American species take place in Ireland in autumn and early winter, and in all cases are species belonging to the northern portion of America which migrate southward at the close of the breeding season. At that time the prevailing winds are from the west, and the birds in their flight become confused, and are carried across by the winds, taking an occasional rest on passing vessels.

MR. J. COBBIN, of Durban, forwards to the *Natal Colonist* the following account of a "sea-serpent" seen by him:—"During my late passage from London, I saw no less than three sea-serpents, but an account of the last will suffice. On 30th December last, on board the *Silvery Wave*, in lat. about 35′ 0″ S., and long. 33′ 30″ E., at 6.20 P.M. solar time, an enormous serpent passing nearly across our bows compelled the alteration of our course. He was at least one thousand yards long, of which about one-third appeared on the surface of the water at every stroke of his enormous fan-shaped tail, with which he propelled himself, raising it high above the waves, and arching his back like a land-snake or a caterpillar. In shape and proportion he much resembled the cobra, being marked by the same knotty and swollen protuberance at the back of the head on the neck. The latter was the thickest part of the serpent. His head was like a bull's in shape, his eyes large and glowing, his ears had circular tips and were level with his eyes, and his head was surmounted by a horny crest, which he erected and depressed at pleasure. He swam with great rapidity and lashed the sea into a foam, like breakers dashing over jagged rocks. The sun shone brightly upon him; and with a good glass I saw his overlapping scales open and shut with every arch of his sinuous back coloured like the rainbow."

*ABNORMAL DISPERSION OF BODIES WITH SURFACE-COLOURS.**

THESE memoirs relate to the abnormal phenomena of dispersion produced by certain bodies which reflect the rays of some colours in the manner of transparent media, and those of other colours in the manner of metals.

In transparent bodies the velocity of light is less than in a vacuum, and the index of refraction increases as the length of undulation diminishes, whereas, in the case of metallic bodies, theory leads to essentially different results. From the researches of Jamin on the elliptic polarisation of light reflected by metals, and from the more recent experiments of Quincke, it appears that the formulæ of Cauchy, Beer, and Eisenlohr give for certain metals, as gold and silver, an index of refraction less than unity, whence it follows that in these metals the velocity of light is greater than in the vacuum. Cauchy's theorem, verified by the experiments of Jamin, likewise shows that the index of refraction in metals varies with the angle of incidence, and that in most metals dispersion takes place in a manner opposite to that which occurs in transparent bodies, that is to say, that the rays of shortest wave-length are less refracted than those whose undulations are longer.

The only physicist who has hitherto attempted a direct verification of these theoretical results is Quincke; but his experiments have yielded contradictory results according to the method employed, and have therefore afforded no decisive information as to the indices of refraction and dispersion of metals. Kundt, in studying the properties of a particular class of bodies which approach the metals in their optical properties, has succeeded, if not in determining the absolute values of their refractive indices, at least in observing certain anomalous phenomena of dispersion, which appear to indicate the direct road towards a new verification of the theoretical formulæ.

The bodies in question are media intermediate between transparent bodies and metals, inasmuch as they behave like metals towards rays of certain colours, and like transparent bodies towards rays of other colours; they also reflect light with a certain degree of metallic lustre. These substances may be included under the denomination of *bodies with surface-colours*. Most (but not all) of them are strongly tinctorial, and exhibit, both in solution and in small fragments, a beautiful coloured transparency; such are most of the aniline-dyes, indigo, carthamine, potassium-permanganate, &c.

The optical properties of these bodies have been studied by Brewster, Haidinger, Stokes, and several others, the chief result of whose researches is the law, first enumerated by Haidinger, that the light transmitted by these media is exactly or nearly complementary to the light reflected from their surfaces, and, therefore, to the colour of the surface. Moreover, Dale and Baden Powell observed that indigo and Prussian blue, in reflecting light, polarise it elliptically, like the metals; and von der Willigen determined the reflection-constants of pale indigo, and found that the principal angle of incidence diminishes from the line B to E, and then increases from E to G.

The author's views respecting these bodies are based on the hypothesis that they exhibit the most general case of dispersion, that, namely, in which the index of refraction may not only increase or diminish when the wave-length in air diminishes, but may even become less than unity.

The examination of the light reflected by these bodies is alone sufficient to lead to this hypothesis. For when a medium is transparent for a particular ray, the intensity of the reflected light is expressed by the formula $\left(\frac{n-1}{n+1}\right)^2$, the value of which increases or diminishes with the increase of n, according as n is greater or less than unity. In most transparent bodies the variation of n for the different colours,—that is to say, the dispersion—is so small, that the whole of the reflected light exhibits the same colour as the incident light, so that, if the incident light is white, the reflected light is white also. Applying this formula to bodies with surface-colours, it would follow that the rays which form the superficial colour, that is to say, those which are reflected in very great proportion, should have, relatively to the others, a very large or very small index of refraction.

As the rays which form the surface-colour may have any wave-length whatever, it would follow from the formula which gives the intensity, that the dispersion of bodies with surface-colours should be, or at least might be, abnormal, in a manner which is perfectly arbitrary. It might even happen that a portion of the transmitted rays, if made to pass with a sufficient intensity through a prism of the substance, would be refracted on one side of the direction of the incident rays, and the rest on the other side. In fact, for rays which are reflected in large proportion, that is to say, rays for which the bodies under consideration act like metals, the preceding formula is not applicable, and it is necessary to employ the formulæ given by Cauchy, in his theory of metallic reflection.

These formulæ give, for the normal incidence:

$$I = \tan\left(\psi - \frac{\pi}{4}\right)$$

where ψ is determined by the relation

$$\operatorname{cotan}\psi = \cos\epsilon \sin 2 \tan^{-1}\theta,$$

ϵ and θ being two constants to be determined by experiment, according to the relations—

$$\theta\cos\epsilon = n\,;\ \theta\sin\epsilon = \gamma,$$

n being the index of refraction, and γ the coefficient of extinction under the normal incidence.

According to these formulæ it is not absolutely necessary, as remarked by Cauchy, that the index of refraction of metals should be very large. Nevertheless it appears from the experiments of Jamin, and those more recently made by Quincke, that the constants of elliptic polarisation have values which indicate for most metals a very large refractive index, and for silver and gold an index less than unity.

Cauchy's formulæ, applied to bodies with surface-colours—admitting that the elliptic polarisation produced by these bodies is analogous to that produced by the metals—renders probable the existence of refractive indices either very large or less than unity: hence the probability of abnormal dispersion resulting from transmission through these bodies.

When one of these surface-coloured bodies is dissolved, it preserves in solution its abnormal properties relatively to dispersion. This abnormal dispersion will be combined with the

* By A. Kundt (Pogg. Ann., cxlii. 177; Journal de Physique, 1872, p. 38) nd J. L. Soret (Pogg. Ann., cxliii. 325; Journal de Physique, 1872, p. 45).

normal dispersion of the solvent; and even if no ray can then acquire an index of refraction less than unity, or be completely isolated from the rest, the succession of colours in the dispersion-spectrum of the solution will be sensibly different from that which is commonly observed.

The method employed by Kundt for the observation of abnormal dispersion in solutions of bodies with surface-colours (suggested by a memoir published by Christiansen of Copenhagen), is as follows:—A drop of the concentrated solution to be examined is placed on a glass plate, and over this drop is fixed, at an angle of about 25°, a sharp edge of a second glass plate of the same breadth as the first. At a small distance from the line of contact of the two plates, the liquid prism formed by capillary action is usually opaque; but close to the line of contact there is a prismatic layer of liquid, scarcely broader than a hair, which is transparent for most of the colours. The dispersion may be recognised by viewing through this layer a narrow and bright flame or an illuminated slit. The observations of course require a certain amount of practice, and the observer must be on his guard against deception arising from phenomena of reflection or refraction. The observation is generally made by carrying the liquid prism to the place of the glass prism in the spectroscope of Bunsen and Kirchhoff, the most favourable angle to give to the liquid prism being determined by trial.

Christiansen has observed that the index of refraction of a strong alcoholic solution of fuchsine increases from the line B to D, then diminishes rapidly as far as G, and increases again beyond that line; and the recent observations of Kundt, made as above described, have demonstrated the generality of this anomalous dispersion for surface-coloured bodies in the state of solution; that is to say, that in the dispersion-spectra of these solutions the order of the colours is not the same as in the solar spectrum, or in the dispersion-spectra of ordinary solutions. Such was found to be the case, not only with fuchsine, but with all specimens of aniline-blue and aniline-violet, with aniline-green (Hofmann's iodine green), indigo (dissolved in fuming sulphuric acid), indigo-carmine, carthamin, murexid (dissolved in potash), cyanine, potassium-permanganate, and carmine.

All the bodies in this list refract red more strongly than violet light; and in bodies for which the green forms the principal part of the surface-colour, and can be distinctly recognised in the transmitted spectrum, the green rays are the least deviated. Cyanine, aniline-violet, and aniline-blue, as well as indigo-carmine, give, therefore, in their dispersion-spectra the following series of colours: green, blue, red, the green being the least deviated. Cyanine is particularly well adapted for producing the abnormal spectrum, and exhibits the following series of colours: green, light blue, dark blue, a dark interval, red, and traces of orange. The dispersion varies however with the concentration of the solution; in dilute solutions all the bodies above enumerated exhibit normal dispersion. Potassium-permanganate and carmine exhibit reversed spectra only when their highly concentrated solutions are mixed with fine solid particles so as to form a sort of pulp, and the two glass plates are pressed strongly together. A change in the dispersion is also observed according to the angle of incidence.

Soret pours the solution under examination into a hollow prism having an angle of about 30°, and places this prism in a glass trough with parallel sides, filled with the liquid which serves as solvent. By this arrangement the reverse spectrum may be obtained with solutions less concentrated and therefore more transparent than when the liquid prism is merely surrounded by air.

If the ordinary prism of a spectroscope be replaced by a hollow prism filled with a concentrated solution of fuchsine, the reversed spectrum will be seen without the aid of the trough above described, provided the light is very strong and passes very close to the edge of the prism. With a less concentrated solution the spectrum is normal, and with a solution of intermediate concentration the spectrum is reduced to a single red line. In this case the anomalous dispersion due to the fuchsine is entirely compensated by the normal dispersion produced by the alcohol, and the result is deviation without dispersion. If now the prism containing this last-mentioned solution be immersed in a trough containing alcohol, the deviation of the rays produced by the alcohol will be almost wholly destroyed, while the abnormal dispersion of the fuchsine will remain, the red being more strongly deviated than the violet. With this arrangement it is no longer necessary to employ so strong a light, or to make the rays pass so close to the edge of the prism.

With the prism in air the deviation of the red rays is about 11° 30′; but when the prism is immersed in alcohol, the violet is scarcely deviated, the red by fifteen minutes, and the orange by twenty-three minutes.

Similar results were obtained with aqueous solutions of aniline violet and potassium-permanganate.

*MR. BENTHAM'S ANNIVERSARY ADDRESS TO THE LINNEAN SOCIETY**

(*Concluded from p.* 114.)

TO Grisebach's notes on the connections of the tropical African flora with that of other countries I shall have but few observations to add. The intergrafting with the South African flora along the eastern side of the Continent may well be attributed to climate and other present physical conditions. The European character of the higher mountain vegetation of Abyssinia and the Cameroons may be indicative of the remains of that western flora, the mysteries of whose distribution north and south of the tropics I have on several occasions alluded to. The supposed evidences derived from the vegetable kingdom of a once existing connection between west tropical Africa and east tropical America through an ancient Atlantis gradually disappear on further investigation. No traces of a western Atlantic or American vegetation were met with by Mann in the mountains of Fernando Po and the Cameroons, nor by Dr. Hooker in the western Atlas of Morocco. The tropical American races found in Western Africa are chiefly confined to the coast region; they are more generally identical than representative species, and they may have been brought over in the course of ages by some of those means of transport which even now may occasionally occur, such as the Gulf Stream, as mentioned by Grisebach. You may recollect, for instance, a short notice by Dr. Dickie inserted in our Journal (Botany, vol. xi. p. 456) of a green floating mass, twelve to fourteen miles broad, crossed by Captain Mitchell in the Atlantic, within 300 miles of the mouth of the Gambia, which had evidently, as Dr. Dickie believes, come from some part of America within the influence of the Gulf Stream, probably passing between the Cape Verde Islands and the mainland of Africa. Besides algæ, the portions of this mass picked up by Captain Mitchell and examined by Dr. Dickie contained, amongst other substances, fruits, seeds and "seedling plants several inches long, all with a pair of cotyledons, roots, and terminal bud, quite fresh."† With regard to those American genera represented chiefly in eastern tropical Africa, to which I called your attention in my paper on Compositæ, there are various considerations, requiring too much detail for me now to enter upon them, tending to show a greater probability of an ancient interchange having taken place far south of the tropics, or eastward over lands long since submerged, than across the tropical Atlantic. A prevailing eastern element in the tropical African flora has, indeed, been frequently pointed out. An interchange with continental India is so well marked north of the equator as to have been generally admitted; but south there are many distinct types represented only in Madagascar, Ceylon, Malacca, the Archipelago, or Australia. This would lead one into speculations put forward also by naturalists in other branches as to a vast continent once bridging over the Indian Ocean, and extending even far to the eastward into the Southern Pacific. Similar views derived from zoology have been recently put forward by Grandidier in a most interesting sketch of the physical geography and natural history of Madagascar, contained in No. 46 (May 11) of this year's *Revue Scientifique*. This island, whose evident antiquity and long isolation, aided by its broken surface, has enabled it to become the seat or centre of preservation of a very large number of endemic monotypes, shows also in its vegetation, besides African, many Archipelago and even Australian types. Grandidier believes that in zoology the more distant eastern connection is at least as evident, if not more so, than that with the almost adjacent African continent. In plants the African connection is decidedly predominant.

I shall not attempt to follow Grisebach in discussing the peculiarities of the remainder of his regions. We may observe throughout the same careful investigation of the climatic conditions and their influence on their vegetative character of the individual

* Delivered Friday, May 24, and abridged.

† It may require, however, as suggested by Dr. Hooker, some further evidence to show that this green mass might not as well have been brought down from some African as from some American river.

plants, and on the general aspect of the whole vegetation they constitute (*Vegetationsformen* and *Vegetationsformationen*), with the same high estimate, or we might say over-estimate, of its effects on the typical character of the species as compared with the complicated consequences of previous possession, foreign invasions, and natural selection in the struggle for life, which he seems disposed to ignore, and with the same allusions to certain mysterious creative or productive forces beyond the reach of our inquiries. A closer examination of his regions show them to be much better conceived in his phyto-climatic point of view, than I had at first thought them to be when regarded as phyto-geographical regions; and although further explorations may cause him to modify their limits in several instances, yet, in regard to all of them, the data he has collected and methodised will be found to be an important contribution to the scientific study of geographical distribution, the value of which is enhanced by copious references to the sources whence he has derived his information.

There are two general subjects upon which the bulky mass of literature continues to receive considerable accessions, both in this country and on the Continent, without perhaps adding much to our stock of information, and which would at any rate require long and patient study to extract what may be really of value; these are Darwinism and so-called Spontaneous Generation. Darwinism in some shape or other, or something under that name, enters more or less into almost all general discussions on points of natural history, especially on the Continent, and in so far as it is applicable to what the Germans call the *Descendenztheorie*, it is being more or less tacitly adopted by the great majority of naturalists; but in a general way, the comprehensive hypotheses propounded by Darwin in his various works are still the subject of much polemical discussion. Seidlitz, in his work entitled "Die Darwinsche Theorie," fills thirty pages with the mere titles of the works, memoirs, or papers published on the subject since 1859, and to this enumeration many additions might be made. Amidst this great mass it might have been expected that I should have selected some to bring specially under your notice—that I should have followed up the observations I made on the "Origin of Species" in my address of 1863, and on the "Variation of Animals and Plants under Domesticity" in that of 1868, by some notice of the "Descent of Man," as well as of some recent works of other writers, such as Mivart's "Genesis of Species;" but these have been already fully discussed by naturalists much more competent than a purely systematic botanist to deal with the question in the phase which it has now reached, and I have not met with any other work in which any connected series of observations has been methodised and brought to bear more directly on the general life-history of animals and plants. The detached observations upon several points connected with Darwin's general theories, especially those relating to dichogamy and cross-fertilisation in plants, continue to be very numerous, as well as the endeavours to connect recent with geologically ancient races of both animals and plants, without, however, making any one move of importance towards the solution of the problems before us; and we are still anxiously awaiting from Mr. Darwin himself that long-promised second portion of his great digest which is to treat of the variations of undomesticated animals and plants.

Spontaneous Generation has perhaps been of late the subject of more controversy in this country than abroad. Since Prof. Huxley, followed by Prof. Tyndall, placed the matter in so clear a light at the Liverpool meeting of 1870, Dr. Bastian has returned to the charge. In his work entitled "The Modes of Origin of Lowest Organisms," he has published an account of numerous experiments further illustrating his views in opposition to those of Huxley and Tyndall, and confirming, in his mind, the theory of Archebiosis, the name he gives to what is commonly called Spontaneous Generation. On the other hand, Mr. N. Hartley has communicated to the Royal Society ("Proceedings," xx. No. 132) his experiments concerning the evolution of life from lifeless matter, which appear to have been conducted with great care, and in some measure under the guidance of Dr. Odling and Prof. Tyndall. From these he concludes that so far as our present knowledge guides us, whether we term it Spontaneous Generation, Abiogenesis, or Archebiosis, the process by which living things spring from lifeless matter must be said to be only ideal. The same number of these "Proceedings" contains abstracts of papers by Dr. Crace Calvert on the development of protoplasmic life, its influence on putrefaction, and the effect of various substances in promoting or arresting its progress, all of which papers are connected with, and in continuation of, his former experiments and conclusions tending to support the theory that this protoplasmic life is derived from invisible germs floating in the atmosphere. Dr. Bastian, at a later meeting of the Royal Society, again returned to the subject in a paper entitled "On some Heterogenetic Modes of Origin of Flagellated Monads, Fungus-germs, and Ciliated Infusoria," inserted at length in No. 133 of the "Proceedings." The experiments and observations here detailed are very interesting as to the development of these organisms in the pellicle that forms on infusions of organic matter when exposed to the atmosphere; but they do not affect the question of the origin of the living components of the pellicle itself, which he considers to have been fully proved by his own former papers, as well as by the well-known experiments of Pouchet and others, to have been evolved from lifeless matter by archebiosis. A more extended work, giving the fullest details of his views of the "Beginnings of Life" is announced, but I have not yet seen it.

If, then, Spontaneous Generation may as a theory in the minds of some persons have become referred to the class of paradoxes like the quadrature of the circle, yet it is still supported by so many naturalists whose opinions are entitled to consideration, and there is so much to be said for as well as against it which appears unsusceptible of direct and positive proof, that it is likely to be long maintained as a subject of controversy, without any further much more definite result. But there is one question of a more practical nature, often supposed to be connected with it, which has excited, and is still calling for the serious attention of men of science, experience, and judgment, as well as of various Governments. I allude to those parasitical scourges which within the last thirty years have made such havoc in several important articles of European food and industry. Thirty years since, and I believe up to the fatal year 1845, the potato-disease, the silk-worm-pébrine, and the oïdium of the vine were unknown in Europe; and we can most of us remember how the sudden appearance and rapid extension of each in succession produced the famine in Ireland, and the ruin of so many French and Italian silk-breeders and wine-growers of the Mediterranean region, Madeira, and Bordeaux; and how for long men of science have been baffled in their efforts at ascertaining the true history of the attendant fungi, and devising an efficacious remedy. The potato-disease appears now to have settled down into one of those chronic epidemics whose varying intensity, according to season and other circumstances over which we have little control, must enter into the calculations of every potato-grower. This useful tuber can no longer, indeed, be advantageously cultivated in that wholesale manner which induced the late Thomas Andrew Knight and others to attach to it so high an economic value, but it may now again be fairly depended upon as an important article of household food.

The pébrine of the silkworm, from the latest reports I have seen of the Commissions of Lyons and other places, shows but little abatement of its intensity, although it it has in some measure changed its character, and is, it is to be feared, through the carelessness or cupidity of interested dealers, spreading even into those eastern regions which have been looked to for the supply of "seed" free from the fatal germ. The oïdium, on the contrary, has been got more under control; and experience now shows that in many districts at least its ravages can be checked or entirely stopped by means within the reach of every intelligent cultivator. But within the last few years a new plague has in the south of France excited even more alarm than the oïdium itself, from its insidious invasion and complete destruction of many of the most valuable vineyards; this time, however, the offending parasite is brought much more within the scope of direct scientific observation. The germs of the potato-fungus, of the pébrine, of the oïdium, are all invisible and inappreciable by any of our instruments; the history of their diffusion and early development, and even their very existence, can only be judged of from their results and other circumstantial evidence; whilst the *Phylloxera vastatrix* can be watched in every stage of its varied existence, from the first deposit of the fertilised eggs, through its several agamic generations, to the latest winged form. The researches, accordingly, which have been already applied to it have not been altogether barren of results, throwing some light even generally upon the origin and dispersion of these pests. Considerable sums of money, either from the French Government or from private subscriptions, have been applied to the purpose, and the investigation has been chiefly carried on by our foreign member, Dr. J. E. Planchon, of Montpellier, assisted by

M. J. Lichtenstein, a relative, I believe, of the late distinguished Prussian zoologist. These gentlemen, since the first discovery of the disease in France in 1868, have devoted much of their time to it. They have compared their observations with those of others who in other countries have studied the insect, especially Mons. Laliman, of Bordeaux, Mr. Riley, of Missouri, and with those of Prof. Westwood in our own country; and they have now, in a pamphlet which, by some inversion of dates not uncommon abroad, is supposed to form part of the Proceedings of the session of the French scientific congress at Montpellier in 1868, given a *résumé* of nearly five hundred memoirs, communications, or journal articles which have been published on the subject up to the close of last year (1871).

The main facts given as having been hitherto elicited as proved or probable may be shortly resumed as follows:—

The *Phylloxera*, like other Aphides, goes through a number of apterous generations of a single sex, but multiplying with enormous rapidity; for one or two individuals will lay as many as five hundred eggs, fertilised without previous copulation. It also gives birth occasionally to a winged generation of both sexes, the females of which lay only two or three eggs each.

The apterous *Phylloxera* is also dimorphous, a smooth-bodied form living in little galls formed on the leaves of the vine, where it is comparatively harmless; and a tuberculate form living in the nodules it produces on the root-fibres, causing first the smaller and then the main roots to rot, weakening, in the first instance, and finally killing the whole vine. Each form has its winged ganeration.

The insect is evidently of North American origin, although the precise history of its transmission to this country has not been ascertained. It was first described by Asa Fitch in the Transactions of the New York State Agricultural Society for 1854; but living there chiefly on the leaves of the native vines, it had not attracted any peculiar attention. More recently, however, Mr. Riley has found reason to attribute to the ravages of the subterranean form the ill success of the various attempts made to establish in America the European grape-vine. In England, where the introduction of the insect from America may be readily conceived, Prof. Westwood's attention was first called to it in 1863, and again from various quarters in 1867 and 1868, whence resulted the above-mentioned account in the *Gardener's Chronicle* for January 1869 (p. 109). With us it does not appear to have spread much, and has therefore not called for any further observation, the damp soil, the mode of treatment, or other external circumstances, proving unfavourable for the development of the underground form. But having by some means reached and established itself in the dry, naturally-drained vineyards of the south of France its general character underwent a change; natural selection at once gave an enormous preponderance to the underground over the epiphyllous form. It was first discovered there in July 1868, and by the close of that year its ravages caused a panic among the vine-growers in many parts of Lower Languedoc and Provence, similar to that which we may remember in this country on the rapid spread of the potato disease in the autumn of 1845. It was immediately made the subject of scientific investigation, which has ever since been steadily pursued. As one result Dr. Planchon inclines to believe that the oïdium and the potato disease, like the *Phylloxera*, and, in former days, the American blight of our apple-trees, had all been imported from America. It would seem that all these parasites, whether insects or fungi, capable of enormously rapid and extensive propagation, remain unnoticed so long as they are kept in check by the mutual relations of their constitution, habits, food, and other circumstances in which they are placed; but that the moment that a change, often very slight, in one or other of these conditions destroys the balance, they may at once and suddenly gain the upper hand, so as to be classed in the popular mind amongst those varied phenomena collectively designed as blights. That such a change is often the consequence of the transportation of the insect from one country to another may be regarded as more probable if Riley is correct in his belief that in America, as in Europe, introduced insects, when once established, are more noxious than indigenous ones. In the case of the *Phylloxera* some clue to the nature of the influencing alteration may be derived from the success attending one of the remedies applied, the inundation and continued submersion of the diseased vineyards during the winter months. The comparative dryness of the soil in the new over that of the original station of the insect has been the change which natural selection seems to have seized upon to effect the extraordinary development of the underground form, aided, perhaps, by some slight attendant change in its constitution. Prolonged, or even temporary inundation, is not however, practicable in the majority of the South of France vineyards, nor, indeed, in any of those producing the best wines. Amongs other remedies, soot (the soot of wood-smoke I presume) promises to be one of the most efficacious applicatious.

Amongst the various publications which these phenomena have called forth, we may still see cropping up not unfrequently the popular notion that they are blights mysteriously connected with meteorological conditions, against which it is vain to struggle; but, fortunately, the need of separately investigating every one of them is becoming generally recognised. In France, Government has appointed special commissions for inquiries into the silk and wine diseases. In Germany the ravages committed by insects on their forests have been the subject of various works, published chiefly under the patronage of the Austrian Government and scientific associations. In North America Mr. Riley, as Missouri State entomologist, makes annual reports on noxious insects to the Board of Agriculture of that State, pursuant to an appropriation for this purpose from the Legislature.* In Italy a special institution has been formed at Padua, under official patronage, for the study of cryptogamic parasites; and our Royal Horticultural Society is also making arrangements for the special encouragement of the study of economic entomology. To these and similar institutions it is the duty of science, in the interest of mankind, to give its unqualified support, to divest itself of all preconceived theories and prejudices, to avoid those polemical discussions which appear to have gone beyond the security they give for the exhibition of facts in all the various points of view they may bear, but impartially to study every detail connected with these scourges, which have so much increased during the present century, fostered, perhaps, by the advance of civilisation and high cultivation.

SCIENTIFIC SERIALS

THE *Lens* (No. 2), April, 1872.—This second number of the new American journal of microscopy contains little that is new or of importance. "The Flora of Chicago and its Vicinity" is continued by H. H. Babcock from the previous number, as is also the "Conspectus of the Families and Genera of the Diatomaceæ," by Prof. H. L. Smith. This second part of the Conspectus is occupied by a "Synonym Register," which promises to be useful, and is in fact the most complete attempt of the kind yet made. "Microscopical Memoranda for the use of Practitioners of Medicine," by Dr. J. J. Woodward, is also a continuation, and consists of two parts, viz., staining the sections, and mounting the stained sections in Canada balsam. There is also a chapter "On the double marking of *Triceratium*," by the same author, accompanied by a Woodbury print of two frustules of *Triceratium fimbriatum*. "On the effect of the reversal of the current of the Chicago River on the Hydrant Water," by H. H. Babcock. "Where to search for Diatomaceæ" is a reprint from the *Intellectual Observer*, and "Alternation of generation in Fungi," by M. C. Cooke, from NATURE. This number of the *Lens* is increased to double the thickness of the previous one by the insertion of the catalogue of optical instruments manufactured or sold by an American firm in Philadelphia and New York.

IN the *American Naturalist* for April we have an article by Dr. J. J. Woodward on the Use of *Amphipleura pellucida* as a Test-object for High Powers, illustrated by a photograph. Dr. Abbott concludes his exhaustive paper on the Stone Age of New Jersey; and the remainder of the number consists of reviews and book notices, and of short paragraphs under the headings of the various departments of natural science.

In the number for May is a note by Mr. J. G. Henderson on the use of the rattles of the rattlesnake, in which he comes to a somewhat different conclusion from Prof. Shaler, believing that it is protective in its object.—Mr. J. A. Allen contributes some ornithological notes from the West, the present communication referring to the birds of Kansas.—Prof. A. H. Tuttle gives the result of a careful study of the genus *Urella* of Flagellate Infusoria, illustrated with a number of woodcuts.

* Since writing the above I have seen a proof-sheet of a portion of the forthcoming fourth report of the Missouri State entomologist, Mr. Riley, in which he enters into further details of the history of the *Phylloxera*, collected during a recent visit to Europe, as well as from closer observations on the subject made in America, where it appears to be acquiring more serious importance. I have not, however, yet seen enough of the report to learn what further conclusions Mr. Riley may have arrived at.

There are also useful practical papers of instructions for herborising, for collecting micro-lepidoptera, and for preparing birds' eggs; as well as a large number of interesting paragraphs of information under the heads of the natural sciences.

THE *Journal of the Frankin Institute* for May contains a good drawing of Danks's patent puddling furnace, and a large number of paragraphs under the head "Items and Novelties." The substantial articles include a continuation of Prof. Nourse's paper on inter-oceanic communication across Central America; Mr. John Warner on the diamond rock drill; Mr. C. Van Bruol on a new modification of the Holtz machine, and a list of auroral displays during February at a number of stations in the United States; and the continuation of various other papers commenced in the preceding numbers.

THE number of the *Transactions of the Linnean Society* just published, vol. xxix. part 1, contains the commencement of Colonel Grant's Botany of the Speke and Grant Expedition, including an enumeration of the plants collected during the journey of the late Captain J. H. Speke and Captain J. A. Grant from Zanzibar to Egypt in 1860-63. The determinations and descriptions of the species are by Prof. Oliver, Mr. J. G. Baker, and other botanists connected with the Kew Herbarium; while Colonel Grant writes an introductory preface, alphabetical list of native names, and notes. It is prefaced by a good map of the whole of the journey; and illustrated by thirty-seven drawings on stone of new or remarkable species. The total number in the whole paper will be 100.

SOCIETIES AND ACADEMIES

LONDON

Geological Society, May 22.—Prof. Morris, vice-president, in the chair. The following communications were read:—1. A communication from the Right Hon. Earl Granville, inclosing a report from H. M. Minister at Rome, relating to the recent eruption of Vesuvius. 2. "On the Phosphatic Nodules of the Cretaceous Rock of Cambridgeshire," by the Rev. O. Fisher, M.A., F.G.S. This paper contained an attempt to explain the origin of the phosphatic nodules which lie in a thin bed at the base of the Chalk in Cambridgeshire, and are largely extracted by washing the stratum for the purpose of making superphosphate of lime. Two hundred and seventy tons per acre, at the rate of fifty shillings a ton, represents the valuable yield of the deposit, which is followed to the depth of about 18 feet. The nodules and other fossils of the bed are chiefly derivative, forming a concentrated accumulation from a deposit belonging to the Lower Cretaceous period. Some of the fossils are, however, believed to be indigenous to the deposit. *Plicatulæ* are attached to all the derivative fossils and nodules, and the sharp, broken surfaces of the latter, with *Plicatulæ* on them, show that they were mineralised before they were deposited in their present *gisement*. The green grains of chlorite have been drifted into patches. Certain calcareous organisms are preserved, but many genera of molluscs only occur as casts in phosphate of lime. The phosphatic matter has been determined in its deposition by *animal* substances. There are two chief varieties of the "ordinary" nodules. The first are amorphous, or else finger-shaped; the second formed like a long cake rolled partially or wholly upon a stick. The surface of these two kinds of nodules is coriaceous and wrinkled, and they usually show marks of attachment to some foreign body. Certain species, clearly zoophytes, are converted into phosphatic nodules, and, when sections are made of these, they are found to show under the microscope structures and spiculæ allied to those of Alcyonaria. Slices of the *common* nodules show similar spicular, and occasionally reticular structure. When casts in plaster are made from *Alcyonium digitatum*, and coloured to resemble the nodules, the similarity in general form and structure of surface is very striking. The phosphate was probably segregated by the animal matter from its solution in water charged with carbonic acid, which is a known solvent of the phosphate; an analysis of the matrix has proved that phosphate of lime is appreciably present in it. The author doubted the derivation of the nodules from the denudation of the subjacent Gault, and exhibited a collection of these to show that they were distinguished by more stunted growth. The deposit was on the whole considersd to represent the thin band with similar fossils at the base of the Chloritic Marl, as seen in the West of England, in which district it is underlain by the true arenaceous Greensand. The absence of the true Greensand was attributed to the intervention of the old palæozoic axis of the London area; and it was finally suggested that a similar axis might stretch from Leicestershire to Harwich, causing the change in character of the Lower Cretaceous beds between Cambridgeshire and Norfolk.—3. "Some observations on the Upper Greensand formation of Cambridge," by Mr. W. Johnstone Sollas. The Greensand Formation consists around Cambridge of a Chalk marl containing harder portions of a different nature disseminated throughout it, these are separated from the Chalk Marl by levigation, and sorted by sifting into larger bodies, consisting almost entirely of the so-called "coprolites," and smaller bodies—the so-called "Greensand." The author gave a general account of his conclusions regarding the "coprolites," reserving details for a future communication. Of all the facts the most obvious is the connection between presence of "coprolite" and former existence of organic matter; when coprolite is found incrusting a bone or other fossil, it is precisely on those parts where animal matter adhered most abundantly. Instances were cited, as in *Palæocorystes*, where the absence of animal matter on the back of the carapace is marked by an absence of phosphatic incrustation; while the sternal side, where animal matter could easily escape, is often altogether embedded in "coprolite." Coprolites are the fossilisation of organic matter derived from very various sources. In many cases they owe their origin to sponges, almost certainly so in the case of cylindrical coprolites perforated by a cylindrical cavity, now filled up with Chalk Marl; other forms have an *allied* origin. Thus coprolites are the flints of the Gault. The Greensand is a mixture of calcareous, silicious, and dark-coloured grains of uncertain chemical composition. The calcareous grains consist of sponge spicules, minute shells, fragments and prisms of shell substance, bivalve entomostraca, microscopic corals, minute echinoderm species, polyzoa, and foraminifera. A list was given of the foraminifera, the abundant occurrence of *Lagma* here being particularly noticed, as, with the exception of *L. apiculata*, mentioned by Reuss, the genus had not before been noticed below the Maestricht Chalk. The silicious grains consist of fragments of various rocks, some of volcanic origin. The dark coloured grains are coprolitic *débris* and true green grains. The green grains are almost all casts of foraminifera, derived chiefly from *Bulimina*; others are derived from *Lituola*, *Rotalina*, *Globigerina*, and other forms. Some green grains of exactly the same nature had been found by the author in the silicious sand of Blackdown.—Prof. Phillips was glad that his casual remark had produced such satisfactory results as the paper he had heard. It was satisfactory to find that the bulk of the phosphatic nodules exhibited such marked traces of an organic origin. Though he had to some extent been prepared for this, it appeared that the view might be extended much further than would at first sight have been anticipated. He drew an analogy between the preservation of the forms of sponges in their silicified fossils with that of the soft organic bodies in the Greensand by phosphatic matter. In each case the surrounding water contributed a large amount of either flint or phosphate of lime, which was segregated and accumulated round certain centres or nuclei of organic bodies.—Prof. Ramsay inquired from what sources the abundance of phosphatic matter requisite for the production of these fossils could have been derived. In such thin strata, which seemed to indicate a transition from a land to a marine surface, it was a matter of great difficulty to his mind to account for so great an abundance of phosphatic matter.—Mr. Godwin-Austen remarked that phosphoric acid was largely present in sea water, and instanced the present seas, where, as on the Newfoundland banks, fish existed in enormous quantities, and no doubt also phosphatic matter. The Cambridge beds, though so rich, were by no means unique of their kind. He referred to a paper communicated some years ago to the Society by Mr. Payne, as affording many interesting particulars with regard to such beds. He considered that much of the phosphate attaching to decaying animal matter might have been derived from comminuted excrementitious deposits floating in the water.—The Rev. T. G. Bonney remembered a fact quoted by the late Dr. Mantell as to the large quantities of dead Mollusca which had been observed floating down some of the American rivers, and which had been regarded as a plentiful source of phosphatic matter. Small fishes might also have furnished a considerable quantity, and their value as manure was recognised at the present day. With regard to the nodules being Alcyonaria or sponges, he observed that what spicules he had seen appeared more like those of sponges. He agreed with Mr.

Sollas as to the foraminiferal origin of many of the green grains. He did not agree with Mr. Fisher in attributing all the nodules to the bed in which they were found, but thought that a considerable portion might be referred to the upper part of the Gault. In proof of the washing the Gault near Cambridge had undergone, he mentioned the occurrence there of a number of boulders of rocks quite foreign to the district.—Mr. J. F. Walker thought that most of the fossils of the phosphatic band at the base of the Chalk-marl were derived from the Gault, whilst the bed differed from chalk only by green grains becoming gradually more abundant. The fossils were generally much water-worn, the characteristic fossils of the Warminster Greensand were absent, and the most abundant fossils were all of Gault species. It seemed that wherever these accumulations of phosphatic matter occurred denudation had taken place, and that they were the residuary heavy materials of a large thickness of rock. This might also be observed in the Upware and Potton beds.—Mr. Whitaker observed that the Upper Greensand thinned out as much to the south as to the north of London. He inquired as to the alleged abundance of phosphate of lime in the upper part of the Gault. He doubted whether the thin band at Cambridge could represent the great thickness of Upper Greensand which was to be found in some other districts. He regarded it rather as a gradual passage into Chalk, though the line of demarcation was evident on the Gault. Though agreeing with Mr. Walker as to some of the fossils having been derived from the Gault, he could not regard them all as having come from that source.—Mr. Meyer thought that the Greensand had always been absent in the Cambridge district, and mentioned the occurrence of a bed of much the same character as that in question at Knighton in the Isle of Wight.—Mr. Forbes pointed out that the amount of phosphatic matter in fishes was so small that it was difficult to assign such an abundance as that described to this source. In limestones almost entirely composed of shells, he could find only from ½ to 1 per cent. of phosphate of lime. Even with true coprolites, he thought that they had become richer in phosphate since their deposition; but whence it was derived he would not pretend to say. He thought this question of derivation still open.—Prof. Morris mentioned the occurrence of similar deposits near Wissant, on the coast of France, and near Calne, in Wiltshire. He called attention to the extremely quiet nature of the sea in which the phosphatic bed had been deposited, and observed on the existence in recent times on certain sea-shores of ooze containing a large amount of phosphatic matter.—Mr. Fisher, in reply, stated that he had in his paper but slightly touched on the sources of derivation of the phosphate of lime; but as to the possibility of that substance being localised and derived in large quantity from fish, he pointed out that the principal manure of modern times, guano, was derived from this source. He alluded to the possibility of some process of dialysis having contributed to the segregation of the phosphate. He disputed the identity of the nodules in the Gault and in the Chloritic Marl of Cambridge. As to the character of the fossils, he regarded it as the same as that to be found in a thin band at the base of the chalk in parts of Hants and Dorset. Mr. Sollas had examined sections of the fossils from the Cambridge beds under the microscope, but had failed to find the canals or tuberculated spicules characteristic of Alcyonaria. He had, however, in the sand found numerous indisputable sponge spicules. He had, moreover, found in sections of the coprolites spicules such as were regarded by Dr. Bowerbank as characteristic of sponges. He hoped, however, to recur to the subject. Both Mr. Fisher and himself concurred in removing these nodules from the category of concretions, and placing them under the head of organic fossils. The transported blocks in the beds bear evidence of glacial action, and he considered had been brought from Scotland or Scandinavia. The cold sea then existing at the base of the Scandinavian chain of mountains flowed southwards over the bottom of the ocean, carrying with it mineral matter in solution, particularly phosphates, so that in this way he thought that some portion of the phosphatic matter was derived from the decomposition of the volcanic rocks north of Lammermuir, which were rich in this substance, and of which rocks he had found fragments near Cambridge. He considered that, under certain circumstances, the phosphate matter present in water would combine with animal matter, and hoped at some future time to offer some remarks on this subject to the Society.

Zoological Society, June 4.—Prof. Flower, F.R.S., V.P., in the chair. Mr. G. Dawson Rowley exhibited a specimen of *Zonotrichia albicollis*, which had recently been captured alive near Brighton, being the second recorded instance of the occurrence of this bird in the British Islands.—Mr. P. L. Sclater exhibited a specimen of the American Black-billed Cuckoo (*Coccyzus erythropthalmus*) killed in Ireland. This specimen had been referred by Mr. Blake Knox to the Yellow-billed Cuckoo (*Coccyzus americanus*), and by Lord Clermont, subsequently, to the Black-billed species (*C. erythropthalmus*). Mr. Sclater remarked that there could be no question of the latter determination being correct.—The Secretary communicated extracts from a letter received from Captain Henry Pain, of the S.S. *Scanderia*, on the habits of the Sea-Lion (*Otaria jubata*) and Fur Seal of the Falklands (*O. falklandica*).—Prof. Owen, F.R.S., read a paper on Dinornis, being the nineteenth of his series of memoirs on this genus. The present communication contained the description of a femur, indicative of a new genus of large wingless bird (*Dromornis australis*, *Ow.*) from a post-tertiary deposit in Queensland, Australia.—Prof. Flower, F.R.S., read a note on some points in the anatomy of the Two-spotted Paradoxure (*Nandinia binotata*), and showed that the cæcum is absent in this animal, contrary to the almost invariable rule which distinguishes the Arctoid subdivision of the Carnivora.—A communication was read from Dr. John Anderson, Curator of the Indian Museum, Calcutta, on the osteology and dentition of *Hylomys*. Dr. Anderson came to the conclusion that this form was most nearly allied to *Gymnura*, and belongs to the Erinaceidæ.—Mr. E. T. Higgins read a paper describing some new species of shells discovered by Mr. Clarence Buckley in Ecuador.—Mr. F. Moore communicated a paper by Captain Thomas Hutton on the Bats of the North-Western Himalayas, in which several new species were described.—Mr. P. L. Sclater read some additional notes on rare or little known animals, now or lately living in the Society's Gardens.—Dr. J. Murie read a paper on the Indian Wild-Dog (*Canis dukhunensis*); his observations being based on two specimens formerly living in the Society's Gardens. After noting points in their anatomy, Dr. Murie specially referred to the variations in the pelage and skulls, which distinguish the four supposed species of the genus. These he was inclined to regard only as one species, viz. *C. primævus*, with geographical varieties.—A second paper by Dr. Murie contained observations on the Bornean Ape (*Macacus maurus*), being the first of a series of papers on the rarer forms of this group.

Entomological Society, June 3.—Prof. Westwood, president, in the chair. Mr. Stainton exhibited specimens of a very large black *Coccus* on the cork oak found at Cannes by Mr. Moggridge. Also specimens of *Antispila rivillei*, bred from larvæ mining the leaves of the vine at Massa di Carrara, found by the Hon. Miss de Grey. This insect was first discovered in the island of Malta about 1750 by De Riville, but was not again noticed until 1871.—Prof. Westwood exhibited a large cottony mass, in which were enveloped the cocoons of a minute parasitic Hymenoptera which infested a large caterpillar in Ceylon; one of these caterpillars had produced at least 1,000 of this parasite .Mr. F. Moore had observed a similar occurrence in the larva of a large *Bombyx* from Bombay.—Prof. Westwood also exhibited apple twigs, the buds of which were destroyed by a larva, apparently of a *Tortrix*.—Mr. Higgins exhibited a selection of magnificent species of *Cetoniidæ* from Java obtained from Dr. Monicki.—Mr. Weir observed that he had recently found the larvæ of *Gonopteryx rhamni* feeding upon *Rhamnus alaternus* in his garden at Blackheath; this insect had not been seen there during sixteen years, and not until he planted this *Rhamnus*, which it immediately discovered, although so totally unlike the two indigenous species of the genus on which the larvæ habitually feed here.—Mr. Miller called attention to a paragraph in the daily newspapers concerning the enormous increase of ants on the island of May to such an extent as to render the land useless to the lighthouse-keepers. The subject had been brought to the notice of the Northern Lighthouse Commissioners, and a visit had been made to the island for the purpose of investigating the matter.

Linnean Society, June 6.—Mr. G. Bentham, president, in the chair. The president appointed Mr. Geo. Busk, Dr. J. D. Hooker, Mr. John Miers, and Mr. W. W. Saunders, vice-presidents for the year. The papers read were:—On some recent forms of *Lagenæ* from Deep-sea Dredgings in the Japanese Seas, by J. W. O. Rymer Jones; On the Cutaneous Exudation of the Water-newt (*Triton cristatus*), by Miss E. A. Ormerod.

Chemical Society, June 6.—Dr. Gilbert, F.R.S., vice-president, in the chair.—"On a Remarkable Salt deposited from the Mother Liquors obtained in the Manufacture of Soda," by Prof. E. T. Thorpe; "On the Composition of Ceylon Jargons," by M. H. Cochran; "On a Double Sulphide of Gold and Silver," by Mr. Pattison Muir; "On the Solvent Action of various Saline Solutions upon Lead," by the same author; "On the Magnetic Sand of Mount Etna," by J. B. Hannay; "New Tests for some Organic Fluids," by J. A. Wanklyn; "Dendritic Spots on Paper," by A. Liversidge; "On Chinoline and Leucoline," by C. Greville Williams, F.R.S. A letter from Mr. Dewar of Edinburgh was then read by the secretary on some derivatives of chinoline.—Dr. C. R. A. Wright read a paper on the "Action of Phosphoric Acid on Morphine," and Mr. W. H. Perkin, F.R.S. "A Note on the Secondary Colouring Matter produced in the preparation of Alizarine from Anthracene;" "On the Effects of Temperature on the Absorption of Gases by Charcoal," by Mr. J. Hunter. Dr. Armstrong then brought forward a series of "Communications from the Laboratory of the London Institution, No. V. On the Nitration Products of the Dibromo-phenolsulphonic Acids; No. VI. On Bromo-phenosulphonic Acid; No. VII. On the Formation of Substituted Nitrophenolsulphonic Acids," and finally the secretary read a letter which had been received from M. E. Maumené of Paris.

PHILADELPHIA

Academy of Natural Sciences, October 3, 1871.—Dr. Ruschenberger, president, in the chair. Mr. Thomas Meehan referred to some observations made by him last spring before the Academy in regard to the office of bud scales and involucral bracts. The general impression was that they were formed for the purpose of protecting the tender parts beneath. At that time he exhibited the branches of *Fraxinus excelsior* on which some of the buds were entirely naked, and others clothed with scales in the usual manner. They could scarcely be for protection in this instance, as both were equally hardy. He now had to exhibit an ear of corn which had been produced without the usual involucral bracts or husks, and yet was as perfect as if clothed in the usual way, showing that the husk was of not much importance as a protecting agent. An interesting point was that this ear had been formed on the end of a male panicle or tassel. It was not uncommon to find scattered grains of corn amongst male flowers, bnt a perfect ear like this he had never before seen. The ear was eight-rowed, and contained two hundred perfect grains. It was the variety known as "popcorn."

PARIS

Academy of Sciences, June 3.—Mr. A. Cayley communicated a paper on the surfaces divisible into squares by their curves of curvature, and on Dupin's theory.—A memoir by M. Yvon Villarceau on isochronous regulators derived from Watts's system was read.—M. de Pambour read a note on the additional friction due to the load of machines.—M. Le Verrier communicated some observations on magnetic declination made at Batavia and Buitenzorg during the solar eclipse of December 12, 1871, extracted from a letter from M. Bergsma, in which the author stated that this eclipse exerted no influence upon the direction of the magnetic needle either at Buitenzorg, where the eclipse was total, or at Batavia, where it was nearly so. M. Le Verrier also presented a note by M. C. Grad on the magnetic declination in Algeria, containing the results of a series of observations made at fourteen stations during the last winter.—A paper was read by M. Berthelot on the formation of acetylene by the obscure electrical discharge; and another by MM. Berthelot and Bardy on the transformation of ethylnaphthaline into acenaphthene.—A note by the Abbé David, on a new species of *Paradoxornis*, was read. This bird was obtained near Shanghai by Father Heude, and is described under the name of *P. Heudei*.—M. C. Robin presented a note by M. A. Dufossé on the noises and expressive sounds uttered by fishes.—M. Bouillaud presented some considerations on chlorosis and anæmia in the human subject, with reference to M. Boussingault's paper, read at the last meeting, on the iron contained in the blood and in food; and M. A. Dumont read a note on the distribution of the water of the Rhone at Nîmes.

BOOKS RECEIVED

ENGLISH.—Michael Faraday: J. H. Gladstone (Macmillan and Co.).—My Garden, its Plan and Culture: Alfred Smee (Bell and Daldy).—A Lecture on Science and Revelation, 2nd edition: Jas. Stuart (Longmans and Co.).—A Discourse on the Inductive Philosophy: A. C. Finch (Longmans).—First Lessons on Health: J. Berners (Macmillan).

DIARY

THURSDAY, JUNE 13.

ROYAL SOCIETY, at 8.30.—Further Experiments on the Effect of Alcohol and Exercise on the Elimination of Nitrogen: Dr. Parkes, F.R.S.—On the Spectrum of the Great Nebula in Orion, and on the Motions of some Stars towards or from the Earth: W. Huggins, F.R.S.—On Blood-Relationship: F. Galton, F.R.S.—Report of further Scientific Researches in the Mediterranean, Aug.-Oct., 1871: Dr. Carpenter, F.R.S.

SOCIETY OF ANTIQUARIES, at 8.30.—Ancient Rings from Palestrina: C. D. E. Fortnum, F.S.A.—Polychrome Vitreous Beads: J. Brent, F.S.A.

MATHEMATICAL SOCIETY, at 8.—On the Surfaces divisible into Squares by Curves of Curvature: Prof. Cayley.—On Prof. Cremona's Transformation between Two Planes and Tables relating thereto: Mr. S. Roberts.—On a Manifold Correspondence of Two Planes: Dr. Hirst.—Note on a Special Case of the Anharmonic Ratio Sextic: J. J. Walker.

FRIDAY, JUNE 14.

ASTRONOMICAL SOCIETY, at 8.

MONDAY, JUNE 17.

ANTHROPOLOGICAL SOCIETY, at 8.—The Tribes of North Aracan: St. Andrew St. John.—Australian Languages and Traditions: Rev. W. Ridley.—Indian Picture Writings in British Guiana: C. B. Brown.—Exhibition of Photograph of the Tattooed Man, and Short Description: A. W. Franks.—The Ainos of Yeso: Commander H. C. St. John.

TUESDAY, JUNE 18.

ZOOLOGICAL SOCIETY, at 9.—On the Cranial Appendages and Wattles of the Horned Tragopan (*Ceriornis satyra*, Linn.): Dr. J. Murie.—On the Cetacea observed during the voyage round the world of H.I.M.S. *Magenta*, 1865-68, with the description of several new or little known species, and of a new genus of Fin-backed Whale: Prof. H. H. Giglioli.

WEDNESDAY, JUNE 19.

GEOLOGICAL SOCIETY, at 8.—On the Discovery of Palæolithic Implements in association with *Elephas primigenius* in the Gravels of the Thames Valley at Acton: Col. A. Lane Fox.—On the Evidence for the Ice-sheet in North Lancashire and adjacent parts of Yorkshire and Westmoreland: R. H. Tiddeman.—On a new Species of Coral from the Crag: Prof. P. Martin Duncan, F.R.S.

METEOROLOGICAL SOCIETY, at 7.—Anniversary Meeting.

THURSDAY, JUNE 20.

ROYAL SOCIETY, at 8.30.

SOCIETY OF ANTIQUARIES, at 8.30.

LINNEAN SOCIETY, at 8.—On the structural peculiarities of the Bell Bird (*Chasmorhynchus*): by Dr. Murie, F.L.S.

CHEMICAL SOCIETY, at 8.—On Deacon's Method of obtaining Chlorine, as illustrating some principles of Chemical Dynamics: H. Deacon.

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