THURSDAY, JANUARY 11, 1872

THE UNITED STATES DEPARTMENT OF AGRICULTURE*

THE absence of a Department of Agriculture from the complicated scheme of British Government offices leads us to inquire whether it is possible for such a Department in the United States to publish annually eleven or twelve hundred pages of matter useful to the agricultural community, and whether those publications have any considerable circulation in the country.

The question of circulation is abundantly answered by a resolution of the House of Representatives passed on July 14, 1870 (the Senate concurring), which enacted, "That there be printed of the Annual Report of the Commissioner of Agriculture for 1869 *two hundred and twenty-five thousand extra copies*, one hundred and eighty thousand of which shall be for the use of the House, twenty thousand for the use of the Senate, and twenty-five thousand for distribution by the Commissioner of Agriculture." These figures are so startling in their magnitude that they seem to prove too much, until we recollect that the United States of America extend over an area proportionately enormous, including every gradation of climate, from the sub-tropical to the sub-arctic, and every variety of culture, from the cotton and rice of the south to the corn and roots of the north.

That these publications contain matter useful to the agricultural community will be readily admitted after even a cursory examination of either of the volumes; and a careful study of the official reports will lead many people to ask why we in England are not similarly favoured. The United States' Department of Agriculture fulfils two functions. It is primarily a Department of Administration, but it is also charged to acquire information concerning agriculture by means of books and correspondence, by practical and scientific experiments, by the collection of statistics, and by any other appropriate means. The papers in its annual volume include well-considered reports by all the chief officers of the Department, including, besides the Commissioner himself, the statistician, the chemist, the entomologist, the superintendent of the garden and grounds, the botanist, the editor, and others. The papers beyond these official documents consist, for instance, of Reports on Agricultural Education in Europe, on the Beet-Sugar Industry in Europe, on the Agricultural Resources of Alaska, on Agricultural Meteorology, &c. There are also papers on special subjects, many of them of the highest scientific value, such as are published in the journals of agricultural and other societies, and which may be regarded as supplementary to the strictly official work of the Department.

With such a sketch of the United States Department of Agriculture before us, it seems worth while, even in the pages of a scientific journal, to compare it with our English institutions. We have no representative of it as a department of administration; but we have a series of unconnected departments and commissions, which are as fancifully associated and divided as the stars of heaven in the time-honoured system of constellations. The Privy Council, for instance, takes cognizance of science and art, the education of children, and the diseases of animals. But why it should be the duty of the same high official to protect our flocks and herds from scab, cattle-plague, and other contagious diseases, and at the same time to educate our children, we cannot understand. Is the Vice-President of the Privy Council an *ex officio* Admirable Crichton, or is there some mysterious connection between the three R's and pleuro-pneumonia? Another of our agricultural anachronisms is the Copyhold, Tithe, and Enclosure Commission, which is the State authority on drainage and cottages, as well as the national land surveyor, valuer, and actuary. The Statistical Department of the Board of Trade is entitled to great praise for the manner in which it performs its varied work, including, besides a statistical report on the imports and exports of the United Kingdom, a fair statement of the agricultural condition of the country from year to year. Leaving out of the question the new Local Government Board, the Local Government Act Department, the Poor Law Board, and other departments which are more or less connected with the agricultural interest at home, we come to the Board of Customs, on which agriculturists are dependent for the enumeration of our agricultural imports and exports, while the nation looks to it for the collection of the revenue on our claret and cigars.

Neither as a means of disseminating information have we any representative of the United States Department of Agriculture, with its Annual Report, printed at the expense of the State in editions of nearly a quarter of a million. It is true that the Royal Agricultural Society of England, with less than 6,000 members, does more, probably, in its special walk than any other private society in the world; but it is still nothing more than a private society, and it cannot possibly, therefore, cover the whole ground required by the progressive agriculture of the present day. Indeed, it is, by its charter, expressly prohibited from interfering in matters which are questions of either law or politics. Its efforts are therefore confined to "practice" and "science," and it supports a large staff of scientific officers, including a chemist, botanist, veterinary inspector, engineer, and others, absolutely without State aid; it also expends at least 2,000*l.* per annum in testing machinery; gives away 3,000*l.* per annum in prizes for the best animals; promotes experimental investigations; and incurs very serious risk in exposing adulterations of manures and feeding stuffs.

It may, doubtless, be urged that if English farmers can do so much for themselves they require no help. But practically our Government has found out that there are things to be done which only a Government can do. Thus, after the nation had suffered fearful losses by the ravages of cattle-plague, it ordered an investigation of the subject, and—published a blue-book. After the condition of the agricultural labourer, and especially of women and children employed in agriculture, had been stigmatised as a blot on our civilisation, it issued a Royal Commission, and the result of this excessive effort for the advancement of agriculture was—a series of blue

* Report of the Commissioner of Agriculture for the year 1868, 8vo, pp. 671, Washington, 1869. Ditto for 1869, 8vo, pp. 702, Washington, 1870. Monthly Reports of the Department of Agriculture for the year 1868, 8vo, pp. 483, Washington, 1868. Ditto for 1869, 8vo, pp. 419, Washington, 1869. Ditto for 1870, 8vo, pp. 498, Washington, 1871.

books. But who reads blue-books? Farmers cannot perform successfully a feat which almost baffles the best-trained member of Parliament. What they want is a Department of Agriculture which shall improve the laws of the land, as well as investigate obscure subjects, and circulate the official reports in the manner of the United States department, in editions of a quarter of a million. The United States Commissioner not only expounds the laws of the federation on roads, fences, &c.; but he learns, for instance, that the beet sugar industry of Europe, and the system of agricultural education in Germany and other countries, present instructive features to the intelligent agriculturist, and he therefore sends a qualified commissioner to report on each of these subjects. American farmers are thus enlightened on European agriculture sooner and more authoritatively than we, who are separated from the Continent by nothing more than a "streak of silver sea." There are our Colonies also; and we would on their behalf inquire whether an intending emigrant to Canada, New Zealand, Australia, or the Cape, can obtain as much reliable information on their agriculture as the American farmer now possesses about his country's recent purchase, Alaska? It thus seems clear that the United States Department of Agriculture presents features which may be profitably copied by our Executive Government, and others which are equally instructive both to our agriculturists and to our men of science.

AGASSIZ'S SEASIDE STUDIES

Seaside Studies in Natural History. By Elizabeth and Alexander Agassiz. Marine Animals of Massachusetts Bay: Radiates. 2nd ed. (London: Trübner & Co., 1871.)

THIS is a reprint, with a few additions, of the charming work which became so popular in America and in England some five years since on account of its intrinsic merits and the beauty of the illustrations. The book includes descriptions and more or less truthful illustrations of the Actiniæ, Madreporaria, Alcyoninæ, Acalephæ, Hydroids, Holothurians, Echinoidea, and Asteroidea which may be found in the neighbourhood of Massachusetts Bay. The history of the development of many of the forms is carefully written, and is obviously the result of patient original observation.

In noticing the reproduction of the Actiniæ the authors remark that the eggs which hang on to the inner edge of the partitions of the visceral cavity drop off into it during different stages of development. Ordinarily they are passed out through the mouth as Planula-shaped ciliated creatures, which soon become attached to a foreign substance. The base enlarges, and the free extremity falls in to form a concavity, the future gastric and visceral cavity. But sometimes the embryo is provided with tentacles and with its stomachal cavity before it escapes. Lacaze-Duthiers has described a similar state of things in the reproduction of *Corallium rubrum*, and probably the embryonic condition of all the stony corals is that of a free swimming sac which undergoes metamorphosis. These usually sedentary Actiniæ are not without nomadic species, and *Arachnactis brachiola* A. Ag. is described as a small floating anemone, very nocturnal in its habits, which swims with its tentacles and mouth downwards, using the body as a float. This form is not quite symmetrical, and has an evident tendency towards establishing a longitudinal axis. The mouth is out of the centre. Bicidium is noticed as selecting the mouth-folds of the common large red Cyanea as its home. It undergoes retrograde development, and its tentacles are short and stout on account of its parasitic existence.

The only stony coral described is the littoral Astrangia, which is probably a descendant of the miocene forms which once flourished on the same area. The tentacles of this coral are covered with wart-shaped masses, crowded with nematocyst lasso cells. Such forms as Caryophyllia and Balanophyllia, which are so well represented on our coasts and in thirty fathom water, do not appear to have been found by the authors in Massachusetts Bay. Amongst the Acalephæ, Cyanea, of course, is well described, and it is observed that so large a portion of its bulk consists of water that one of no less than thirty-four pounds weight being left to dry in the sun for some days, was found to have lost 99 per cent. of its original weight. Writing of the not very attractive appearance of these huge jelly fish, Agassiz observes that "to form an idea of his true appearance, one must meet him as he swims along at midday, rather lazily withal, his huge semi-transparent disc with its flexible lobed margin glittering in the sun and his tentacles floating to a distance of many yards behind him. Encountering one of these huge jelly fishes when out in a rowing boat, we attempted to make a rough measurement of his dimensions upon the spot. He was lying quietly near the surface, and did not seem in the least disturbed by the proceeding, but allowed the oar, eight feet in length, to be laid across the disc, which proved to be seven feet in diameter. Backing the boat slowly along the line of the tentacles, which were floating at their utmost extension behind him, we measured these in the same manner, and found them to be rather more than fourteen times the length of the oar, thus covering a space of some hundred and twelve feet." This huge mass is produced by a hydroid measuring not more than half an inch in length when full grown.

The parasitic early life of *Campanella pachyderma* A. Ag. appears to throw a doubt whether this acaleph passes through the hydroid state or not. Should the eggs develop at once into the medusa in this instance, there is no small significance to be attached to the fact. An anomaly of an opposite character is noticed in the case of *Laomeda amphora* Ag. This campanularian develops medusæ which never separate from the parent hydroid, but wither on its stem after having laid their eggs. The development of these abortive medusæ is not far advanced. This species flourishes in the sewage of Boston. There is a very admirable drawing of *Tubularia Couthouyi* Ag., a tubularian whose medusæ buds are never freed from the stem, and do not develop into full-grown jelly fish, but always remain abortive. These buds cluster like a bunch of grapes under the expanded umbrella-shaped tentacles of the hydroid, which are gracefully supported by a curved stem.

The process of the budding of the medusæ of Hybocodon, where small jelly fish similar to the original grow by gemmation from a large tentacle, is well described, and the hydroid stage and general want of symmetry in the

medusa also. Then the budding from the proboscis of *Dysmorphosa fulgurans* A. Ag. is noticed, and the nomadic or free-floating hydroid Nanomia also. Synapta, amongst the Holothurians, is noticed on account of its curious sand-ring clothing. "They live in very coarse mud, but they surround themselves with a thin envelope of fine sand, which they form by selecting the smaller particles with their tentacles, and making a ring around their anterior extremity. This ring they then push down along the length of the body, and continue the process, adding ring after ring, till they have entirely encircled themselves with a sand tube. They move the rings down partly by means of contractions of the body, but also by the aid of innumerable appendages over the whole surface. To the naked eye these appendages appear like little specks on the skin ; but under the microscope they are seen to be little warts projecting from the surface, each one containing a little anchor with the arms turned upward. Around the mouth the warts are larger, but do not contain any anchors." "By means of these appendages, though aided also by the contractions of the body, the Synaptæ move through the mud, and collect around themselves the sand tube in which they are encased." They gorge themselves with mud and sand for the sake of the nutritious substances they may contain. The office of the pedicellariæ of the Sea Urchin is well described, as follows :—"If we watch the Sea Urchin after he has been feeding, we shall learn at least one of the offices which this singular organ performs in the general economy of the animal. That part of his food which he ejects passes out at an opening on the summit of the body, in the small area where all the zones converge. The rejected particle is received on one of these little forks, which closes upon it like a forceps, and it is passed on from one to the other down the side of the body till it is dropped off into the water. Nothing is more curious and entertaining than to watch the neatness and accuracy with which this process is performed. One may see the rejected bits of food passing rapidly along the lines upon which these pedicellariæ occur in greatest number, as if they were so many little roads for the carrying away of the refuse matters ; nor do the forks cease from their labour till the surface of the animal is completely clean and free from any foreign substance." Some higher animals might take a profitable lesson from the Urchin. The Crinoids are passed by rather briefly. The existence of Comatulæ from Greenland to South Carolina is mentioned, but the authors do not appear to have devoted special attention to them. A very excellent notice of the embryology of the Echinodermata precedes the last chapter, which consists of a brief *résumé* of the distribution of life in the ocean. The book might be taken as a model by many European naturalists who write popular works, for there is a vast amount of philosophy in it. The authors have not contented themselves with serving up a number of "wonders" for the public bewilderment ; nor have they simply given us a series of descriptions of forms, as is the practice especially amongst those who trade upon butterflies and beetles ; but they have taken a vast amount of trouble in explaining the development and embryology of the Invertebrata which have come under their notice. In fact, they have given a reasonable amount of bread with their "sack."

P. M. D.

EARNSHAW'S DIFFERENTIAL EQUATIONS

Partial Differential Equations. An Essay towards an entirely new Method of Integrating them. By S. Earnshaw, M.A. (Macmillan and Co., 1871.)

THE present work, as its title indicates, contains a detailed explanation of a new method of integrating Partial Differential Equations ; it is in no sense a text-book or introduction to the subject. The author's object is not to collect and describe the known methods, but to develop a new one. The principle of the method is easily explained and understood. The independent variables in the given differential equation being $t, x, y, z \ldots$, we can transform it so that the new independent variables are $t, \xi, \eta, \zeta, \ldots$, by equations of the form $D_t u = d_t u + d_x u \cdot D_t x + \ldots$; but the practical application of the method consists in comparing the original equation with the equation last written, and thus determining relations from which, by the elimination of $\xi, \eta, \zeta \ldots$, the integral of the original differential equation is found. The quantities $t, \xi, \eta, \zeta, \ldots$, with the exception of the one with regard to which the differentiation is being performed, are treated as constants, and are here called *quasi-constants* (semi-constants we should have preferred). Mr. Earnshaw, as is apparent from the equation of transformation quoted above, adopts d when the differentiation is with regard to the old variables, and D when with regard to the new ; the suffix notation for differential coefficients is also made use of. For this latter departure from custom the author in the preface offers an apology, and states that he has been warned that it "will form a serious hindrance to the acceptableness of the present work." This fear we think is groundless ; the notation is not inconvenient in such investigations as the present, as it somewhat simplifies the appearance of the equations without rendering the analysis more difficult to follow.

In the first few chapters the method is applied to the integration of numerous equations of the first and second orders, and throughout the book the applications to particular cases are so numerous that whole chapters consist entirely of "examples worked out." This excessive number of examples is a drawback, as many of them (for instance, all in Chapter V., which treats of linear equations of the second order with constant coefficients) can be more simply and perfectly discussed by Boole's symbolic and other methods. The reader is also left in doubt as to how far the examples have been chosen so as to suit the method of solution here adopted. In the development of a new principle it is always a matter of great importance to point out the cases in which it enables us to obtain results previously beyond our reach, and also the cases in which the previous methods are preferable. This Mr. Earnshaw does not appear to have done ; he has integrated a great number of equations, many of which, however, are capable of solution by well-known methods in as straightforward a way as ordinary quadratics in algebra. It is, for such reasons as these, generally desirable that original mathematical investigations should appear first in the memoirs of a Society or other recognised organ, where the new matter is distinctly stated, rather than in the form of a book where there is nothing to check the temptation to overburden the explanation with examples. Mr. Earnshaw claims to have for the first time integrated in

finite terms several most important partial differential equations of the second order, including the equation of continuity in a homogeneous incompressible fluid; and the chapters in which these equations are discussed are by far the most important and interesting in the work. Mr. Earnshaw is already known for his able treatment of the equation for the motion of a sound wave in the Philosophical Transactions for 1860, and no one can doubt the importance of the subjects suggested for consideration by this and other equations. The question is discussed whether there must necessarily exist an integral of every partial differential equation that can be proposed, and on this part of the subject we wish the author had extended his remarks. The real question considered seems however rather to be the possibility of the existence of a continuous function expressible in finite terms as an integral. With regard to the considerations having reference to certain physical problems, we should not expect to learn very much from the discussion of such questions, as the differential equation might admit of a solution incapable of satisfying the physical conditions.

We must notice one singular error made by Mr. Earnshaw. He concludes that the well-known partial differential equation of the second order of surfaces having their principal radii of curvature equal and of opposite signs at all points, admits of no integral, because the form of a surface possessing this property would be such as could not exist; but it is well known that the surface formed by the revolution of a catenary round its directrix does possess the property in question, and it is easy to see that this arises simply from the fact that the normal and radius of curvature in the catenary are equal and of opposite signs; the form of the surface is quite easy to conceive. A particular integral of the equation obtained by Poisson's method is also given in Boole's Differential Equations, chapter xv. Even admitting Mr. Earnshaw's reasoning, it would only establish the non-existence of a real surface possessing the required property. The integrals of the equation of continuity in three dimensions, and of one or two other equally important equations, we do not remember to have seen before, and they are perhaps the most general finite solutions the equations admit of. Of the value and power of the method it is impossible to speak at present; but we heartily commend Mr. Earnshaw's book to the reader as one containing much matter of great interest systematically and clearly developed and treated by a novel method. It is remarkable that the subject of partial differential equations has not attracted more attention than it has in recent years, as an advance in this quarter is more immediately felt in physics than an advance in any other pure mathematical subject. The present work will help to bring the matter prominently forward; and as the analysis is nowhere of a very difficult nature, it will probably come under the notice of many readers not accustomed to study mathematical memoirs on their appearance.

If the work had been intended to be a Treatise on the subject, we should have had good reason to object to the total omission of all reference to the usual methods, but the title and preface explain that this was not contemplated; it is one of the few English books containing original mathematics.

J. W. L. G.

OUR BOOK SHELF

Three and Four Place Tables of Logarithmic and Trigonometric Functions. By James Mills Peirce. 16 pp. (Boston: Ginn Brothers, 1871.)

PERHAPS the best way of treating this work, which does not contain a single word of explanation, will be to give a summary of the tables contained in it. First we have proportional parts of all numbers up to 100; then on one page three-place logarithms of numbers and of the six trigonometric functions, natural and logarithmic. On pages 4 and 5 we find four-place logarithms of numbers, then logarithms of sums and differences (Gaussian logarithms) also to four places, then follow tables of logarithmic trigonometric functions, inverse trigonometric functions (a new table, to which attention is specially invited, for finding angles from the logarithms of their trigonometric functions), traverse table, the correction of the middle latitude (in an improved form), and meridional parts.

In a prospectus issued by the publishers, it is stated as a result of experiment that it has been found that the times occupied, in regular computation, in doing one piece of work by tables of 4, 5, 6, and 7 places, are proportional to the numbers 1, 2, 3, and 4; hence it is that the author has drawn up the majority of the tables under review to 4 places as sufficient for ensuring the degree of accuracy usually required in computations of common surveying, engineering, &c.

The type employed is very clear, the arrangement of the work is good, and the printer's part has been well done; the book requires only a few words of elucidatory matter. There is on the last page a useful Table of Constants with their logarithms, here we observe a few symbols which are new to us, and which are presented to our notice on the Title-page.

After all the value of such a work consists in its accuracy, and that can only be tested by practice, "the greatest pains have been taken both in preparing and printing to secure perfect accuracy." We commend the work to the notice of such as agree with old Burton (Anatomy of Melancholy, pt. II., sec. 2), "What so pleasing can there be . . . if a man be more mathematically given (as) to calculate or peruse Napier's logarithms, or those tables of artificial sines and tangents, not long since set out by . . . . Edmund Gunter, which will perform that by addition and subtraction only, which heretofore Regiomontanus' tables did by multiplication and division." But then the same quaint writer advises those who are melancholy to square a circle; does it follow that all circle-squarers are melancholy? R. T.

The Laws of the Winds prevailing in Western Europe. By W. Clement Ley. Part I. (Stanford, 1872.)

EVEN when we differ from an author's conclusions, the work of one who shows himself an honest and capable inquirer has a just claim to our attention. Mr. Ley evidently writes from practical knowledge of his subject, and his assiduity in collecting and charting observations must have entailed on him an amount of labour which only those who have been engaged in similar work can thoroughly understand. Unfortunately, as it appears to us, he has confined his investigations almost entirely to the limits set forth on his title-page; and the winds of Western Europe, though highly suggestive and subject to more exact observation than any others except those of the United States, are by no means to be taken as representative. Mr. Ley has taken them as such, and has thus laid down a series of general propositions, which may be briefly summed up in one—that revolving storms are caused by the barometric depression consequent on heavy rain over a large area. He brings forward some curious home instances in illustration of this; but looking farther afield, on the slopes of the Himalayas—to mention only one locality—a much heavier and longer continued pre-

cipitation than any he has instanced takes place every summer, and does probably cause a very great depression of the barometer, but certainly does *not* give rise to any winds such as he has described. On the hills of Khasia, again, where the unparalleled rainfall is as much as from 30 to 40 inches a day for days together, and puts the paltry $\frac{1}{2}$ or $\frac{3}{4}$ of an inch a day of Mr. Ley's examples almost beyond the pale of comparison, no such storms are generated. In the same way, the explanation of the eastward direction which these barometric depressions take in our latitudes, which differs only in its greater detail from that given by Prof. Mohn in the "Storm Atlas," is applicable only to temperate latitudes; the westward advance of tropical cyclones cannot be referred to it; and it seems to us improbable in the extreme that the course of a storm is regulated by one law in one part of the world, and by a totally distinct law in another. Besides this, in the detailed application of the law which he deduces for Western Europe, the author appears to fall into the mistake of attributing the rainfall of mountain districts to the mere contact of the moist air with the cold mountain slope; that this is not the case—that it is due rather to the hoist into the upper regions which the air receives on impinging against the slope—is curiously shown by the fact that, when the hills are not high, most rain falls on the lee side. One familiar instance of this will illustrate our meaning. The gauge which in all England shows the greatest rainfall is at Stockley Bridge, just above Seathwaite; it is distinctly under the lee of the ridge which joins Great Gable to Great End, and separates Wastdale from Borrowdale. The mist, blown in from seaward, fills Wastdale, and is lifted up the slope of this ridge (Stye Head Pass). Crossing over out of Wastdale, the mist curling up the hill is frequently so thick that the path cannot be seen 10 feet in advance; but immediately on reaching Stye Head Tarn the mist vanishes, to fall as rain over Seathwaite. But altogether, though we admit neither the author's premises nor his conclusions, his work is none the less highly interesting. It does not contain much that is new, but it discusses and illustrates the theories of Mohn and Buchan in greater detail than has yet been attempted. We would, however, decidedly object to the *ex cathedrâ* tone which is occasionally adopted. In empirical science very little is "obvious," and perhaps nothing is a "truism;" certainly the influence attributed to the earth's rotation is neither one nor the other, for it is denied, disputed, and doubted by very many capable meteorologists. J. K. L.

The Young Collector's Handy-book of Botany. By the Rev. H. P. Dunster. (London: L. Reeve and Co., 1871.)

WE opened this little book with pleasure, hoping to find in it an addition to the too few popular manuals of botany, and the pleasure was increased by recognising at the end some familiar and excellent illustrations. Great therefore was our disappointment when we found that instead of "assisting the student in the beginning of his work by setting him forward on a right road," as is stated in the Preface to be its object, it would be far more likely to mislead him. Botany seems to be peculiarly unfortunate, in that every one who is fond of flowers thinks himself capable of writing a handbook, without himself possessing any accurate scientific knowledge of his subject. Some of the definitions given in this book are so bad that we should have been surprised to find them in the answers to the examination papers of the botanical classes in any of the great schools where natural science is now taught. Take four examples:—"Albumen: a gummy substance surrounding certain seeds;" "Embryo: the leaf in an immature state;" "Matrix: that upon which any other thing grows;" "Petals: leaves while in the corolla." After this we are somewhat prepared to hear that the corolla "is made up of petals which, when expanded, are the flower-leaves, *and* of the stamen and pistils;" and that "county collections (of ferns) are valuable as illustrations of the *fauna* of particular parts." We are utterly unable to see the object gained by the publication of this book, when beginners already have such admirable manuals as Oliver's "Lessons in Elementary Botany," Lindley's "School Botany," and Cooke's "Manual of Structural Botany," neither of which, by the way, is mentioned by Mr. Dunster in the list of books recommended to the learner. Especially are we unable to understand how the names of respectable publishers, who have issued many admirable works on natural history, come to be appended to a book of this character. As we see that it is intended to be the first of a series of Handy-books upon "the popular and recreative sciences," we would recommend the publishers to submit the manuscript of the remainder of the series to a competent judge before publication. A. W. B.

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

LEAVING out of account a few small inland seas, the globe may be said to have but one sea, as well as but one atmosphere. We have, however, accustomed ourselves to speak of parts, or geographical divisions, of the one great ocean, such as the Atlantic and the Pacific, as if they were so many separate oceans. We have become accustomed, also, to regard the currents of the ocean as separate, and independent of one another; and this idea has, no doubt, to a considerable extent, militated against the acceptance of the theory, that the currents are caused by the winds, and not by difference of specific gravity, for it leads to the conclusion that currents in a sea must flow in the direction of the prevailing winds blowing over that sea.

The true way of viewing the matter, as I hope to be able to show in my next letter on the cause of Ocean Currents, is to regard the various currents merely as members of one grand system of circulation, produced, not by the trade winds alone, as some suppose, but by the combined action of all the prevailing winds of the globe, regarded also as one system of circulation.

If the winds be the impelling cause of currents, the *direction* of the currents will depend upon two circumstances, viz. (1) the direction of the prevailing winds of the globe; and (2) the conformation of sea and land. It follows, therefore, that as a current in any given sea is but a member of a general system of circulation, its direction is determined, not alone by the prevailing winds blowing over the sea in question, but by the general system of prevailing winds. It may, consequently, sometimes happen that the general system of winds may produce a current directly opposite to the prevailing wind blowing over the current.

Taking into account the effects resulting from the conformation of sea and land, the system of ocean currents is found to agree exactly with the system of the winds. I trust to be able to show that all the principal currents of the globe, the Gibraltar current not excepted, are moving in the exact direction in which they ought to move—assuming the winds to be the sole impelling cause. Given the system of winds and the conformation of sea and land, the direction of all the currents of the ocean, or more properly the system of oceanic circulation, can be determined *a priori*. Or given the system of the ocean currents, together with the conformation of sea and land, and the direction of the prevailing winds can also be determined *a priori*. Or, thirdly, given the system of winds and the system of currents, and the conformation of sea and land may be, at least, roughly determined. For example, it can be shown by this means that the Antarctic regions are probably occupied by a continent, and not by a number of separate islands, nor by a sea.

The influence of the rotation of the earth on ocean currents has certainly been greatly over-estimated. Rotation, as is well known, exercises no influence in generating motion in any body placed on the earth's surface; but if this body be already in motion, no matter in what direction the motion may be, rotation will deflect it to the right on the northern hemisphere, and to the left on the southern hemisphere, as has been shown by Mr. Ferrel. But it must be borne in mind that the deflecting power of rotation depends wholly on the rate at

which the body is moving. If difference of specific gravity be regarded as the impelling cause of any current, the deflecting power of rotation will certainly be infinitesimal.

Difference of specific gravity, resulting from difference of temperature between the ocean in equatorial and polar regions, might, if sufficiently great, produce some such interchange of equatorial and polar water as Dr. Carpenter supposes; but surely the difference of temperature between the equator and the poles could not produce currents like the equatorial current and Gulf Stream in a wide expanse of water. Such a general difference of temperature might tend to produce a general motion of the ocean; but it is inconceivable that it should produce motion in particular parts of the ocean, as Maury, Colding, and others, conclude.

But I think it is by no means difficult to prove that the circulation of the waters of the ocean cannot be due to the difference of temperature between the equatorial and polar regions. And Dr. Carpenter must be mistaken in supposing that it requires great mathematical skill to determine the value of the forces to which he attributes the circulation of the ocean. The whole subject, when properly viewed, resolves itself into a mechanical problem of such extreme simplicity as not to require for its solution the aid of any mathematics whatever in the ordinary sense of the term. Taking Dr. Carpenter's own data as to the difference of temperature between the waters at the equator and the poles, and also his estimate of the rate at which the temperature of the equatorial waters decreases from the surface downwards, I have, in my paper in the *Philosophical Magazine* for October last, proved that the amount of *force* which gravity exerts on, say, a pound of water, tending to make it move from the equator to the poles supposing the pound of water to be placed under the most favourable circumstances possible, is only $\frac{1}{500}$ of a grain.

I have shown also that the greatest amount of *work* that gravity can perform in impelling the waters from the equator to the poles as a surface current, and back from the poles to the equator as an under current (assuming that the waters would actually move under an impulse so infinitesimal) is only nine foot-pounds per pound of water. And in regard to the Gibraltar current, the amount of work which gravity can perform does not exceed one foot-pound per pound.

If these results be anything like correct, and it be admitted that a force so small is insufficient to produce the necessary motion, then it is needless to expect that any future observations in reference to currents of the ocean will in the least degree aid Dr. Carpenter's theory; for, supposing it were found that the waters of the ocean do circulate in some such manner as he concludes—a supposition very improbable—still we should be obliged to refer the motion of the water to some other cause than to that of differences of temperature. JAMES CROLL

Edinburgh, Dec. 22, 1871

"Nature Worship"

IN a spirited article under this title in the last number of the *Medical Times and Gazette*, we are accused of "the most dismal want of appreciation of the true scope of the medical art and science." This is hard! The ground for it is to be found in the following sentences in the short notice of the Brown Institution in NATURE of Dec. 21:—

"The true physician fears to meddle with the processes of which he is the attentive and anxious spectator. Although the more ignorant members of the medical craft—the so-called 'practical' men—may sometimes, with the best intentions, experiment on their patients with harmful drugs, such experimentation is repudiated by the man of Science."

If objection had been taken by our guarded suggestion that it may happen that practitioners may sometimes use powerful agents by way of remedies without any adequate knowledge of their property, we should not have been surprised, and would have been very willing to apologise had we been assured that the insinuation was unfounded. What our critic finds fault with, however, is the second part of the sentence, viz., our assertion that such experimentation on human beings with harmful drugs is objectionable. If experiments had never been made on human beings, he argues, we should not have learnt to know some of our most useful and valuable drugs. This may be so; but even if it is, it perhaps scarcely affords a sufficient justification for a continuance of the practice.

In another part of the article we are accused of "unconsciously reproducing the superstitious and false philosophy of 2,000 years back," and we are distinguished by the epithet "Nature worshippers." Let us quote the superstitious sentence which has laid us open to so unexpected an imputation:

"The pathologist at the bedside is not in the position of an experimenter, but only in that of a student, who stands by at a greater or less distance; while another over which he has no control performs experiments in his presence without deigning to explain to him their nature or purpose."

By these words we are supposed to imply that while nature works we worship. Does the student who stands by while the professor performs an experiment in his presence, the nature of which he very imperfectly understands, ready to help if need be, but fearing to meddle or even ask a question least he spoil the wished-for result, worship his teacher? Or is it the mere speaking of Nature as a teacher at all that is superstitious and unphilosophical?

The truth is, that our contemporary has obviously found the sentences quoted from our article a convenient text for a telling homily on a subject with which our remarks had nothing whatever to do. Our object was to point out that for the purposes of pathological investigation, and for trying the action of unknown remedies, a fellow mortal stretched on a sick bed is not a fit subject; that it is better to use dogs, cats, and rabbits. His aim, on the other hand, is to impress upon his readers the important practical lesson, that the doctor when called to see a patient must not stand by inactive, but use every means at his disposal for the relief of suffering and the prolongation of life. If he had found that he could add force to the admonition by clothing it in figurative language, and had said that the physician should grapple with the disease as with a fiend, it would not have occurred to us to call him a "devil worshipper."

THE WRITER OF THE NOTICE

Prof. Helmholtz and Prof. Jevons

JEALOUS of any and every restriction to that full liberty of scientific thought which cannot be over-advocated, we have recently gone so far as to deny the necessary and universal validity of the old axioms or "self-evident principles," not only in geometry, but in logic. Now I would submit that, if without *some* elementary or initial certainties all scientific thought is impossible, we must either retract these denials altogether, or so far limit them as to leave the logical certainties intact. But can we do the latter while geometrical axioms are in dispute? Towards answering this question, I propose to consider the hypothesis advanced by Prof. Helmholtz, to be found in NATURE, No. 103, October 19, and ably commented on by Prof. Jevons.

In order to show how geometrical axioms, with conclusions based thereon, may not be necessarily or universally true, Prof. Helmholtz tells us "to imagine the existence of creatures whose bodies should have no thickness, and who should live in the mere superficies of an empty globe," and then, as a consequence, to admit that, "while, with us, the three angles of a rectilineal triangle are exactly equal to two right angles, with them, the angles of a triangle would always, more or less, exceed two right angles." I propose to show that this position, so far as it affects the question, contains a logical uncertainty and unsoundness, which, if admitted, would vitiate all reasonings whatsoever.

We should premise that the "imagined creatures" are supposed to be "in possession of human powers of intellect," however their external conditions differ from ours. This assumed (and conceded), Prof. Helmholtz has to prove that the assumed difference of the external conditions will necessitate the intellectual difference assigned in his hypothesis; but he cannot assume this also without begging the whole question.

Let us first ask, what here is the import of the expression, "with them, the angles of a triangle would always, more or less, exceed two right angles"? To take the term "exceed," do the supposed beings detect the excess, or not? If they do, they find these three angles exceed two of our right angles, and they are acquainted with our right angles, and are consequently capable of conceiving four such rectilinear angles, and, thence, a rectilinear triangle with all its angles together equal to two right angles; and thus the entire supposition is unproductive. If we assert now that they do not detect the excess because they cannot, under their new conditions, conceive a rectilinear figure, we are simply begging the question we proposed to institute, viz., whether we derive our geometrical notions through our conditions, or whether these notions are intuitive? And, lastly, if we say that the beings in question take the spherical angles they have for rectilinear angles, and their four equal angles about a

point for four right angles, *i.e.*, that they have our notion, but misapply it; then it follows that they have our conclusion, that the angles of a triangle together equal two right angles; and their misapplying does not avail anything, seeing that the geometrical conclusion (the universality of which is here disputed) does not propose to deal with facts, but with suppositions only. The supposed rectilinear figures of these beings are (though wanting all physical counterparts) the very figures of Euclid.

Now, first, the fallacy lies in what the late Professor John Grote called the "pseudo-psychology," the confusion of thought and thing, of the psychical and the physical. For the question is here of geometry, the science which regards (say) all the supposed or postulated rectilinear angles about a point as equal to four right angles: the question is not of the physical science which discovers "more or less" exactly what angular or other qualities may belong to any physical object; and so true is this, that geometry is not conversant with right and left hand, nor with above and below. And, secondly, the fallacy is concealed by an ambiguous use of terms in the statement, "with them, the angles of a triangle would always, more or less, exceed two right angles." The "with them" may mean with them in imagination, or with them in fact; and, but for this ambiguity, the fallacy must have exposed itself; for, first, it is obvious that two angles which they imagined right ones would, in their imagination, equal, and not be "exceeded by," the angles of a triangle they imagined rectilinear; we could not have said otherwise than this, with the case clearly stated And, secondly, we could never have said (distinctly) that the physical fact being one way or another, could affect the universality of a geometrical position which does not affirm anything of physical facts; but we should have perceived that we were only combating a statement that the angles of a physical triangle supposed to be, though not really, rectilinear, are together really equal to two right angles; a statement obviously not true, and as obviously not geometrical.

In mathematical argument, anything I should bring in aid of Prof. Jevons's able comments would be equally presumptuous and useless; and it is only because I feel that his reasonings are not quite so unassailable on the psychological side that I venture any additional evidence. Prof. Jevons asks (I think needlessly), "Could the dwellers in a spherical world appreciate the truth of the 32nd proposition of Euclid's first book? I feel sure that, if in possession of human powers of intellect, they could. In large angles the proposition would altogether fail to be verified; but they could hardly help perceiving that, as smaller and smaller angles were examined, the spherical excess of the angles decreased, so that the nature of a rectilineal triangle would present itself to them under the form of a limit." Now the terms "spherical excess" here mean the quantum by which all the angles of their triangle would, to the knowledge of these beings, exceed two *bonâ fide* right angles. They therefore know already (by Prof. Jevons's supposition) what a rectilinear angle is, and, thence, what a rectilinear triangle is with all its geometrical properties (as above shown), for it is admitted that we require no objective experience beyond that of a rectilinear angle in order to deduce said properties, and these beings, having our intellectual powers and our data, can deduce the same. I would only suggest here that, after this, to suppose any experimental evidence necessary to "verify" the proposition is very much like conceding the hypothesis that geometrical conclusions are not independent of experience.

Another point not directly met by Prof. Jevons is ingenious, but amounts to the assertion that, if we could not actually *draw* a straight line, we should not be able to define it as "the shortest distance between two points;" for these imagined beings, who cannot possess a physical straight line, will have "an infinite number of shortest lines between any two diametrically opposite points in their sphere." An argument, interesting only so far as it illustrates to what lengths of ingenuity a sophism may be carried; for have we not to prove that our geometrical conception or definition depends upon our physical experience, and are we not here advancing for proof, that beings without this experience cannot have the geometrical conception, and that they cannot have it because—we cannot have it? If anything could convince us of the inherent impotence of these *experimental hypotheses*, it should be this inevitable appearance of the "circle" just when proof is called for. And again, "shortest distance" here has two senses. First it means the shortest path available to the imagined beings, and then (in order to invalidate the definition of a straight line) it means the shortest path conceivable.

In this case it appears then (as I proposed to show) that, while the geometrical certainties have been questioned, the logical code has been violated, and all logical certainty confounded by an ambiguous use of terms. I have here attempted no demonstration of the opposite theory; but I think if the eminent supporters of the hypothesis just examined would be content to affirm roundly that all our notions, conclusions, and beliefs are mere resultants of intellectual action *plus* given experience, and to forbear any hypothetic deductions till this thesis is made good, they would find that the essence of the question is distinctly psychological, and that any experiments with hypothetical physics are so many attempts to get out of a complex thing that which is simply not in it.

J. L. TJPPER

Meteorological Phenomena

ON the 10th of November, a little after 4 P.M., the sun was behind a bank of thick stratus clouds, on the upper edge of which, attached to it, about 10° above the sun's position, and 15° to 20° to the north of it, I, with two other persons, observed a small irregularly-shaped cloud, about 2° in apparent diameter, which exhibited the colours of the least refrangible portion of the spectrum, commencing with the red on the south end nearest the sun, succeeded by orange, yellow, and pale greenish yellow, fading into white on the north edge, the rays being perpendicular. This appearance continued for about five minutes or upwards while we viewed it, and then faded away. Though the phenomenon appears simple, the light cloud merely refracting the sun's rays, it is not evident why the complementary colours of the more refrangible portion of the spectrum should not have been visible; and, as far as I am aware, a similar appearance has not been recorded before. G. F. D.

IN NATURE of August 31 there is a note headed, "A Rare Phenomenon," from Magdeburg. Your correspondent, I think, evidently refers to what in India, or at any rate in Ceylon, is called "Buddhu's Rays," an appearance in the sky very commonly observed here, and for which I have never heard any scientific explanation attempted. I regret to say that hitherto I have never taken any exact notes of the position of these rays. They generally occur, I think, when the sun is low, sometimes in the west at sunset, but also occasionally in the east. The appearance presented is that of alternate broad streaks of rose colour and blue radiating from one point on the horizon, and extending, I should say, for about thirty or forty degrees. I will, whenever I see them in future, take exact notes of their position, &c. At present I can only say that I certainly think that dust in the atmosphere can take no part in their production.

Colombo, October 1871 BOYD MOSS

Crannogs in the South of Scotland

IT may interest some readers of NATURE to learn that a considerable number of crannogs, various articles of the New Stone Period, and some "kitchen-middens" have been discovered in connection with the small lochs which stud the surface of Wigtonshire and Dumfriesshire. Dowalton Loch, Machermore Loch, and the lochs which surround Castle Kennedy in Wigtonshire, have been examined within the last few years, and have disclosed ancient lake-dwellings. The Black Loch of Sanquhar and Lochmaben Loch in Dumfriesshire contain platforms of wood and stone. In some cases canoes and causeways connecting the artificial islands with the adjacent shores have been traced. Sir William Jardine, in his presidential address to the Dumfries Natural History Society, 1864-5, gives an interesting account of the crannog discovered at Sanquhar Black Loch; and recently the Rev. Geo. Wilson, Glenluce, read a detailed description of the crannogs in his vicinity to the Scottish Antiquarian Society.

J. SHAW

Freshwater Lakes without Outlet

IN your notice of Morelet's "Central America" (NATURE, December 28, 1871) you speak of the water of the lake of Peten as fresh, though without an outlet. This is uncommon, but not unexampled. The lake of Araqua in Venezuela, described by Humboldt, is of this kind, and so are the lakes near Damascus, into which the Abana and Pharpha respectively discharge. The best account of these latter is, I believe, in Mr. Macgregor's work, "The *Rob Roy* on the Jordan."

JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim, Jan. 1

Pupa of Papilio Machaon

WHILST working at the colour patterns of Insects in November 1867, I very carefully dissected off a portion, about one-eighth of an inch square, of the hard integument from the side of a pupa of *P. Machaon*, near the anterior extremity. The portion of the interior thus displayed was filled with a clear colourless fluid, in which was floating a delicate membrane, to which were attached several tubes, trachea, formed by a spiral fibre. In the fluid were floating many roundish grains. Another pupa of the same brood was examined January 15, 1868, and another on April 15. The floating grains were now evidently made up of ganglia of the spiral fibre of the trachea, and were connected with the tube by long pedicels of the same kind of fibre. On May 20 the tubes had enlarged to such an extent that they were almost contiguous, and were covered with minute granules, apparently incipient scales; in fact, a few small but well-formed scales appeared on one portion. The specimen examined in November was laid in cotton; a perfect cicatrice was formed, and the butterfly in excellent condition appeared at the usual time.

Rainhill, December 23, 1871 HENRY H. HIGGINS

Lunar Calendars

IN reply to "Myops" in NATURE, No. 111, p. 123, the English New Moon of the Jews is really the Month-Head (*Caput mensis*), formed from an artificial system. The true mean conjunction derived from the 19-year cycle is called the Molad or Moon-Birth, and generally differs from the festival-day.

Said artificial system consists in combining AZ, BY, CX, &c., as follows :—

1st	Day of Passover	has	Black Fast (9th Ab)	on same week day.
2nd	,, ,,	,,	1st of Pentecost.	do.
3rd	,, ,,	,,	1st of New Year (Tishri).	do.
4th	,, ,,	,,	Last of Tabernacles—Rejoicing of Law.	do.
5th	,, ,,	,,	White Fast (Atonement Day).	do.
6th	,, ,,	,,	Preceding Purim (Esther's Feast.	do.

This actual Jewish Calendar depends on the Moveable Feasts, 1st Passover never falling on Monday, Wednesday, or Friday.*

39, Howland Street, W., Dec. 15, 1871 S. M. DRACH

Hints to Dredgers

APPEALED to by name—spirits from the vasty deep—I have waited for my elders, also named, to answer Mr. Hennah's queries about dredging, and, failing to see anything more, I venture to trouble you with a few lines, the more so as I felt the want of advice when I was fitting out the *Norna* in 1870. Details would be out of place here; I will only at present give a few hints. And first—to repeat Punch's advice to those about to marry—if about to buy a yacht, DON'T! Begin by hiring one of the tonnage you require, the proper price being 1*l.* 5*s.* per ton per month, including the wages of skipper and crew, but rarely of cook or steward. After your first season buy by all means if you like.

If bound on a long cruise your craft should not be under 80 to 100 tons. But for dredging in the Channel or round our coasts 25 tons and upwards are sufficient; but not on any account under that. A little boat of 25 tons makes up two good berths and two more possible ones, exclusive of the crew's sleeping quarters, and being decked stands a good chance in a gale of wind.

Beware the discomfort of a half-deck and a small boat, remembering that you may unavoidably have to face some nasty breezes which an ordinary yachtsman would run away from. You may, for instance, be caught in a bay offering rich results, and have to thrash out of it.

Hire a man knowing the locality in which you desire to try your fortune.

Take a particular line, say the comparative life on the borders of fresh and salt water junctions, or at spots where the depth suddenly increases. No better locality, with a good pilot, could be picked out to begin with than the Channel Islands.

Especially note the submarine geology. Exactly fix the spots you dredge in by cross bearings. A small prismatic compass is invaluable, both afloat and ashore. Take carefully temperature, current, tidal observations, a multitude of soundings, and keep specimens of all. Fill a private log-book with the most trivial and infantile details. You will afterwards laugh at much you have noted; but it is a great gain, and, unlike partridges, impressions are best fresh.

This is not the occasion to go into matters of outfit. One thing I must name, on no account let any man on board be without a life-belt for his own use.

Any intending dredger writing to me at this club will be cordially answered. A small squadron of yachts working together under a commodore of their own election would partition the labour, and produce a little emulation among the crews. Make a rendezvous every few days, and talk results over.

MARSHALL HALL

New University Club, St. James's Street, S.W., Jan. 6

Anacharis Canadensis (A. Alsinastrum)

I SHOULD esteem it as a favour if you would allow me to ask, through the medium of NATURE, if there be any published account of observations, confirmatory or otherwise, of Mr. Wenham's notes on the free-cell formation which he has described as being carried on at the terminal growing point of *Anacharis*, quoted by Dr. Carpenter in "The Microscope and its Revelations," p. 405, *et seq.* (3rd ed.) H. POCKLINGTON

FIGHT BETWEEN A COBRA AND A MONGOOSE *

THE snake was a large cobra 4 ft. 10½ in. in length, the most formidable cobra I have seen. He was turned into an enclosed outer room, or verandah, about 20ft. by 12 ft., and at once coiled himself up, with head erect, about ten or twelve inches from the ground, and began to hiss loudly. The mongoose was a small one of its kind, very tame and quiet, but exceedingly active.

When the mongoose was put into the rectangle, it seemed scarcely to notice the cobra; but the latter, on the contrary, appeared at once to recognise its enemy. It became excited, and no longer seemed to pay any attention to the bystanders, but kept constantly looking at the mongoose. The mongoose began to go round and round the enclosure, occasionally venturing up to the cobra, apparently quite unconcerned.

Some eggs being laid on the ground, it rolled them near the cobra, and began to suck them. Occasionally it left the eggs, and went up to the cobra, within an inch of its neck, as the latter reared up; but when the cobra struck out, the mongoose was away with extraordinary activity.

At length the mongoose began to bite the cobra's tail, and it looked as if the fight would commence in earnest. Neither, however, seemed anxious for close quarters, so the enclosure was narrowed.

The mongoose then began to give the cobra some very severe bites; but the cobra after some fencing forced the mongoose into a corner, and struck it with full strength on the upper part of the hind leg. We were sorry for the mongoose, as but for the enclosure it would have escaped. It was clear that on open ground the cobra could not have bitten it at all; while it was the policy of the mongoose to exhaust the cobra before making a close attack. The bite of the cobra evidently caused the mongoose great pain, for it repeatedly stretched out its leg, and shook it, as if painful, for some minutes. The cobra seemed exhausted by its efforts, and putting down its head, tried hard to escape, and kept itself in a corner. The mongoose then went up to it and drew it out, by snapping at its tail, and when it was out, began to bite its body, while the cobra kept turning round and round, striking desperately at the mongoose, but in vain.

When this had continued for some time, the mongoose came at length right in front of the cobra, and after some dodging and fencing, when the cobra was in the act of striking, or rather, ready to strike out, the mongoose, to the surprise of all, made a sudden spring at the cobra, and bit it in the inside of the upper jaw, about the fang, and instantly jumped back again. Blood flowed in large drops from the mouth of the cobra, and it seemed much

* For Mahommedan Calendar inquire of a Moslem, or such an authority as Capt. R. J. Burton, the famous Hajji El-Iraki, and Consul to El-*Sham*.

* The following interesting narrative has been obligingly forwarded to us by Prof. Andrews, of Queen's College, Belfast.

weakened. It was easy now to see how the fight would end, as the mongoose became more eager for the struggle. It continued to bite the body of the cobra, going round it as before, and soon came again in front, and bit it a second time in the upper jaw, when more blood flowed. This continued for some time, until at last, the cobra being very weak, the mongoose caught its upper jaw firmly, and holding down its head, began to crunch it. The cobra, however, being a very strong one, often got up again, and tried feebly to strike the mongoose; but the latter now bit its head and body as it pleased; and when the cobra became motionless and dead, the mongoose left it, and ran to the jungle.

The natives said that the mongoose went to the jungle to eat some leaves to cure itself. We did not wish to prevent it, and we expected it would die, as it was severely bitten.

In the evening, some hours after the fight, it returned, apparently quite well, and is now as well as ever. It follows either that the bite of a cobra is not fatal to a mongoose, or that a mongoose manages somehow to cure itself. I am not disposed to put aside altogether what so many intelligent natives positively assert.

This fight shows at any rate how these active little animals manage to kill poisonous snakes. On open ground a snake cannot strike them, whereas they can bite the body and tail of a snake, and wear it out before coming to close quarters. This mongoose did not seem to fear the cobra at all; whereas the cobra was evidently in great fear from the moment it saw the mongoose.

Ratnapura, Ceylon, April 11, 1871 R. REID

AUSTRALIAN PREPARATIONS FOR OBSERVING THE SOLAR ECLIPSE

THE following letter has been received at the office of the English Government Eclipse Expedition, from the Government Astronomer at Melbourne:—

"Melbourne Observatory, Nov. 4, 1871.

"My dear Sir,—The Eclipse instruments, copies of instructions, and your letter, reached me safely. Some of the instruments slightly damaged however, though not serious. About half the collodion bottles broken.

"The organisation of the Expedition is not yet quite complete; but a start, I think, is now certain. About 1,000*l.* has been contributed by various Australian colonies:—Victoria, 450*l.*; New South Wales, 300*l.*; South Australia, 100*l.*; Queensland, 100*l.*; and we expect to get 50*l.* from Tasmania. The cost of steamer, &c., will be from 1,400*l.* to 1,500*l.* Twelve or fourteen amateurs have joined, paying 30*l.* each for passage. The voyage will occupy about four weeks, including a week or ten days at Cape Sidmouth. The country at Sidmouth is quite unknown, and inhabited only by Aboriginals, who, although not very warlike, are often exceedingly troublesome. Little is known of facilities for landing, &c., but as there are several coral islands in the vicinity, it is possible we may select some of them for observing stations, as they can easily be reached by laden boats. The whole of the coral sea inside the barrier reef is nearly always smooth water, so there cannot be much surf to contend with. The Expedition will have to start from here about the 20th instant.

"Now, about our equipment:—First, we have Grubb's integrating spectroscope, which, by-the-bye, was considerably damaged; it had got adrift from its packing, and had evidently made sundry excursions of its own inside its case. Our instrument maker has set this right, and it is now in good working order, and I tried it with the hydrogen spectrum yesterday, and it performs satisfactorily.

"Second, the large field analysing spectroscope came out all right, only one reflector of the kind indicated available, and that altazimuth mounting, Browning 8-inch. We can hear of no others. We are busy making equatorial mounting for this, but I am afraid we shall have no time to apply clock-work. One five-inch equatorial with its clock-work will be devoted to photographs, for this purpose the telescope will be dismounted and camera substituted, as no good can be done with both.

"Third, Photography. We shall have to confine ourselves to the operations with the camera as indicated in instructions, and we are doing all we can to ensure good results.

"Fourth. Polariscope work.—The two polarimeters came all right. Prof. Wilson, of our University, has offered to take charge of polariscope observations; his experience in experimenting on polarised light will ensure this part being thoroughly done if clouds permit.

"I think we thoroughly understand all the instruments and the instructions, and intend to take up such observations which appear from the latter to be most desirable, and for which we have instrumental means.

"We have sets of Kirchhoff's and Angström's maps here, we shall have several hand spectroscopes, opera-glasses, &c., provided for general observations.

"The little tube with the compound spectra of Mg, Ba, &c., appears to require Leyden jar and coil and a strong current, even then I am doubtful if it can be used.

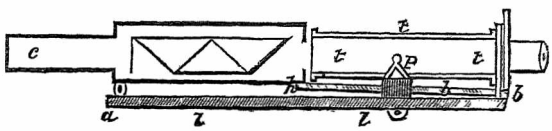
"We take up one or two field instruments to determine position, &c.

"The observing party of Melbourne will number about nine, that from Sydney about six. We can at best only form two observing stations, and those not many miles removed from one another. Sydney observers, under Mr. Russell, will be engaged principally in photographs with refractor and spectrum work (analysing), and possibly we shall be able to arrange some polariscopes for them.

"I shall send you the earliest possible information of our success or otherwise on our return, which will be about Christmas.

"Our chances of fine weather are somewhat doubtful, as the cloudy N.W. monsoon generally sets in about the middle of December; it appears, however, that this seldom fairly sets in till after Christmas, and as the eclipse takes place on the 12th, we have some reason to hope for success.

"We are trying to get a recording spectroscope ready, but I am afraid there is scarcely time to finish it. The small telescope has a loose tube around it, covered with paper. The eye-piece and pointer slip across the field, and are made to do so by a long lever, moved by a pricking frame.



ttt is a loose tube forming recording barrel, *bb* is attached to eye-piece by flat spring, *ll* long lever pointed at *a*, *h* slide bar parallel to telescope, *p* pricker frame which slides along *b b* crossing eye-piece and pointer to traverse field (the lever and slide bar are drawn too parallel, they should be more inclined to one another). By moving *p* up and down the slide bar the pointer is made to coincide with a line, and the pricker *p* is pressed—after pricking one set the loose tube is slightly revolved, and a second set obtained. It is nearly complete, but has not been tried yet. I hope you will have good success in India.

"At Cape Sidmouth we shall have 3m. 34s. totality, the sun at an altitude of about 45°, a more convenient position than I thought before the data were computed. Like you, we are working almost night and day to get ready, for it was only a fortnight ago I had authority from Government to organise a party and prepare instruments. Again wishing you the best success,

(Signed) "ROB. L. J. ELLERY

"J. NORMAN LOCKYER, ESQ."

ELECTROPHYSIOLOGICA :

SHOWING HOW ELECTRICITY MAY DO MUCH OF WHAT IS COMMONLY BELIEVED TO BE THE SPECIAL WORK OF A VITAL PRINCIPLE

II.

2. How Electricity may do much of what is commonly believed to be the work of a vital principle in muscular action.

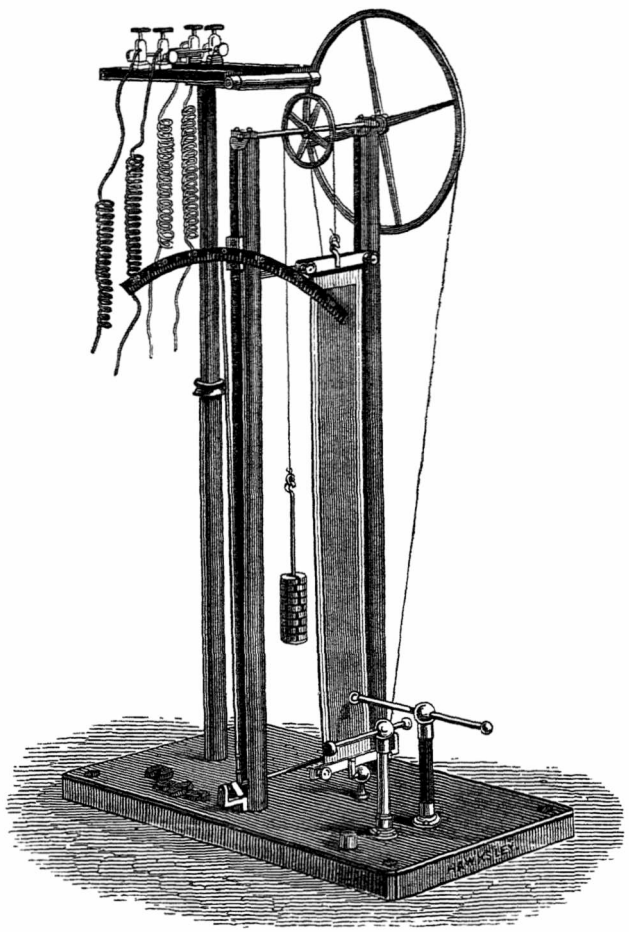
I HAVE long held that a vital property of "irritability," or "tonicity," was unnecessary in muscular action. As it seemed to me, the state of relaxation in living muscle was to be accounted for by the mutual repulsion of molecules arising from the presence in the muscle at the time of a charge of electricity, sometimes positive, sometimes negative; as it seemed to me, muscular contraction, whether in ordinary muscular action or in rigor mortis, was nothing more than the result of the operation of the elasticity of the muscle upon the discharge, sudden or gradual, of the charge which had previously kept up the state of relaxation. And I still hold that the state of relaxation is caused by the presence in the muscle of a charge of electricity, and that muscular contraction is brought about by the elasticity of the muscle coming into play upon the discharge of this charge; but, since I began to work with the new Quadrant Electrometer of Sir Wm. Thomson, I have been obliged to take a different view of the way in which the charge operates in causing relaxation. The fact, discovered by means of this instrument, that there are two charges of electricity in muscle, positive *and* negative, was fatal to the idea that the state of relaxation was due to the mutual repulsion of molecules consequent upon the presence in muscle of a single charge, positive *or* negative. With either charge singly the idea might be entertained, though it was not easy to understand how, wanting effectual insulation, the electricity could be kept to its work; with two opposite charges, on the contrary, the attraction of each charge for the other *must* neutralise the repulsion arising from the presence of either singly. Nor did I find a way of escape from this difficulty until I began to seek it in a totally different direction, even in the theory according to which the sheath of muscular fibre during rest is charged as a leyden-jar is charged. Is it possible, I asked myself, that the two opposite charges, disposed leyden-jar-wise upon the two surfaces of the sheath, may cause elongation of the fibre by compressing between them the elastic sheath? Opposite charges of electricity *must* attract each other; that was plain enough. Opposite charges attracting each other across an elastic sheath *may* compress that sheath in such a way as to cause elongation of the fibre; that was not impossible. Upon this view, too, there was no difficulty in understanding how each charge was prevented from escaping, and made to work in this manner, by the mutual attraction of each for the other. In a word, the idea that the two charges might act in this way in causing muscular relaxation was far more easy to realise than that which regarded the state of relaxation as the result of the muscular molecules being kept in a state of mutual repulsion by the presence of one charge in the muscle. And so it was that it became necessary to look into this matter a little more closely—to put it to the test of experiment, as best I could.

In order to this, I began by inquiring whether the idea in question was possible or not. I wanted to be certain that the mutual attraction of two charges of electricity, dispersed leyden-jar-wise upon the two surfaces of the sheath of the fibre, would cause elongation, and that the discharge of this charge would be followed by contraction; and, after several abortive attempts, I found what I wanted, and more than I expected at first, by the means which are represented in the accompanying figure.

Vulcanised india-rubber sheeting being at once elastic and dielectric, it occurred to me that this material was the very thing for putting to the test of experiment what I believed might happen in the elastic and dielectric sheath of muscular fibre. I therefore took a band of this sheeting, provided it with the conducting surfaces necessary for charging and discharging it as a Leyden-jar is charged and discharged, and had constructed an apparatus for showing whether or not the anticipated changes in length were produced by this charging and discharging. The band (which is to be regarded as the counterpart of a *strip* of the actual sheath of the muscular fibre) is 14 in. in length by 2 in. in breadth, the commercial number of the india-rubber sheeting being 30. The necessary conducting surfaces to allow of the charging and discharging are made by painting the band on each side with fluid dutch-metal, care being taken to leave at the edges a sufficient unpainted margin to secure the necessary insulation of the two painted surfaces. The frame-work of the apparatus consists of two strong brass pillars, 18 in. in height, and 4 in. apart, rising from a flat brass stand. Across these pillars work two axles, horizontal in direction and parallel to each other—the one at the top, the other near the base, immediately above the stand. At the middle of the upper axle, midway between the pillars, is a wheel with a grooved edge, 2 in. in diameter, which may be called the driving-wheel; at one end, which projects beyond the pillar on that side, is another and larger wheel, 6 in. in diameter, also with a grooved edge, which may be called the multiplying-wheel. At one end of the lower axle, beyond the pillar on that side and immediately under the multiplying-wheel is a collar with a grooved edge; at the other end, also beyond the pillar on that side, is a socket for carrying a long index, of which the free end moves backwards or forwards before a graduated arc fixed immediately over the socket upon the same pillar near its top. The two axles move together, the upper telling upon the lower by means of an endless band which at one and the same time bites in the grooved edge of the multiplying-wheel at the end of the one, and in that of the collar at the end of the other; and thus the movements of the index before the graduated arc are made to represent a very considerable exaggeration of the movements of the upper axle. The india-rubber band is clipped at each end in a clamp, acting by screws, and having a hook on its free edge; and, being so clipped, it is fixed in a a vertical position by passing the hook on the clamp at its lower end into a socket provided for it on the stand, and by attaching the hook on the clamp at its upper end to a string which passes over the grooved edge of the driving-wheel to a short hanging rod with a button at its lower end, upon which rod are to be slipped coin-like weights, notched in the centre for this purpose, which weights have to be so adjusted as to put the band gently upon the stretch. In this way the band is so fixed that it cannot lengthen or shorten without these changes being made to tell upon the index, for as it lengthens or shortens, the driving-wheel which moves the index must be made to turn this way or that by the string which bites into its grooved rim in passing from the band to the weights. For charging and discharging, two short pillars are fixed to the stand in front of and at a short distance from the bottom of the band, that for the former purpose having an ebonite shaft, that for the latter being altogether metal; and through holes in the caps of these pillars the rods which are intended to serve as the actual channels for the charge and discharge are made to slide horizontally backwards or forwards in a suitable direction. In charging, the electricity is supplied to the metallic surface on the front of the band by pushing forwards the charging rod so as to touch this surface, and at the same time taking care that the discharging rod is drawn back so as to leave the necessary break in the circuit. In discharging, the discharging rod is pushed home so as to complete the circuit between the two opposite

metal coatings of the band by touching the centre of the charging rod. And for the rest, all that need now be said of the apparatus (this is not all that has to be said, but what remains has to do with a totally different set of experiments, and had better be reserved until the time comes for dealing with these experiments) is, that in order to allow of this charging and discharging, the metal surface at the back, instead of being insulated all round like the metal surface at the front of the band, is put in communication with the earth by bringing it down a little so as to allow it to be clipped by the metal clamp which fixes the band to the stand.

In the actual experiment with the band, all that has to be done is first to charge and then to discharge, watching the index the while. It was anticipated that the band would elongate with the charge, and shorten with the discharge, and this is what happens in fact; for on charging, the index at once moves before the graduated arc in the way which shows that the band elongates in proportion to the charge, and on discharging it suddenly jumps back again to the position it occupied before the charging, these forward and backward movements being through 40° or 60°, or even over a still wider range, and not merely through one or two degrees. The band plainly elongates in proportion to the charge. The band as plainly shortens in proportion to the discharge, suddenly or gradually, as the



case may be, suddenly if the charge be augmented until it overleaps the barriers of insulation, or if the discharge be brought about by pushing home the discharging-rod, gradually if the band be charged and then left to discharge itself slowly by keeping back the discharging-rod. And these results are constant, provided only before charging and discharging the weights attached to the band are so adjusted as to balance without overbalancing the elasticity of the band—a matter which is easily managed with but little patience and practice.

All, in fact, that was anticipated is fully borne out by the experiment. And thus it may be taken for granted that elongation of the muscular fibre *may* be caused by the attraction of two opposite charges of electricity disposed leyden-jar-wise upon the two surfaces of the sheath of this fibre, and that contraction of this fibre *may* follow the discharge of these charges; for what is assumed to happen in this case is nothing more than what does actually happen with the band of india-rubber sheeting under perfectly analogous circumstances.

But if this be the way in which muscular fibre may be affected by its natural charge and discharge, how will it be affected by an artificial charge of the same kind? Will this artificial charge—the sheath being still a dielectric—act like the natural charge, the charge imparted to one side of the sheath inducing an equivalent amount of the opposite charge on the other side? Will the artificial charge, presuming it to be larger in amount than the natural

charge, overrule the natural charge? Will the artificial charge, thus larger in amount than the natural, produce a greater degree of elongation in the muscular fibre than that which is natural to the fibre? Will the contraction following the discharge of this artificial charge be greater in amount than that which is natural to the fibre, because the elasticity of the muscle has freer play under these circumstances? These questions, and others also of a like nature, are suggested by the experiment upon the elastic band; for not only does the band elongate with the charge and shorten with the discharge, but the elongation and shortening are manifestly in proportion to the amount of the charge and discharge. Nor are these questions unanswerable. On the contrary, answers may be found in more ways than one—in the examination of the phenomena of electrotonus more particularly; and these answers are in no way ambiguous in their meaning.

In electrotonus are strange modifications of muscular action. In electrotonus, too, as I have shown elsewhere,* are strange modifications of the electric condition of the parts, there being everywhere in the region of anelectrotonus a positive charge overflowing from the positive pole of the battery employed in the production of electrotonus, there being everywhere in the region of cathelectrotonus a negative charge overflowing from the negative pole of the same battery. In anelectrotonus there is a positive charge, not only present, but at work; in cathelectrotonus there is a negative charge, not only present, but at work. At work certainly, for as I have shown, the movements of the needle of the galvanometer characteristic of electrotonus are caused by the movement, not of a voltaic current, but of these charges through the coil of the instrument, the movement of cathelectrotonus by the flow of the negative charge, that of anelectrotonus by the flow of the positive charge. At work also, as I have also shown, in modifying muscular action. At all events, the presence of a positive charge in anelectrotonus and of a negative charge in cathelectrotonus are facts, and therefore I am justified in looking to the phenomena of muscular action in the two electrotonic states with a view to find answers to the questions now under consideration.

At the onset of the inquiry, however, a grave difficulty has to be coped with—a difficulty as to facts, for the actual facts are not what they are believed to be. In a word, it is not true that the action of anelectrotonus upon muscular action is essentially different from that of cathelectrotonus. Differences there are no doubt, but not any that will prove to be of moment in the present place. It is a fact that muscular action is suspended, not in anelectrotonus only, but in cathelectrotonus as well as in anelectrotonus. It is a fact that muscular *elongation* is a phenomenon common to both electrotonic states. Nor are these the only points in the history of electrotonus which require to be looked into carefully. So that, before proceeding further in this matter, it is necessary to ascertain what are the facts which have here to be dealt with.

The true history of muscular action during electrotonus may be well seen in the gastrocnemius of a frog by means of certain experiments for the exhibition of which the apparatus already used in the experiment with the elastic band is furnished with certain parts which have yet to be described. These parts consist of a pillar and a platform resting upon it horizontally, the pillar rising from the side of the stand opposite to that occupied by the charging and discharging rods. The pillar has a telescope arrangement, by which its length may be altered, and a screw-collar, by which it may be fixed at any length. The platform consists of a four-sided metal floor, five inches in length by three in breadth, with a narrow and rather thick border of ebonite in which are two binding screws for holding electrodes upon each of its sides, with a long roller at one of its ends, and with a moveable gutta-percha cover of such a shape and size as to allow it to be slipped on and off between the ebonite borders, and fixed when on by having its edges made to play under the hollowed-out inner margins of the borders. In the actual experiment what has to be done is—to remove the elastic band and the weights attached to it—to fix the platform, so that it is a little behind and above the level of the driving-wheel, with the end to which the roller is attached turned towards this wheel—to fix the wires from the battery and induction apparatus to the binding-screws on the platform, the wires from the battery being carried to the side on which the screws are farthest from the roller (the battery, I should have said, consists of four medium-sized Bunsen-cells, and the induction-apparatus is one in which the secondary coil may be slipped altogether away from the primary—a Du Bois-Reymond's inductorium, in fact),—to prepare a frog's limb by stripping off the skin and dissecting away all parts of the thigh except the sciatic nerve,—to remove the gutta-percha cover from the platform, and pin upon it the prepared limb with its heel close to one end, care being taken not to injure the nerve or muscle in doing this,—to tie to the tendo-achillis the string which belongs to the weights,—to put back the gutta-percha cover into its place with the limb thus pinned and arranged upon it, the string attached to the tendo-achillis being brought out over the end which comes next to the roller,—to carry this string over the driving-wheel to the rod carrying the weights,—and to adjust these weights so as to put the gastrocnemius gently on the stretch,—and lastly, to draw out the nerve, and carry it first across the electrodes belonging to the induction-apparatus and then across those belonging to the battery, these electrodes, to allow of this, being made to point inwardly to a sufficient distance across the platform, two from one side, two from the other. In this way, when the circuits are closed (they are open at first) the nerve may be acted upon by voltaic and faradaic electricity as in an ordinary experiment in electrotonus. In this way, any change in the length of the gastrocnemius must tell upon the index, just as the changes in the length of the elastic band were made to tell, only in the contrary direction.

These arrangements being made, two experiments have to be tried, the one for exhibiting the action of anelectrotonus upon the gastrocnemius, the other for exhibiting that of cathelectrotonus, and each differing from the other only in the relative position of the voltaic poles, the positive pole being next to the insertion of the nerve into the muscle in analectrotonus, the negative pole being in this position in cathelectrotonus.

In the experiment for exhibiting the action of anelectrotonus upon the muscle—that with the positive pole in the position next to the insertion of the nerve into the muscle—there are three distinct steps, the first taken before setting up the state of anelectrotonus, the two others after this time.

The first step, or that which is taken before the establishment of anelectrotonus, is to tetanise the muscle with faradaic currents only just strong enough to act upon the muscle at all in this way. In this case the circuit of the induction-apparatus is closed, but not that of the voltaic battery, and therefore the nerve is acted upon by faradaic currents before the establishment of anelectrotonus. At first, the faradaic currents used are strong enough to tetanise the muscle effectually; then these currents are weakened by drawing away the secondary coil from the primary until the tetanus comes to an end; last of all, the tetanus is brought back again to the very slightest degree by moving the secondary coil back again towards the primary coil, and leaving it at the point where the currents produced in it just begin to have a tetanising action. This is the first step in the experiment.

The second step consists in the establishment of anelectronus while the nerve is still being acted upon by these feeble faradaic currents. Hitherto the circuit of the induction apparatus was closed, while that of the voltaic

* "Dynamics of Nerve and Muscle." Macmillan, 1870.

battery was left open. Now the latter circuit is also closed, and with this result—that the index gives a sudden great jump in the direction showing contraction, and then, immediately moving in the opposite direction to that signifying contraction, takes up a position on the other side of zero—at 15° or 20°, it may be—a movement showing, not contraction, therefore, but elongation. Eliminating, as non-essential, the strong contraction which happens at the closing of the circuit—for this has to do, not with anelectrotonus, but with the *extra-current* which traverses the nerve between the poles at the closing of the voltaic circuit—what happens, therefore, on the establishment of anelectrotonus is, first, *suspension of the tetanus* caused by the feeble faradaic currents; and, secondly, *elongation of muscle*. This is the second step of the experiment, and these the results.

The third step follows upon the second. Its object is to ascertain whether the tetanus may be made to return during anelectrotonus by slightly increasing the strength of the faradaic currents acting upon the nerve; and the way of arriving at this is to leave the voltaic circuit still closed, to go on moving the secondary coil of the induction apparatus nearer to the primary, and to stop the moment the faradaic currents acquire strength enough to call back any tetanus. And this is what happens—that after moving the secondary coil but a short distance towards the primary, the index shows, not only that the tetanus has reappeared, but that it has reappeared in greater force. Before the establishment of anelectrotonus, the tetanus caused by faradaic currents only just strong enough to tetanise the muscle carried the index to 20° or thereabouts; after the establishment, the tetanus caused by faradaic currents only just strong enough to exert a tetanising action moved the index to 40° or 60°. In a word, contraction may happen in anelectrotonus, and when it happens it is considerably increased in amount. This is the third step of the experiment, and this the result.

In the experiment for exhibiting the phenomena of cathelectrotonus—that in which the negative voltaic pole is placed next to the insertion of the nerve into the muscle—all the steps are the same, and so are the results. The setting up of cathelectrotonus suspends the tetanus caused by feeble faradaic currents, and causes elongation in the muscle. The tetanus brought back during the cathelectrotonus by currents only just strong enough to have a tetanising action is in increased force. The degree of elongation is the same as in anelectrotonus. The increase of contraction is the same as in anelectrotonus. The only difference, indeed, between the two experiments is this, that somewhat feebler faradaic currents serve to recall the tetanus in cathelectrotonus than those which were required to do this in anelectrotonus.

Nor are these facts at variance with those which are brought to light when the state of electrotonus is produced by a smaller amount of battery power—by a single element, for example. In this case it often happens (not always) that the tetanus caused by salt or very feeble faradaic currents is suspended by anelectrotonus, and intensified by cathelectrotonus. It seems as if there was an essential difference between this action of the two electrotonic states upon nerve and muscle, but after what has just been seen this is by no means a necessary conclusion. It has been seen that anelectrotonus has a greater power of suspending tetanus than cathelectrotonus, therefore tetanus may be suspended by anelectrotonus when it is not suspended by cathelectrotonus. It has been seen that during both anelectrotonus and cathelectrotonus contraction when it happens is greater than that which happens in the non-electrotonised state; and therefore, during cathelectrotonus, if tetanus be not suspended, it is likely to be intensified. This is all. The facts are in keeping with those which have gone before when they are properly looked into, and there is no ground in them for supposing that there is an essential difference between the action of anelectrotonus and cathelectrotonus—no ground for supposing that the effects of using a small battery power in the production of electrotonus are in any way different from those which attend the use of a larger power of this kind.

C. B. RADCLIFFE

CONJOINT MEDICAL EXAMINATIONS *

WE are able to open the new year with the satisfactory announcement that the last difficulty has been removed which impeded the action of the great medical examining incorporations of England in uniting to frame a conjoint scheme for a minimum examination, which will constitute, in fact, a single and uniform portal to the profession. All the committees of the bodies concerned have signified their approval of the following scheme:—

In view of the legal difficulties which have been stated by the Society of Apothecaries to prevent that society taking part in the formation of an examining board in this division of the United Kingdom, it was resolved:

I. That a board of examiners be appointed in this division of the United Kingdom by the co-operation of the Royal College of Physicians of London, the Royal College of Surgeons of England, and of such other of the medical authorities in England, mentioned in Schedule (A) to the Medical Act, as may take part in its formation; it being understood that, liberty being left to such co-operating medical authorities to confer, as they think proper, their honorary distinctions and degrees, each of them will abstain from the exercise of its independent privilege of giving admission to the "Medical Register."

II. That the Board be constituted of examiners, or of examiners and assessors appointed by the several co-operating medical authorities.

III. That examiners be appointed on the following subjects: Anatomy and physiology; chemistry; materia medica, medical botany, and pharmacy; forensic medicine; surgery; medicine; midwifery; or on such subjects as may be hereafter required.

IV. That no examiner hold office more than five successive years, and that no examiner who has continued in office for that period be eligible for re-election until after the expiration of one year.

V. That the examiners be appointed annually by the several co-operating medical authorities on the nomination of a committee, called herein "The Committee of Reference;" but no member of the Committee of Reference shall be eligible for nomination as an examiner.

VI. That a Committee of Reference, to consist of an equal number of representatives of medicine and surgery, be appointed as follows: One representative of medicine and one representative of surgery to be appointed by each of the Universities in England; four representatives of medicine to be appointed by the Royal College of Physicians of London; four representatives of surgery to be appointed by the Royal College of Surgeons of England.

VII. That one-fourth of the Committee of Reference go out of office annually, and that, after the first four years, no retiring member be re-eligible until after the expiration of one year.

VIII. That the duties of the Committee of Reference be generally as follows: 1. To determine the number of examiners to be assigned to each subject of examination. 2. To nominate the examiners for appointment by the several co-operating medical authorities. 3. To arrange and superintend all matters relating to the examinations, in accordance with regulations approved by the co-operating medical authorities. 4. To consider such questions in relation to the examinations as they may think fit, or such as shall be referred to them by any of the co-ope-

* Reprinted from the *British Medical Journal*.

rating medical authorities, and to report their proceedings to all the said authorities.

IX. That there be two or more examinations on professional subjects, and that the fees of candidates be not less than thirty guineas to be paid in two or more payments.

X. That every matriculated student of an English university who shall have completed the curriculum of study required by his university, and shall have passed such an examination, or examinations, at his university as shall comprise the subjects of the primary examination, or examinations, conducted by the Board, be eligible for admission to the final examination; and that every candidate so admissible to examination be required to pay a fee of five guineas, but he shall not be thereby entitled to the license of the Royal College of Physicians of London, nor to the diploma of member of the Royal College of Surgeons of England, without the payment of an additional fee of not less than twenty-five guineas.

XI. That every candidate who shall have passed the final examination conducted by the Board shall, subject to the by-laws of each licensing body, be entitled to receive the license of the Royal College of Physician of London, and the diploma of member of the Royal College of Surgeons of England.

This is signed by George Burrows, President of the Royal College of Physicians, and George Busk, President of the Royal College of Surgeons.

Sir Roundell Palmer, Mr. Denman, and Mr. Bevis have given their opinion that this scheme can be legally carried into effect by means of by-laws to be adopted by the respective Colleges of Physicians and Surgeons. This opinion was presented at the meeting of the Joint Committee on the 3rd inst. The examiners in surgery will be chosen from among the examiners who have been appointed under the charters of the College of Surgeons, and the Court of Examiners will adopt the certificate of the new examining body.

Meetings are being held in Dublin with a view to the formation of a conjoint examining board for Ireland. So far, no insurmountable difficulty has arisen in the several matters which have come under the notice of the deputed representatives of the Universities and of the other licensing bodies, and it is hoped that the board, as proposed, will become an accomplished fact. A claim was put forward by the Universities that the first part of the professional examination conducted by the conjoint board should not be required of university students who had passed their examination on the same subjects; and that in their case the examination should be confined to the final one. To this, however, the other licensing bodies properly objected; but an offer has been made by the other corporations that the preliminary examination should be wholly conducted by examiners appointed by the Universities.

NOTES

THE celebrated ethnological collection of the late Dr. Gustavus Klemm, of Dresden, which had obtained a world-wide celebrity from its richness in illustrations of dress and ornaments, household utensils, furniture, warlike, fishing, and hunting implements, &c., extending from the earliest times down to the immediate present, has been purchased by subscription, and transferred to Leipsic, where it forms the nucleus of the new German Central Museum of Ethnology, and around which is to be grouped whatever additional material can be procured in illustration of the general plan. An earnest appeal is made by the officers and others interested in this enterprise to their countrymen and others in the United States for contributions. It will occupy the place in Germany of the great Archæological Museum of Copenhagen: of that of Mr. Blackmore at Salisbury, in England; of the Museum of St. Germain, near Paris, under direction of M. Mortillet; and of the Smithsonian and Peabody Museums in the United States.

THE Exhibition of Neolithic Instruments by the Society of Antiquaries at Somerset House will be re-opened to-morrow, and will finally close on Thursday, January 18. For tickets apply at the Society's apartments.

ON Saturday last, at an early hour in the morning, the female hippopotamus in the Zoological Society's gardens gave birth to a young one—being the second occasion on which this interesting occurrence has taken place. As in the former case, it has been found necessary to close the building in which the female is placed entirely, not even the keepers entering into it except when absolutely necessary, in consequence of the extreme savageness and jealousy exhibited by the fond mother. Some days must therefore elapse before the "little stranger" can be prepared to undergo the ordeal of public exhibition.

ANOTHER interesting addition just made to the Zoological Society's collection is a young specimen of the King Penguin (*Apterodytes pennanti*) from the Falkland Islands. For this remarkable bird, which is still in the down-plumage, the Society are indebted to the kind exertions of F. E. Cobb, Manager of the Falkland Islands Company, who has been for some time endeavouring to obtain living examples of this species for the Society. The King Penguin is placed in the great eastern aviary, along with a specimen of the Cape Penguin (*Spheniscus demersus*) which has been for some time under the Society's care.

WE have just received the fourth report of the Radcliffe Trustees from the Radcliffe Librarian, Dr. Henry W. Acland, including also a catalogue of the transactions of societies, periodicals, and memoirs, available for the use of professors and of students in the Library; a catalogue of books recommended to students in physical science by the museum professors; and the Regulations of the Library. The additions to the Library are made, as far as the annual grant of 500*l.* will allow, either on the judgment of the librarian as to the intrinsic value of a work, or on the advice of a professor, or upon the knowledge that students require it.

IT is stated that the average yearly number of visitors at the South Kensington Museum during the last five years has been 905,084.

THE University Court of the University of Edinburgh, at a meeting held on Tuesday, Jan. 2, declined to give effect to the recommendation of the Senatus, that the regulations in reference to the medical education of women should be rescinded. The Court guarded itself against being understood to indicate any opinion as to the claim of women to proceed to graduation, or as to the powers of the University to confer on women degrees in the faculty of medicine.

THE Second Course of Cantor Lectures of the Society of Arts for the session will be delivered by the Rev. Arthur Rigg, M.A., on "Mechanism." The first lecture will be given on Monday evening, Feb. 5, at eight o'clock, and the remainder of the course will follow on the five succeeding Monday evenings.

AT the annual meeting of the Birkbeck Literary and Scientific Institution, Sir John Pakington, M.P., in the chair, it was stated that, during the past year, the following new subjects have been introduced into the curriculum of the Institution:—Acoustics, Light and Heat, Practical Chemistry, Mineralogy, Metallurgy, and the Theory of Music.

THE authorities of the American Museum of Natural History, at the Central Park in New York, have set apart Monday and Tuesday especially for the use of those persons who may desire

to examine the specimens in the Museum for the purpose of special study. Notifications of this arrangement have been distributed to the principal learned societies throughout the country, inviting them to attend on these days.

DE LA RUE'S indelible diaries for 1872 are as usual beautifully printed and bound, with ample room for memoranda. We miss the astronomical article, but still the letter-press being curtailed is an advantage, the book being less weighty for the pocket. The desk diary is a most useful appendage to the writing table, containing, besides the almanack, tables, &c., extra pages for memoranda and accounts.

THE eighth Annual Report is issued of the Belfast Naturalists' Field Club for 1870-71. The papers of which abstracts are printed in the Report are of varied interest, the subjects comprised including—"The Geographical Distribution of Cyclones," "The Latest Fluctuations of the Sea Level on our own Coasts," "Ocean Currents and their Effect on Climate," "Report of a Committee appointed to examine some Ancient Remains in the neighbourhood of Armoy, county Antrim," and numerous others. A number of prizes are offered to be competed for during the session ending March 31, for the best herbarium, collections of fossils, recent Crustacea and Echinodermata, shells, insects, sponges, &c., and others.

PROF. HALFORD has received from Simla the thanks of the Government of India for his paper on "The Treatment of Snake-bite by the Injection of Liquor Ammoniæ into the Veins." The Governor-General in Council has determined to have Dr. Halford's pamphlet reprinted for general distribution to medical officers in different parts of India. It appears to be placed beyond doubt that this treatment is by far the most efficacious yet discovered in cases of poisonous snake-bite.

CONDURANGO root, the reputed specific for cancer, is becoming a subject of speculation in Ecuador and the United States. In Ecuador it has reached 17*l.* a ton, but in New York it has been selling for fabulous prices, though its virtues are contested. The Government of Ecuador has imposed an export duty. The Condurango root is now reported to have been discovered by Mr. Simmons in the neighbourhood of Santa Marta in Colombia or New Granada, and a small shipment has been made to the United States. It is not stated whether it has been tried for cancer in that country.

THE Chilian Government has sent the war steamer *Chacabuco* to survey the islands of Guaiatecas.

THE U.S. Government has directed a survey of the Bay of Limon, the Atlantic terminus of the new Costa Rica Railway, where a city is being laid out with a pier.

ANTHRACITE coal has been discovered in the district of San Miguel, five miles from the capital of Costa Rica in Central America. There are several seams of about 40 miles wide, and the coal has been proved to be of good quality. A railway is in progress in the neighbourhood. It may be remembered that coal is also found in the State of Panama.

IT is noted as remarkable that a spring of fresh water has been discovered near Mollendo in Peru.

THE pearl oysters are said to have disappeared this season from the Madras coast, as well as from that of Ceylon.

M. BERTILLON lately read before the Academy of Medicine in Paris a paper on the relative influence of marriage and celibacy, based on statistical returns derived from France, Belgium, and Holland. In France, taking the ten years 1857-66, he found that, in 1,000 persons aged from 25 to 30, 4 deaths occurred in the married, 10·4 in the unmarried, and 22 in widowers; in females at the same age, the mortality among the married and unmarried was the same—9 per 1,000, while in widows it was 17. In persons aged from 30 to 35, the mortality among men was, for the married, 11 per 1,000, for the unmarried, 5, and for widowers, 19 per 1,000; among women, for the married, 5, for the unmarried, 10, and for widows, 15 per 1,000. There appears to be a general agreement of these results of marriage in Belgium and Holland, as well as in France.

WE are so accustomed to associate tattooing almost entirely with the natives of New Zealand and the Indians of North America, that it comes to us almost as a new fact to learn from a correspondent of the *Field* what a high standard the art of tattooing has reached among the Japanese. There we find men who make it their business to tattoo others, and these "professors of tattooing" are artists of no mean power, "for no india-rubber or ink-eraser can possibly take out a false line once imprinted; and they most invariably in the 'printing in' improve upon the drawings previously made." The bettoes or Japanese grooms will frequently have depicted on their skins, not only perfectly-drawn pictures of birds, reptiles, beasts and fishes, but also representations of whole scenes, often from some old legend or history. A very common device is the red-headed crane, the sacred bird of Japan, depicted standing on the back of a tortoise, and this is emblematic of woman's beauty treading down man's strength. These designs are pricked in by needles, and two or three colours are used.

PROF. KENGOTT, of Zurich, states that a hail-storm lasting five minutes occurred at eleven o'clock in the morning of August 20, 1871, the stones from which were found to possess a salty taste. Some of them weighed twelve grains. They were found to consist essentially of true salt, such as occurs in Northern Africa on the surface of the plains, mainly in hexahedric crystals or their fragments, of a white colour, with partly sharp and partly rounded grains and edges. None of the crystals were entirely perfect, but appeared as if they had been roughly developed on some surface. They had probably been taken up and brought over the Mediterranean from some part of Africa, just as sand is occasionally transported thence to the European continent and the Canaries by means of hurricanes. A still more remarkable phenomenon has been recently recorded by Prof. Eversmann, of Kasan—namely, the occurrence of hailstones, each containing a small crystal of sulphuret of iron. These crystals were probably weathered from some rocks in large quantity, and were then taken up from the surface of the ground by a storm, and when carried into the hail-forming clouds served as a nucleus for the formation of hail-stones.

A PRACTICAL extension of the metalliferous region of Chile to the south is announced in the discovery of rich silver deposits in the southern province of Nuble. The place is called Cuesta del Caracol, and is between the Rivers Lota and Nuble, about fifty miles from San Carlos towards the east. The standard on assay is estimated at 100lb. of silver to the ton. Operations are already prepared on a large scale. The Lota district has hitherto only been known for its large trade in coal and fire-bricks.

THE Indian Government has taken measures for a survey of the Tenasserim tin mines and their present state of production, for which purpose it has despatched Mr. Mark Fryar, mining engineer, to that province.

IN the native State of Kolapore in the Bombay Presidency sheep suffered from a strange form of animal plague. This consists of a swarm of unusually voracious leeches. Besides this the wolves were out, carrying off children, invalids, and the aged in the exposed villages.

A WHITE elephant having been discovered in our possessions in Tavoy, on the Malay Coast, the Buddhist sovereigns are extremely anxious to obtain such an important minister of religion.

The King of Burmah has made special application to be favoured with the holy beast.

AN earthquake took place at Valparaiso in the early part of November (date not given) at 10.5 P.M. The shock was smart, and apparently from E. to W. There was another slighter shock shortly after midnight.

ON Oct. 10 an earthquake was felt at Salvador, also in Central America, at 8.27 A.M. It was slight. Another was felt on the 12th, at 11.36 P.M., lasting nineteen seconds, with a strong shock. After the 12th were two slight shocks, it is to be supposed conforming with those of Nicaragua.

ON Sept. 25 an earthquake was felt at Carrizal Bajo, in North Chile, at 4.3 P.M., preceded by a loud noise.

THREE islands have lately been surveyed by the United States Government in the North Pacific Ocean. They are Ocean Island, in latitude 28° 25′ N., longitude 178° 25′ W. Midway Island, or Brooks Island, in latitude 28° 15′ N., longitude 178° 20′ W.; Pearl and Hermes Islands, latitude 27° 50′ N., and longitude 175° 50′ N. They are all three coral islands, and abound in turtle, and birds were found in great numbers. There is but little guano and not much vegetation.

IN connection with the bad weather in November in the Bay of Bengal, the telegraph lines were on the 10th affected by earth-lines on the east coast of India. At Madras these currents were first noticed at 6 A.M., they abated at 4 P.M., and were strongest in the lines forming a considerable angle with the magnetic meridian. They were also observed in the Madras cable. In Calcutta the currents were noticed at about 3 A.M. and ceased at 2 P.M.

ANCIENT ROCK INSCRIPTIONS IN OHIO *

SEVERAL diagrams were presented to the section representing rock sculptures in Ohio, that are presumed to be ancient and to have some significance. The largest is a tracing made by Dr. J. H. Salisbury, of Cleveland, with the assistance of Mrs. Salisbury, from a mural face of conglomerate, near the famous "Black Hand" in Licking County, Ohio. Once there was a space of ten or twelve feet in height, by fifty or sixty feet in length, covered by these inscriptions. Most of them have been obliterated by the recent white settlers.

In 1861, Dr. Salisbury took copies from a space about eight by fifteen feet, by laying a piece of coarse muslin over them, and tracing such as remain uninjured, life size, on the cloth. In this space there are found to be twenty-three characters, most of which are the arrow-head or bird-track character. These are all cut on the edge of the strata, presenting a face nearly vertical, but a little shelving outward, so as to be sheltered from the weather.

Another copy of the remnants of similar inscriptions was taken by Colonel Whittlesey and Mr. J. B. Comstock, in 1869, from the "Turkey Foot Rock," at the rapids of the Maumee, near Perrysburg. These are on a block of limestone, and in the course of the twenty-five past years have been nearly destroyed by the hand of man. What is left was taken by a tracing of the size of nature.

On the surface of a quarry of grindstone grit at Independence, Cuyahoga County, Ohio, a large inscribed surface was uncovered in 1854. Mr. B. Wood, Deacon Bicknell, and other citizens of Independence, secured a block about six feet by four, and built it into the north wall of a stone church they were then building. Colonel Whittlesey presented a reduced sketch, one-fourth size of nature, taken by Dr. Salisbury and Dr. J. M. Lewis, in 1869, which was made perfect by the assistance of a photographer. Some of the figures sculptured on this slab are cut an inch to an inch-and-a-half in the rock, and they were covered by soil a foot to eighteen inches in thickness, on which large trees were growing. Like all of the others, they were made by a sharp-pointed tool like a pick, but as yet no such tool has been found among the relics of the mound-builders or of the Indians. The figures are very curious. Among them is something like a trident, or fish-spear, a serpent, a human hand, and a number of track-like figures, which the people call buffalo-tracks, but which Dr. Salisbury regards as a closer representation of a human foot covered by a shoe-pack or moccasin. Another figure somewhat resembles the section of a bell with its clapper.

Near the west line of Belmont County, Ohio, Mr. James W. Ward, then of Cincinnati, now of New York, in 1859 took a sketch of two large isolated sandstone rocks, on which are groups of figures similar to those already noticed. Here are the bird-track characters, the serpent, the moccasin or buffalo-tracks, and some anomalous figures. These are plainly cut, with a pick, into the surface of the rock, which, like the Independence stone, is substantially imperishable. Here we have also the representation of the human foot, and the foot of a bear. Another figure, which appears to be the foot of some animal with four clumpy toes, Prof. Cope thinks may be the foretrack of a Menopome. One peculiarity of these sculptured human feet is a monstrously enlarged great-toe joint, even greater than is produced by the modern process of shoe-pinching. This has been observed in other ancient carvings of the human foot upon the rocks near St. Louis, Missouri. These feet range in size from seven to fifteen inches in length. Of all these representations, the bear's foot is closest to nature. The bird-track, so called, presents six varieties, some of which are anatomically correct. The human hand is more perfect than the foot.

Dr. Salisbury finds, on comparison of these symbolical figures with the Oriental sign-writing, or hieroglyphical alphabets, that there are many characters in common. Some 800 years before Christ, the Chinese had a bird-track character in their syllable alphabet. The serpent is a symbol so common among the early nations, and has a significance so various, that very little use can be made of it in the comparison.

These inscriptions differ materially from those made by the modern red man. He is unable to read that class of them which appears to be ancient.

Lieut. Whipple has mentioned in the "Government Report of the Pacific Railroad Surveys," an instance of the bird-track character, inscribed upon the rocks of Arizona. Prof. Kerr, of North Carolina, states that he has noticed similar characters cut in the rocks of one of the passes of the Black Mountains, at the head of the Tennessee river.

These facts indicate wide-spread universality in the use of this style of inscription, and they indicate something higher than the present symbolical or picture writing of the North American Indians.

* Paper read before the American Association for the Advancement of Science, Section of Archæology, by C. Whittlesey. Reprinted from the *American Naturalist*.

SCIENTIFIC SERIALS

Monthly Microscopical Journal, January.—"The markings on the Battledore scales of some of the Lepidoptera." By John Anthony, M.D., &c. In this paper the author contributes the result of his observations on the plumules of *Polyommatus Alexis*, from which he is led to the conclusion that the markings on the ribs of the scales are elevations, very much resembling in shape the vegetable glands on the petal of Anagallis, that is, the elevations have a base, a column, and a rounded head, or capital; the form being very much like that of an ordinary collar-stud. The methods employed during observation are detailed in the paper, which is illustrated by two plates.—"The Nerves of Capillary Vessels and their probable action in health and disease" By Dr. Lionel S. Beale, F.R.S., This paper is divided into two parts, the anatomical investigation, and probable mode of action. The first part, containing the results of anatomical investigation alone, is published in the current number of the journal. The sections of this paper are, "Structure of Capillaries," "Nuclei or Masses of Bioplasm of Capillaries," "Nerve Fibres," "Arrangement of the Nerve Fibres distributed to the Capillaries," "Central Origin and Peripheral Connections of Nerve Fibres distributed to the Capillaries," and the "Method of Demonstration." Such an important contribution to microscopic anatomy could not be abstracted within the limits of this notice with justice to the author and his subject. We therefore commend it to the notice of all interested therein, with the assurance that they will find much matter for reflection.—On a New Micrometric Goniometer Eye-piece for the Microscope. By J. P. Southworth. The eye-piece micrometer here described is obtained by photographic reduction from heavy India-ink lines drawn on a white Bristol board. In the micrometer the lines are $\frac{1}{200}$ of an inch apart, and jet black, whilst the spaces between them are trans-

lucent enough to admit of the accurate measurement of the details of minute algæ and fungi to the $\frac{1}{25000}$ of an inch. The goniometer is also described. Both are said to posses advantages not secured before by any instrument. The remaining papers are—Note on Dr. Barnard's Remarks on the Examination of Nobert's Nineteenth Band, by J. J. Woodward, Assist. Surg. U.S. Army; a New Erecting Arrangement, especially designed for use with binocular microscopes, by R. H. Ward, M.D.,; and On the Action of Hydrofluoric Acid on Glass, viewed Microscopically, by H. F. Smith.

OF the *Mémoires de la Société de Physique et d'Histoire Naturelle de Genève* the first part of the twenty-first volume has recently been published. It is chiefly occupied by an admirable memoir on the Orthopterous family Mantidæ by M. Henri de Saussure, forming the third fascicule of his "Mélanges Orthoptérologiques." In this paper the author not only describes a great number of new species, but also discusses the internal classification of the family, and gives tables of the subordinate groups and genera, and the synonymy of nearly all the species, so that his work (including its supplement) is very nearly a monograph of the curious and interesting group of insects which constitutes its subject. A great number of the species described by the author are figured on four beautifully executed plates which accompany the memoir, and these will astonish the non-entomological reader by the variety of curious forms produced by modifications of the same plan of structure.—The other papers in this part consist of descriptions of new or little-known exotic Cryptogamia (Mosses), by M. J. E. Duby, illustrated with four plates; a paper on gelatiniform matter by M. Morin, and a report on the labours of the society by its President, M. Henri de Saussure.

PART II. of the *Bulletin of the Royal Swedish Academy of Sciences* (Ofversigt af Kongl. Vetenskaps Akademiens Förhandlingar) for the present year commences with a paper (in Latin), by Dr. E. Fries, containing a description of *Queletia*, a new genus of Lycoperdaceous Fungi, and of a new species of the genus *Gyromitia*. The characters of the former are illustrated in a plate.—Another botanical paper is a notice of some Algæ from the inland ice of Greenland, by M. S. Berggren. The author describes and figures a peculiar form, which he regards as most approaching the Zygnemaceæ, but as having an unmistakable resemblance to some Desmidiaceæ.—Passing by a rather wide step from Greenland to South Africa, we have Latin descriptions of 226 Caffrarian Curculionidæ, collected by Wahlberg, from the pen of M. O. J. Fahreus. These all belong to Lacordaire's second division of the family.—M. B. Lundgren publishes a notice of the occurrence of amber at Fyllinge, in Halland.—The remaining papers are upon chemical subjects, and include a paper by M. P. T. Cleve on some remarkable isomerisms in organic chemistry; a paper by the same author on the nitrites of some platinum-bases; and one by M. L. F. Wilson on the sulphides of arsenic.

Journal of the Chemical Society, September 1871. Bolas and Groves have continued their researches on carbon tetrabromide, and have obtained some interesting results. In their former paper they mentioned that antimony terbromide could be substituted for iodine in the preparation of the tetrabromide. They now find that bromine will act on carbonic disulphide in the presence of the bromides of the following metals:—bismuth, arsenic, gold, platinum, cadmium, zinc, and nickel; the bromides of iron, tin, phosphorus, and sulphur, however gave very unsatisfactory results. The authors still think the mixture of bromine and iodine the most convenient reagent for the preparation of the tetrabromide. The authors recommend for the recovery of bromine from residues the action of dipotassic dichromate and sulphuric acid.—R. C. Woodcock has examined the action of ammonic chloride on normal and acid salts; he has experimented on the following bodies:—potassic chromate, microsmic salt, trisodic phosphate, dipotassic tartrate, succinate, &c. By the action of ammonic chloride on sodic metaborate the whole of the ammonia is evolved, sodic chloride and metaboric being formed. Borax also yields the whole of the ammonia, sodic chloride and tetrametaborate remaining behind. Both soluble and insoluble chromates yield ammonia when distilled with ammonia salts, an acid chromate being formed; the whole of the ammonia, however, is not evolved, the acid chromate formed at a certain point stopping the evolution of ammonia; if the acid salt be removed by crystallisation, a copious evolution of ammonia again takes place on boiling.—W. Mattieu Williams communicates a short abstract of a paper "On Burnt Iron and Steel." Iron which has been damaged by re-heating is designated "burnt iron;" it is brittle, its fracture being short, displaying the so-called crystalline structure. In all the samples which the author has examined, he has found particles of black oxide of iron diffused in the mass. The oxidation must of course take place after that of the carbon present in the iron. It is found that iron attains its maximum toughness when the carbon is reduced to the lowest possible proportion without the oxidation of the iron commencing. When steel is raised to a yellow or white heat, and is suddenly cooled, it turns brittle. Burnt steel has a coarse, granular fracture, and contains small cavities, technically called "toads' eyes." These are probably due to the sudden cooling of the iron imprisoning the carbonic oxide, which is evolved by the oxidation of the carbon; this oxidation not only takes place at the surface of the mass, but also in the interior, from the fact that certain gases can pass readily through heated iron. This explanation is strengthened by "burnt steel" being cured by welding up these cavities. The remainder of the number is occupied with the abstracts of chemical papers, which extend over seventy-five pages, and are quite up to the usual standard, both in scientific interest and as regards literary merit.

Journal of the Chemical Society, November 1871.—This number does not contain any papers originally communicated to the Society. It is not certainly to the credit of English chemists that this should be the case for two months in succession; the number of English chemists who devote their time to original research seems every year to become smaller; on the Continent, however, the reverse is the case, as is shown by the very large number of abstracts, which are published monthly by the Society. This month about 130 papers are abstracted, which fill 127 pages. Amongst them we notice a remarkable communication by Angström "On the Spectra of Simple Gases." Angström took a tube filled with atmospheric air and gradually exhausted it by a mercurial pump, the spectra being obtained by the use of an induction coil. He states that he observed successively the following spectra: 1st, that of atmospheric air; 2nd, the band spectrum of nitrogen; 3rd, that of carbonic oxide; and 4th, when the rarefaction had reached its limit, the lines of sodium and chlorine. He has also experimented on hydrogen, and concludes that it possesses only one spectrum, that of four lines, which is observed in the spectra of the sun and stars. He believes that the various spectra of hydrogen obtained by Plücker, Frankland and Lockyer, Wöllner, and others, are entirely due to impurities, such as acetylene and sulphur.—An abstract of a paper by Andrews contains a curious fact. A fine tube is half filled with bromine and hermetically sealed; on heating, the bromine becomes opaque, so that the tube appears to be filled with a dark red resin.—Lieben and Rossi continue their researches on the normal alcohols and acids of the methyl series; a review of their results has already appeared in these pages.—Ladenburg contributes another most interesting paper, 'On the reduction products of silica, ether, and some of their derivatives;" these researches are very important, and have opened out quite a new branch of chemical inquiry. He has obtained such bodies as silicium, diethylketonic ether ($SiC_2H_{52}OC_2H_{52}$), silicoheptyl ether ($SiC_2H_{53}OC_2H_5$), and so on.—Another paper of some interest is by Heinrich, "On the Influence of Heat and Light on the Evolution of Oxygen by Water Plants." He experimented on the leaves of the *Hottonia palustris*, which were placed in common water. At a temperature of 2·7° C. in full sunlight no evolution of gas took place, but at 5·6° a regular evolution commenced. The most active formation was at 31°, and at 50° to 56° gas ceased to be formed, but the leaf resumed its activity in cooler water. If the leaves were exposed to a temperature of 60° for ten minutes, their power of decomposing carbonic acid was destroyed.

SOCIETIES AND ACADEMIES

LONDON

Geological Society, December 20, 1871.—Mr. Joseph Prestwich, F.R.S., president, in the chair. Mr. Frederick H. Bowman, F.R.A.S., F.C.S., of Halifax, Yorkshire, and Mr. Thomas Charles Sorby, B.A., F.R.S., of 27, Brunswick Square, W.C., were elected Fellows of the Society. The following communications were read:—1. A Letter from Mr. G. Milner Stephen, F.G.S., to the late Sir Roderick Murchison, dated Sydney, 5th October, 1871, announcing the discovery of a rich auriferous deposit on the banks of the River Bondé, on the N.E. coast of

New Caledonia, and of a great deposit of tin-ore in the district of New England, New South Wales. The gold in New Caledonia is found in drift, and there are indications of the near proximity of a quartz-reef. The tin-ore in New South Wales is said to be in "pepitas, crystals, and beds of conglomerate, especially in micaceous granite, more or less decomposed." Mr. D. Forbes stated that in 1859 he had placed in his hands some specimens of granite from the district the discovery of tin in which was announced by Mr. Stephen, and that he found them to be perfectly identical with the stanniferous granites of Cornwall, Spain, Portugal, Bolivia, Peru, and Malacca, which he had also examined. These granites were all composed of white orthoclase, felspar, colourless or black Muscovite mica and quartz. He was not aware that tinstone (cassiterite or oxide of tin) occurred anywhere in rock of a different character. It was always accompanied by more or less native gold. Mr. Pattison remarked that in many places where tin occurred it was not present in sufficient quantity to be remuneratively worked. Mr. D. Forbes, in answer to a question from Prof. Ramsay, stated that, as far as could be ascertained, the age of the stanniferous granites mentioned by him must be between the end of the Silurian and the early part of the Carboniferous period. Prof. Ramsay would carry them down to the close of the Carboniferous period, and would be contented to term them pre-Permian.—"Remarks on the Greenland Meteorites." By Prof. A. E. Nordenskjöld, For. Corr. G.S. The author stated that the masses of meteoric iron brought from Greenland by the recent Swedish expedition seem to have formed the principal masses of an enormous meteoric fall of miocene date, extending over an area of some 200 miles. The iron appears to be free from silicates. Against its eruptive origin the author urges that when heated it evolves a great amount of gaseous matter, and that it contains imbedded particles of sulphide of iron, the mass itself being nearly free from sulphur. The masses are composed of meteoric nickeliferous cast and wrought iron, or of mixtures of the two; in the last case the Widmannstætten's figures are best developed. The author further noticed the various modes in which the iron occurs, viz., 1, as meteorites; 2, filling cracks; 3, as breccieform stones cemented with oxide and silicate of iron; and 4, in grains disseminated in the basalt. Mr. Roberts protested against the evolution of gaseous matter being considered as a proof of meteoric origin. Prof. Ramsay reiterated his previously-expressed opinion, that the masses of iron might be of telluric origin.—"Further Remarks on the Relationship of the *Limulidæ* (*Xiphosura*) to the *Eurypteridæ* and to the *Trilobita*." By Mr. Henry Woodward, F.G.S. In this paper the author described the recent investigations made by Dr. A. S. Packard, Dr. Anton Dohrn, and the Rev. Samuel Lockwood upon the developmental history of the North American King-crab (*Limulus Polyphemus*), and discussed the conclusions as to the alliances of the *Xiphosura* and *Eurypterida*, and to the general classification of the *Arthropoda*, to which the results of these investigations have led Dr. Dohrn and some other Continental naturalists. According to this view, the *Xiphosura* and *Eurypteridæ* are more nearly related to certain Arachnida (the Scorpions, &c.) than to the Crustacea; and this opinion is further supported by the assertion of Dr. Dohrn, that in *Limulus* only one pair of organs (antennules) receives its nerves from the supracesophageal ganglion, and that the nature of the underlip in *Limulus* differs from that prevailing among the Crustacea. Dr. Dohrn also recognises the relationship of the Merostomata to the Trilobites, as shown especially by the development of *Limulus*, and considers that the three forms (*Limulidæ*, *Eurypteridæ*, and *Trilobita*) should be combined in one group under the name of *Gigantostraca*, proposed by Haeckel, and placed besides the Crustacea. The author stated, on the authority of Prof. Owen, that *Limulus* really possesses two pairs of appendages which receive their nerves from the supracesophageal ganglion; that, according to Dr. Packard, the young *Limulus* passes through a Nauplius-stage while in the egg; that no argument could be founded upon the lower lip, the condition of which varied extremely in the three groups proposed to be removed from the Crustacea; and he maintained that even from the ultra-Darwinian point of view taken by Dr. Dohrn, the adoption of his proposal would be fatal to the application of the hypothesis of evolution to the class Crustacea. Prof. T. Rupert Jones remarked upon the interest attaching to the study of the Crustacea, and called attention to the absence of any indications of convergence in our present knowledge of the class. He thought that, in the present day, we must nevertheless look back to some point of convergence from which the varied forms known to us may have proceeded by evolution. Prof. Macdonald remarked that difficulties must be expected to occur in classification. He believed that all Invertebrate animals were to be regarded as turned upon their backs, as compared with Vertebrata. The cephalic plate in *Limulus* he regarded as the equivalent of the palate-bone. The incisive palate was very distinct in the Crabs. The absence of one pair of antennæ did not appear to be any reason for removing *Limulus* from the Crustacea. Dr. Murie considered that the contemplation of the multitude of young forms referred to by Mr. Woodward should serve as a warning to describers of species, and also as a check to generalisations as to the number of species occurring in various formations. He remarked that if we were at a point when the presence or absence of a single pair of nerves could be taken as distinguishing class from class, these classes must be regarded as very nearly allied. He thought that the doctrine of evolution was being pushed further than the known facts would warrant. Mr. Woodward, in replying, drew attention to the diagrams of the embryo and larva of the recent *Limulus*, comparing them with *Limulus* of the Coal-measures, *Neolimulus* of the Silurian, and also with the larval stages of the Trilobites, discovered by Barrande. He pointed out the strong resemblance which the fossil forms offer to the early stages of the modern King-crab, and expressed his assent to the proposal of Dr. Dohrn to bring the Trilobita, if possible, nearer to the Merostomata. If, however, the Trilobites have true walking-legs instead of mouth-feet (gnathopodites) only, they would be more closely related to the Isopoda. He showed by a tabular view of the Arthropoda that the known range in time of the great classes is nearly the same, and therefore affords no argument for combining the Merostomata with the Arachnida; but on the contrary, he considered that the Trilobita were, with the Entomostraca, the earliest representatives of the class Crustacea, and could not therefore be removed from that class.—The following specimens were exhibited:—Specimens of Auriferous Quartz from New Caledonia, and of Tin Ore from New South Wales, exhibited by Mr. G. Milner Stephen; specimen of gold from the Thames Goldfield, New Zealand, exhibited by Prof. Tennant; specimens of *Eurypterus Scouleri* and of *Belinurus* and *Prestwichia*, exhibited by the President; specimens of recent and fossil Crustacea, exhibited by Mr. H. Woodward, in illustration of his paper.

Zoological Society, January 2.—Mr. John Gould, F.R.S., in the chair. An abstract was read from a letter received from Mr. T. G. F. Riedel, of Gorontalo, Celebes. in reference to the true locality of a rare Kingfisher, *Tanysiptera Riedeli*, which he stated to be from Kordo—an island in the Bay of Geelvink, and not from Celebes.—Prof. Newton exhibited and made remarks on a specimen of Ross' Gull (*Larus Rossi*), from the collection of the late Sir William Milner, which was said to have been obtained in Yorkshire.—Mr. Gould exhibited an adult specimen of the same bird, from the Derby Museum, Liverpool.—Mr. P. L. Sclater read a paper on the species of monkeys found in America north of Panama, being supplementary to a former paper on the northern limit of the Quadrumana in the New World. The species of monkeys now ascertained to occur in Central America from Panama to Mexico were stated to be eleven in number—namely, ten belonging to the family Cebidæ, and one to the Hapalidæ. Full particulars were given concerning the range of each of these species.—Mr. Henry Adams communicated some further description of new species of shells, collected by Mr. R. McAndrew, in the Red Sea. A second paper by Mr. H. Adams contained descriptions of fourteen new species of land and marine shells from Mauritius, Mexico, Formosa, Borneo, and the New Hebrides.—Mr. George Gulliver communicated a paper on the œsophagus of a hornbill (*Toccus melanoleucus*), being an appendix to a former paper by him on the taxonomic character of the muscular sheath of the œsophagus of the Sauropsida, read at a previous meeting of the Society.—Mr. J. Brazier communicated some observations on the distribution of certain species of volutes found in the Australian seas. In a second paper Mr. Brazier gave descriptions of six new species of land and marine shells from the Solomon Islands, Western Polynesia, and Australia.—Dr. J. C. Cox communicated descriptions of some new land shells from Australia and the South Sea Islands.

Entomological Society, January 1.—Mr. Alfred R. Wallace, president, in the chair.—The secretary read an extract from a letter received from Mr. Gould respecting the question of the liability of dragon-flies to the attacks of birds. Mr. Gould had no doubt that the hobby and kestrel attacked the larger kinds, and he had seen sparrows, &c., preying upon the smaller *Agrionidæ*.—Mr. Müller called attention to a statement by

M. Emile Joly to the effect that Latreille's supposed crustaceous genus, *Prosopostoma*, is probably founded upon the immature condition of certain *Ephemeridæ*.—Mr. Butler read a paper "On certain species of *Pericopides*."—Mr. F. Smith read a letter from Mr. J. T. Moggridge with reference to the habits of some species of ants belonging to the genus *Aphenogaster*, as observed at Mentone in the winter. Mr. Moggridge affirmed that those ants harvested the seeds of various plants in chambers, sometimes excavated in solid rock. He had seen them busily engaged in conveying the seeds into these chambers, and found that, in most cases, the radicle was bitten off, so as to prevent germination; but he had also observed sprouted seeds being brought out again as apparently unfitted for store purposes. Many of the seeds had their contents extracted through a hole in one side, and though he had not actually seen the ants feeding upon them, he was inclined to believe that the stores were made for the purpose of providing food in the winter months.

Society of Biblical Archæology, January 2.—Mr. S. Birch, president, in the chair.—A paper entitled "Hebræo-Ægyptian in Hebrew-Egyptian Analogues," contributed by M. François Chabas, Membre de l'Institut, and translated for the society by Mr. E. R. Hodges, was read by the translator. In this the learned Egyptologist, having enumerated the various sources and original texts from which his materials were taken, proceeded to consider the various moral and religious parallelisms of the Egyptians and Hebrews under three distinct sections: (1) Laws respecting charity and special duties; (2) Commands and proverbs enforcing the obligation of filial obedience; (3) Legal formulæ and reports, referring to the prohibition of blasphemous and irregular oaths. Under each of the divisions several translations of hieroglyphic texts were given, together with an exegesis justifying the renderings adopted by M. Chabas. The last section, in which the adjuration "by the life of God, and by the life of Pharaoh" was explained, possessed, in the opinion of the learned author, special interest from its exact attestation of the minute accuracy of certain portions of the Pentateuch, and as throwing much light upon a passage hitherto obscure or unknown to the bulk of English students.—The president read a paper "On the Cypriote Inscription on the Bronze Tablet of Idalium" (Dali). Having referred to the felicitous discovery, by Messrs. Lang and Smith, of the Cypriote alphabet, as announced to the society at its last meeting, he entered into the consideration of the Cypriote parts of the bi-lingual inscription of Dali, and the Hellenic element of the Cypriote language. He then proceeded to give some account of the Cypriote inscription on the bronze tablet of Dali, which records donations to the Temple of Idalium by the monarch, Pythagoras, and Indostes. It also referred to various writings in connection with a temple of Isis. Its date of inscription appears to be about B.C. 256. Examples were given of the Hellenic structure of the language, and the identification of many Cypriote with Greek words. An interesting discussion took place, in which Sir C. Nicholson, Emanuel Deutsch, Rev. J. M. Rodwell, S. M. Drach, W. R. A. Boyle, the president, and the secretary, took part.

Edinburgh

Royal Physical Society, Dec. 20, 1871.—Mr. C. W. Peach, president, in the chair.—"Zoological Notes," by Prof. Duns. (1.) On a dog-fish (*Scyllium marmoratum*) from Java (2.) On the Porbeagle, or Beaumaris shark (*Lamna cornubica*). The specimen exhibited was a beautiful young one captured last year near Elie, Fifeshire. The difference between the dentition of the adult and the young was well illustrated in this case. The lanceolate teeth of the former have a small basal cusp on each side. The cusps are absent in the latter. (3) On Rondelet's little Sepia (*Sepiola Rondeletti*). A specimen taken in the Firth of Forth was exhibited. (4.) On the Redwing (*Turdus iliacus*).—On the Extirpation of Venomous Serpents from Islands, by Robert Brown. This consisted of correspondence addressed to the author and Mr. W. B. Tegetmeier relating to the subject. It was shown that the common domestic pig had exterminated rattlesnakes in the vicinity of the Dalles and other settlements in Oregon, and that in India the same antipathy is shown by the same animal to the deadly cobra di capello. The subject was important economically to the inhabitants of some of the West Indian Islands infested by these reptiles, and physiologically in so far as facts went to show that the pig enjoyed an immunity from the poison of both the rattlesnake and the cobra. In Ireland it was well known few or no snakes of any kind are found, and nowhere is "the pig" more abundant, showing a probable relation between these two facts, without calling in the supposed aid of St. Patrick.—Exhibition of Glacial Shells of the Clyde Beds, from a recent Excavation near Greenock, by David Grieve. Also of Specimens of various Polyzoa and Foraminifera from the same locality, with remarks by C. W. Peach.—"On Shells, Foraminifera, &c., from the recent post-tertiary beds between the Bridge of Allan and Stirling" (specimens exhibited), by C. W. Peach.

Glasgow

Geological Society, December 14, 1871.—Mr. James Thomson, F.G.S., read a paper on "The Stratified Rocks of Islay." He described in detail the sedimentary deposits on the south side of the island, and then gave a transverse section of them from Port-na-Haven on the west to Port Askaig on the east. Although the rocks in the central valley of the island had not yet yielded identifiable organic remains, he did not despair, if properly investigated, of forms being found that would place them beyond doubt in the Lower Silurian series. In mineral character they quite coincided with those described by the late Sir Roderick Murchison as occurring in Ross and Sutherlandshires. On the east side of the island, at Port Askaig, these deposits repose upon a series of stratified rocks of much higher antiquity, which correspond to the Cambrian rocks of the North-West Highlands, described by the same distinguished author. At the base of these latter sedimentary rocks there is a mass of conglomerate, made up of fragments and boulders of granite, imbedded in an arenaceous talcose schist; and as no granite occurs *in situ* in the island, he was disposed to account for its presence in this conglomerate by the agency of ice. Specimens of the granite and a striated block of quartzite were laid upon the table. He then described the rocks of the western extremity of the island, which consist of highly metamorphosed stratified rocks, as gneiss, serpentine, dolomite, quartzite, and schists, extending from Port-na-Haven, on the west, to Brouch-Ladach, a distance of nine miles. At the latter point the superior deposits are seen resting on the metamorphosed sedimentary rocks, nearly at right angles to the planes of stratification. In lithological aspect and mineral character these rocks agreed so entirely with the "fundamental or Laurentian gneiss" of Sir R. Murchison, as occurring in the North-Western Highlands and other parts of the world, that he had not the slightest hesitation in placing them as belonging to this, the oldest division of known sedimentary rocks. It thus appeared that both Cambrian and Laurentian rocks occurred farther south in Scotland than had hitherto been recorded. Taking a general view of the group of deposits to which he had called attention, there were—1. The calcareous deposits in the central valley of the island, of Lower Silurian age; 2. The deposits from Ardnahuamh on the north to Balleochreoch on the south, of Cambrian age; 3. The metamorphic rocks in the west of the island, of Laurentian age. He was not prepared to speak with any degree of certainty regarding the source of the materials constituting the basic conglomerate mass. These differ so widely from the granites found *in situ* in other parts of the Highlands, that he felt the necessity for tracing them to another source, and hoped he would not be thought to overstep the bounds of prudent speculation in suggesting that these erratics are the reassorted materials of some great northern continent that has yielded to the gnawing tooth of time, leaving only these scattered fragments to attest its former existence. The portion of striated rock which he had laid before the meeting pointed to an agency adequate to the transport of such materials, and indicated that we should have to contemplate a glacial period deeper in time than had hitherto been suspected, when glaciers and icebergs planed down the hardest rocks and dispersed their fragments, obedient to the same great laws which still regulate the economy of Nature.

New Zealand

Wellington Philosophical Society, August 26, 1871.—Capt. Hutton described the two species of bats found in New Zealand, and proposed that the name *Mystacina tuberculata* be changed to *M. velutina*, to avoid confusion with *Scotophilus tuberculatus*. Dr. Hector mentioned that large numbers of the former species lodged in the topsails of H.M.S. *Clio* when in Milford Sound last summer.—Mr. Skey proposed as a convenient method of generating H_2S for laboratory use, to employ galena, zinc, and dilute hydrochloric acid.—Captain Hutton described the microscopic structure of the egg-shell of the moa, and showed that it was altogether different from the kiwi egg.

September 16.—Mr. W. T. L. Travers described the traditions of the Maories, showing reasons why they were not reliable as history, and that the usual date assigned for the first landing of the Maories is much too recent.—Captain Hutton read a paper on the lizards of New Zealand, and described a new species from

White Island, belonging to the genus *Norbea*, hitherto only found in Borneo, and also a new species, *Mocou laxa*.

September 30.—Mr. Travers described the habits of the birds that frequent the lake in the interior of Nelson, mentioning that the blue duck (*Hymenolaimus*) does not exhibit solicitude for the safety of its young like other ducks. Captain Hutton showed that this supported the Darwinian theory, as the blue duck belongs to a genus peculiar to New Zealand when there were no destructive animals previous to the arrival of man, and in which genus, therefore, instinctive fear has not been developed. Dr. Hector showed that absence of fear is characteristic of most of the birds peculiar to New Zealand, but that the weka of the North Island is much more shy than the species in the South.—Dr. Hector described a portion of a wreck discovered on the west coast of the Middle Island, and pointed out that the coast line had advanced 300 yards since it was cast up.

October 14.—A communication by Dr. Wojeikof, of St. Petersburg, on the change of climate effected by clearing forests, led to much discussion, from which it appeared that this colony is now suffering in many districts from the sudden and severe floods that are due to this cause.—Captain Hutton read critical notes of the birds of New Zealand that accompany a descriptive catalogue he has published.

October 28.—Dr. Hector reported the result of Dr. Thomson's exploration of the cave in Otago in which the Moa's nest was found (see NATURE, vol. iv. pp. 184, 228). It is an irregular fissure in mica schist rock, about fifty feet deep, and with thin flat ledges or floors on which the bones rest. There are entrances, one from rocks on the mountain side, and the other by a funnel-shaped hollow in an alluvial flat. On the first floor Dr. Thomson found traces of a fire and charred bones. On the second floor, by scraping away the loose dust to the depth of two feet, leg bones, ribs, vertebræ, a pelvis, toe bones, tracheal rings, and pieces of skin and muscle were found. On the third floor were found fragments of egg-shell, and the bones of a bird with a keeled sternum. In Dr. Thomson's collection there are sixteen tibiæ, so that he obtained remains of at least eight birds. A perfect skull with lower jaw and trachea attached, and a femur with well preserved muscular tissues attached, were found on the spot where the nest was obtained. From another locality in the same district Dr. Thomson sends twenty feathers. These were found by a gold digger eighteen feet below the surface. A report on these feathers by Capt. Hutton showed that they were of the form peculiar to struthious birds, but quite different from any known species. They are eight inches long, with soft yellow down on the lower half, and black above except the tip, which is white. The form of the feather is very peculiar, as it expands in width to the tip. He considers that the structure of these feathers shows that the bird to which they belonged was allied more to the American robin than to any of the struthious birds of the old world.

VIENNA

I. R. Geological Institution, Dec. 5, 1871.—M. Ernest Favre exhibited a geological map of the central part of the Caucasus Mountain chain, which he had surveyed last summer. The region which formed the object of his inquiries is limited to the east by the military road which leads to Georgia, to the west it ends with the Elbrus Mountain, to the north it is limited by the Steppe, and to the south by the Koura Valley, the mountains of Souram and the plain of Mingrelia. In this region the Caucasus rises to its greatest height; summits of 12,000 to 18,000 feet above the the sea level being not rare. Granite and crystalline slates form large masses in the central part, further to the east and west they disappear beneath the younger sedimentary rocks. The lowest fossiliferous strata belong to the Liassic formation. The gigantic peaks of the Elbrus and the Kayhek on the north flank of the chain are formed by trachite.—Mr. F. Schrökenstein "On the Cyipka Balkan." The author has crossed the Balkan mountains in two lines, unvisited before by any geologist, once from Drawna by Selce to Kysanlik, and than back over the Cyipka to Grabowa. The series of rocks found there he enumerates as follows:—1. Crystalline schists; 2. Coal formation, the base of which is formed by quartzite, higher up follows calcareous slate, and finally sandstone and slate with coal measures; 3. Dyas; 4. Magnesian limestone; and 5. The Neocomian series covering the older rocks unconformably. The discovery of large coal seams in the coal formation near Radience is very important. German capitalists have got permission to work them, and have already traced a railway from the mine to the Danube.

BOOKS RECEIVED

ENGLISH.—Schellen's Spectrum Analysis: Translated by Jane and Caroline Lassell; Edited, with Notes, by W. Huggins (Longmans).—Deschanel's Natural Philosophy; Part III., Electricity and Magnetism: Translated by Prof. Everett (Blackie and Sons).—Zoological Record, Vol. vii.—Rudimentary Magnetism: Sir W. S. Harris and H. M. Noad (Lockwood).—Spiritualism Answered by Science: Serjt. Cox (Longmans).

AMERICAN.—Reports on Observations of the Total Solar Eclipse of Dec. 23, 1870, conducted under the direction of Rear-Admiral Sands, U.S.N.

DIARY

THURSDAY, JANUARY 11.

ROYAL SOCIETY, at 8.30.—Experiments made to determine Surface Conductivity in Absolute Measure: D. McFarlane.—On the Myology of the Cheiroptera: Prof. Macalister.

SOCIETY OF ANTIQUARIES, at 8.30.—Ballot for the Election of Fellows.

MATHEMATICAL SOCIETY, at 8.—On Surfaces: the loci of the vertices of cones which satisfy six conditions: Prof. Cayley.—On the Constants that occur in certain summations by Bernouilli's series: J. W. L. Glaisher.—On the Construction of large tables of divisors and of the factors of the first differences of prime powers: W. B. Davis.—On Parallel Surfaces of Conicoids and Conics: S. Roberts.

FRIDAY, JANUARY 12.

ASTRONOMICAL SOCIETY, at 8.

QUEKETT MICROSCOPICAL CLUB, at 8.

MONDAY, JANUARY 15.

ANTHROPOLOGICAL INSTITUTE, at 8.

LONDON INSTITUTION, at 4.—Elementary Chemistry: Prof. Odling.

TUESDAY, JANUARY 16.

ZOOLOGICAL SOCIETY, at 9.—On a fourth collection of Birds from the Pelew and Mackenzie group of Islands: Dr. G. Hartlaub and Dr. O. Finsch.—Notes on the Myology of *Leiolepis bellii*: Alfred Sanders.

STATISTICAL SOCIETY, at 7.45.—On Licensing and Capital Invested in Alcoholic Drinks; Prof. Levi.

ROYAL INSTITUTION, at 3.—On the Circulatory and Nervous Systems: Dr. W. Rutherford.

WEDNESDAY, JANUARY 17.

SOCIETY OF ARTS, at 8.—On the Oral Education of the Deaf and Dumb: G. W. Dasent.

METEOROLOGICAL SOCIETY, at 7.

THURSDAY, JANUARY 18.

ROYAL SOCIETY, at 8.30.

SOCIETY OF ANTIQUARIES, 8.30.

ROYAL INSTITUTION, at 3.—On the Chemistry of Alkalies and Alkali Manufacture; Prof. Odling, F.R.S.

LINNEAN SOCIETY, at 8.—On the Anatomy of the American King-Crab (*Limulus polyphemus*, Lat.): Prof. Owen, F.R.S. (*Continued.*)

CHEMICAL SOCIETY, at 8.

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