THURSDAY, MAY 18, 1871

THE PEOPLE'S UNIVERSITY

A GIGANTIC and imposing educational scheme is about to be launched, which, whether it proves feasible or not, must attract the attention and enlist the sympathy of all well-wishers to the intellectual development and material welfare of the country. This is no less an idea than the establishment of a National Working Men's University, which is to be founded with special reference to instruction in those subjects which have a direct bearing on the arts and manufactures. That our workmen are, as a rule, altogether ignorant of the scientific principles upon which the processes they ought to guide and govern are dependent, and that England in this respect stands in a much inferior position to continental nations, is now a well-recognised fact. The result of this lamentable ignorance is stated by certain authorities to be severely felt in those of our trades and manufactures in which we have to compete with other nations; and although this conclusion has been denied by many, yet concerning the necessity for scientific education amongst our artisans there has never been a difference of opinion. The question then arises, How are we to bring to our rising artisans on an extended and national scale the knowledge of scientific principles which they so much need, and for which the best of their class show so much desire and even aptitude? One solution to this problem is being attempted by the scheme of a National University for Industrial and Technical Training. The proposal is to establish a metropolitan institution in which complete and thorough instruction in all those branches of knowledge which are of importance to our manufacturing industry shall be given. It is proposed (1) to build ample lecture-rooms, laboratories, art (as well as scientific) museums on the most extended scale; (2) to create professorships both of the pure sciences and of such more technical subjects as can be systematically treated, and we will also hope chairs of at least such literary subjects as the modern languages; and (3) to found scholarships by which artisans may be enabled to live during the years of their studentship. This central university is to be connected with other similar institutions scattered over the country in the foci of the industrial pursuits, each carrying out in its locality the same function which the central one is to perform perhaps on a somewhat higher scale for the metropolis and the country in general.

The idea is a noble and grand one, but the difficulties of carrying it out are immense, whilst the dangers of the scheme proving abortive are scarcely less so. The first requisite in such a scheme for artisan education is money, the second condition of success is good management. If the wealthy city guilds come forward to the good work with subscriptions of tens and hundreds of thousands, and if men of ability and of high views and of sound practical knowledge on educational questions undertake to work the scheme, the University of the People may possibly become a reality.

That the best of the English artisans value a scientific training when it is placed within their reach, is a matter which has now been satisfactorily proved, and if any system of high science instruction can be inaugurated by which the force of thousands of powerful brains, now lying dormant, can be made productive, an increase of energy will be gained to the country of which we cannot form the slightest conception.

When, however, we come to count the cost, we may well doubt the accomplishment of the design, for we must set it down as a first principle that every artisan must not only be gratuitously taught, but also kept during the period of his studentship. This would necessitate a scholarship of at least 40*l.* per annum for each student; or 40,000*l.* for every thousand students; add to this a like sum (a moderate estimate) for the payment of professors, expenses of working the science departments, museums, &c. we see that each student will cost probably nearly 100*l.* There is, of course, plenty of money, even in the metropolis itself, which might with propriety be applied to this most laudable object, but whether such a sum can be raised as shall yield an annual income say of 80,000*l.* to 100,000*l.* large enough to support a People's University on a truly national scale (and anything less than this would be a practical failure) appears more than doubtful. For although the importance of this movement, in a national point of view, cannot in reality be overestimated, it is but too evident that this opinion is not held by the world at large, and certainly not (unless they are much belied) by rich corporations or city companies; and without aid from some such old and wealthy foundations, a scheme of this kind can scarcely be permanently supported.

The financial are, however, by no means the only or the most important difficulties which will beset the new University. These will only begin to be felt when the scheme has been started—such as dangers of giving an instruction too purely theoretic, or of running into the worse evil of teaching details without scientific *aperçu*.

In face of such difficulties it all the more behoves those who really believe the movement to be a wise and beneficial one, to exert themselves to support it. It is simply a duty to draw attention to a proposal which, if properly carried out, may improve to a very important extent the condition of Science in England.

H. E. ROSCOE

THE SUN

Le Soleil. Exposé des principales découvertes modernes sur la structure de cet astre, son influence dans l'univers et ses relations avec les autres corps celestes. Par le P A. Secchi, S.J. Pp. 422, 8vo. (Paris: Gauthier Villars, 1870. London: Williams and Norgate.)

The Sun: Ruler, Fire, Light, and Life of the Planetary System. By Richard A. Proctor, B.A., F.R.A S. Pp. 480, crown 8vo. (London: Longmans, Green, and Co., 1871.)

DURING the past few years the number of workers in the domain of solar physics has been so great, their progress so rapid, and the results of their labours have been published in so many forms, that it has been difficult to keep pace with them. Under these circumstances, a summary of these labours, which shall extract what is most valuable from all, and refer the reader to the original publications for the remainder, is a great desideratum.

The work of the Père Secchi seems designed not so much to supply this particular want as to give a general popular *resumé*, of what is known of the physical constitution of the Sun. It would therefore scarcely be just to measure it by the standard in question, and all the less just because the very branch of research in which the author is most eminent is that of which he speaks the least. Only one chapter and part of another are given to spectrum analysis of the solar light and its results, and as the operation of spectrum analysis itself is described at some length, there is little space left for the discussion of the results. Roughly speaking, one half the book is devoted to a description of purely optical phenomena as observed with a telescope. The appearances and movements of the solar spots are in particular treated at great length. The other half is devoted to radiation, temperature, gravitation, spectrum analysis, and the relation of the sun to the stars. The chapter on Radiation seems designed to save the reader the trouble of referring to elementary works on natural philosophy or chemistry, and the next has nearly the same object with respect to astronomy.

The chapter on Temperature is that which has most piqued our curiosity. The author calculates that the temperature of the sun must be at least ten millions degrees centigrade. On examining the process by which he reaches this conclusion, we find that he sets aside the law of radiation of Dulong and Petit, and substitutes that of radiation proportional to the simple temperature. He gives no reason for the adoption of this new law, and we were not aware that the other had been disproved. The question is of importance, for, if the law of Dulong and Petit were true, a sun at a temperature of ten million degrees would speedily reduce our earth to vapour. It would be interesting to measure the temperature of a furnace by the effect of its radiation upon a thermometer, in the same way that Père Secchi has measured that of the sun.

The paper and typography of the work are excellent, and among the illustrations are six finely-executed charts of stellar spectra, illustrating the author's classification of such spectra.

Mr. Proctor's work, while covering nearly the same general ground with the former, is much more complete in its account of recent observations and theories, especially of the phenomena of solar eclipses. It is, on the whole, better than might have been supposed from its stilted title.

The first chapter is designed to give an historical discussion of the solar parallax. A history of this subject at the same time popular, accurate, and complete, is indeed much to be desired; but Mr. Proctor's is imperfect and inaccurate in a remarkable degree. He begins very well, but grows worse and worse as he approaches his conclusion. He suddenly stops his history with the year 1868, and ignores all that has been said or done since. Confining ourselves to two or three paragraphs and a note near the close of the chapter, we find the "ligaments," "black drops," and distortions sometimes seen in interior contacts of the limbs of Mercury or Venus with that of the Sun, described as if they were regular phenomena of a transit, without a mention of the facts and experiments which indicate that these phenomena are simple products of insufficient optical power and bad definition, which disappear in a fair atmosphere, with a good telescope well adjusted to focus; and this is followed up with a grave proposal to measure this product of bad definition during the next Transit of Venus. One might suppose, from his closing statements, that Mr. Stone was the first to "infer from the account given by the different observers, whether real or apparent contact was noticed," and to allow for the difference between the two. The subsequent examinations of the observations used by Mr. Stone are, with a single insignificant exception, entirely ignored. We cannot, therefore, but wish that the author, before printing this chapter, had submitted it for revisal to some one acquainted with the subject.

In the second chapter we find the author more at home. We rarely see the accuracy of the mathematician united with that vigour and clearness of style so desirable in the popular presentation of truth. Mr. Proctor, however, here seems to unite both qualifications in a high degree.

The third chapter gives a very clear and satisfactory account of the first principles of spectrum analysis. The historical and the logical development of this subject coincide remarkably with each other, and it is therefore that very properly adopted in its presentation. We find one statement which we must ask leave to doubt, until a more satisfactory proof is given than we have yet seen. It is that the intensity of the D light (if we may use the expression) of incandescent sodium vapour is not only apparently but actually diminished by passing sun-light through it. If this were so, it would follow that the sodium flame not only absorbed the light in question, but that, in doing so, it lost the power of emitting it. This would, indeed, be a remarkable result. We understand Kirchhoff, in the experiment alluded to, to speak only of relative light and darkness, and to assert that the D part of the combined spectrum is less bright than the surrounding and intermediate parts. But we cannot conclude from this that there was really less light there than when the sodium flame shone by itself, as Mr. Proctor does.

The succeeding chapters give a very full, classified summary of recent observations upon the sun, the protuberances, the corona, and the zodiacal light. The accounts of the phenomena observed during total eclipses are carried up to that of August 1869. From the preface it would seem that the work was passing through the press in December 1870, and it is a pity it could not have been completed by adding the observations of the eclipse during that month. The discussion of theories of the corona and protuberances is evidently honest, and perhaps intended to be complete. He tries to disprove the "atmospheric glare theory" by showing that no part of our atmosphere in the direction of the corona is illuminated by direct sunlight, a proposition which we apprehend no one ever maintained. But we know that every bright celestial object is surrounded by a certain amount of stray light, due to atmospheric reflection, which increases rapidly in intensity as we approach the object; and such a light must therefore surround the real corona and protuberances. We also know that every bright object of this kind appears larger than it really is, and of a different form, from mere optical illusion. Until these two effects are eliminated, we can gain no positive knowledge either of the exact form or the exact extent of the real objective corona. The "meteoric theory" of the corona and zodiacal light, sustained by the author, is subject to objections as grave as those he brings against other theories;

but we have no room to explain them at length in the present article. It is the less necessary to do so, as the final conclusion of the subject is very well embodied in two lines of the table of contents:—"The origin of the prominences still a mystery," "The corona's true nature also unknown."

Respecting the general spirit of the work, it may be remarked that while the author doubtless intends to do justice to all the investigators whose labours he describes, there is one feature of the work which may lead the reader to doubt whether he has really done so. We refer to the indications of personal feeling scattered here and there, and the depreciating tone adopted in treating of the labours of those he does not personally like. However this may be, there are few or no popular expositions of a scientific subject in which the observations, opinions, and labours of so many men of science have been collected and referred to their authors.

S. NEWCOMB

FOREIGN SCIENTIFIC ASSOCIATIONS

Proceedings of the Scientific Association of Trinidad, 1866—69, Port of Spain. (London: Trübner and Co.)

Proceedings of the Essex Institute. Vols 4 to 6. 1864—70. Salem, U.S. (London: Trübner and Co.)

Journal of the North China Branch of the Royal Asiatic Society. 1864—68. New Series. (Shanghai: A. de Carvalho. London: Trübner and Co.)

THE Scientific Association of Trinidad has now been in existence for some years. Its object is "the cultivation of scientific knowledge in the West Indies;" and if we may judge by the character of most of the memoirs contained in the parts of the Proceedings hitherto published, it must be a very useful society.

Dr. Mitchell has communicated more papers than any other member. He has contributed articles "On the Use of Sulphites in Medicine," with an "Additional Note on the Use of Sulphites and Bisulphites, whether Medicinally or otherwise," "On Earth Closets," "Hints on the Breeding and Rearing of Horses," "On the Manufacture of Sugar by the Process of Drying the Cane," and "On the Manufacture of Sugar by Evaporation." Mr. Guppy contributes three papers, "On the Mollusca of Trinidad," "On Petroleum and Naphtha," "Remarks on the Cultivation of Scientific Knowledge in Trinidad," "On the Tertiary Fossils of the West Indies," and "On the Marine Shells found on the Shores of Trinidad." Amongst other articles of permanent interest we may especially mention Dr. Goding "On the Petroleum or 'Green Tar,' and the 'Manjack' of Barbadoes," the Hon. Richard Hill, "On Poisonous Fishes," and "On Fish Poisons;" and Mr. Prestoe's "Catalogue of Plants in the Royal Botanic Gardens." Many of the subjects treated of in these Proceedings serve to illustrate various points described by the Rev. Canon Kingsley in his charming "Letters from the Tropics."

The Essex Institute seems to have commenced its existence as the Essex County Natural History Society, and it published a "Journal" as early as 1836. This Journal subsequently merged in the "Proceedings" and "Historical Collections" of the Institute, the former commencing in 1848, and the latter in 1859. It is only with the "Proceedings" that we have to deal at present, and the volumes now before us contain "The Records of the Meetings, the Written Communications on Natural History and Horticulture, and the Naturalist's Directory." Amongst the most important memoirs we may especially notice Morse "On a Classification of Mollusca based on the Principles of Cephalization;" Verrill's "Synopsis of the Polyps and Corals of the North Pacific Exploring Expedition from 1853 to 1856, collected by Dr. Stimpson;" Hyatt's "Observations on Polyzoa;" Dr. Wilder's "Revision of researches and experiments upon Silk from Spiders, and upon their Reproduction, by Raymond Mariâ de Termeyen, a Spaniard, translated from the Italian;" Horace Mann, "On the Flora of the Hawaiian Islands;" Cowes's "Catalogue of the Birds of North America in the Museum of the Essex Institute;" Wood, "On the Phalangeæ of the United States;" and Packard "On Insects inhabiting Salt Water."

These quarterly "Proceedings" came to a close at the end of the year 1868, when the "Bulletin of the Essex Institute," which appears in monthly parts, took its place. The "Bulletin," which we shall take an early opportunity of noticing, contains "All the short Communications of General Interest, both of an Historical and Scientific character, made at the Meetings of the Institute, and the Records of the Meetings and Business of the Institute."

Turning from the West to the uttermost parts of the East, we take up the "Journal of the North China Branch of the Royal Asiatic Society," of which the new series commenced in December 1864, when the Society which had been formed in 1861 was reorganised.

The papers contained in this Journal are for the most part very interesting, in consequence of their treating of subjects on which comparatively little is known in this country. The geographer will find articles "On the City of Yeddo," "On the Overland journey from St. Petersburg to Pekin, "On an Overland trip through Hunan from Canton to Hankow," "On the Sea-board of Russian Manchuria," "On a Journey from Pekin to Chefoo *viâ* the Grand Canal," "On a Journey from Pekin to Shanghai," and "On a Journey from Canton to Hankow through the Provinces of Kwangtung, Kwangsi, and Hunan." The naturalist (using the term in the widest sense) will find articles "On the Geology of the Great Plain, and of a portion of Quangtung Province," "On the Coal-fields in the South Eastern Province of China," and "On the Bituminous Coal Mines west of Pekin," "On the Birds and Beasts of Formosa," "On Chinese Notions regarding Pigeons and Doves," "On some Wild Silk Worms of China," "On the Entomology of Shanghai," "On the Sorgo or Northern Chinese Sugar Cane," and "On the mineral and other productions of North China and Shantung." Amongst other valuable papers may be mentioned those by the late Dr. Henderson "On the Medicine and Medical Practice of the Chinese," by Dr. Bastian "On the Remains of Ancient Kanbodies," Dr. Keer "On the Great Examination Hall at Canton," the Rev. A. Wylie "On the Opinions of the Chinese with regard to Eclipses, and on the Eclipses recorded in Chinese works,"

Mr. Hollingworth "On the Chinese Game of Chess," Mr. Forrest (acting Consul at Ningpo) "On the Christianity of Hung Tsiu Tsuen, being a Review of Taeping Books," and the Rev. S. R. Brown's translation of a curious old Japanese manuscript entitled "Annals of the Western Ocean." The last-named article is one of singular interest in many respects. It is divided into three parts, the first of which contains an account of the arrest of a Roman Catholic priest upon an island called Yaku-Shirna in the year 1708, his removal to Nagaski and examination there, and his subsequent arrival at Yeddo, imprisonment, trial, and death. The name of the person as given in Japanese syllables was Jean Baptista Shirotte, and he is supposed to have been the last Roman Catholic missionary who landed in Japan previous to the year 1859. The second part contains the report of the prisoner's examination, and the information obtained from him respecting the military and naval power, and the wars and conquests of the Western nations; while the third comprises the missionary's answers to the questions put to him about himself and his family connections, his reason for coming to Japan, and his religious creed.

From the very curious paper on the "Birds and Beasts of Formosa" which is translated by Mr. Swinhoe, H.B.M. Council at Taiwan, from the 18th chapter of the "*Tai-wan-foo-che*, or Statistics of Taiwan," we learn that "as soon as the doe that has finished suckling observes her roe getting to maturity, she deserts it and repairs to other hills, fearing that her young might entertain an improper affection for herself. Animals do not confuse the laws of consanguinity, the horse excepted. The doe deprives her offspring of any such opportunity by setting a distance between herself and her young." We have quoted this passage because it contains almost the identical views expressed by Aristotle,* but we suspect that this idea is not based on any sound foundation.

Several of the articles, and especially those of Dr. Henderson "On the Medicine and Medical Practice of the Chinese," and of Mr. Walters "On Chinese Notions about Pigeons and Doves," throw considerable light on the absurd mode of practice adopted by the native doctors. From the latter paper we learn that the eggs of pigeons are an antidote to the injurious effects of boils and smallpox. Some persons may think the remedy worse than the disease, as the following course has to be followed:—Two eggs must be hermetically sealed in a bamboo tube and placed in the middle of a cesspool for half a moon. The whites are then to be mixed with three ounces of *shen-sha*, a very fine red sand-like substance, and the compound is to be divided into pills of the size of a green pea. If thirty of these pills are taken three times a day, the patient will soon find relief, for the poisonous matter will be rapidly discharged by the bowels and kidneys. The excrement of the same bird, when roast to cinder and soaked in wine, forms a cure for cold on the chest, and there are several other affections in which it is very useful. Let us conclude with a pleasanter remedy. "Of the *shi-chin* or wood-pigeon it is written that its flesh is sweet, delicate, and without poison. It also gives one a composed mind, and enables him to do with little sleep. Its foot and leg bones have the very delightful quality of exciting affection between husband and wife. If on the fifth day of the fifth moon the husband takes one of these bones and the wife takes one, each putting the bone in a basin of water, one from the left and the other from the right side, the two bones will come together and float together, thus indicating a long and happy union to the parties trying the experiment."

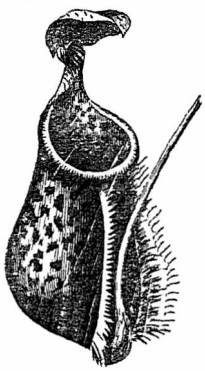
G. E. D.

* See his "History of Animals," Book ix., chap. 34 (Creswell's Translation in Bohn's *Scientific Series*), in which he tells two very remarkable stories regarding a camel and a stallion in relation to this subject.

OUR BOOK SHELF

A Manual of Structural Botany for the Use of Classes, Schools, and Private Students. By M. C. Cooke. New Edition. (London: R. Hardwicke.)

WE have so often felt it our duty to expose the incompetence of those who attempt to write elementary text-books of science, that it is a real pleasure to come upon one like Mr. Cooke's "Manual of Botany," where a man of really accurate scientific knowledge applies himself to writing an elementary work on the rudiments of his science. The special object of the publication, as stated in the preface, is to supply a cheap manual to place in the hands of students in the Botanical Classes established for operatives in connection with the Department of Science and Art; but it may well be used as a first book to prepare for other objects, as, for instance, for the first B.Sc. examination, or that for Women, at the University of London, though it would then have to be supplemented by others on the systematic branch of the subject. The descriptions are clear and accurate, and expressed in commendably terse language. It is illustrated by over two hundred woodcuts, some of them of decided merit; and we have reserved our crowning sentence of commendation till the last—the price is one shilling!



Pitcher of Nepenthes

A. W. B.

Geographisches Jahrbuch. III. Band, 1870. Unter Mitwirkung von A. Anvers, J. Baeyer, A. Fabricius, A. Griesbach, Fr. Müller, Fr. Neumann, L. K. Schmarda, F. R. Seligmann, J. Spörer, H. Wagner:—Herausgegeben von E. Behm, Mitredakteur von Petermann's Geogr. Mittheilungen, 1870. (Gotha: Perthes. London: Williams and Norgate.)

WE lately had occasion to speak in terms of high commendation of Vivien de St. Martin's *Année Géographique*, and we can award equal praise to Behm's corresponding work, which is the more elaborate of the two, and consequently the less agreeable to the ordinary reader. It is divided into four parts, devoted respectively to Geographical Chronology, Geographical Statistics, Essays on the Progress of Geographical Knowledge, and Tables of use in Mathematical Geography. The first part consists of a geographical calendar, stating the date of the discoveries of various countries, of the birthdays and deaths of great geographers, &c. (for example, on the day on which we are now writing, April 22nd, J. Richer arrived at Cayenne, 1672; the island of Rea or Wallis was discovered by Maurelle, 1781; Reao was discovered by Duperry, 1822; Denham arrived at India (Mandara) 1823; and the *Novara* sailed from Singapore, 1858); and it treats of the manner in which time is calculated in certain countries. The second part is extremely valuable, but is very dull; any information that may be required as to the state of the population of any country, of the number of houses and inhabitants in a square mile, &c., may be readily found here. The third part consists of extremely

valuable memoirs by Baeyer, on the progress lately made in the measurement of the degree; by Griesbach, on the Geography of Plants; by Schmarda, on the progress of our Knowledge of the Distribution of Animals; by Seligmann, on the Progress of Ethnology; by Müller, on Linguistic Ethnography in Relation to Anthropology; by Fabricius, on the Progress of our Knowledge of National Statistics; by Spörer, on the History of Geography; by Neumann, on the Products, Merchandise, and Currency of Different Nations; and by Behm, on the most important Geographical Travels during the years 1868-69. Behm's memoir, which extends over more than a hundred pages, is unquestionably the most valuable portion of the book, and next in order of interest, at all events to the naturalist, we should place the essays of Schmarda and Griesbach. The last part of the volume is purely numerical, and requires no comment. Everyone desirous of keeping himself up to the existing level of geographical knowledge should purchase both the German and French annuals. For those who must content themselves with a single volume, we should say the French one was the better.

G. E. D.

The Romance of Motion. By Alec Lee. (Longmans: 1871.)

THIS is another of those books in which the author does not understand the first principles of the science with which he deals. The laws of motion seem to be affording more than usual trouble to certain people just now, and most unfortunately they write books about it couched in the longest scientific terms and the most formidably accurate-looking phraseology. The author alleges, as one of the extraordinary paradoxes among the opinions of the nineteenth century, "how all bodies are supposed to persevere in their state of rest or of motion, in a straight line, unless compelled to change that state of rest or motion by the impression of some force on them; and how, in opposition to this law, the planets become accelerated and retarded in their orbits without such adequate impression of force; also how bodies initially projected at the surface of the earth, fall by the force of gravitation with velocities uniformly accelerated, and how the planets similarly projected descend towards the sun with velocities comparatively equal throughout the entire duration of their revolutions." We need hardly remind the reader that these conclusions, so far from being in any way in *opposition to* the law of motion stated by the author, are in complete harmony with that law, and, as was demonstrated by Newton, follow from it on the hypothesis (to give it no higher name) of gravitation. The author at least might have observed, in comparing the case of the stone and of the planet, that the direction of the force on the former is unaltered, while that of the force on the latter is continually changing.

LETTERS TO THE EDITOR

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

Thickness of the Earth's Crust

ARCHDEACON PRATT'S explanation in NATURE of May 11 seems to assume that a rigid body moving in contact with a fluid body can never communicate its own rate of motion to the latter as quickly as it would do if this were also a rigid body attached to itself. Supposing the earth to consist of a rigid crust inclosing a fluid interior, and the crust to be moved by the forces producing precession, it would, he says, "slip over the surface of the revolving fluid through a small space proportionate to the push given to the poles. The fluid could not possibly acquire in an instant this new motion, however small it might be, because the fluid is not rigidly connected with the crust."

I venture to suggest that if in the last sentence Mr. Pratt would substitute the word "slow" for "small," the question would have a different aspect, notwithstanding his subsequent statement to the contrary.

Strictly speaking, when a body, however rigid, is moved, the whole of it never moves instantaneously. The particles on which the moving force immediately acts move first, and the rest move in succession afterwards. The smallness of the interval is the measure of the rigidity, but some interval must always be assumed. Bodies move as a whole through the attractive or repulsive forces of their particles; and every such force resolves itself into a power of moving something through a certain space in a certain time. The reason why a moving solid will "slip over" the surface of a fluid instead of carrying it with it, is that the rate at which it can carry it with it by reason of its attractive force is commonly less than the rate at which the solid is moving. But if the motion is slow enough to exceed that which the attractive force will cause in the fluid, it will slip over no longer; and if it be so slow that not only the power of the solid over the fluid, but of the fluid particles over each other, is able to produce an equal rate of motion, the whole mass will move together as if it were a rigid body. This rate will depend chiefly on the nature of the fluid. If a metal plate four inches in diameter is filled with lamp oil, and made to rotate at about one revolution in three minutes, the oil will move with the plate without appreciable retardation, though if the speed be doubled, the oil is seen to be "slipped over." If water is used, or the size increased, the rotation must of course be very much slower. It would appear on these grounds, I think, that the extremely slow movement of precession might practically affect the whole body of the earth as if it were rigid, notwithstanding the granting of a fluid interior.

May 14 A. J. M.

IT requires no little courage to attack so eminent a mathematician as Archdeacon Pratt on his own ground, and it is, therefore, with the utmost diffidence that I venture to suggest that in his defence of Hopkins against Delaunay in your last number, he has mistaken a mathematical fiction for a fact.

In calculations involving quantities which vary in magnitude, the imperfection of our methods oblige us to have recourse to an artifice, and for the benefit of the non-mathematical reader, I will try to explain what this artifice is, taking the case of nutation as an example:—

The motion of the earth's axis which is known by this name, is caused mainly by the attraction of the moon on that part of the earth which lies outside a sphere, whose centre is the earth's centre, and its radius the polar radius of the earth. Now this force of the moon's attraction is never the same in magnitude; and, however small be the interval of time we consider, it is not the same at the end as the beginning of that interval; it is incessantly changing. Everyone will realise the difficulty of estimating the effect of such a force. This difficulty is got over by the artifice I mentioned, which is as follows:—The time is divided into a number of small intervals, and the attraction is supposed to keep during anyone of these intervals the magnitude which it has at the beginning of that interval, and at the end of that interval *suddenly* to assume the magnitude which it has at the beginning of the interval next following, and so on; the force, in short, instead of varying by insensible changes, is supposed to act by a series of fits and starts. This must be what Archdeacon Pratt means when he talks of "a succession of slight horizontal pushes being given to the poles." The amount of motion produced during each interval on the above supposition is then determined, and these amounts are added together to obtain the displacement produced.

It is clear enough that such a method can only be approximately correct; but it is also clear that the smaller each interval is, the nearer will the hypothetical be to the real state of the case, and the nearer will the calculated be to the actual result. As long as the intervals are finite there must be some error, but the smaller the intervals are made the less will this error be. I need not go into the methods of mathematical analysis which enable us to get rid of this error, and which, when we have found out what will be the effects of a force acting with variable intensity by fits and starts separated by small finite intervals, enables us to deduce the effect of the same force when it comes to vary incessantly; for I hope I have made clear the nature of the mathematical artifice on which this analysis is founded.

Now it seems to me that Archdeacon Pratt all along reasons on the supposition that the moon's attraction acts after the manner the mathematical artifice I have described supposes it

for the mere necessities of calculation to act. All his argument, if I understand it aright, depends upon the displacement being by fits and starts. Thus he says (NATURE, July 28, 1870), "The precessional force has its full effect in producing the precession of the solid crust, the fluid *not having time** to diminish that effect before the axis has assumed a new position;" and "The friction of the fluid within, which *has not time* to influence the nutation before the nutation is actually produced;" and (NATURE, May 11, 1871), "Suppose a succession of slight horizontal pushes to be given to the poles in a continually altering direction, the effect will be that the revolving crust will be continually slipping over the revolving fluid, which *has not time* to acquire the new motions given *instantaneously* to the solid crust."

The leading idea in all these passages seems to me to be that the attractions of the sun and moon, to which precession and nutation are owing, act by impulses, by a succession of sharp pulls quickly repeated. This is truly enough the supposition with which mathematical calculation starts; but the real action, I need not say, is a steady, continuous, though ever varying, pull, and it is the result of such an action which our calculations in the end lead us to, by a method which enables us to get rid of the error necessarily involved in the approximate result which would follow from our first supposition.

I cannot then help thinking that even Archdeacon Pratt has for once been carried away by the beauty of mathematical analysis, and has for the moment forgotten that the conditions which it is obliged to employ for its ends do not in their initial form represent the actual conditions of nature. The explanation occurred to me on first reading his paper in the *Philosophical Magazine*, but seemed to me so unlikely that I shrank from putting it forward. I can, however, in no other way imagine how he can have come to the startling conclusion, that, if a solid shall be moved by a steady, continuous pull over an interior ball of fluid, it can make no difference in the result, whether there is or is not friction between the interior of the shell and the surface of the fluid. Archdeacon Pratt, will, I know, if I am wrong, pardon my presumption and put me right.

Barnsley, May 12 A. H. GREEN

Pangenesis: Graft-Hybrids

EACH person who assails this unfortunate "provisional hypothesis" makes the attack from his own particular point of view. Thus, in NATURE of last week Prof. L. S. Beale, as a microscopist, objects to it because the gemmules cannot be made evident to the senses. From this somewhat narrow view of the case the atomic theory of chemistry, the undulatory theory of light, or the mechanical theory of heat, must all break down, for no one has as yet seen an ultimate atom, or an ethereal undulation. Mr. A. C. Ranyard, in the same paper, publishes a letter which is quite at variance with fact, for if he will turn to pp. 390, 391, 394, 397 in vol. i. and pp. 364 and 365 vol. ii. of Mr. Darwin's work on "The Variation of Animals and Plants under Domestication," he will there find many cases given of the scion affecting the stock and producing intermediate forms known as "graft-hybrids." Pangenesis has not yet "received its death blow." R. MELDOLA

May 13

IN your last number Mr. Ranyard brings forward an objection to Mr. Darwin's theory of Pangenesis on the ground that the grafting of a bud on a stock of a different species does not produce a hybrid offspring. I am not about to defend the doctrine of Pangenesis, which appears to me incapable alike of proof and of disproof. It is, however, a well-known fact that the stock does affect the scion, and *vice versâ*. In Prof. Henfrey's "Elementary Course of Botany" (Dr. Masters's edition) he says, "A certain amount of physiological influence of the stock over the scion is shown to exist by such facts of horticultural experience as that the fruit of the pear is smaller and more highly coloured when 'worked on' the quince and medlar than when grafted on pear-stocks, and is earlier when worked on the mountain-ash." The well-known instances of the communication of variegation from the scion to the stock in *Abutilon*, recorded by Prof. Morren and others, are considered cases of contagious disease; but what is the theory of contagion but that the blood or other "fluid" of an animal or plant is affected by emanations, call them "gemmules" or what you will, from another individual? The same writer records an instance which he considers well authenticated of the production of the hybrid *Cytisus Adami* by the grafting of *C. purpureus* on *C. laburnum*.

ALFRED W. BENNETT

* I have taken the liberty of italicising those expressions which seem to me of vital importance to the argument in these quotations.

The Rev. Mr. Highton and Thermodynamics

YOU are cruelly kind to Mr. Highton in giving him space to develop his absurdities.

His new remarks on Joule, like his earlier ones on a paper by Sir W. Thomson, simply show that *he does not understand* what he ventures to criticise. Of course, what Joule now says is precisely what he said a quarter of a century ago, with the simple difference that it is put in a somewhat more popular form.

No one who has taken the trouble to understand the experimental *facts* and the elementary reasoning of which the Laws of Thermodynamics are the condensed expression, has any more doubt of their truth than of the truth of Newton's Laws of Motion. They are, perhaps, a little harder to understand; but the proof is of the same nature, and already almost of the same extent, in the newer science as in the older one.

I have not seen the *Review of Popular Science* referred to by Mr. Highton, but I hope (for the credit of that journal) that he misconceives its statements as he does those of Joule.

Your "first reviewer" (or rather précis-writer) of his article, whoever he may be, certainly gives him no encouragement in the number for Jan. 19, whatever may have been the effect of my treatment of his not singular case.

YOUR REVIEWER

On the Radial Appearance of the Corona

WOULD an indefinitely extending solar atmosphere, if its existence could be proved, be in itself sufficient to explain the appearance of the solar corona? Should we not still have to explain the apparent radiation which is so distinctly part of the phenomenon?—If the light or heat of the sun which radiates symmetrically outwards as from a point at its centre be the cause of the illumination, surely the figure of the corona would bear some relation to the figure of the atmosphere or medium on which the light or heat acts? Yet I think I may say that it is quite impossible to conceive a medium so distributed and arranged as to form rays such as those seen in the corona. If the recent photographs had not shown beyond a doubt that this irregular radiating appearance belongs to the corona and the neighbourhood of the sun,* it would have gone a long way to prove that the corona is at least partly due to the earth's atmosphere or mere optical effect. But, as it is, I think this radiation clearly proves that the corona cannot be due to the direct action of the light and heat of the sun on any surrounding matter. In fact, I cannot conceive an atmosphere the character of which varies in a radial manner, however rapidly either its nature or density may vary with the distance from the surface of the sun. If, instead of an atmosphere, we try to conceive a ring of meteors, still the radial gaps so clearly marked on the photographs present insurmountable difficulty. This, moreover, is impossible on other grounds. It is impossible that there can be an almost homogeneous mass of meteoric matter circulating round the sun in the form of an outer sphere, and if it circulated in the ecliptic or any other plane, it would present the appearance of Saturn's belt, whereas the corona appears altogether different from this, and cannot possibly be a film of light in any plane but that of the sun's limb.

Nor can these radial rifts be of the nature of shadow. For the shadow which anything like a sun spot would produce in a misty atmosphere must be conical, the vertex of the cone being outwards, so that the edges of the shadow would approach each other instead of receding as they do. Moreover, such a shadow would still be seen through a great extent of illuminated solar atmosphere, and therefore be only partial or faint, whereas the rifts are so dark and definite as to imply a total absence of coronal light; this must be the case unless the rifts or gaps in the spherical envelope extended right across the sphere from front to back, and we know that there is no obstruction on the surface of the sun that could cast such an extensive shadow.

What, then, does this radiated appearance show the corona to be? I think that it proves that the corona is an emission either of illuminated matter or of an action illuminating matter,

* Has this yet been established?—ED.

such as electricity, driven off unequally from parts of the sun's surface, and in directions radiating from points either on or beneath the surface.* If only a small portion of the sun's surface, such as that covered by sun spots, sent out such streamers, the appearance might exactly coincide with that of the corona; for these streamers, when seen projected on to the plane of the sun's limb, might in some places appear to overlap so as to form a continuous corona, whereas in others they might appear to be separated by gaps.

So far as the appearance is concerned, it would be the same whether the emission consisted of matter or was electricity; there are, however, other indications of its being of the latter kind.

The action which the sun exerts on terrestrial magnetism shows it to be in an electric state, and the observations of Stewart and others have established a connection between the variations in its electric condition and the changes in the sun-spots and red flames, and the observations on the recent eclipse have connected the red flames with the brighter parts of the corona. Here then we have a distinct and independent reason for assuming that the electric condition of the sun's surface is partial and unequal, and for connecting the corona with this electricity.

As I have already ventured to explain the solar corona, as well as comet's tails and the aurora, to be a kind of electric brush, I now offer these remarks on the radial appearance of the corona in confirmation of my views.

Owens College, May 8 OSBORNE REYNOLDS

A few more Words on Daylight Auroras

IN NATURE for December 29, 1870, there is a letter from Dr. G. F. Burder in reply to a previous correspondent,† who had sent a description, with an illustration, of a Daylight Aurora observed by him, wherein he made the following statement:—

But auroral arcs, as far as I know, never appear in the east, and the conclusion, therefore, is unavoidable, that the object observed was nothing more than a remarkably symmetrical form of cirrus cloud."

He then states his convictions that all records of so-called daylight auroras are "errors of observation."

As assertions like these might have an undue influence on the minds of those who read my letter on "Aurora by Daylight" (NATURE, May 4, 1871), I am induced to say a few more words on this subject, especially to prove the fallacy of such reasoning.

It is well known that the aurora borealis assumes innumerable shapes; some of the most remarkable were given by me some time ago in these pages;‡ and that they appear, at times, actually in the *east*, but more often in the north, north-west, and stretching to the south. A writer of some excellence in the last century § says:—

"Sometimes the aurora appears like arches, nearly in the form of a rainbow, reaching from one point of the horizon to another. The arches always cross the meridian at right angles, *tending to the east and west point of the compass.*"

The correspondent whom Dr. Burder is so hard upon, most probably saw the arc in a position nearer to this, than directly *facing* him, with his back to the *west*, and as the illustration sent by him shows only a segment of the arc, I am inclined to think that the extremities were nearly in the east and west.‖ The "cirrus cloud" hypothesis is simply untenable, when it is known positively that on several occasions the aurora was seen against an azure background, with no form of cloud in the field of view, as for instance that mentioned by me, where a faint arc was seen before sunset in the east (possibly N.E.) against a cloudless sky.¶ His other assertion, from which I must dissent, was: "A comparison of the auroral light with the light of other objects whose visibility can be more easily measured, tends strongly to confirm the view I have advanced." He then instances the invisibility of Donati's comet by daylight. He might have instanced the invisibility of the stars, although they can be seen in broad daylight when the observer is placed at the bottom of a deep pit; but this need not be done, for daylight does not always mean bright sunshine; and with diffused light, Venus is often seen before the sun has actually gone below the horizon. This, so far, may appear mere assertion, but the following will, I hope, be sufficient to show that the view he holds requires some kind of modification.

"A.D. 678.—This year the star (called a comet) appeared in August and shone like a sunbeam every morning for three months" (Anglo-Sax. Chron.).* By every morning I take to mean daylight, because in these months the mornings would invariably be very light, especially the few moments before the comet actually disappeared.

With regard to all the record of daylight auroras being mere "errors of observation," I am sure no one will continue to entertain such an opinion after carefully examining all that has been said upon the subject in these pages. As it may be useful to those who are interested in this question, I have made a summary of all the daylight auroras recorded in this and other publications, which do not admit of doubt.

A.D. 1122. A phenomenon appeared like a great and broad fire, and lasted till it was quite light. (Anglo-Sax. Chron.)

A.D. 1467. A *most probable day aurora*, described as "horsemen and men in armour rushing through the air."† (Ingulf. Second Cont.)

A.D. 1788. May 5 at 11 A.M. an auroral display seen, consisting of "whitish rays ascending from every part of horizon." Observed by "three different people." (Trans. Royal I. Academy for 1788, quoted by Rev. T. W. Webb in NATURE, May 11, 1871.

A.D. 1827. "Aurora Borealis seen in the day-time at Canonmills" at 4.30 P.M. Described in "Jameson's Journal" and NATURE for May 4, 1871. (Arcana of Science and Art for 1828.)

A.D. 1849.—In September an aurora seen, consisting of "three slightly diverging beams of light on the eastern horizon. One might have taken them for beams from a setting sun . . . had it not been that they did not emanate exactly from the spot where the sun had set; that they had an evident motion to the southard, and that two of them extended to the zenith, and finally down to the eastern horizon." ‡ (Mr. J. Langton, in NATURE, April 27, 1871.)

A.D. 1870.—September 4, about 4.30 P.M., an aurora observed "in the form of thin reddish streaks." ("S. B." in NATURE, October 13, 1870.)

A.D. 1870.—October 25, at 4.30 P.M., a brilliant aurora seen in the *east*, and fully described with illustration of it. (NATURE, December 8, 1870.)

A.D. 1870.—December. A *probable* auroral display, which was observed a "little before sunset," and developed as the evening advanced into a brilliant aurora borealis. The day phenomenon, however, not sufficiently described to make the record trustworthy. (J. Langton, in NATURE, April 27.)

A.D. 1871.—April 10, about 4.30 P.M., a whitish arc seen, almost east, against a cloudless azure sky. On the previous night there was a magnificent aurora borealis.§ (Mentioned by me in NATURE, May 4.)

These form the whole of the most reliable records, which are certainly few, for the period embraced between the earliest and present date; but I am inclined to believe that the occurrence of daylight auroras is not so rare as is here shown, but that they have been seen and actually recorded in the works which I have here and elsewhere quoted, but for the want of the statement of the time of day or night, one cannot tell to which the appearance belongs. Often a display which can be said to have been seen in the night, might as easily be said to belong to the day, so far as the actual wording of the record goes. It will follow from this that the scanty records we have of daylight auroras referred to phenomena of extraordinary magnitude and magnificence. JOHN JEREMIAH

The Conservation of Force

I HAVE been endeavouring to understand what is meant by the Conservation of Force; and as it is one of the most interesting subjects I have studied, I send you the result of my labours.

* We are of opinion that there is still another explanation.—Ed.

† NATURE, Dec. 8, 1871. ‡ Ibid, Dec. 29, 1871.

§ "Compendious System of Astronomy," by Margaret Bryan. London: 1797, p. 132.

‖ For evidences of night auroras being seen in the east, consult the letters in NATURE for 1870.

¶ NATURE, May 4, 1871, p. 8.

* This is confirmed in Beda, Flor. of Wor. (under A.D. 677) and Chronicum Scotorum (under A.D 673 in error for 677).

† See also Pliny, Bk. II. c. lvii.

‡ This very singularly explains the following passage in Pliny:—"Round about the sun there was seen an arch when Lu. Opinius and Q. Fabius were consuls" (about B.C. 123) This was not an ordinary halo, for he says further:—"and a *circle* when L. Porcius and M. Acilius were consuls." (Bk. ii. c. xxix.)

§ It appears curious that the majority of the displays occurred at or about 4.30 P.M., in the autumn, winter, and spring months. Cases of magnetic disturbances during this hour are not rare, accompanying the aurora. It may prove of some value to note this.

The first law of motion laid down by Sir Isaac Newton (Princip. Math. Jes. Ed. tom. i. p. 15) is not a universal law, but is only capable of a restricted application. The incapacity of matter to alter its condition, whether of rest or motion, is a doctrine which becomes untenable when we examine matters which are always *proprio motu* altering their condition. Grave as such a statement may at first sight appear, we must begin with it if we wish to arrive at the truth.

Motion is the property which matter possesses of always changing its position relatively to other matter, and each little atom of the 64 elementary substances known to chemists contains a certain amount of tendency to move ; this is a part of its nature, it would not be what it is without this ; as that great mathematician, M. Poisson, says, the tendency to move resides in it. The five gaseous elements, for instance, have each their respective amounts of tendency to move residing in the atoms of which they are composed. Prof. Faraday says, in his "Researches in Chemistry," p. 454, "a particle of oxygen is ever a particle of oxygen—nothing can in the least wear it. If it enter into combination and disappear as oxygen—if it pass through a thousand combinations, animal, vegetable, and mineral—if it lie hid for a thousand years, and then be evolved, it is oxygen with its first qualities—neither more nor less. It has all its original force, and only that ; the amount of force, which it disengaged when hiding itself, has again to be employed in a reverse direction when it is set at liberty."

Now what is the meaning of the word *force* which Prof. Faraday uses here ? is it not the certain amount of tendency to move which I mentioned before ?

A particle of oxygen contains a certain amount of tendency to move, without which it would not be a particle of oxygen at all ; and this tendency it can never get rid of, "it has all its original force, and only that."

What, then, does the Conservation of Force doctrine amount to in plain English ?

It amounts to the simple admission that the tendency to move is a property of matter inseparable from it and coexistent with it, and it is this tendency to move which is the cause of all the changes which we observe around us.

There is, however, nothing new under the sun, for the old doctrine of Argan in *Le Malade Imaginaire* is revived again ; when Argan answers his examiner for a licence to practise in medicine, he says :—

Mihi a docto Doctore
Domandatur causam et rationem quare
Opium facit dormire
A quoi respondeo
Quia est in eo
Virtus dormitiva
Cujus est natura
Sensus assoupire.

Many a clever student has laughed at this answer who little thought that research and experience would confirm it so strongly as they now do.

The virtues of opium are chiefly dependent on the morphia which it contains, and morphia is one of the vegetable alkalis containing nitrogen in combination with carbon, oxygen, and hydrogen. The *virtus dormitiva* of morphia is the certain amount of tendency to move inherent in this combination ; and this tendency, if the morphia is exhibited in the human subject, comes in contact with and retards the tendencies to move which certain component parts of the body possess, and produces that state which we call sleep. The salts of morphia are largely used to allay pain and produce sleep. Dr. Bence Jones says in his Croonian Lectures on Matter and Force, p. 84, "Stimulants, tonics, and evacuants may perhaps not only take part directly in the motions of any part of the body, but they may also promote or retard the conversion of one motion into other motions. Specifics and alteratives may directly as well as indirectly change the motions in the system. And sedatives and narcotics may have the same double action in retarding or stopping the motions that take place. This view will almost lead us to consider all medicines as alteratives, and if so we may perhaps place stimulant and sedative medicines at the two extremes of the alterative actions ; the stimulants giving rise to the greatest increase of motion, and the sedatives allowing the least motion or the nearest approach to rest."

The practical student of our day, when he speaks of terrestrial matter being at rest, means that it is then moving at the same rate of motion as the earth itself. Prof. Ansted treats of motion thus :—"The first and greatest lesson that the students of Geography and Geology must learn is that motion is not limited to masses of bodies, but is actually taking place always and under all circumstances within all masses, whether solid, liquid, or gaseous, and often without approaching the surface."—"Physical Geography," p. 2.

The Universe is one mighty system of changes, and these changes arise from the inseparable connection between matter and motion ; and Dr. Bence Jones says truly, "The question between materialism and spiritualism is in fact only a question between ponderable and imponderable materialism."

Trinity College, Oxford N. A. NICHOLSON

THE BIG GUN OF WOOLWICH

WHETHER considered as a weapon of terrible power or simply as a specimen of skilful and successful forging, the 35-ton Fraser cannon is without parallel. Of extraordinary strength and proportions, and withal so carefully, and one might almost say, elegantly finished, this magnificent gun is indeed a masterpiece well worthy of the greatest factory in England, from which it emanates. Cannon of larger dimensions have, it is true, been produced, capable actually of delivering a heavier projectile than that employed with the Woolwich weapon, but none of them are to be in any way compared with this, either in respect to battering power or length of range. That the gun is, moreover, not merely a show production, as was the case with the monster Krupp cannon, but a really serviceable and efficient fire-arm, is shown by its endurance of the severe test to which it was subjected at proof. On this occasion the 700lb. projectile was thrown from the gun by the enormous charge of 130lbs. of gunpowder—the largest, in fact, that has ever been safely consumed in any fire-arm—the explosion being without the slightest injurious effect upon the steel bore or surrounding wrought-iron castings. The solid cylinder of iron which constituted the shot issued forth at the terrible velocity of 1,370 feet per second, and, after travelling some fifty yards, buried itself in the butt of loose earth to a depth of thirty-three feet.

The pressure of the gas at the time of explosion was, as may be supposed, exceedingly great, and herein obviously lies the great difficulty to be overcome in the construction of large guns ; this pressure or strain, we find, increases in a much greater ratio than the amount of powder that is burnt would appear at first sight to justify, and for this reason large guns require to be proportionately much stronger than little ones. Thus, in the present instance, when a charge of but 75lb. of powder was fired, the pressure of the gas upon the copper piston at the rear of the projectile was shown to be seventeen tons per square inch, while 130lbs. of powder (not double the former charge therefore) gave a pressure amounting to sixty-four tons on the square inch. It has, by the way, been questioned whether this method of estimating the pressure, by means, namely, of a copper piston which is pushed in upon itself, affords a strictly reliable test, but in any case there can be no doubt that the strain upon the gun is increased in a greatly increasing ratio to the quantity of powder consumed. When we state, therefore, that the weapon withstood in every part this excessive strain, and that, under ordinary circumstances, the cartridge will contain but 90lbs. of powder, there is every reason to believe in the solidity and perfection of the structure.

The data obtained by the firing of the gun at proof lead us to hope for very successful results from its employment. It is calculated that at a distance of fifty yards the heavy projectile would be thundered forth with such force as to penetrate fourteen and a half inches of solid iron, an armour plate such as no vessels of our present construction are enabled to carry. At two thousand yards—at upwards of a mile, therefore—the shot would possess

enough penetrating force to pass clean through the side of the strongest ironclad afloat—those of the *Hercules* class—or, in other words, is endowed with impact sufficient to pierce twelve inches of iron ; and it must be remembered that this last-named distance is one at which gunners can make very good practice, so that, under ordinary circumstances, every other shot would take effect against a target such as is presented by the keel of a large frigate. As regards extreme length of range, a quality of some importance, when, as in the recent instance of the Paris siege, great projecting power is of more importance than precision of aim, this Fraser gun may vie with almost any other, with the exception, perhaps, of Whitworth's cannon. The utmost distance to which "the Woolwich infant," as it has been nicknamed, will in all probability be capable of projecting a shell is about ten thousand yards, supposing the arm to be laid at an elevation of some thirty-three degrees.

So satisfactory, indeed, has this experimental structure turned out, that a further batch of sister guns have forthwith been commenced, and will serve to arm some of our heavy iron-clads which are now building. Only a small number of such weapons will be carried by these vessels—two, or at the most four, apiece—and thus our modern men-of-war will present a perfect contrast to those of a dozen years ago, when a ship, being regarded merely as a box of guns, sometimes received on board as many as a hundred and thirty cannon. Nevertheless, a broadside delivered from four guns of these giant dimensions (for the whole armament being carried in turrets may be brought to bear at one time), representing almost a ton and a half of metal, very far exceeds that which an old first-class three-decker could throw into her antagonist, and would indeed be sufficient to sink most vessels at a first discharge.

As regards the method of building up these large guns, we need say nothing, seeing that the subject was fully discussed recently in these columns. It may be of interest to know, however, that in the present instance as much as fifty tons of metal were employed in constructing the arm, and that at one time thirty tons of this was brought to a glowing white heat for the purpose of welding. The reverberatory furnace in which this massive coil was heated is an apartment in which a dozen persons could dine comfortably, and the length of the bars before coiling amounted to upwards of 1,200 feet. The length of the arm is sixteen feet and a quarter, and its extreme diameter fifty-six inches.

A NEW INEXTINGUISHABLE STORM AND DANGER SIGNAL LIGHT

THIS new Signal, possessing most remarkable properties, has now been brought before the public. It was first exhibited at the President's meeting of the Royal Society on 22nd April, when it attracted great attention. The peculiarities of the Signal Light are, that it is self-igniting when placed in water or thrown on the sea. Contact with water being the only means of igniting the lamp, it is inextinguishable when once ignited ; neither wind nor storm has any effect upon the flame. The light is of intense brilliancy, and of great duration, and can be seen for a great distance in the open-air. Photographs may be taken by the light of this new signal. Experiments were tried on the evening of 25th April, at ten o'clock, in the presence of some scientific gentlemen, to determine its brilliancy as a signal. A lamp was placed in a bucket of water on the top of Primrose Hill, and the light was so intense that after the signal had been burning for twenty minutes small newspaper-print could be distinctly read at a distance of seventy feet, notwithstanding that the night was thick and foggy. This new signal light will burn for over forty minutes. In construction the lamp is exceedingly simple, and so contrived that when once burnt the whole may be thrown away. The chemical preparation contained in the lamp is a solid, hard substance, free from danger ; not affected by heat, and so non-explosive ; and the signal is comparatively inexpensive. Its applications for marine signals are numerous. In case of shipwreck a few lamps thrown on the sea would illuminate the entire scene, and enable assistance to be promptly and efficiently rendered. For rocket-line apparatus it is equally valuable, as, bursting into a flame on falling into the sea, it would indicate the position of the rocket-line. In connection with life buoys it would be a mark to the drowning sailor. In life-boat services it would be a signal to the vessel in distress, and the brilliant light would greatly assist in the rescue. In cases of salvage, ships' signals, tide and harbour warnings, the duration of the light renders this new invention of great value. As a railway signal, to be used by the guards and station porters in cases of accident, it is equally available, and will be of great utility. The difficulties of preparing the chemical compound have been entirely overcome by Messrs. Albright and Wilson, of Oldbury, the contractors for the manufacture of the lamp for Mr. Nathaniel Holmes the patentee.

FRESHWATER BATHYBIUS

AT a late meeting of the Natural History and Medical Society of the Lower Rhine, the well-known zoologist, Dr. R. Greeff, noticed an organism inhabiting freshwater and approaching very nearly, both in its structure and mode of occurrence, the celebrated deep-sea *Bathybius Haeckelii* of Professor Huxley.

Dr. Greeff, as much as three years ago, published a notice (in Max Schultze's "Archiv für mikrosk. Anat." Bd. iii., p. 396) of a new shell-less freshwater Rhizopod, which was remarkable for its gigantic stature in comparison with all previously-known organisms of that kind. He called attention at that time to its occasional occurrence in great quantity in the mud of standing waters, and indicated that, on account of its peculiar structure, it could be referred neither to the true *Amœbæ* nor to the *Actinophryes*. Since that time, the author has never lost sight of this extremely remarkable creature, and he thinks it desirable no longer to keep back his observations, especially considering the high degree of interest that has been excited by the *Bathybius*-mud which has been discovered in the depths and abysses of the ocean (to beyond 25,000 feet).

As regards the occurrence of this freshwater organism, to which the author provisionally gives the name of *Pelobius*,* and which he considers to be truly comparable with *Bathybius*, Dr. Greeff states that it is found in many standing waters with muddy bottom, which have apparently persisted for a long time, and seldom, if ever, have dried up. Thus, near Bonn the bottom of the Poppelsdorf fish-pond is found occasionally to be *almost entirely covered with masses of Pelobius ;* to such an extent, indeed, that sometimes a glass vessel brought up from the bottom contains almost more *Pelobius* than true mud-particles, &c. The *Pelobius* never disappears in these waters, but remains throughout the year in great masses, sometimes in one place, sometimes in another. The cake-like lumps of mud which rise to the surface and float about there by the agency of enclosed gas and air-bubbles, especially during the warm season, also sometimes contain *Pelobius* in masses.

In their external form, in both the living and the contracted state, these organisms present the appearance of more or less spherical lumps, varying from one or two millim. in diameter down to the most minute points, scarcely perceptible by the naked eye. Middle-sized

* From πηλός, mud. [The name *Pelobius* has been long preoccupied.—Ed.]

examples of about one millim. in diameter are the most abundant. They are generally so densely filled with mud-particles, Diatomaceæ, shells of *Difflugia* and *Arcella*, &c., that by transmitted light they can scarcely be distinguished from the actual mud without experience and careful examination; they may consequently be compared to a living mud. By direct light, on the other hand, they appear as grayish-white, yellowish, or brownish bodies. Their movements consist in an amœboid and often lively creeping by means of processes which are usually broad and lobate; during this process, the transparent body substance often protrudes at the margins in elevations and undulations. This fundamental substance of the body consists of a *hyaline protoplasm* of irregularly *frothy or vesicular* consistency, containing, besides the above-mentioned ingested particles, a great number of very peculiar elementary particles. Among these there may be distinguished *round or roundish oval nucleiform bodies*, and *fine bacilliform structures*. Of the former by far the greater number consist of *shining pale bodies without any special structural characters*, but *of great firmness*, and presenting *considerable resistance to reagents* (acetic acid and caustic potash). These bodies may possibly be correlated with the coccoliths, &c., of *Bathybius*. Besides these, however, there are less numerous roundish nuclei of softer consistency, and with more or less finely granular contents, which, from their whole nature, must undoubtedly be regarded as equivalent to the ordinary cell-nuclei.

Hence in spite of its great simplicity in other respects, *Pelobius* represents a *pluricellular organism*, and is not to be referred to the so-called Monera, like *Bathybius Haeckelii*, according to the investigations of Huxley and Haeckel. Nevertheless, in connection with its possible relationship to *Bathybius*, it must be noticed that the cell-nuclei of *Pelobius* may occur in very variable quantity, often in so small a number as almost to disappear altogether; and further, that they can be detected only in the perfectly fresh state. This latter statement applies also to the frothy vesicular arrangement of the body-substance, which disappears immediately after death or the application of reagents.

The second kind of the chief elementary parts of *Pelobius* consists of *fine, clear, shining bacilli*, which are scattered through the whole body, and likewise present great resistance to the action of acetic acid and caustic potash. These were mentioned by Dr. Greeff in a former publication, when he expressed the opinion that they originate in certain nuclei, which, however, he has since seen reason to doubt.

The author has devoted much time and trouble to the investigation of the developmental history of this interesting organism, an exact knowledge of which would be in many respects of the greatest importance. He proposes to publish what has hitherto been observed upon this point (which in some respects recalls the Myxomycetes) in a detailed memoir upon *Pelobius* in Max Schultze's "Archiv für mikrosk. Anatomie," in which some other Rhizopods found under the same conditions as *Pelobius*, and resembling it, will also be described.

NOTES

THE intelligence of the death of Sir John Herschel will fall on the whole scientific world with a sense of personal bereavement. Though he had attained above the ordinary span of life, his mind was still in the maturity of its powers; and few men have been so familiarly known by their writings and their discoveries beyond the narrow pale of the world of science. Next week we hope to give a biography of the great astronomer whose loss we deplore. It is fitting that Herschel II. should be buried in Westminster Abbey, and it is creditable to the authorities that his ashes will be permitted to rest there.

THE annual visitation of the Royal Observatory by the Board of Visitors is fixed to take place on the 3rd of June.

LETTERS have been received in this country from Dr. Adolf Bernhard Meyer, who left Europe last year for a journey through a part of the Malayan Archipelago and New Guinea. He reached Manado in Celebes in November last, just as the wet season commenced. He had chosen this place as his starting point, because he had been informed by a celebrated traveller in the East that the fine season commenced at Manado in the month of October. Nevertheless, he succeeded in making large collections of birds, reptiles, and fishes, which are on their way home.

THE Anniversary Meeting of the Geographical Society takes place on Monday next at 1 P.M., and that of the Linnean on Wednesday at 3. The Victoria Institute holds its annual meeting at eight o'clock on Monday, 22nd May, at the Society of Arts Rooms, John Street, Adelphi, when the Rev. W. J. Irons, D.D., will deliver the address.

A MANUAL OF ORGANIC CHEMISTRY, by Dr. Henry E. Armstrong, F.C.S., Professor of Chemistry in the London Institution, is advertised by Messrs. Longmans and Co., as being in preparation for their admirable series of Text-books of Science.

AT a session of Council on Saturday last, the Right Hon. Lord Belper, vice-president in the chair, Mr. E. J. Poynter, A.R.A., was appointed Slade Professor of Fine Art in the College. The buildings, forming part of the north wing, which have been designed for the Fine Art School, are nearly completed, and it is intended to open the classes for drawing, painting, and sculpture at the beginning of the College session in October next. The late Mr. Felix Slade has established at the college six scholarships for proficiency in those branches of Art, each of the value of 50*l.* per annum tenable for three years, and which may be held by ladies.

AN exhibition of Palæolithic Stone Implements will be on view at the rooms of the Society of Antiquaries, Somerset House, from May 19th to 25th inclusive, from 11 A.M. to 6 P.M.

AT the General Examination of Women at the University of London, just concluded, four passed in honours and nine in the first division. It is understood there were about double that number of candidates.

WE learn from the *Academy* that the Zoological Collection of the British Museum has been lately enriched by the purchase of a magnificent series of Sponges from South Africa, the majority of which are likely to prove new to science. It is to be hoped that the group of the *Spongiadæ*, now attracting so much attention in scientific circles, will receive a more liberal allotment of space in the new museum to be erected at Kensington. The utter unfitness of the present building to meet the daily increasing requirements of the national collection is evidenced from the fact that numerous groups of the *Invertebrata* are literally "crowded out," and entirely unrepresented in the series devoted to public exhibition, for want of the necessary space. This, and the inadequacy of the present slender staff of the Natural History department to effect the thorough and systematic arrangement of the extensive and valuable collection, and to elevate it to that high scientific status enjoyed in the leading continental museums, demand the most earnest and speedy attention.

MR. BOUCARD, the well known dealer in specimens of Natural History, and traveller, formerly living in Paris, but now resident in London, proposes the publication of a work on the Coleoptera of Mexico and Central America, including the adjacent portions of the United States, especially the Pacific region. He earnestly desires contributions of specimens, whether named or not, to be used in his investigations, and will return such as he is not per-

mitted to keep, suitably identified, and will render an equivalent in other specimens, if desired, for such as are sent to him to be retained. Any specimens intended for him may be sent to his establishment, 55, Great Russell Street, Bloomsbury.

MR. C. H. BELFRAGE, of Waco, M'Lennan Co., Texas, announces that, at the request of several gentlemen in the United States and Europe, he intends making an extensive eight or nine months' entomological collecting tour in Western Texas and Southern New Mexico, if sufficient means can be raised, and invites every entomologist who wishes to enrich his collection to assist in the undertaking. Mr. Belfrage is recommended by Dr. A. S. Packard, jun., the editor of the *American Naturalist*, as a faithful and excellent collector, and the opportunity seems to be an unusual one of obtaining specimens of rare or little-known insects. Mr. Belfrage's address is at the above township, care of Messrs. Forsgard and Co.

THE Clifton College Scientific Society has just issued the first part of its "Transactions," which affords a happy illustration of its motto, *Virescque acquirit eundo*. Not yet two years old, and commencing with eighteen members, it has steadily increased in popularity and usefulness under the able presidency, first of Dr. Debus, and then of Mr. Barrington-Ward, till at one of its most recent meetings, nearly ten times that number of visitors and members were present. In this volume a number of interesting papers by the members, on various branches of natural and physical science, are printed; but we are most interested in the sketch of the constitution of the society. The School Museum has wisely been constituted especially a British one, and in order to facilitate the study of the natural history of the neighbourhood, and promote the other objects kept in view, the Society has been divided into sections of botany, geology, entomology, chemistry, physics, and archæology, the novel principle being introduced of limiting the number of members of each section to ten, in order to ensure a thoroughly working body. The Society has entered on its work in a spirit which entitles us to hope that it will be among the leaders in the spread of a real love of science among the generation now rising up.

MR. H. ROGERS read an important paper before the Edinburgh Botanical Society on March 9, a report "On the Effects of cutting down Forests on the Climate and Health of the Mauritius." The epidemic which broke out in 1865 in the colony, previously so remarkable for its salubrity, he traced to this cause, and stated that between 1854 and 1862 vast tracts of forests had disappeared, causing a diminished amount of rainfall, an increased amount of dryness, and a proportionate elevation of temperature. The difference in seasons is now much less marked, rains are scarce, droughts frequent and excessive, vast tracts of land, formerly productive, are now barren and desolate, and districts before noted for salubrity are now notoriously unhealthy. Although the amount of rainfall is much reduced, the violence of the rain is increased when it does fall, and heavy floods are the result. It was immediately after one of these inundations that the fever broke out in February 1865, which proved so terribly fatal in the colony.

FROM Ireland we have received the First Annual Report of the Natural History and Philosophical Society of Derry. Among papers of local history we find some on the antiquities, geology, entomology, and fucology of the neighbourhood of Derry, with drawings and photo-lithographs of cinerary urns found at Grange, Malin, and Buncrana, to illustrate a paper on that subject by the president, Mr. W. Harte. The society has made a good start, and we wish it all success.

THE Manchester Scientific Students' Association has issued its Tenth Annual Report for 1870. Although none of the papers read during the past year are printed in the report, the association, judging from the list of proceedings at the ordinary meetings, the Microscopical Club, and the Mechanical and Engineering Section, appears to have been doing some good and useful work. The number of members has slightly decreased during the year, but the committee hope soon to raise it again, and thus obtain funds for some desirable additions to the library.

IT is stated in *Land and Water* that the laudable effort of the Acclimatisation Society of Otago to introduce birds and animals into New Zealand has lately met with great success. The ships *City of Dunedin* and *Warrior Queen* have arrived in New Zealand with a living cargo of birds and animals which have thriven wonderfully well on board ship during their long voyage. Thus there are now in New Zealand five red-deer—we regret the stag died on the voyage—goldfinches, skylarks, blackbirds, sparrows, chaffinches, &c. The robins, numbering over a hundred, unfortunately died on the voyage. It is certain that the climate of New Zealand is admirably suited for the well-being and establishment of a British fauna. The colonists wisely recognised the importance of the study of "Practical Natural History," particularly as regards keeping insect life in check by means of small birds, the little feathered servants whose services are not sufficiently appreciated by agriculturists at home. Within the next fortnight thousands of young rooks will fall victims to the pea-rifle in England. How much better would it be if these unfortunate birds could have been sent across the ocean to our friends and relations in New Zealand! We understand that the cockchafer has been imported with English grasses, but the enemy to the cockchafer, the rook, has been left at home. We hope that next year the Otago Society will repeat their experiments with insect-eating birds, the unpaid "police of nature," which would keep in check the insect "pests of the farm," which have now pretty nearly their own way, to the injury of the farmer and horticulturists at the antipodes. The greatest credit is due to Mr. John A. Ewen for the pains he has taken in shipping the birds, and to Mr. Bills for the care and skill he has shown by his judicious management of the birds during the long voyage.

ON the 4th and 6th of March two shocks of earthquake were felt at Bogota, in Columbia, and these shocks were felt at the same dates at Cartago.

ON the 19th February the great earthquake in the Hawaian Islands took place. This was succeeded on the 2nd March by an earthquake at Eureka, in Humboldt County, California.

THE whole west coast of America, throughout its great mountain range, has now been seriously disturbed for some months. As far north as Washington Territory, Mount Rainer is reported as in commotion.

ON the 22nd February an earthquake was reported at Pano, in Peru, and a stronger one at two A.M. on the 23rd. These were slightly felt at Lima.

FROM recent advices we have to report the continuation of serious disturbances on land and by sea of the meteorological and physical conditions of the west coast of the Pacific. The phenomena appear to have been preceded long since, and are now accompanied, by volcanic disturbance, and some of them have passed from north to south. One remarkable feature is that of the inundations, particularly in the districts actually rainless. On the Isthmus of Central America rain is common, but this year the amount has been great, and the inundation greater. During the season immense quantities of vapour have been converted into rain along the western slopes of the Cordillera and the Andes. In northern Peru the effects have been particularly felt, and the more severely as the cities were unprovided to encounter rains or floods. Lambayegue, an interior town of 7,000 people, is destroyed, and the population have abandoned that of Supé. In some places bogs have been produced in which the cattle perish. Mud is washed far out to sea, and among the

animals carried off was an alligator driven into Payta Bay. The circumstances are worthy of notice, as they illustrate some of the incidents of geological disturbance. At sea rain is met with a hundred miles out, to the surprise of captains, who report the winds and currents as changed.

IT is stated in some of the papers that the system of storm-signal observations, now in progress under the direction of the Signal Corps of the army, was devised by Great Britain before it was made use of by the United States Government. This is perhaps correct, so far as it goes; but it is to Prof. Henry, Secretary of the Smithsonian Institution, that we owe the original idea of procuring despatches regularly in relation to the weather, and tabulating them, as also of placing them on a map so as to show, day by day, the general character of the weather through out the United States. For several years prior to the beginning of the war this system was carried on regularly, and was of great interest to visitors to the Institution. The occupation of the telegraph lines for military purposes, and the fire in the Smithsonian building, broke up the arrangement; and it was about to be resumed when the Government undertook the work, thereby relieving the Institution from the necessity of its further prosecution.

THE California vulture (*Cathartes Californianus*) is the largest species possessed by the fauna of Western America, where it ranges over an immense space of country in search of food. When any large game is brought down by the hunter these birds may be seen slowly sweeping towards it, intent upon their share of the prey. Nor in the absence of the hunter will his game be exempt from their ravenous appetite, though it be carefully hidden and covered with shrubs and heavy branches, as they will drag it forth from its concealment and speedily devour it. Any article of clothing, however, thrown over a carcase will shield it from the vulture. In some localities the nests are known to the Indians, who year by year take the young, and, having duly prepared them by long feeding, kill them at one of their great festivals. The California vulture joins to his rapacity an immense muscular power, as an instance of which it is stated that four of them jointly have been known to drag for over two-hundred yards the body of a young grizzly bear weighing more than a hundred pounds.

DR. NEWBERRY, in his interesting report of the botany of the explorations for a railroad route from the Sacramento Valley to the Columbia River, speaks thus of the district lying east of the Sierra Nevada and the Cascade Mountains:—"The general aspect of the botany of this region is made up of three distinct elements. Of these the first is presented by the grassy plains which border the streams flowing down from the mountains. On these surfaces grows a considerable variety of animal vegetation, not unlike that of the Sacramento Valley in its general character. The second of these botanical phases is that of the 'sage' plains, surfaces upon which little or nothing else than clumps of artemisia will grow. The third is formed by forests of yellow pine (*Pinus ponderosa*), which apparently finds on these arid surfaces its most congenial habitat. It sometimes happened to us that, during a whole day's ride, we were passing through a continuous forest of these yellow pine trees in which scarcely a dozen distinct species of plants could be found."

THE night heron of the United States (*Nyctiardea Gardeni*) is much dreaded by the Indians, who have many traditions and superstitions connected with it, and believe that it has the power of transforming human beings into inferior animals. Of the blue heron (*Ardea Herodias*), they say that he was formerly an Indian, and that perpetual quarrels raged between his wife and himself. On this account they were both transformed by a superior power, the man becoming a heron, the woman a dabchick (*Podiceps cornutus*), at the same time the brother of the woman was changed into the western grebe (*Podiceps occidentalis*), a native of the Pacific coast.

REPORT ON THE DESERT OF TIH

(*Continued from page* 35)

THE following are the various observations I have made and tales I have collected about some of the birds and mammals found in the desert of Tíh and adjoining regions. For convenience of reference I have arranged them alphabetically. In the cases of well-known animals, or of such as have been before scientifically described, I confine myself chiefly to the Arab stories or legends attaching to them:—

Bears (*Ursus syriacus*), Arabic *Dabb*, are still found on Mount Hermon and the Anti-Lebanon, and must formerly have existed in Palestine, but the destruction of the woods has now driven them northwards. They do much damage to the vineyards in the neighbourhood of Hermon, but seldom interfere with the herds of goats. The Arabs share in the widely-spread belief that bears sustain themselves during their hybernation by sucking their paws. They also say that when the female drops her cub it is quite shapeless, and that she carries it about in her mouth for fear lest it should be devoured by the ants, and then licks it into proper shape. Bear's grease is said to be useful in cases of leprosy.

Boar, wild, Ar. *Halhouf*, or usually in Palestine, *Khanzir*, which simply means pig. These animals are very abundant wherever there is cover near water, as on the banks of the Jordan and in the Ghor es Sáfi at the S. of the Dead Sea. I was much surprised to find traces of recent rooting by them in the W. Rákhamah, which lies between El Milh and 'Abdeh. This place is far from any water except what may have collected in hollow rocks, and can boast of no cover. The 'Azázimeh eat the wild boar, but the Ghawárineh, who will eat a hyæna, though it is known to frequent the grave-yards, will not touch them.

In this, as in the case of the other animals, I can insert but a few amongst the many medicinal uses to which they are put by the Arabs, as these are in general unsuited to the taste of European readers.

Bustard (*Otis hubara*) Ar. *Hubara*. I noticed a few of these birds in the Tíh; the Arabs say that the lesser bustard (*Otis tetrax*) which is also occasionally found there, is the young of the larger, but does not attain its full growth for two years. They also say that these birds, when attacked by a falcon, will cover it with their fæces, and so drive it off.

Camel, Ar. masc. *jemel*, fem. *nágah*. A stallion camel is called *fahl*. Collectively, *ibil* vulgo *bil* or *báir*, pl. *aarán*. *Hejjin* is usually applied to a dromedary, but is properly used of a man, horse, or camel having an Arab sire and foreign dam, which, in the case of the animals, is considered the best possible cross. Hence, a dromedary (or well-bred camel used for riding) is so called.

Camels are most peevish animals, docile only from stupidity; ill-tempered, they never forget an injury. I have but once seen a camel show the slightest sign of affection for its owner, although they are always well treated. All their feelings of like and dislike, pleasure and annoyance, are expressed by a hideous sound between a bellow and a roar, to which they give utterance whether they are being loaded or unloaded, whether they are being fed or urged over a difficult pass; in fact, they disapprove of whatever is done. Without them, however, it would be impossible to cross the deserts, for no other animal could endure the fatigue and want of water; I have myself seen a camel refuse water after having been without any for three days. For their food they always choose the most uninviting thorny shrubs; the seya] (acacia) which has thorns two or three inches long, is an especial favourite with them. Many of the Arabs subsist almost entirely upon the milk and cheese afforded by their herds of camels.

The Pelican is called *jemel el ma*, or water camel; and the Chameleon, *jemel el yehúd*, the Jew's camel.

Cat, or *Kutt*, also *Sinnaur* and *Hirr*. According to some lexicographers, the first name is not a pure Arabic word. Cats are held in great estimation in the east, and large prices are sometimes paid by native ladies for fine Persian specimens. In Cairo a sum of money was left in trust to feed poor cats, who daily receive their rations at the Mahkemah (law courts).

Though the Arabs in Sinai and the Tíh spoke of a wild cat, *gatt berri*, I found that this was always the lynx (*Felis caracal*), which is called in some parts of Arabia *'inak el ardh*, or earth-kid; in Sinai, it is also spoken of as *ânazeh* (from *ânz*, a she-goat). In Morocco, it is only known as *owdál*.

I may here remark that the word *Fahd*, translated by Lane and others as "lynx"—an animal that is never used for hunting—really means the *cheeta*, or hunting leopard of Persia and India.

The Arabs in the Tîh and in Morocco, as well as the Fellahin in Egypt, eat the lynx, and esteem it a delicacy, bnt, as some of them eat hyænas, jackals, foxes, vultures, and ravens, they can hardly be quoted as epicurean authorities.

Many animals have in Arabic a large number of names, more than 560, for instance, being applied to the lion. The following story current among them will illustrate this fact with reference to the cat. A Bedawi was out hunting one day, and caught a cat, but did not know what animal it could be. As he was carrying it along with him, he met a man, who said, "What are you going to do with that *Sinnaur?*" then another asked him, "What is that *Kutt* for?" A third called it *hirr*, and others styled it succesively *dhayùn*, *khaidà*, and *khaital*. So the Bedawi thought to himself, this must be a very valuable animal, and took it to the market, where he offered it for sale at 100 dirhems. At this the people laughed and said, "Knowest thou not, O Bedawi, that it would be dear at half a dirhem?" He was enraged at having his dream of wealth thus rudely dispelled, and flung it away, exclaiming, "May thy house be ruined, thou beast of many names, but little worth."

The Arabs say that the occasion of the cat's first appearance was as follows. The inhabitants of the ark were much troubled with mice: Noah, in his perplexity, stroked the lion's nose, and made him sneeze, whereupon a cat appeared and cleared off the mice.

In the East, as in Europe, a black cat is regarded as "uncanny," and various parts of it are used for magical and medicinal purposes; its claws, for instance, are said to be a charm against the nightmare.

Coney (*Hyrax Syriacus*) Ar. *Waber* (lit. fur, from the thickness of their coats) *ghanem beni Israël*—sheep of the sons of Israel. Some Arabs say that this animal may be eaten, but others, as in Sinai, declare that it is unlawful, and call it Abu Salmàn, or else the brother of man, and say that it was originally a man who was metamorphosed for his sins, and they believe that any one who eats him will never see his house again. It is a common joke among the Hajjis and people of Mecca to say "A good digestion to you who have eaten Abu Salmàn."

Dog, Ar. *Kelb* (in Morocco *jero*, which properly signifies *puppy*, *whelp*), is the ordinary dog. A large kind of rough greyhound is called *Seluki*, from the town Seluk, in Yemen.* This dog much resembles the Scotch deerhound (cf. Gaelic name, *slogie*). In Syria and east of the Jordan there is a variety which is smooth, but has its ears, tail, and legs feathered like a setter; the females are said to be keener for hunting than the males, and black dogs are said to be the most patient. The dogs in Eastern towns live in communities, and have distinct bounds, usually ending at a street corner, and woe betide any dog who wanders beyond his own proper limits. I have often, when living at Cairo, amused myself by watching these animals. No sooner does a strange dog appear than all the rightful owners of the soil rush at him; the intruder takes to his heels, but the moment he has reached his own frontier, he turns round and snarls defiantly at his pursuers, and if they do not quickly retire his friends come to his assistance and drive them back in turn.

Dogs are said to have an intense hatred of hyænas, so much so that if a dog is smeared with the fat of a hyæna, he will go mad; and—which seems inconsequent—if a person carries a hyæna's tongue the dogs will not bark at him. This certainly would be most useful on entering an Arab encampment, for there a stranger is immediately surrounded by a pack of snarling brutes, who seem to sleep all day with one eye open, and at night to be continually awake and barking, either to frighten away some prowling jackal or lynx, or to repress some errant sheep or goat, who may wish to wander outside the circle of tents.

The Arabs believe that a dog can tell a dead person from one feigning death, and say that the Greeks (*Room*) never bury a person till they have exposed him to the dogs. It is, however, of only one breed that this is asserted, namely, the kind called *el Kalti*, and which is of small size, with very short legs. It is also called the Chinese dog. Of the origin of this story I am quite ignorant. The following is almost identical with a well-known Northern legend:—

A king had a favourite dog, whom he left at home one day while he went out hunting. Having ordered his cook to prepare a dish of *leben* (sour milk) for him on his return, the cook obeyed the order, but carelessly left the milk uncovered, and a snake came and drank of it and rendered it poisonous. On the king's return the dog tried to prevent him from touching it; at this moment the cook came in with some bread, which the king took and became to dip into the *leben*, when the dog immediately bit his hand. Upon this the king was very angry, and stretched out his hand again to the bowl; the dog, however, was before him, and began to lap the sop, whereupon it straightway fell down dead. The king then became aware of the sagacity and faithfulness of the beast, whose loss he mourned ever after, and erected a splendid tomb to his memory.

Donkey, Ar. *Himár*. The donkey, much used by the Arabs, (for it will thrive in the desert where a horse could not exist) chiefly for carrying waterskins, as the Bedawin often encamp several miles from water, and the women bring up a supply every two or three days.* At Damascus there are three breeds of donkeys—(1) The white, which is most valuable, being sometimes worth 30*l.* or 40*l.*, and in Egypt I have heard of 60*l.* being given for a fine animal of this kind; (2) the ordinary donkey, which is used for riding, &c.; (3) A large donkey, standing from 13 to 14 hands, which is used for carrying burdens in the town; in the country, however, it is useless, as unlike the other breeds, it is far from sure-footed.

The Wild Donkey, Ar. *Air*, *fera*, or *himár wahshi*, is found to the east of Damascus; it is said to be very long-lived.

Dugong (*Halicore Hemprichii*), Ar. *otum* (called by Dr. Robinson *tûn*). This curious mammal is found in the Red Sea, and harpooned by the fishermen as it basks on the surface on the water. The skin is used by the Sinai Bedawin to make sandals of, for which purpose it is admirably adapted. In some parts of Arabia, it is said, that *khifaf*, or boots to protect the camels' feet from the rocks, are made of it. Some commentators take the Heb. *tachash*, which is translated "badger-skins," to mean the *otum*, and there is an Arabic word, *Tukkas*, applied to the dolphin species generally.

Fox, Ar. *Taâleb*, *Abou'l Husein*. In the East, as in Europe, this animal is looked upon as the type of cunning, and numberless stories are current concerning it. The following are examples:—

When a fox is over much troubled with fleas, he plucks out a mouthful of his hair, and then he takes to the water, holding the tuft in his mouth; all the fleas creep up on to this to escape drowning, and the fox then drops it into the stream and retires, freed from his enemies.

The celebrated Arabic author and theologian, Esh Shafiey, relates that when in Yemen, he and his fellow travellers prepared two fowls for dinner one day, but the hour of prayer coming on, they left them on the table and went to perform their devotions; meanwhile a fox came and stole one. After their prayers were finished, they saw the fox prowling about with their chicken in his mouth, so they pursued him and he dropped it; on coming up nearer to it, however, they found it only to be a piece of palm fibre, which the fox had dropped to attract our attention, and had, in the meantime, crept round and carried off the second chicken and left them dinnerless.

The fox is said to feign death, and to inflate his body, and when any animal, prompted by curiosity, comes to look at him, he springs up and seizes it.

The fable of the fox and stork is changed to the fox and raven; the former invites the latter to dinner, and gives him soup in a shallow wooden bowl; the raven returns the compliment, and pours out some wheat over a *sîlleh* bush. The *sîlleh* is one of the most thorny of the desert plants.

Another story told of the fox is, that one day he met five slaves, who were travelling with a large supply of food and other goods; he joined them, and after a time they reached a well, but had no rope wherewith to draw up the water. The fox suggested that they should throw down the meal and that one of their number should go down and knead it, which was accordingly done. After a while the fox said to the four who remained above, "Your comrade must have found a treasure, why don't you go down and share it?" This hint was enough, and they all hurried down, while the fox decamped with their goods and chattels.

A fox's gall is said to be a specific for epilepsy, and his fat for the gout.

Gazelle (*Gazella dorcas*), Ar. male *'ard.*, fem. *ghazâleh*, also (chiefly in poetry) *Dhabyeh* (cf. Tabitha, Acts ix. 36). This gazelle is found in the more open parts of the country between Sinai and the Lebanon; their haunts vary much with the different seasons. Though we never found any in the centre of the

* The usual derivation, however, is "Seleucia."

* A tribe in the Desert, towards the Euphrates, is said to use donkeys only, and to possess neither horses nor camels.

Tíh, the Arabs said that, after a good rainy season, large numbers come there.

The Arabs speak of three kinds, viz. :—1. *El Rim* (*antelope addax*). 2. *El Edam* (*A. leucoryx*). 3. *El 'Afar*, which I cannot satisfactorily identify.

The tongue of an antelope must be an invaluable charm, for if it be dried and powdered, and then given to a woman who henpecks her husband, it will ensure her future good behaviour!

Goat, Ar. *ma'az* f. *ma'azeh* or *anz*. A he-goat (either wild or tame) is also called *tais*. In mountainous districts, large herds of goats are kept by the Arabs, chiefly for their milk and hair, which is used for making tents and sacking. The Arabs more usually eat a kid than a lamb on the occasion of a feast, and always a male. Full-grown animals are seldom killed. There are several varieties of goats from the upright eared kind to the Syrian goat with pendant ears, 12–14 inches long. That usually seen in the desert has ears slightly drooping and rather curling up at the top.

Horse: the generic term in Arabic, *Kheil*; a horse, *hisán* (in Morocco *'owd*); a mare, *fars*; a colt, *mohrah*.

'Atík is a thorough-bred Arab. Tradition says that the Devil will never enter a tent in which an *atik* is kept.

Hejín: a crossed horse. (The term is explained under the head "Camel.")

Berdhún is a pack-horse with foreign sire and dam.

Kadish is a badly-bred *berdhún*.

The Bedawin reckon seven principal breeds of horses, which are as follows :—

1. *Musalsal*, which ought to be thin-crested, with short white stockings, red-eyed, short-coated, full in the barrel, and long-winded.
2. *Haikali*.
3. *Sharthar*.
4. *Hareifish*, a breed well known in Syria.
5. *Tubal*.
6. *Jij*.
7. *Kumeit*. These horses are usually bay, with black points, and ought, say the Arabs, to have a very fine muzzle; head thin, and well set on; upright, small ears; conspicuous white star on the forehead; round quarters, and to be well ribbed up; with a short or rat tail. They add, a well-bred horse is known by having the tail thick at the root, and carried well out.

The favourite colours are chestnut, gray, dun, black, and dark bay. The Prophet is related to have pronounced the following dicta :—"The best horses are black with white foreheads, and a white upper lip; next to these a black horse with a star, and three white stockings; next a bay with these marks." "Prosperity is with sorrel horses." The same authority judged *shikál*, *i.e.*, having the right-fore and left-hind feet white, to be the sign of a bad horse.

The first man who tamed and rode a horse is said to have been Ishmael. The first horse appeared when Adam sneezed on first awaking into life (cf. the story of the cat.)

Hyæna (*H. striata*) Ar. *Dhaba'*, also (in Sinai) *Arkudha*. This animal is found throughout the desert and Palestine. It is a cowardly beast, feeding chiefly on carrion, and is consequently little feared by the natives; as I have before mentioned, the Ghawárineh eat it. It is said to change its sex yearly; the same fable is told of hares.

Jackal, Ar. *Ibn 'Awi*, or in Syria *Waáwi*, in Morocco *Deeb* and *Taaleb Yusuf*. These animals are not found in the desert, but are common in the cultivated parts of Egypt and Palestine, where their weird cry is very frequently heard, beginning just after sunset. They are timid beasts, and do little damage, except in the vineyards, where they commit great ravages, being exceedingly fond of grapes.

Ibex (*Capra beden*), Ar. *Bedan* (from *bedn*, a body: probably so called as being the largest game in Sinai), the correct Arabic is *waal;* this is the name given to them north of Damascus. Some travellers have called them *Taytal*, but the word is not Arabic, and is only used by the Sinaitic Bedawin when speaking to Europeans, "poor simpletons," as they politely put it, "who don't understand Arabic." The derivation of this word I am quite unable to determine. Among themselves the Bedawin speak of the buck as *Bedan*, and the doe as *Anz* (she-goat), and the kids as *Dhalít*. A male in his first year is called *Fenaigil;* after this he is distinguished by the length of his horns; thus in his second year he is called *Abu Shibrain*, the father of two spans; in his third, *Thelathi;* in his fourth, *Rubai;* in his fifth, *Khammasi*; and they add that the horns never exceed five spans in length, which I believe to be true, for on measuring the largest pair that I have ever seen, I found them to be just 5 spans (about 41 inches) long. The term *garími* (red) is applied in a general way, much as we speak of red deer. These animals are found in Sinai and on both sides of the Dead Sea. I have reason to believe that those near Palmyra are a different variety.

Jerboa, Ar. *Yerbuah*, also *Dirs* or *Dars*, and sometimes *Za rumaih* (the lord of the little lance). There are several kinds of jerboas and desert rats; some of them are only found amongst the rock, others only burrow in the sand and gravel. Opinion is divided amongst the Arabs as to whether the jerboa is lawful for food or not; some eat it, but others reject it as being "a creeping thing." The Arabs say that they never drink, and believe that they live in communities, and appoint a sheikh, whom, however, they unhesitatingly kill should his rule not suit them. There is an Arabic proverb about a deceitful man: "He acts like a jerboa." This is said with reference to the ground outside a jerboa's hole, which, though seemingly solid, is really undermined, and gives way when trodden upon.

Leopard (*Felis leopardus*), Ar. *Nimr*, occasionally called in Sinai *Giblán** (corruption of the Turkish *Koplán*), the cubs are called *Weshek*. In the more secluded and inaccessible mountains of Sinai these animals are far from rare, and in a former visit to that country I was told that eleven camels had been killed by them during the preceding year in the district lying between Senned and W. Nasb. Like the hyrax the leopard is said to have been formerly a man changed into his present shape for performing his ablutions before prayer in milk, thus despising and diverting from their proper uses the good gifts of God.

Leopards are tolerably abundant on the shores of the Dead Sea; their tracks were here mistaken by M. de Saulcy for those of the lion, which animal is, however, quite extinct in Palestine and the Tih.

The Bedawin assert that young leopards are born with a snake round their necks, and that when a leopard is ill he cures himself by eating mice. Their fat is used medicinally, and their hair is burnt as a charm to drive away scorpions and centipedes.

Lizard. The larger lizards, especially the *Uromastix spinipes*, are called in Arabic *Dhabb*, and the smaller *Hardhun*. The Bedawin say that the former lays seventy eggs and even more, resembling pigeons' eggs, and that the young are at first quite blind. They are believed to be very long lived, indeed I have heard 700 years assigned as the term of their existence. By some tribes they are eaten, but are generally thought unclean. The Syrians curse them freely, for they say that they mock the devotions of the true believers. Certainly the way in which they jerk their bodies up and down is not unlike a caricature of the Muslim prostrations.

The dried bodies of some of the Skinks or Sand-lizards (Ar. Sakankúr) are much sought after as an aphrodisiac throughout the East. The particular kind in vogue is found in Nejed, and large quantities are brought by the Hajj caravans.

Owl, Ar. *Boomeh*. This bird is in some places regarded with veneration on account of a tradition which says that the souls of men appear on their tombs in the form of owls. I am told that they are sometimes used by fowlers as decoys.

Pigeon, Ar. *Hamám;* wild-pigeon, *Yemám*. In Egypt there are enormous numbers of pigeons who live in towers specially built for them. They are chiefly kept for their dung, which is very valuable as manure, and largely exported.

Most mosques are tenanted by pigeons, and not unfrequently a sum of money is left by some pious Moslem to buy corn for them. At Jerusalem they are especially numerous, whence the Arabic proverb, "Safer than the pigeons of the Harem." The mourning of doves is as frequently alluded to in Eastern as it is in Western poetry.

Quail, usually called in Arabia *Summana*, or *Selwa*. I only met with one specimen in the Tíh, and that was called by the natives *Flrreh*. There is a tradition that the first instance of meat becoming corrupt and stinking was when the children of Israel stored up the flesh of the miraculous quails contrary to the commands of the Almighty.

Raven. There are three species of this bird scattered over the Desert, viz., *Corvus corax*, *C. umbrinus*, and *C. affinis;* all of these are called by the Arabs *Ghoráb*. They are generally found near a herd of camels, and may often be seen perched on the backs of these animals searching for ticks. Their chief food consists of reptiles and insects, but any dead or dying animal

* Giblán is the name of the chief of the Nimr (leopard) family of the Adwán Arabs in Moab.

will attract them. On one occasion I saw two ravens attack a horse which had fallen from exhaustion.

An Arabian proverb says, "Take a raven for your guide and he will lead you to a dead dog."

An Arab tradition evidently taken—as many others are—from the Old Testament, ascribes the first idea of burial to the raven. "While Adam was absent on a pilgrimage to Mecca, Cain and Abel each erected an altar for sacrifices. Cain, a husbandman, offered the refuse of his garden, but Abel chose the finest young ram of his flock and laid it upon the altar. His sacrifice was accepted, and the ram taken up to heaven, there to remain till it was required as a substitute for Ishmael when his father Abraham should offer him up on Mount Moriah. Cain seeing his offering refused, conceived so sudden a jealousy against his brother that he slew him, but being perplexed after the deed, and knowing not how to dispose of the body, he carried it about with him for many years. At last he saw two ravens engaged in deadly conflict, and one having killed the other scraped a hole in the ground and buried it, a hint which Cain took, and thus instituted the first burial rites as he had caused the first death. Adam returning mourned for his son and cursed the ground which had drunk up his blood, wherefore say the Muslims, the earth will never more absorb the blood of one who is slain, but it remains above ground, a lasting testimony to the murderer's guilt."

Sandgrouse (*Petrocles sctarius*).—This species is most common in the Desert, but three other kinds are also found, viz. *P. exastus* and *P. sengalensis* (found by Tristram near the Dead Sea) and *P. arenarius*. All these are called *Kata*, or, in Bedawi dialect, *Gata* (in Morocco *Koudri*). The first and last mentioned species are called by some Bedawin *Koudriyeh* and *Sunifeh* respectively.

These birds require to drink morning and evening, and thus often prove of great service to the traveller by indicating the proximity of water. While staying at Damascus I was assured that these birds exist in such numbers in the territory of the 'Anazeh Bedawín that during the nesting season two men will go out with a camel's-hair bag between them and fill it with eggs in a very short space of time. The women then squeeze out the eggs and cook them, leaving the shells inside the bag. The Kata is said always to lay three eggs, neither more nor less. Its bones when properly prepared are said to be a cure for baldness, and the head may be used as a charm to extort secrets from a sleeping person. From its being so sure an indicator of the presence of water, the Arabs have the proverb "More truthful than the Gata."

Sheep. The proper Arabic name is *Dhán ; Ghanem* is the general term for flocks of sheep and goats.

In the Tíh there are few sheep, but in Moab and Palestine they are numerous; these are generally the fat-tailed variety (*Ovis laticaudata*). A fine-woolled breed is found in some districts. I have always noticed that in the East sheep's milk is much better than that of either cows or goats.

Snake, Ar. *Haiyeh*, *Tuabán 'Offi* (cf. ὄφις) *Dúdeh* (*lit. worm*) *Rakshah* (speckled one). Owing to its being winter when I passed through the Tíh. there were very few snakes to be found. The attitude taken by a horned snake (*Cerastes hasselquistii*) which I captured was remarkable. Immediately it saw me it began to hiss, and, tying itself as it were into a knot, created a curious grating sound by the friction of its scales. This snake is considered the most deadly of all by the Arabs, who hold it in great dread. They also affirm that if a snake has swallowed a bone which it cannot digest it will coil itself tightly round a tree or stone till the bone inside it is completely broken up.

Tortoise (*Testudo graca*), Ar. *Salahfát* (in Morocco *afkah*). The water-tortoise (*Emys caspica*) is called *Lejah*. The former is occasionally found in the Tih. though common in Palestine. The latter abounds in the pools and streams of that country. Another species of land tortoise (*Testudo marginata*) is mentioned by Tristram, as being found on Mount Carmel. The water-tortoise is known to be carnivorous, and the Arabs declare that the land species also eat snakes, but this I believe to be quite false. Tortoises have a very strong odour, and I have frequently seen pointers in Morocco stand to them as they would to game.

Vulture, Egyptian (*Necphron peronopterus*), Ar. *Rakhamah* (Heb. *racham*) or *Onak* (in Morocco *Sew*). This is the only vulture at all frequently seen in the Desert. The Griffon (*Gyps fulvus*) and Lammer-geier (*Gypaetus barbatus*) seldom wander beyond the limits of cultivation. The Egyptian Vulture is commonly found near Arab encampments, where it shares the office of scavenger with the dogs. Many tribes, however, both in North Africa and the East, consider its flesh a delicacy.

Wolf (*Canis lupus*), Ar. *Deeb*. These animals are found in the mountains of Sinai and Palestine, but rarely in the Tih. They do not pack like European wolves, but hunt by twos and threes.

The Bedawin say that "they sleep with one eye open," and have a similar proverb to our own, "A wolf in the stomach." Hunger is sometimes called *Da' ed deeb*, wolf's malady. Various parts of the animal are used for charms, *e.g.* a wolf's head in a pigeon cote, or a tail in a cattle stall, will keep off other wild beasts.

In addition to stories about real animals, the Bedawin have many fables of imaginary creatures, such as the Ginn, the Efreet, and the Ghoul. These hardly come within my province, and are well described by Lane ("Arabian Nights," vol. i.). I may however mention the *Nis-nás*, which is said to resemble a man bisected longitudinally, and to possess but one arm, one leg, and half a head. The story goes that it is found in Yemen, and that the people there hunt and eat it, notwithstanding that it can speak Arabic! The *Hud-hud* (so called from its cry) is a mysterious creature, not uncommon in Sinai. The Bedawin declare that it is never seen Though I often heard its plaintive cry close to my tent, and rushed out gun in hand, yet I never could obtain so much as a glimpse of it. At one moment the sound came from just over my head ; the next instant it was far away up the hill side, and would either pass into the distance, or as suddenly return to me. From this I am convinced that the cry is made by some bird, probably of the owl tribe. The Arabs, of course, will accept no such materialistic solution of the mystery.

The Botany of the Tíh, especially in a season of drought such as we experienced, is very limited. The climate is so dry that mosses and even lichens are not found, except near Nakhl, where I gathered some much resembling the true Reindeer moss. This only grows on the northern side of the hillocks.

The passage in Job xxx. 4, "Who cut up mallows by the bushes," seems wrongly referred to the Sea Purslane (*Atriplex Halimus.*) In North Africa and the country east of Bir-Erba there is a small mallow which is eaten. This *invariably* grows either where an Arab encampment has stood or on the site of an ancient town. It has a small pinkish flower, and seldom exceeds seven or eight inches in height.

In the caves near Ain Muweileh a considerable quantity of salt crystallises on the surface of the limestone. Though disagreeable to the taste, it is eaten by the Arab.

At Petra the natives chip the interior of the caves. The fragments of sandstone are crushed and boiled, and a saltpetre sufficiently pure for the purpose of making gunpowder is thus obtained. The sulphur is found on the Lisan and coasts of the Dead Sea.

The above report necessarily contains but a sketch of our work. It will, however, I trust, give some idea of the country we had to examine, and of the difficulties which we encountered. In conclusion, I must here tender my best thanks to the University of Cambridge for having aided me in the investigation of this hitherto so little known but important district. It is the intention of Mr. Palmer and myself to publish together as soon as possible a full and systematic account of our explorations.

CHAS. F. TYRWHITT-DRAKE

(Note by Mr. C. R. Crotch on the Coleoptera brought from the Tíh.)

"In the small collection now before me are contained ninety species of Coleoptera, representing more or less all the larger families of the order, except the Water-beetles, an omission easily to be accounted for. The group most largely represented is, as throughout Syria, the Heteromera. These curious apterous, sluggish forms seem to thrive under the most arid conditions. The whole cast of the fauna is essentially Mediterranean; that one is on its southern side is shown by genera like Adesmia, Graphipterus, Pachydeura, &c. The relations of this collection with an Egyptian one are very marked, many specimens being identical. None of them, however, extend to the Algerian deserts, though congeneric species occur there in their place. Nearly all are confined to the S. corner of Palestine and E. of Egypt, except the Dung-beetles (Histerida, Aphodiadæ, and Coprida), and these are more or less identical with those of S. Europe. The paucity of vegetation is very strongly indicated by the fact that the two great groups of Rhynchophera and Phytophaga number only seven species between them."

AMERICAN NOTES

THE annual meeting of the National Academy of Sciences was held on the 18th of April last in the rooms of the Smithsonian Institution, in Washington, and continued in session four days. A number of interesting communications were presented. A report was presented by the treasurer of the Academy in regard to the Bache bequest, in which it was stated that its present value was about 41,000 dols, invested at 6 per cent., and bringing an income of about 2,400 dols. a year. It may be remembered by some of our readers that Prof. A. D. Bache, the late head of the Coast Survey, left his property in trust to the National Academy of Sciences, after the death of Mrs. Bache, for purposes connected with the advance of science, appointing as special trustees Prof. Agassiz, Prof. Peirce, and Prof. Henry. The precise disposition of this fund has not yet been determined upon, the bequest having fallen too recently into the hands of the society to make it necessary to come at once to a conclusion.—The ship *Onward* arrived at New Bedford a few days ago, and her captain —Pulver—reports passing Sunday Island on the passage from Honululu, and states that the volcano near by, referred to in a previous number of Scientific Intelligence, was at that time three miles long, and from 300ft. to 400.t. high. The sulphurous vapours extended around to a distance of three to four miles. He thinks that when the volcano becomes quiet there will be a good harbour between it and the main land, where before there has been only an open roads ead. The island is in latitude 29° south, and in longitude 178° west. The statement of Captain Pulver, according to the New Bedford *Standard*, is corroborated by other witnesses.—An examination has recently been made by an officer of the United States army of an old pueblo situated about twenty-five miles from the town of Socorro, on the Rio Grande. The walls of the buildings of this pueblo are composed of thin sandstone, heaped one layer upon another without mortar, and without any traces of beams or timber of any kind. The edifices seem to have been but one story high, and to have consisted of four separate buildings, arranged so as to form a hollow square with a fifth a little outside of these. The longest range was over 200ft. in length, and the whole five contained about two hundred rooms. Near the pueblo extensive silver mines have recently been discovered, and a town is to be laid out during the present year, the material for the houses to be derived from the ruins. There are evidences of ancient workings of these mines in the form of shafts now entirely filled up with earth, although it is probable that these do not antedate the period of the occupation of the country by the Spaniards. —According to late advices from South America, an unusually brilliant electric phenomenon was visible from Tacna, on the coast of Peru, early in March of the present year, around the snowy peak of Tacora, lasting for over two hours. The lightnings were of extraordinary shapes, and the thunders were of such intensity, and were heard over so wide an extent of country, as to completely terrify the population, unused to such exhibitions. This unwonted display was preceded by a slight shock of earthquake on the previous night.—According to the *Comercio*, of Lima, on the 12th of February, at Pitchican, an extraordinary meteor, of an oblong shape, and of a red colour, was seen to descend suddenly from the sky toward the earth; and, as soon as it touched, an explosion occurred, leaving a dense cloud over the place, and knocking down a fence for about five hundred yards. Among the stones heaped around by this meteoric body were found recently dead fishes of different species, which were supposed to have been lifted out of the river and dashed against the stones.—The cattle disease continues to spread throughout South America, all efforts to resist its progress having been unavailing. At the present time it is very prevalent in the Southern provinces of Chili, and in the adjacent country.—The details of later advices from the Isthmus of Panama indicate the discovery of a rather low water-shed between the Atlantic and Pacific, on the Isthmus of Darien, although the feasibility of constructing a canal is, after all, by no means well-established. As far as the engineering possibilities are concerned, the chance seems to be much more favourable by way of Nicaragua, the result of a late investigation by Mr. Sonnenstern, on behalf of the Nicaraguan Government, serving to show that a route of 220 miles can be found connecting the two oceans, 196 of which is a ready constituted by the rivers and lakes of the country, leaving only twenty-four miles of land to be excavated, with a maximum elevation of not more than twenty-six feet. A slight drawback, however, to the value of this line is to be found in the fact, stated in the same paper, that the harbour of San Juan del Norte has been nearly filled up by a sand-bar, entirely preventing the entrance of vessels!

SCIENTIFIC SERIALS

THE *Zeitschrift für Ethnologie* for the present quarter begins with a critical paper on "Ethnological Classifications," especially those which rest on language. The writer comments on the arbitrary character of the division of languages into "isolating," "agglutinating," and "inflecting," and contrasts the comparatively exhaustive knowledge of animal types on which zoological classifications depend, with the very scanty acquaintance which ethnologists possess of the great mass of languages beyond the Indo-European group. Exact knowledge of these latter highly complex and differentiated languages is, he argues, of very little use in tracing the origin and affinities of more primitive speech. It is suggested that peculiarities of language often depend on local characters of climate rather than on race. Thus, short words may be the result of a warm and lazy climate, like Siam, while, on the contrary, the chilly Indians of Athapascow take an athletic delight in calling their feet "choachastlsokai." Many interesting examples are given of Dog-Latin, Pigeon-English, Chinook-French, and other bastard varieties of civilised languages, which appear to be modified in a certain definite way according to climate and to race. Here is an example of Monks' Latin of the date 1127. "*Donent illis in Dominicis diebus carnem Mottotinum* (Mouton) *in quartis feriis ciceroues, cum lardo.*" The second article in the same journal, by Franz Engel, is on the national types and races of Tropical America. It contains an interesting account of the habits and characters of the Spanish Americans, the Creoles, Negroes, and Indians, with the various cross-breeds among them. But there is little addition to our knowledge of their anatomical and physiological peculiarities, and the whole description is written in a diffuse and affected style, including in one passage a very prosaic travestie of verses from "Das Lied von der Glocke." A much shorter but valuable paper, by Adolf Hübner, gives an account, with figures, of a great series of drawings he discovered on a flat slate rock in the Trans-Vaal Republic of South Africa. Indigenous wild animals of all kinds were, to judge from the specimens given, very fairly represented, with a few human figures, one holding a bow; but no domestic animals were to be seen, nor was there any appearance of alphabetical or even picture-writing. The same writer gives also an account (with plans) of ancient Caffre fortifications in Mosalikatzi's kingdom.

IN the Berlin *Academy of Anthropology*, &c., a sketch by Dr. H. H. Hildebrand was exhibited (and is reproduced in the *Zeitschrift für Ethnologie*) of one of the urns with sculptured faces which have attracted so much attention in this Academy before. It was found in Cyprus. Other communications were on pile-dwellings in the Kuder See (Holstein), by L. Meyer; on an instrument of bone, about eight inches long, shaped like a knife-blade, and jagged along the edge, found in Mecklenburg, about fifteen feet deep, and covered by ten feet of chalk; on a burying-place in East Prussia, which proved by the utensils discovered in the graves to have been used by Romans; on stone implements in East Greenland; and on the ethnological characters of the Turcos of the French Army, for the study of which recent events have offered unusual facilities. At a subsequent meeting of the Academy, Prof. Virchow read a paper on the use of *tibiæ* and and other bones as skates in early times; and Herr Jagor one on the discovery of kitchen middens in the Andaman Isles.

IN a reprint from the *Archæologia* (vol. xlii.) Prof. Rolleston gives an interesting account of his researches in a Roman-British cemetery at Frilford, near Abingdon. Superficial to the more ancient interments, which were mostly in coffins and belonged to Christian times, were found later remains of the Saxon Pagan period. The latter were placed promiscuously, the former with more or less orientation, and the fact that the direction of the grave usually deviates towards the south is ingeniously explained as due to the majority of deaths having taken place then, as now, in the winter quarter of the year, when the sun would rise south of the due east. From the character of the skulls, and the urns, weapons, nails, &c., found in the graves, various important conclusions are drawn as to the social condition of this country during the obscure period between the departure of the Romans and the conversion of the Saxons; and the whole paper is illustrated by a curious and felicitous erudition which reminds the reader of the account of a Roman cemetery at Old Walsingham, given in the "Hydriotaphia" of Sir Thomas Browne."

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 4.—"On the Molybdates and Vanadates of Lead, and on a new Mineral from Leadhills," by Prof. Dr. Albert Schrauf, of Vienna.

"On the Structures and Affinities of *Gwynia annulata*, Dunc., with Remarks upon the Persistence of Palæozoic Types of Madreporaria," by Prof. P. Martin Duncan.

The dredging expedition which searched the sea-floor in the track of the Gulf Stream of 1868, yielded, amongst other interesting Madreporaria, a form which has been described by Count Pourtales under the name of *Haplophyllia paradoxa*, and which was decided by him to belong to the section *Rugosa*.

The last expedition of the *Porcupine*, under the supervision of Dr. Carpenter and Mr. J. Gwyn Jeffreys, obtained, off the Adventure Bank in the Mediterranean, many specimens of a coral which has very remarkable structures and affinities. The species is described under the name of *Gwynia annulata*, Dunc. The necessity of including it amongst the Rugosa and in the same family, the *Cyathoxonidæ*, as *Haplophyllia paradoxa*, is shown. Having this proof of the persistence of the rugose type from the palæozoic seas to the present, the affinities of some so-called anomalous genera of midtertiary and secondary deposits are critically examined. The Australian tertiary genus *Conosmilia*, three of whose species have strong structural resemblance with the Rugosa, is determined to be allied to the *Stauridæ*, and especially to the Permian genus *Polycœlia*. The secondary and tertiary genera with hexameral, octomeral, or tetrameral and decameral septal arrangements are noticed, and the rugose characteristics of many lower Liassic and Rhetic species are examined. The impossibility of maintaining the distinctness of the palæozoic and neozoic coral faunas is asserted; and it is attempted to be proved that whilst some rugose types have persisted, hexameral types have originated from others, and have occasionally recurred to the original tetrameral or octomeral types; and that the species of corals with the confused and irregular septal members, so characteristic of the lowest neozoic strata, descended from those *Rugosa* which have an indefinite arrangement of the septa. The relation between the Australian tertiary and recent faunas, and those of the later palæozoic and early neozoic in Europe, is noticed, and also the long-continued biological alliances between the coral faunas of the two sides of the Atlantic Ocean.

"Remarks on the Determination of a Ship's Place at Sea." In a Letter to Prof. Stokes, by G. B. Airy, LL.D., Astronomer Royal.

May 11.—"An Experimental Inquiry into the Constitution of Blood, and the Nutrition of Muscular Tissue," by William Marcet, M.D., F.R.S. The results obtained from the inquiry which forms the subject of the paper are as follows:—

First. That blood is strictly a colloid fluid.

Second. That although blood be strictly a colloid, it contains invariably a small proportion of diffusible constituents amounting to nearly 7·3 grms. in 1,000 of blood, and 9·25 grms. in an equal volume of serum, these proportions diffusing out of blood in twenty-four hours.

Third. That the proportion of chlorine contained in blood has a remarkable degree of fixity, and may be considered as amounting to three parts (the correct mean being 3·06) in 1,000.

Fourth. That blood contains phosphoric anhydride and iron in a perfect colloid state, or quite undiffusible when submitted to dialysis, the relative proportions appearing to vary from 78·61 per cent. of peroxide of iron and 29·39 of phosphoric anhydride, to 76·2 and 23·8 respectively, the proportion of phosphoric anhydride having a tendency to be rather higher.

Fifth. That blood contains more phosphoric anhydride and potash, bulk for bulk, than serum.

Sixth. That a mixture of colloid phosphoric anhydride and potash can be prepared artificially by dialysis, and that the colloid mass thus obtained appears to retain the characters of the neutral tribasic phosphate from which it originates; it exhibits an alkaline reaction, yields a yellow precipitate with nitrate of silver, and after complete precipitation the reaction is acid.

Seventh. That by dialysing certain proportions of phosphate of sodium and chloride of potassium during a certain time, proportions of phosphoric anhydride, potash, chlorine, and soda are obtained in the colloid fluid very similar to the proportions these same substances bear to each other in serum after twenty-four hours dialysis.

Eighth. That muscular tissue is formed of three different classes of substances; the first including those substances which constitute the tissue proper, or the portion of flesh insoluble in the preparation of the aqueous extract, and consisting of albumen and phosphoric anhydride with varying proportions of potash and magnesia; the second class including the same substances as are found in the tissue proper, and in the same proportions relatively to the albumen present in that class, but existing in solution and in the colloid state; the third class including the same substances as are found in the two others, and moreover a small quantity of chlorine and soda, which, although relatively minute, is never absent. The constituents of this class are crystalloid, and consequently diffusible, the phosphoric anhydride and potash being present precisely in the proportion required to form a neutral tribasic phosphate, or a pyrophosphate, as the formula $2KO\ PO_5$ can equally be $2KO\ HO\ PO_5$.

Ninth. That flesh contains in store a supply of nourishment equal to about one-third more than its requirement for immediate use, this being apparently a provision of nature to allow of muscular exercise during prolonged fasting.

Tenth. That the numbers representing the excess of phosphoric anhydride and potash in blood over the proportion of these substances in an equal volume of serum in the regular normal nutrition of herbivorous animals, appear to bear to each other nearly the same relation as that which exists between the phosphoric anhydride and potash on their way out of muscular tissue.

Eleventh. That vegetables used as food for man and animals, such as flour, potato, and rice, transform phosphoric anhydride and potash from the crystalloid or diffusible into the colloid, or undiffusible state; and it is only after having been thus prepared that these substances appear to be fit to become normal constituents of blood, and contribute to the nutrition of flesh.

A final remark, and one which is worth consideration, is the fact established by the whole of the present investigation, that there is a constant change, as rotation in nature from crystalloids to colloids, and from colloids to crystalloids.

"On Protoplasmic Life." By F. Crace-Calvert, F.R.S.

A year since the publication of Dr. Tyndall's interesting paper on the abundance of germ life in the atmosphere, and the difficulty of destroying this life, as well as others paper published by eminent men of science, suggested the inquiry if the germs existing or produced in a liquid in a state of fermentation or of putrefaction could be conveyed to a liquid susceptible of entering into these states; and although at the present time the results of this inquiry are not sufficiently complete for publication, still I have observed some facts arising out of the subject of protoplasmic life which I wish now to lay before the Royal Society.

As a pure fluid free from life, and having no chemical reaction, was essential to carrying out the investigation, I directed my attention to the preparation of pure distilled water. Having always found life in distilled water prepared by the ordinary methods by keeping it a few days, after many trials I employed an apparatus which gave satisfactory results, and enabled me to obtain water which remained free from life for several months.

The water had to be redistilled three or four times before it was obtained free from germs, and it was then kept in the apparatus in which it was distilled until wanted, to prevent any contact with air.

Some water which had been distilled on the 20th of November, 1870, being still free from life on the 7th of December, was introduced by a siphon into twelve small tubes and then left exposed to the atmosphere for fifteen hours, when they were closed. Every eight days some of the tubes were opened, and their contents examined. On the fifteenth, therefore, the first examination was made; when no life was observed; on the 23rd two or three other tubes were examined, and again no life was detected; whilst in the series opened on the 2nd of January, 1871, that is to say, twenty-four days from the time the tubes were closed, two or three *black vibrios* were found in each field. Being impressed with the idea that this slow and limited development of protoplasmic life might be attributed to the small amount of life existing in the atmosphere at this period of the year,* a second series of expements was commenced on the 4th of January. The distilled water in the flask being still free from life, a certain quantity of it was put into twelve small tubes, which were placed near putrid meat at a temperature of 21° to 26° C. for two hours, and then sealed. On the 10th of the same month the contents of some of the tubes were examined, when two or three small *black vibrios*

* During the intense cold of December and January last, I found it took an exposure to the atmosphere of two days at a temperature of 12° C. before life appeared in solution of white of egg in the pure distilled water, whilst as the weather got warmer the time required became less.

were observed under each field. This result shows that the fluid having been placed near a source of protoplasmic life, germs had become impregnated in two hours in sufficient quantity for life to become visible in six days instead of twenty-four. Other tubes of this series were opened on the 17th of January, when a slight increase of life was noticed; but no further development appeared to take place after this date, as some examined on the 10th of March did not contain more life than those of the 17th of January.

This very limited amount of life naturally suggested the idea that it might be due to the employment of perfectly pure water, so that Mr. Calvert commenced a third series of experiments.

On the 9th of February 100 fluid grains of albumen from a new-laid egg were introduced as quickly as possible and with the greatest care, into ten ounces of pure distilled water contained in the flask in which it had been condensed, and an atmosphere of hydrogen kept over it. On the 16th some of the fluid was taken out by means of a siphon and examined, and no life being present, twelve tubes were filled with the fluid exposed to the air for eight hours and closed. On the 21st the contents of some of the tubes were examined, when a few vibrios and microzyma were distinctly seen in each field. On the 27th other tubes were examined, and showed a marked increase in the amount of life. In this series, in which a *fermentable substance* was employed, life appeared in five days, and an increase in ten, instead of requiring twenty-four days, as was the case when pure water only was employed.

As the weather had become much warmer, and a marked increase of life in the atmosphere had taken place, some of the same albumen solution as had been employed in the above experiments was left exposed in similar tubes to its influence, when a large quantity of life was rapidly developed, and continued to increase. This result appears to show that the increase of life is not due to reproduction merely, but to the introduction of fresh germs; for, excepting this fresh supply, there appears to be no reason why life should increase more rapidly in the open than in the closed tubes.

"Action of Heat on Protoplasmic Life," by F. Crace Calvert, F.R.S.

Those investigators of germ-life who favour the theory of spontaneous generation, have assumed that a temperature of 212° Fahr., or the boiling-point of the fluid which they experimented upon, was sufficient to destroy all protoplasmic life, and that the life they subsequently observed in these fluids was developed from non-living matter.

I therefore made several series of experiments, in the hope that they might throw some light on the subject.

To carry out the experiments I prepared a series of small tubes made of very thick and well-annealed glass, each tube about four centimetres in length, and having a bore of five millimetres. The fluid to be operated upon was introduced into them, and left exposed to the atmosphere for sufficient length of time for germ-life to be largely developed. Each tube was then hermetically sealed and wrapped in wire gauze, to prevent any accident to the operator in case of the bursting of any of the tubes. They were then placed in an oil-bath, and gradually heated to the required temperature, at which they were maintained for half an hour.

Sugar Solution.—A solution of sugar was prepared by dissolving one part of sugar in ten parts of water. This solution was made with common water, and exposed all night to the atmosphere, so that life might impregnate it. The fluid was prepared on the 1st of November, 1870, introduced into tubes on the 2nd, and allowed to remain five days. On the 7th of November twelve tubes were kept without being heated, twelve were heated to 200° Fahr., twelve to 300°, and twelve to 400° Fahr.

The contents of the tubes were microscopically examined on the 1st of December, twenty-four days after heating.

In the sugar solution which was not heated there were about thirty animalcules under each field of the microscope, principally *small black vibrios;* two or three microzymes swimming slowly about; three or four *ordinary swimming vibrios*, and a few bacteria. In that which was heated for half an hour at 212 F., a great portion of the life had disappeared, and no animalcules were swimming. Four or five *small black vibrios* were observed moving energetically to and fro; two or three *ordinary vibrios* were also observed moving energetically *in the same position of the field, that is, without swimming about.* Heated for half an hour at 300° F. the sugar was slightly charred, but one or two *ordinary vibrios*, and one or two *small black vibrios* were observed in motion under the field of the microscope. In the solutions heated to the higher temperatures there was no trace of organisms.

Remarks.—The black vibrios here referred to are far more opaque than the other varieties of vibrios, and are the most important of all, as I have found them to resist not only very high temperatures, but all chemical solutions. I shall, in my paper on putrefaction and the action of antiseptics, describe the various vibrios, and give various drawings of them.

Hay Infusion.—An infusion of hay was made by macerating it in common water for one hour, then filtering the liquor, and leaving it exposed to the atmosphere all night, when it was sealed in the small tubes, twelve of which were used for each experiment. The infusion was made on the 4th of November, sealed in tubes on the 5th, and heated on the 7th.

The results were examined on the 1st of December, 1871, twenty-four days after being heated.

The hay infusion not heated contained "fungus matter" and other low organisms. The tubes, which were heated to 212° F. and 300° F., contained a few small "black vibrios," [but whether they were living or dead is not stated]. The tubes exposed to higher temperatures showed no trace of organisms.

Gelatine Solution.—A solution of gelatine, prepared of such strength that it remained liquid on cooling, was exposed for twenty-four hours to the atmosphere. It was then introduced into the small tubes, and the tubes sealed. The solution was made on the 4th of November, the tubes sealed on the 5th, and subjected to the different temperatures on the 7th.

The fluids were examined on the 1st of December, 1871, twenty-four days after being heated.

In the gelatine solution which was not heated, there were seven or eight animalcules under each field, five or six of which were quite different from anything observed in the other fluids. They had long thin bodies, swimming with a peristaltic motion. One or two ordinary swimming vibrios were also present; but the small black vibrios were absent. In the gelatine solution heated for half an hour at 100° F., the organisms ceased to exhibit any active movements; and in that which was heated for half an hour at 212° F., a very decided diminution in the quantity of life present was noticed In the solutions heated to the higher temperatures no life was found.

Putrid Meat Fluid.—Water was placed in an open vessel, and a piece of meat suspended in it until it became putrid and contaminated with myriads of animalcules. This fluid was placed in the usual tubes, which were sealed on the 7th November, and heated on the same day.

The contents of the tubes were subjected to examination on the 1st of December, or twenty-four days after having been heated.

In the solution which was not heated, a large quantity of life was present, namely, microzyma and several distinct species of vibrios, among which were a number of the small black ones frequently mentioned. In that which was heated for half an hour at 100° F., this temperature had but slightly affected the life present, the animalcules being as numerous as in the liquid not heated, and not moving as usual. In that which was heated for half an hour at 212° F., although heat had *deprived the animalcules of the power of locomotion,* still they retained a sufficient amount of vital force to "place it beyond a doubt that life was not destroyed." In that which was heated for half an hour at 300° F. a large quantity of the life in the fluid was destroyed, but some vibrios still remained, the small black ones being the most numerous. In the solutions exposed to the higher temperatures there was no trace of organisms.

Although perfectly aware of the interesting researches of Prof. Melsens, proving that the most intense cold does not destroy the active power of vaccine lymph, still I thought it desirable to ascertain the effect of a temperature of 15° F. on well-developed germ-life, similar to that which had been subjected to the action of heat.

Some putrid-meat liquor, therefore, containing a large quantity of microzyma and vibrios, was subjected for twenty hours to the influence of a temperature ranging between the freezing-point of water and 17° below that point, when the ice was melted, and the liquor examined. The animalcules retained their vitality, but appeared very languid, and their power of locomotion was greatly decreased. Two hours after melting the ice the liquor was again examined, when the animalcules appeared to be as energetic as before.

In the discussion which followed the reading of Dr. Calvert's papers Dr. Charlton Bastian remarked upon the number of assumptions which were introduced, and gave reasons for his opinion that the experiments were wholly inconclusive in their nature. He was not aware that Prof. Tyndall had ever revealed an "abundance of germ life" in the air, whilst M. Pasteur had distinctly stated that he had been unable to recognise Bacteria or their germs in the dust filtered from the atmosphere. Even if Bacteria were widely diffused in the air, it would still have to be shown that they were alive. From the fact that some eminently inoculable fluids might be pretty freely exposed to the air for two or three weeks without showing the least signs of turbidity—though they could always be rendered turbid in two or three days after bringing them into contact with actual living Bacteria—he thought there was reason to believe that *living* Bacteria were by no means abundant in the air. And as he had found that all other naked lower forms of life with which he had experimented were unable to survive the effects of even short periods of desiccation, he thought there was much reason for the belief that the same rule would hold good for Bacteria. Dr. Bastian failed to find in Dr. Calvert's papers sufficient evidence that the organisms found in some of the solutions were really alive, and with regard to those experiments in which fermentable substances had been employed, it was assuming the very point at issue to suppose that the more numerous organisms which were present in them could only have come from the atmosphere. With regard to the influence of heat upon the life of Bacteria and many other organisms, Dr. Bastian gave some particulars concerning experiments, which tended to show, as he thought, conclusively, that they were all killed by an exposure in fluids, for ten minutes, to a heat of 60° C. (140° F.) There was no difficulty in ascertaining when Amœbæ or Ciliated Infusoria were killed, though with respect to Bacteria there was much more difficulty. Where the movements were not of an active character, after the Bacteria had been subjected to different degrees of heat, no reliable opinion as to their life or death could be arrived at. Bacteria which were really living might in many cases exhibit movements differing in no respect from those which dead Bacteria would display. From the exhibition of such movements, therefore, it could not be positively affirmed that the organisms were living, or that they were dead. The case was different, however, with regard to reproduction—dead organisms could not multiply. Having found a fluid, therefore, which was most suitable for the nourishment of Bacteria, but which seemed to be wholly incapable of giving origin to them *de novo*, he inoculated portions of it with living Bacteria, and then found that those fluids which had been heated to 50° C. or 55° C. for ten minutes became quite turbid in two or three days, whilst others, heated for the same time to 60°, 65°, 70°, 75° C. and upwards, invariably remained clear and showed no signs of turbidity. As living Bacteria will always multiply under suitable conditions in suitable fluids, their failure to multiply was the best evidence that they had been killed. The conclusion that Bacteria were killed by exposure in fluids to a heat of 60° C. was one which had been previously arrived at by Prof. Wyman and M. Pouchet, though such a conclusion was now much strengthened by Dr. Bastian's recent experiments. These results were harmonious also with the fact that Amœbæ, Ciliated Infusoria, and almost all the other lower organisms with which experiments had been made, were also killed by even a shorter exposure to a temperature of 60° C. (140° F.)

Geologists' Association, May 5.—Rev. T. Wiltshire, president, in the chair.—"On the Fauna of the Carboniferous Epoch," by Henry Woodward. In this paper the author protested against that mode of thought which seemed to imply that the globe was, during the various geologic periods, a vast aquarium, and urged the similarity of the conditions which now prevail with those that were obtained during the deposition of the various systems of the stratified rocks. Mr. Woodward combated the opinion of many, that during the Carboniferous period the atmosphere was heavily charged with carbonic acid gas, which, while it supplied the profuse vegetation of that epoch with carbon, prevented the radiation of heat from the earth, and thus produced an abnormal warmth which, with abundant moisture, was the cause of the vast growths that formed the beds of coal we now use for fuel. It was contended that the atmosphere under normal conditions was quite sufficient to supply all the carbonic acid that was required for the vegetation which composed all the beds in the world, and that, as we find the Gulf Stream exerting a great influence on the climate of England at the present time, so unusual warmth and humidity and great alterations of the isothermal lines of the globe, might have been produced by ocean currents consequent upon changes of coast-lines and other causes of which we can know little. The animal life of the epoch was then described, and some valuable lists of species were appended to the paper. The Rev. Mr. Henslow, referring to Mr. Woodward's remarks respecting the discovery by Prof. Morris of the "Mother coal" of Bradford being made up of spores and spore cases, stated that Prof. Huxley had concluded that coal generally was formed in this manner. Prof. Morris heartily approved of Mr. Woodward's opinion in favour of the contemporaneity of formations usually considered to be of successive epochs, and pointed out the great differences in the thickness in the underlying beds, and in other stratigraphical conditions of the Carboniferous limestone, millstone grit, and coal measures, in various districts. In Shropshire, for instance, the Carboniferous beds repose upon Silurian rocks, and in Scotland the coal seams are intercalated with the main limestone. Mr. Woodward, after passing a high eulogium on Prof. Morris, whose knowledge of the subject was most varied and extensive, briefly described several species of crustacea of which diagrams were exhibited, and directed the attention of the Association to a cast of the head of an undescribed species of *Anthracosaurus* allied to *A. Russelli*, recently obtained by Mr. George Maw, from the coal measures of Coalbrook Dale.

PARIS

Academy of Sciences, April 10.—M. Chasles read a very interesting paper on the properties belonging to a system of cones. Every one of these properties discovered by the law of analogy relates to a series of certain geometrical objects, compared with a series of other objects of the same nature. The demonstrations are not given except by the arrangement of the different propositions, which are sixty in number, and fill twelve closely printed pages of the *Comptes Rendus*.—Dr. Declat, who does not belong to the Academy, read a memoir on the effects of phenic acid. He attributes to this specific the power of curing the German cattle plague, or at least of preventing it. The experiments do not appear, however, very conclusive.—M. Aubert presented a memoir on the moral causes of the inferiority exhibited by French armies during the last campaigning. These causes are very numerous, and the principal of them is the making of the army an instrument for the protection of an internal despotism. The discussion of these subjects was considered as being out of the limits and province of the Academy. The memoir in former years would have been rejected under the old rules, but the president, M. Delaunay, referred it to a special committee, composed of General Morin, director of the Conservatoire des Arts, and M. Amiral Paris. The *Comptes Rendus* for this sitting publishes a list of periodicals which were offered to the French Academy in the month of March. As many as fifteen publications were special periodicals, which resumed their publication during the few weeks of the cessation of fighting round Paris. The celebrated Abbé Moigno has lost no time in starting his *Les Mondes*, as the whole set for March was presented to the Academy. The foreign list was very short and incomplete, as NATURE, which had been presented, was omitted. The only English paper mentioned was the *Monthly Notices of the Royal Astronomical Society*.—M. Barral, the editor of two agricultural papers which are mentioned in the aforesaid list—*Bulletin hebdomadaire du Journal d'Agriculture* and *Journal de l'Agriculture*—having taken steps opposed to Communist rule, was obliged to leave Paris. His papers are now published at Versailles. M. Wolf, an Austrian subject, was present at the sitting. He is conducting observations at the National Observatory, where the instruments were not packed as on the occasion of the former shelling and investment. They run the risk of being smashed to pieces.

April 17.—M. Payen read an important paper on Cellulose. It is known that stony fruits or stony parts of fleshy fruits, like cherries and peaches, are composed of cellulose, impregnated with incrusting materials. The digestion of this cellulose is rendered more easy and complete by giving to the animals some fatty matters. The same may be said of stems of vegetables and straw. The application of this theory to the breeding of cattle is obvious. M. Payen exhibited some reactions, which show theoretically that the results obtained in Germany by the analysis of evacuations are truthful and genuine. The paper

elicited some observations from M. Chevreul, who read afterwards on his own account a short report on a small pamphlet written by him during the investment of Paris. The title of this *brochure* is somewhat long, and explains clearly the meaning of the work: "On a fault of reasoning which is committed very often by people engaged in natural philosophy when reasoning on the concrete. The explanations are drawn from the last writings of M. Chevreul." These writings are mostly communications presented by M. Chevreul to the Academy for the last three years, when he was strenuously advocating a new classification of sciences as well as of the different objects of nature.—M. Trécul read some interesting observations on the Vegetation of Ferns.—M. Sant Venant, a member of the Section of Mechanics, presented a paper written by M. Boussinerg, a promising young French mathematician, who does not belong to the Academy. The paper related to the observations of an immense number of transcendental equations which present themselves to the mathematical inquirer when studying physical phenomena.

April 24.—The account of this sitting was published in the last number of NATURE. We have nothing of importance to add to it. All the *Comptes Rendus* of the period are signed by M. Elie de Beaumont, acting as perpetual secretary. M. Elie de Beaumont was formerly a senator, although it can hardly be said he has ever meddled with politics. M. Delaunay, the present director of the National Observatory, has inaugurated the regular publishing of a monthly abstract of meteorological observation. It is a practice which is revived from Arago's, but was stopped by M. Leverrier when he stepped into office in 1854.

BERLIN

Royal Prussian Academy of Sciences, March 6.—M. Roth read the continuation of his historical remarks upon the theory of metamorphism, and the production of crystalline slates.—Prof. A. W. Hofmann read papers on phosphuretted hydrogen, and on the direct substitution of the alcoholic radicals for the hydrogen in that compound.

March 9.—M. Riess read a paper on the action of the subsidiary currents of the electrical battery upon the main current and upon each other.

March 30.—Prof. Hofmann described an eudiometer with movable wires. The apparatus consists of a glass tube, with two short narrow tubes attached to it at right-angles, and opening into it opposite to each other; these are closed by steel caps, through which steel screws pass, bearing the platinum wires. The screws are furnished with loops for the attachment of wires.—Prof. Hofmann also read a memoir on isodicyanic æthers, compounds which occupy a middle place between the cyanic and cyanuric æthers; and another on biuret and allied compounds.—Prof. Dove read a paper on the behaviour of agate in the magnetic field.

VIENNA

I. R. Geological Institution, April 18.—Prof. Peters, of Gratz, sent a communication about a newly discovered mineral spring at Hengsberg, near Gratz. Besides a large quantity of free carbonic acid and carbonate of lime, the water contains chlorine, bromine, traces of iodine, boracic acid, and among the alcalies a considerable quantity of lithium.—M. J. Pauer related a remarkable phenomenon which has occurred during recent years in the large lake of Neusiedel, near Oldenburg, in Hungary. This lake, which measured nearly six German (about 150 English) square miles, was entirely dried up in the year 1865, and the ground was gradually converted into arable land. During the last winter, however, the water regained its territory, and to the great damage of the cultivators the basin is again filled up nearly to the same extent which it occupied formerly. Documents were found which prove that similar events took place in former centuries, and on one spot were discovered trunks of trees rooting in the ground as much as three feet in diameter. They prove that at a former period the lake was dry through a long series of years.—M. E. v. Mojrisovics presented a memoir on the so-called alveolaric Orthoceratites from the Triassic and Liassic deposits of the Alps. He proved that they all are the phragmocones of a particular genus of the family of the Belemnitidæ, and that their isolated rostra are the forms which Gümbel called Attractites. The genus was described many years ago by Fr. v. Hauer and named Aulacoceras, but he had united it with the family of the Orthoceratidæ. To Aulacoceras belong all formerly so-called Orthoceratites with a marginal sipho, from the mesozoic formations of the Alps, and only the species with a central sipho are real Orthoceratites.

BOOKS RECEIVED

ENGLISH.—Discourses on Practical Physic: Dr. B. W. Richardson (Churchill).—The Coming Race (Blackwood and Sons).

FOREIGN.—(Through Williams and Norgate)—Vorwort zu der Physik der Erde: Dr. R. Reuschle.—Grundzüge der technischen Natur-lehre: Dr. Ph. Huber.—Leh-buch der Physik und Mechanik: Dr. L. Blum.—Lehrbuch der Physik: Dr W. Eisenlohr.—Anatomie und systematische Beschreibung der Alcyonarien: Dr A. Kölliker.

DIARY

THURSDAY, MAY 18.

SOCIETY OF ANTIQUARIES, at 8.30.—Exhibition of Stone Implements (Palæolithic), with Papers by A. W. Franks, V.P., and J. Evans, F.R.S.
CHEMICAL SOCIETY, at 8.—On a New Double Salt of Thallium: R. J. Friswell.—On a New Benzolic Derivative: Dr. Armstrong.
ROYAL INSTITUTION, at 3.—On Sound: Prof. Tyndall, F.R.S.

FRIDAY, MAY 19.

ROYAL INSTITUTION, at 9.—On Bishop Berkeley and the Metaphysics of Sensation: Prof. Huxley, F.R.S
ROYAL UNITED SERVICE INSTITUTION, at 3.—The Winds of the North Atlantic: Captain H. Toynbee, F.R.A.S.

SATURDAY, MAY 20.

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

MONDAY, MAY 22.

ROYAL GEOGRAPHICAL SOCIETY, at 1.—Anniversary Meeting.

TUESDAY, MAY 23.

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

WEDNESDAY, MAY 24.

GEOLOGICAL SOCIETY, at 8.—Geological Observations on British Guiana: J. G. Lawkins, F.G.S.—On the Principal Features of the Stratigraphical Distribution of the British Fossil Lamellibranchiata: J. Logan Lobley, F.G.S.
LINNEAN SOCIETY, at 3.—Anniversary Meeting.

THURSDAY, MAY 25.

ROYAL SOCIETY, at 8.30.
SOCIETY OF ANTIQUARIES, at 8.30.
ROYAL INSTITUTION, at 3.—On Sound: Prof. Tyndall, F.R.S.

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