Nature. Vol. I, No. 25 April 21, 1870

London: Macmillan Journals, April 21, 1870

THURSDAY, APRIL 21, 1870.

ON ORIGINAL EXPERIMENTAL RESEARCH IN RELATION TO EMPLOYMENT FOR WORKMEN.

IT is an important national question, "By what means can employment for workmen in this country be increased?" My reply is, "By encouragement of experimental scientific research."

I have observed that increased employment of workmen constantly results from original experimental research in science in the following order: Experimental researches in science lead to scientific discoveries; scientific discoveries lead to practical inventions; and practical inventions lead to increase of employment. Usually, a scientific investigator first discovers some new fact or principle in science; next, an inventor applies this discovery, in the form of an invention, to some useful purpose; and then a manufacturer or man of business brings it into general use, and employs workmen or servants to assist him. In some cases, however, the discovery of a new truth in science, its application by invention, and its practical carrying out, are all effected by the same individual.

The following examples will illustrate the foregoing observation:—The discoveries of voltaic electricity, electro-magnetism, and magneto-electricity, by Volta, Oersted, and Faraday, led to the invention of electric telegraphy by Wheatstone and others, and to the great manufactures of telegraph cables and telegraph wire, and of the materials required for them. The value of the cargo of the *Great Eastern* alone in the present Bombay telegraph expedition is calculated at three millions of pounds sterling. It also led to the employment of thousands of operators to transmit the telegraphic messages, and to a great increase of our commerce in nearly all its branches by the more rapid means of communication. The discovery of voltaic electricity further led to the invention of electro-plating, and to the employment of a large number of persons in that business. The numerous experimental researches on specific heat, latent heat, the tension of vapours, the properties of water, the mechanical effect of heat, &c., resulted in the development of steam-engines and railways, and the almost endless employments depending upon their construction and use. About a quarter of a million of persons are employed on railways alone in Great Britain. The various original investigations on the chemical effects of light led to the invention of photography, and have given employment to thousands of persons who practise that process, or manufacture and prepare the various materials and articles required in it. The discovery of chlorine by Scheele led to the invention of the modern processes of bleaching, and to various improvements in the dyeing of textile fabrics, and has given employment to a very large number of our Lancashire operatives. The discovery of chlorine has also contributed to the employment of thousands of printers, by enabling Esparto grass to be bleached and formed into paper for the use of our daily press. The numerous experimental investigations in relation to coal-gas have largely been the means of extending the use of that substance and of increasing the employment of workmen and others connected with its manufacture. The discovery of the alkali metals by Davy, of cyanide of potassium, of nickel, phosphorus, the common acids, and a multitude of other substances, have led to the employment of a whole army of workmen in the conversion of those substances into articles of utility.

The foregoing examples might be greatly enlarged upon, and a great many others might be selected from the sciences of physics and chemistry, but those mentioned will suffice. There is not a force of nature, nor scarcely a material substance that we employ, which has not been the subject of several, and in some cases of numerous original experimental researches, many of which have resulted, in a greater or less degree, in increasing the employment for workmen and others.

The variety and extent of the employments which have resulted from scientific research are so great that they ramify in some form or other through nearly all our manufacturing, artistic, and commercial occupations, our social relations, and our every-day life; and those employments have become of such common occurrence that we are apt scarcely to think how much experimental research has had to do with their production, and we are thus led to undervalue original experimental investigation as a means of producing employment. Persons in general can easily understand that an acorn planted in the ground will, in the course of time, become an oak, because it is a palpable and visible effect; but they cannot so readily perceive that the abstract scientific fact discovered by experiment to-day will probably soon become an invention of practical daily use, not because it is less real, but simply because it is a phenomenon less evident to the senses, and requires a greater exercise of intellect to perceive it.

In many instances the application of original experimental science in new inventions has superseded, and in a limited sense diminished, manual labour, but it has in such cases either substituted more intellectual occupation for it, or has opened up new sources of employment to a far greater extent by increasing trade and manufacture. For example, the number of waggoners and horses now employed to collect and deliver all the goods for railways is much greater than the whole of those employed for conveying the goods of the country before railways were constructed.

The capability of developing increased employment by the means proposed is immense, and practically unlimited, because scientific discovery is quite in its infancy, and we are at present only on the very threshold of a knowledge of the forces of nature and of the constitution of material substances; in this sense, therefore, experimental scientific research may be viewed as *the* great fountain-head of employment for workmen.

The reason why original experimental science is the great fountain-head of industry in manufactures and trades trades is, that it is only by means of such research that we can become accurately acquainted with the forces and substances involved in manufactures, and be enabled to use them to the greatest advantage. The intimate connection between science and industry is shown by the fact that when new scientific discoveries are published there are numerous inventors who immediately endeavour to apply them to useful purposes, and men of business ready to carry out the inventions practically.

The great and important results already obtained by

the cultivation of original experimental research show that it is a national necessity, and naturally suggests the idea, can we not by a greater degree of encouragement of such research still further increase employment for working men, and still further elevate their intellectual condition?

At the present time there is in this country no recognised payment for the labours of scientific discovery, and no provision for the support of men who investigate science; any person is at liberty to take the published results of scientific men from the Transactions of the Royal Society, the Chemical Society, and other learned bodies, and employ them as the basis of inventions and patents, without the slightest payment, notwithstanding these results have been obtained at an immense cost of study, time, and labour, and a large amount of money. I do not mean by these remarks to conclude that scientific discoveries should not, on publication, become at once public property, but that some means of support should be provided for the men who make them, and thus the development of employment for workmen be increased.

Experimental scientific research, in the stricter sense of the words, is a comparatively modern thing, and though it has existed in a more limited degree during many centuries, it can only freely exist and thrive in civilised countries. Even at the present time, in consequence of the peculiar nature of the occupation, its hopelessness as a source of emolument to the investigator, the great skill and extreme self-denial required, and frequently danger incurred in its pursuit, and the consequent great difficulty of achieving success in it, *scarcely one person in one million of the population of England is exclusively devoted to it*, although a much greater proportion occupy a small amount of their time in its advancement.

The extension of physical and chemical knowledge by means of experiments and observations is *national* work: it benefits the nation, but does not pay the investigator. The various scientific men who discovered the chief facts and principles of science upon which steam-engines, electric telegraphs, and all the modern applications of science are based, received no remuneration for their researches. The results of purely scientific investigations are generally unsaleable, because, instead of benefiting a single manufacturer only, they benefit the whole nation; the nation, therefore, being the gainer, should pay and provide for those who make such researches. And when we consider that in this country upwards of 576 millions of pounds have been expended in the construction of railways alone, and immense sums upon electric telegraphs, which would never have been expended but for such labours, and nearly all of which have given employment to numberless workmen, it is evident that the magnitude and national character of the results would fully justify national encouragement of original experimental research.

The more abstract an experimental investigation is, the more important and widely diffused are its practical results. Who would have thought, when Oersted in his original abstract research in electro-magnetism first made a magnetized needle move by the influence of an electric current, that his labours would lead to the expenditure of many millions of pounds in the laying of telegraphs all over the earth, and the employment of many thousands of persons in their construction, maintenance, and use? And who can tell how many similar important discoveries have been lost to the nation, and how much of the present deficiency of employment for workmen has arisen, in consequence of experimental scientific investigators not having been paid for their labours?

At present, original experimental researches are generally made by teachers of science who expend a portion of their incomes in making experiments and observations; but the very limited means of such men is a serious loss to the nation by greatly retarding the progress of discovery, and consequently also of improvements in manufactures. Many of the experiments, also, necessary for the development of new discoveries are beyond the means of such persons at present, and cannot be made without the command of greater wealth.

If England is to keep pace with the progress of foreign intellect and of foreign manufacture, and keep her workmen fully employed, there must not only be a general diffusion of scientific knowledge throughout this country, but there must also be national encouragement of original scientific investigation.

Has it been wise in our Governments thus to overlook a great source of the nation's wealth, to disregard a most important means of national economy, to neglect the great fountain-head of industry? Shall we allow foreigners to supplant us in manufactures, and shall our fellow-men continue to be driven to emigration by want of employment? or shall we develope for them new sources of labour by means of original experimental research? It needs only to bring the subject fairly and effectually before the attention of our present enlightened and progressive Government, to ensure its careful and early consideration.

The neglect of original experimental science in this country by our Governments has long been noticed by scientific men and others, and a suggestion has been made to the British Association by Lieut.-Colonel Strange, to found "National Colleges of Original Research," in which science should be investigated, but not taught. This would be *one* way of supplying the want; the funds for supporting such colleges might with propriety be obtained from the fees paid for patents, because patents are in many cases based upon the published results of original experimental researches; other ways of supplying the want might also be indicated.

GEORGE GORE.

OUR DOMESTIC FIRE-PLACES

Our Domestic Fire-places. By Frederick Edwards, jun. A new edition, &c. (London: Longmans, Green, and Co. 1870.)

THIS book, although bearing considerable traces of having for its object the advocacy of a particular manufactured article—nevertheless shows the author to have so much mastery over his subject as to justify its publication; and if the work be considered merely as the contribution of a highly qualified producer, the duty of the reviewer would be almost entirely to commend it; but if it is proposed as a complete and unbiassed treatise on the domestic fire-place he finds a good deal of reason to dissent.

After a somewhat diffuse essay on the hearth of the ancients—in which, by the way, the theory is too easily adopted that the Romans were entirely ignorant of the chimney—we come to the methods of our ancestors. Why the cosy folding screen must henceforth be given up, and why, in speaking of the introduction of the smoke-jack, the past services of the turnspit dog are entirely ignored, may be asked in passing.

Page 17 introduces some interesting particulars of the first use of coal, and page 30 a well-merited eulogium on the labours of Count Rumford in the improvement of fire-grates, and we now approach the pith of the whole matter, namely—how to burn our coal so as to get the maximum of heat with the minimum of smoke and soot. (pp. 44 *et. seq.*) Here the author, having one excellent contrivance to recommend (namely, Dr. Arnott's smoke-consuming grate), has allowed himself to be unfair to other inventors whose grates for certain purposes are preferable. Of this class perhaps the most conspicuous example is the manner in which Taylor's stove, manufactured by the Coalbrookdale Co., is treated in the work before us. It is indeed mentioned (page 51) as an ingenious contrivance but full of deficiencies in practice, and as one which "now appears to have become forgotten." As respects its deficiencies, several instances are well known to us in which this grate of Mr. Taylor's has given the greatest satisfaction. No unsightly contrivances—no troublesome machinery—a bright fire—the whole apartment pervaded by the fresh warm air brought from an external source to the back of the stove, and emitted from the radiating tiles—the chimney-sweeper's visits for years dispensed with—such are some of its characteristics; and as to its "having become forgotten," assurance has been received from good authority that the demand for these grates is well kept up.

There are also several stoves which in a work like the present should have been noticed, *e.g.* Wright's, Woodcock's, Rosser's, and especially Galton's.

At page 54 the author discusses the recommendations of the committee appointed by the Board of Health, and gives some valuable comments upon them, and then proceeds to consider the question of the *Stove of the Future*, in its materials and management. Nothing has been more clearly established than the superiority of fire-brick over iron for the "fire-pot," or actual inclosure of the fuel. But the benefit of this discovery has, as yet, only reached the upper and middle classes of society, "but," says the author, p. 66, "in small houses and in the apartments occupied by skilled and unskilled workmen, the use of fire-brick is unknown, so that those who most require to use economical grates are those who are most ill provided. The working classes have either the most trumpery contrivances that Thames-street can furnish, and which are put into the fire-place at the smallest possible expense for labour and materials; or they use, in streets which have become gradually deserted by the classes which once lived in them, the badly arranged fire-places of thirty or fifty years ago."

We hope that these valuable observations will not be lost. Such fire-places as Pierce's Cottage Grate, described p. 39, are scarcely more expensive than the cheap and trumpery contrivances referred to, and if the proper arrangement of the chimney throat could also be secured in all newly constructed houses for the working-classes, the effect would be soon apparent both in favour of their health and of their pockets.

This improvement of the chimney throat is described by the author p. 73, and consists in contracting the flue to its ordinary capacity at once at the top of the fire-place opening, instead of the more common practice of gathering it in by degrees.

In p. 85, the plan of having a single main chimney-shaft for all fire-places which are situated in the same part of the house is advocated. It is not evident, from the text, whether the author is aware that this plan has been carried out, in several instances, in different parts of the country. It is a subject, certainly, which deserves more attention than it has yet received.

In the last chapter (p. 90), the general warming of halls, corridors, &c., is considered. It may be mentioned in connection with the Russian and Swedish method referred to, that the Germans, who have hitherto adopted generally the same plan, are beginning to place the fire-front of the stove in the apartment that is to be warmed by it, instead of in the corridor, with the stove surface only in the apartment, and, as may be supposed, with a manifest improvement in the ventilation.

This chapter is well worth attention: exception must, however, be taken to the way in which Gurney's stove is mentioned, p. 108. "The prestige attaching to the name of its producer," may, indeed, have not been without its use in obtaining for these stoves their first trial, but would hardly have been sufficient, apart from their intrinsic good qualities, to have obtained for them the wide reception both at home and abroad which they have had; or to have created the almost invariable satisfaction with which their use has been attended.

The book is a useful contribution to the literature of the subject, and well illustrated by engravings. F.C.P.

OUR BOOK SHELF

The Mammalia of Massachusetts. By J. A. Allen. (Trubner & Co.)

FROM this carefully drawn-up report we learn that there are sixty-five mammals at present indigenous to this American State. The common ones, with a few exceptions—as the mink (*Putorius lutreolus*), weazel (*P. erminеus*), and skunk (*Meflutis mephitica*), among the carnivores; *Vespertilio subulatus* and *Lasiurus noveboracensis* among the bats—belong to the families of the rodents, the squirrels, mice, and hares, and to the *Balænidæ* and *Delphinidæ*, which latter are of course marine. The panther, moose, reindeer, elk, and beaver have comparatively recently become extinct. A notice is appended to the work by Prof. Agassiz, earnestly requesting friends to forward to him males, females, and young of almost any of the European mammals. Books on mammalia would be equally valued, and in exchange he offers on the part of the museum at Cambridge, U.S., representatives of the North American fauna and American books.

Effects of Climate and Soil upon Plants.—*Die Abhängigkeit der Pflanzengestalt von Klima und Boden.* Von A. Kerner. Pp. 48. (Innsbruck, 1869. London: Williams and Norgate.)

THIS pamphlet is of greater importance than would be indicated by its mere size, as a contribution towards an investigation of the causes which lead to the diversities of floras, and hence towards a knowledge of the laws on which depends the great problem of the origin of species. M. Kerner has made a special study of the flora of the

Tyrolese Alps, and has even attempted to introduce into a small plot of ground in the mountains surrounding Innsbruck, a number of plants indigenous to the lowlands of the Tyrol. In this enterprise, however, he met with no very encouraging success; "the greater number of the plants which I brought to those heights with inexpressible toil, succumbed to the uncongenial Alpine climate; and in the remaining small portion, I have noticed at present only very unimportant changes." His conclusion from these experiments is "that changed conditions of life can kill the species, or they can reduce it to a starved existence, but can in no case produce a *direct* change into a new permanent species adapted to its altered conditions." Such change can only take place by the slow process of natural selection among slightly varying offspring from the parent species. The writer notices a number of interesting features that characterise the Alpine flora with which he is familiar, as contrasted with those found under other climatal conditions. One of these is the very small number of annual plants, which bear to perennials the proportion of 4 to 96, as contrasted with that of 42 to 58 in the Mediterranean district, and of 56 to 44 in that of south-eastern Europe; a result of the very short period of summer warmth, varying from $1\frac{1}{2}$ to $3\frac{1}{2}$ months, which does not allow time for the seeds to ripen. The same cause produces also the appearance in many Alpine species of the flower-buds at the close of the summer, ready to burst into blossom during the first days of returning warmth in the spring. The remarkably large proportion of Alpine plants with evergreen rosettes of fleshy or succulent leaves, *Primulas*, *Gentianas*, *Androsaces*, *Saxifragas*, *Drabas*, &c., he attributes to the advantages of some contrivance for obviating the effects of the intense heat of the sun during the long days in their short summers, and also to the necessity that the plant should possess leaves at the very commencement of the warm season, in order to afford it a store of nourishment, and thus economise the whole of the brief period of vegetation. With this peculiarity he contrasts the poverty of the Alpine flora in plants possessing stores of *underground* nourishment in the form of bulbs, a class so abundant and prominent in the south of Europe. The necessity for great caution in deriving general conclusions from a small array of facts, is shown by the mention by M. Kerner, among the plants well adapted by their constitution to withstand the great alternations of an Alpine climate, of *Dryas octopetala*, a species which flourishes equally well in the remarkably uniform climate of the west coasts of Ireland and Scotland. The want of any considerable number of large shrubs and forest trees is obviously due to the rigours of the climate; and the almost entire absence of climbing and creeping plants indicates that protection from the sun is not one of the first conditions of existence, as it is in tropical forests. The large proportion of plants with flowers of intense hues, and the deficiency of spiny and stinging species, are not so easy to account for, though the author attributes the latter to the comparative absence of destructive animals; and the former may possibly have some connection with the advantage derived from the speedy attraction of insects, after the flowers expand, to assist in their fertilisation. We can conceive no greater service to biological science than a series of observations on the floras of limited areas, both with respect to what they possess and to what they are deficient in, carried out with the care of those recorded in the work before us.

A. W. B.

The fourth volume of the *Atti della R. Accademia delle Scienze di Torino*, contains several important papers on various departments of science. We may notice especially Prof. Salvadori's memoir on some birds from Costa Rica, and the same author's monograph of the genus *Ceyx;* a memoir by M. F. Giordano, on the orography and geological constitution of the Gran Cervino; and mineralogical papers by Prof. Strüver and Dr. Cossa.

LETTERS TO THE EDITOR

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

Evidence concerning Heterogeny

THE question of the truth or falsity of "heterogeny," as it is called, is perpetually recurring both in your columns * and elsewhere, in connection with several of the most important scientific controversies of the day. It is a subject which has engaged my attention for several years, and I am anxious to be permitted to lay before your readers as concisely as possible a statement of what appears to me to be its present position.

I think the impression which most recent references to it are likely to leave on the minds of readers is this—viz., that while amongst the most advanced thinkers there is a gradually strengthening conviction that the weight of theoretical considerations is in favour of the actual existence of heterogeny as a real mode of origin of living beings, yet that the authority of M. Pasteur's famous researches inclines the balance of experimental evidence heavily the other way.

I am perfectly willing to admit the principle of authority in matters scientific as far as any reasonable person can admit it—that is to say, I believe it is natural and right that when a scientific man of so deservedly high reputation as M. Pasteur publishes a long series of carefully conducted researches, and announces the conclusions to which they lead him, and when no evident flaw can be shown in his processes, either of experimentation or of reasoning, his conclusions should be accepted as against those of another comparatively unknown experimenter. But in the present case neither of these conditions is fulfilled. In the first place, instead of merely an unknown experimenter we have in this case a consensus of at least eight experimenters—some of them by no means unknown—who have given their best attention to the same investigation in different parts of the world and under widely differing conditions, and who agree in disputing M. Pasteur's results.†

In the next place, there is a step in M. Pasteur's experimentation which has been pointed out as a flaw, and of which it is in the power of any one of your readers to judge for himself by a process of simple inspection as to whether it really be a flaw or not. I refer to the subject of the microscopic power used by M. Pasteur in his investigation. The organisms which I found during my own experiments on this subject appeared often but little larger than a full point in the type used in your columns, even when seen with a power of 1700 diameters. In the woodcuts attached to my paper in the Proceedings of the Royal Society (April, 1865), they may be seen as they were kindly drawn for me by my friend Dr. Beale, who, though an uncompromising opponent of the doctrine of heterogeny in all its forms, is a very high authority in microscopy; there can therefore be no question as to their size, nor as to their actual presence in the experimental vessels. Now under the power used by M. Pasteur (350 diam.) these organisms would be about $\frac{1}{13}$ part of the size which they appear in the drawings. Yet it is upon the authority of observations made with such a power that M. Pasteur has pronounced, not upon the *presence* of these objects, but upon their *absence.* It is now nearly five years since my observations were made public. Since that time several critics have noted them as requiring an answer, but, so far as I am aware, no answer has been made to them; and meanwhile naturalists have gone on complacently quoting M. Pasteur's experiments as having settled the question against heterogeny, even though they have not failed to acknowledge the weight of the theoretical considerations which tell in its favour.

The theoretical aspect of the question I have fully discussed elsewhere,‡ and I will only here state my entire agreement with the belief expressed by Dr. Charlton Bastian in your issue of February 24, viz. "that the time is not far distant when the doctrine of the evolution of living things will be as much an

* NATURE, Feb. 1, p. 351; Feb. 24, p. 424.

† 1. Pouchet, "Nouvelles Experiences" passim. 2. and 3. Joly and Musset, *Comptes Rendus*, 1860. 4. Schaafhausen, of Bonn, *Comptes Rendus*, 1860 and 1862. 5. Mantegazza, of Pavia, see *Cosmos*, 1863, p. 630. 6. Wyman, Harvard, U.S., *American Journal of Arts, &c.*, vol. xxxiv., July 1862, vol. xliv., September 1867. 7. Proceedings of Royal Society G. W. Child, Oxford, June 1864 and April 1865. 8. Hughes Bennett, Edinburgh, *Edinburgh Medical Journal*, March 1868.

‡ "Essays on Physiological Subjects," 2nd edition, pp. 137–154.

accredited dictum of science as are the other doctrines of the correlation of the physical forces and of the correlation of the vital and physical forces which have been its necessary predecessors."

GILBERT W. CHILD

Elmhurst, Great Missenden, Bucks.

Prismatic Ice—Sandstone Boulder in Granite.

THE "two phenomena" observed on Dartmoor by Mr. C. Spence Bate and Mr. W. Morrison, and described by the former in NATURE of the 31st ult., have been previously noticed.

The late Rev. Dr. Scoresby, F.R.S., published a paper "On Columnar Crystallisation of Ground Ice," in the *Edinburgh New Philosophical Journal* for January 1850 (vol. xlviii.), and illustrated it with a plate containing eighteen figures. A presentation copy of this paper is now before me.

The so-called *sandstone boulders* in granite are by no means rare. They occur in various parts of Devon and Cornwall. I first noticed them at Shaptor, near Bovey Tracey, in Devonshire, and have subsequently seen them in several other localities, but nowhere in such abundance as at Sennen Cove, near the Land's End, in Cornwall. There are several good specimens in my private collection. The following description of them occurs in a paper on "The Age of the Dartmoor Granites," which I read to the British Association at Manchester, and to the Royal Geological Society of Cornwall in 1861, as well as to the Devonshire Association in 1862. "Nodules, apparently segregative, sometimes occurring in the substance of the ordinary granite, might, from the fineness of their grain, be almost mistaken for sandstone; indeed, I not long since heard them appealed to as proofs of the metamorphic origin of granite. 'Here,' said the appellant, 'are unaltered remnants of the old sandstone rocks, which, with these exceptions, metamorphism has converted into granite. I do not quote this for the purpose of endorsing it, but simply to show the general dissimilarity of the nodules to granite proper. Excepting their darker colour, they reminded me much of the granite veins which pass through the older granite of Goatfell, in the Isle of Arran; nevertheless, they are not veins but nodules, and capable of being extracted as such from the granitic mass containing them. . . . They consist of very fine grains of quartz and schorl in about equal quantities, or with the latter somewhat preponderating."*

Irrespective of the origin of the nodules, it is no doubt "clear that when this granite was formed, the temperature of (the surface of) the earth must have cooled down to below the boiling point of water," for the granite, as has long been established, is of post-carboniferous age; or, in other words, was formed after the rich faunas and floras of the Silurian, Devonian, and Carboniferous periods had successively passed away, to say nothing of the pre-Silurian organic eras.

WM. PENGELLY

Torquay, April 2

The Transits of Venus in 1874 and 1882

IN the paper on this subject by P. L. S., there occurs a remark which is calculated to convey a mistaken impression. He states that "an Antarctic station is only required for the transit of 1882, and there is ample time to make a preparatory Antarctic expedition to ascertain" whether a suitable station can be found. The reverse is the case. No Antarctic expedition can be of any service in 1882, so that in a preparatory expedition the lives of our seamen and men of science would be uselessly risked. On the contrary, there are several Antarctic stations suitable for observing the transit of 1874; and I have shown that the comparison of observations made at such stations with observations made in Siberia would give the most effective means of determining the sun's distance available before the 21st century.

I may remark here, that the choice of stations for observing the transits of 1874 has been founded on calculations admittedly inexact, and it would be to the credit of English astronomy that the whole matter should be re-examined while there is yet time for a change to be made. In saying this, I am not by any means insisting upon the views put forward in my own papers on the subject; though the only error pointed out by the Astronomer Royal in my charts and calculations consists in the fact that they aim at an unnecessary exactness. But the utilisation of the coming transits is a matter too important to be endangered for any personal considerations whatever. If errors have been made it behoves men of science to see that those errors shall not be suffered to prejudice the cause of scientific progress.

RICHARD A. PROCTOR

* See *Geologist*, 1863, p. 15; Trans. Roy. Geol. Soc. Com., vol. vii., p. 425; or Trans. Dev. Assoc., 1862, p. 50.

Euclid as a Text-book

I REGRET that Mr. Wormell has imported so much of a personal nature into his reply to my former letter. Personality and unintentional misrepresentation appear to me to be its predominating features. Unintentional, I say, for I know little of the writer beyond the fact of his being the author of two or more admirable text-books, and that he is a distinguished member of the London University.

Though I feel that the columns of NATURE ought hardly to be taken up with such matter, yet, in self-defence, I am compelled to say a few words. As I have neither time nor inclination for controversy, I hope that the discussion, if continued, will be entirely *ad rem*, and not diverge into personalities. Owing all my geometrical ability (*quod sentio quam sit exiguum*) to a twenty-three years' acquaintance with Euclid, and having had, as a teacher, to use that author for the last fourteen years, it would not be strange if I *were* a favourer of the old system, which I *am not* to the extent Mr. Wormell seems to think.

My plan of teaching geometry under the old system was to overcome Euclid's deficiencies by *viva voce* explanation, and, offering slight assistance, to get my classes to work a number of geometrical exercises. With my sixth class I have generally got well through three or four hundred such exercises as are given in Todhunter's edition of the Elements.

This is not the same as sending out boys who have merely "committed Euclid to memory," and certainly my pupils have found no great difficulty in the matriculation papers. Pupils thus prepared have taken first, second, third, and other high places in the examination, which places, I think, were in a measure due to their "flooring" the geometrical papers—with the exception, perhaps, of a "rider;" also, during the time I have held my present post, my pupils have carried off the Andrews Entrance Exhibition at University College each year, with one exception, when the finest geometer I have had was beaten. This is not the place for chronicling successes in other examinations.

I did not state that it was advisable for students to read Euclid only; what I did say was to the effect that I had heard of boys who were doing this with the idea that such a course would "pay" best. Mr. Wormell charges me with using an "infelicitous and ungenerous expression." That I willingly retract, as it has struck myself as being uncalled for; but Mr. Wormell must have read my purposely concise letter hastily, for I nowhere say that I desire a change in the syllabus; the syllabus is excellent, and I quite agree with him in the remarks he adds about the "unflinching courage in the reform of English methods of education" as far as regards the matter under discussion. But what is possible is, that the examiners, being chosen from the older universities, may overlook this distinction; until now, I have had to regard the papers from the old point of view, in which light they have suited me exactly; Mr. Wormell has viewed them from the modern stand-point, and bears the like testimony; this being so, it must be admitted that the examiners have well carried out the syllabus. That I should "impeach the integrity" of such men as the present examiner, from whom I have always experienced the greatest kindness, or the late examiner, one of the most successful teachers of my own university, would be absurd, were it not that it pains me to have it supposed. To return, I do not want quite such a change as Mr. Wormell thinks; the difficulty in my case has not yet arisen, for I have not yet sent in pupils whose training has been wholly confined to the new Geometry, and I wished to have the change made, if any were necessary, before sending them in. The difficulty will not be so great when we have obtained a thoroughly good modern text-book; ours is a very good one, but there are blemishes which will doubtless be removed in a new edition, and to adapt it to the matriculation scheme more propositions than at present must be proved, as I think, independent of proportion. I applied the term "Euclidean type" to the recent examination paper, because the questions are given in the exact words of Euclid; I would have this changed; they follow in the order assigned in the Elements, and perhaps my experience of

Cambridge Examinations leads me erroneously to think that the proofs are expected to be given in the same order. In drawing this personal statement to a close, I may say that I am not singular in the view I took, as I learn from several gentlemen who have spoken to me on the point, and indeed, had it not been that the authorities* of University College School thought I had some ground for my views, I should have kept silence altogether. I believe the matter will come under the consideration of the proper authorities, and in their hands I am perfectly willing to leave the settlement of the question, if there be any need for a change.

R. TUCKER

University College School

Science and the University of Cambridge

ONE of the last sentences in your paragraph concerning the report of the Syndicate for providing better opportunities for the study of physical science in the University of Cambridge, though founded upon a partial misconception of the state of affairs, suggests what is probably the best solution of the difficulty. The colleges, if polled upon the simple question, "Shall we aid in promoting the study of physical science?" would, I believe, reply by a considerable majority in the affirmative. It is upon the best mode of contributing that there is so much division of opinion; and this has caused the apparently "lame and impotent conclusion."

The question of taxing the college revenues is one of considerable difficulty; some colleges already support out of their corporate funds teachers of natural science, some have recently taxed themselves heavily to improve their buildings.

Most would think that non-resident fellows who do little for the college should be taxed more heavily than those who reside to do much work for no great amount of pay; but to bring about this would require much alteration of statutes. The question, therefore, being so complicated, and there being, as I believe, a general willingness to contribute, if only a just and equitable mode of raising the funds can be devised, and proper control retained over them (for the University is not generally considered to manage its property so well as the colleges), I believe that the difficulties would be most simply solved by the appointment of a commission composed of a few well-qualified persons, thoroughly acquainted with the University, to devise a scheme and to draw up an act for carrying it into effect. T. G. BONNEY

St. John's College, Cambridge

EXPLORATION OF CAVES AT SETTLE, YORKSHIRE

IN the mountain limestone of the West Riding are many caves, some of which are empty, some traversed by water, which is silting up their lower chambers, while others are full up to the very roof with débris of various kinds. All have been, at some time or other, subterranean watercourses, and have been formed, partly by the friction of the substances set in motion by the current, but principally by the chemical action of the carbonic acid of the rain-water by which the insoluble carbonate of lime in the rock is converted into the soluble bicarbonate. Some have been inhabited, at various times, by man, and by wild beasts, and therefore may be expected to furnish valuable evidence of a condition of things that has now passed away. The last recorded case of their being used by man as a place of refuge was during the rebellion of 1745, when the eldest son of one of the gentlemen in the neighbourhood was hidden in a large cave, in the fear that the Scotch would pass southwards in that direction instead of by the Preston route.

The gentlemen of the West Riding have formed a committee for the systematic exploration of these caves, and will doubtless obtain from them evidence of the very highest archæological value, relating to a time of which we know next to nothing,—that begins with the disappearance of the mammoth, hyæna, and lion from Northern Europe, and extends as far down as the dawn of history in Britain, during which the neolithic and bronze-using races spread over Europe from the south-east. The older caves have been explored in many parts of Britain, while the pre-historic of the later have only been systematically examined in Somersetshire and Denbighshire by myself and Mr. Sanford. That the work in Yorkshire is planned well is clear from the following extracts from the Resolutions :—

That the following scheme, proposed by Sir James Kay-Shuttleworth (chairman), be adopted, viz. :—

1. To examine the ground around the mouth of the caves for signs of fire, implements, utensils, remnants of food, or traces of sepulture.
2. To make a survey of the caves in order to provide a plan of the interior drawn to scale, and of a sufficient size to enable a record to be made on it of the situation in which each thing is found.
3. To ascertain by one or more vertical excavations of limited extent what are the deposits chronologically arranged.
4. Then to proceed to examine these strata from the mouth of the cave inwards, so as to secure the discovery of all remains throwing any light on the history of each stratum.
5. To keep a record of the things discovered.

The first cave chosen by the committee is that found by Mr. Jackson, high up in a limestone cliff near Settle, on the coronation-day of our Queen, and which is therefore known as "the Victoria cave." It consists of a series of large chambers and passages, which are nearly filled to the roof with a reddish grey clay and stones. It must at one time have been of wonderful beauty, for there are the remains of massive stalactites, and of thick stalagmitic pavements; but now these are so decomposed by the carbonic acid that they are reduced to the condition of very soft mortar. Curiosity-hunters have also been doing their usual ruthless mischief. When it was first opened, Mr. Jackson obtained from a chamber at the original entrance a large series of ornaments and implements of bronze, iron, and bone, along with pottery and remains of animals. There are in his collection bronze fibulæ, iron spear-heads, iron nails, bone spoons, spindle whorls of stone and pottery, fragments of Samian ware, and other pottery turned in a lathe, cockle-shells, flint flakes, whetstones and stone balls. The remains found with these belong to the red deer, roebuck, pig, horse, and Celtic short-horn (*Bos longifrons*), sheep or goat, badger, fox, otter, and dog. There are also Roman coins of bronze and silver. All these were derived from a superficial deposit, and could not be assigned to an earlier date than that of the Roman occupation. The pottery was of the same kind as that so commonly found in the refuse heaps near Roman villas. It is worthy of note that the two domestic animals, the Celtic short-horn and the sheep or goat, were those that had been most abundantly used for food. The exploration committee resolved to follow up this discovery by a thorough examination of the cave, which they are able to undertake by the courteous permission of the owner, Mr. Stackhouse.

Outside the entrance of the cave, and at a lower level, is a small plateau composed of *débris*, which occupies the exact point where daylight could be seen through chinks, from the inside of one of the large chambers. As both the plateau and the chamber were undisturbed, the committee determined to begin work by removing the *débris* and making a new entrance into the cave. While this was being done, the following section was exposed. On the surface there was a layer of fragments of limestone that had fallen from the cliff above, two feet in thickness. Underneath was a layer of dark earth with stones about eighteen inches in thickness. It furnished large quantities of bones, nearly all of which had been used for food, and several articles of bronze, iron, or bone of the same kind and age as those I have already mentioned. The pottery is also of the same Roman character. Fragments of charcoal were also abundant, and stones bearing the

* What strong views in favour of the modern methods are held by Prof. Key, may be seen from Prof. Hirst's preface to our Geometry.

marks of fire. There can be no doubt that this stratum marks the place where the dwellers in the cave, during Roman or immediately post-Roman times in Britain, kindled their fires and cooked their food. Underneath is a talus of limestone fragments detached from the cliff by atmospheric action, like the superficial accumulation. It is from six to seven feet in thickness. In some places the fragments were cemented together with a soft decomposing stalagmite. It rested on a layer of grey clay, of a thickness which at present has not been ascertained. At the bottom of the talus, and close to the entrance that is now being made into the chamber, there were found two rude flint flakes, a remarkably large lower jaw of bear, the broken bones of the Celtic shorthorn (*Bos longifrons*), and of the red-deer. On the 4th April a most remarkable bone harpoon was dug out from the same horizon. It is between four and five inches in length, and is furnished with two barbs on each side, arranged opposite each other, composing the head of the implement. The base presents a form of attachment to the handle which, so far as my knowedge extends, is new to Britain. Instead of having a mere projection to catch the ligatures, there is a well-cut barb on either side that points in a contrary direction to those on the head. Were the bases of a barbed arrowhead and of a harpoon joined together, the resultant form would be analogous to the one in question. Therecan be no doubt from the position of these remains, that man occupied the spot before the accumulation of the overlying *débris*. Ample use for his harpoon he would find in the mere, now drained and turned into green fields, which are almost overlooked by the cave. So far as the work has proceeded there is no trace of metal at this horizon in the section.

The value of the evidence hitherto obtained lies in the fact that the Roman stratum is separated from the lower level, in which the flints, harpoon, and bear were found by the talus of angular stones. And this in a rough way enables a computation to be made of the date of the lapse of time between them, if we allow that for a considerable time past, immediately outside the historical epoch, the disintegration of the cliff has been equal, in equal times. For since, in twelve hundred years, to put it at the lowest, only a thickness of twenty-four inches has been accumulated above the Roman remains, it would take three thousand six hundred years for a deposit of six feet to be formed, and thus the harpoon and flint stratum would be about four thousand years old. The accuracy of this calculation is indeed injured by the possibility that the winter cold was more intense, and the splitting action of the frost greater in Pre-, than in Post-Roman times. Nevertheless, the change from the Arctic severity of the post-glacial winter, to the climate which we now enjoy in Britain, has been so gradual, and has been spread over so long a period, that it may be assumed to have been very small in so short a time as four or five thousand years.

This account is merely an outline of the results obtained up to April the 4th. The cave promises to be a rich one, and will probably add very much to our knowledge of the Pre-historic dwellers in Yorkshire.

W. Boyd Dawkins

THE ABRADING AND TRANSPORTING POWER OF WATER

I.—MECHANICAL PROPERTIES OF WATER

IT is not my intention to lay down definite rules or formulæ regarding the flow of water, but rather, by drawing attention to generally-acknowledged facts, to throw out suggestions which may serve to lead to the discovery of some general laws of practical use to the hydraulic engineer.

In 1857 a paper was read by me before the Royal Society of Edinburgh, "On the Delta of the Irrawaddy," in which I expressed an opinion that depth somehow affected the abrading and transporting power of water.

My experience of Indian rivers and canals during the succeeding ten years went to confirm this opinion, and before the Institution of Civil Engineers, as well as on two occasions before the British Association in 1868 and 1869, I ventured to give expression to my views of this law, as affecting artificial rivers for irrigation, and the bridging of rivers which flow through the alluvial plains of Northern India.

In the *Artizan* there have appeared during the last six months several short articles bearing on the same subject, showing how all questions relating to flowing water are affected by this supposed law, which may be stated as follows: "*the abrading and transporting power of water increases in some proportion as the velocity increases, but decreases as the depth increases.*"

The first question that arises in this inquiry is—What is water in a mechanical point of view?

This may be briefly answered by saying that it is a fluid, the particles of which, though easily separated, do again unite, and exert a certain affinity towards each other, and also to other bodies, so that a certain amount of power is necessary to effect a separation. The attraction of the particles of water to other bodies varies with different substances; for instance, in all bodies of a fatty nature the facility for wetting is very slight; and different temperatures also affect this property of water. This attraction or force is technically known as "skin friction," and deserves the most careful investigation; for it is owing chiefly, if not altogether, to the fact that water has the power of abrasion, and it is this property which introduces the most difficult problems that a naval architect has to solve.

The affinity of one set of particles of water to another set, may possibly be measured by noting the size of a drop of water which falls from a wetted surface of a given area. By thus determining accurately the weight of water a given area can support, some approximate results of an instructive character may be arrived at; but what adds to the complication of the question is, that the cohesion of the particles probably differs according to the temperature and the purity of the water experimented on. Thus, when water reaches the boiling point the affinity, it is believed, becomes very much lessened; and, again, it is thought that with pure or distilled water the particles probably have less affinity to each other than with water less pure. This impurity may arise from various causes; sewage, for example, would probably give much heavier drops from the same wetted area than rain water, in the same manner that drops of treacle are much larger than those of water; that is to say, the affinity, attraction, or cohesion of the particles is as a general rule increased by the introduction of foreign matter held in solution. With solid matter held in suspension a similar result is obtained, not by increasing the cohesion of the particles of water, but by increasing the surface area wetted; for each grain of foreign matter, be its shape what it may, must have all its surface in contact with the water. This probably explains how a drop of mud should be so much larger than one of water, and, at the same time, it may possibly explain why thick muddy water, or more properly speaking, liquid mud, with the same section and slope, cannot travel so fast as water.

From this it may reasonably be supposed, that when muddy water runs down an inclined plane, the solid particles cannot by their own gravity sink so rapidly towards the bottom as to overcome the power dragging them in a different direction. As a consequence, the flow of water is retarded by having solid matter held in suspension in some proportion according to the load. On large rivers where this proportion may be only $\frac{1}{1000}$ or $\frac{1}{2000}$ part of the weight of water in motion, the retarding force may not be appreciable by the most careful experiments; so when calculating, the discharge may be left out

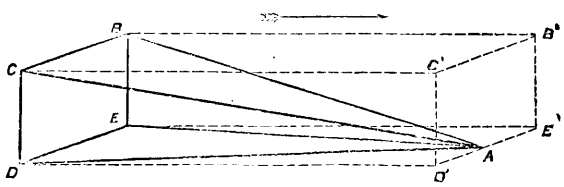
altogether; but with torrents transporting 5 per cent. and more of solid matter, and with the discharge of sewage, it is believed that the retarding power is quite appreciable. The whole question is no doubt a very complicated one; yet by a set of careful experiments, conducted with a view to discover this adhesive power of water, it appears highly probable that an important step would be gained, towards the solution of some other difficult but important problems.

The next point to consider is—How does water travel? This also is a very abstruse question; but I believe that the true answer is given in the brief statement that water *rolls* rather than *slides*.

Were it not so, a ship with a foul bottom could not be so much retarded when passing through the water as experience shows she is. For example, supposing there are two ships in every respect the same, only that the first is covered with a coating of clean pitch a quarter of an inch thick all over her bottom to above her water line; and that the second, in place of the pitch, has got all her bottom covered with marine animals and weeds, so that when this second ship is passing rapidly through the water, none of the sea-weeds or marine animals extend more than this $\frac{1}{4}$ inch beyond the ship's sides, which is the thickness of the coating of pitch on the first ship: in such a case the displacement and the lines are exactly the same, but it is hardly necessary to ask any sailor which of the two ships, with the same wind and sails, would pass most rapidly through the water, and, in the case of two steamers, the extra resistance caused by the foul bottom could be easily measured in extra horse power required to force the foul vessel through the water at a speed equal to the other.*

If the motion of the water was a *sliding* one only, the speed in both cases would be the same with the same power, for the resistance would be simply the separation of the two films of water, the one in contact with the ship's sides and the other with the surrounding sea; and these, in both cases, would be identical, the displacement being the same. If, however, as is believed, on a body passing through water, or water flowing down a channel, the particles of water are set in motion in a revolving direction, the convolutions increasing directly in proportion to the wetted surface, then by this hypothesis some assignable reason for this retarding of the foul-bottomed ship can be given.

If the particles slid over each other rather than rolled, they would, so to speak, pass each other in parallel straight lines; but any one in a gale of wind, going behind a high square block of building, would very soon discover that, in air, such is not the case: for if he went a few yards away in the direction the wind was blowing, he would soon discover that the building no longer afforded any protection from the blast, but that there was some certain point to leeward where the currents again converged, while beyond this the storm raged with the same violence as at any other point. (Every boatman knows what it is to get under the lee of a very high island; the sea may be smoother, but the sudden gusts of wind are often more dangerous than when exposed to the full force of the gale.) Immediately in rear of the wall itself he would find eddies of air whirling about in all directions. Within the space



A B C D E there would be a partial protection from the storm, and instead of the wind being in the direction shown by the arrow, there would be whirling eddies within this space, which could not exist were the air to pass off in straight lines as represented by the dotted lines B B', C C', D D', E E'; neither could the several currents of air converge at the point A, which it is well known is always the case.

In the same manner any obstruction placed in a stream of water, causes eddies in rear of it; that is to say, the water does not pass on in straight lines, but within this space it goes revolving about in all directions, the distance of A probably depending on the velocity: showing that there is neither a sliding motion nor a parallelism in the direction of the lines of current.*

T. Login

* Possibly by the introduction of an elastic medium, such as air, between the ship's bottom and the water, the skin friction may be reduced, as it may, in a measure, reduce this rotatory action.

THE CLIMATE OF IRELAND

In the science of nature there is no chapter more interesting than that which treats of Physical Geography, which, properly understood, means the account of physical phenomena as they are modified by geographical position; and at the present moment the physical geography of Green Erin, or it speculiarities of soil and climate, presents a theme of no slight importance. It has been stated in the House of Commons as a proof of the retrograde condition of Ireland, that its production of cereals has of late years diminished, while its pasture lands have increased. To this it ought to have been answered that the decreased cultivation of cereals, and of wheat in particular, was a proof of improved knowledge. Years ago, at the meeting of the British Association in Cork, a communication was read, pointing out that agriculturists in general are governed wholly by example, their scanty science not allowing them to quit the beaten path. Hence Irish farmers, when they aim at improvement, endeavour to imitate the farming of Norfolk or the Lothians, and in so doing fail miserably, owing to the wide difference between the climates of the western isle and of the eastern side of Great Britain. It is commonly stated that Ireland has a very wet climate. It has undoubtedly a humid atmosphere, owing, perhaps, in some measure, to a great extent of undrained surface. But the total quantity of rain that falls in Ireland, little, if at all, exceeds the rainfall of England. In its distribution through the year, however, it differs much from the latter. The vicinity of the Atlantic gives Ireland in the highest degree an oceanic and, to some extent, an equatorial climate. Winter in the Green Isle is extremely mild. The southern and western coasts, though seldom free from wind and drizzling rain, never experience severe cold. Vegetation remains in mid-winter brilliantly green and undepressed. As spring advances, everything seems to flourish; crops of all kinds promise abundance, and already, in May, harvest seems to be close at hand. But now the scene changes. There is little or no dry summer. When the sun is highest in the meridian, there is a constantly clouded sky and no sunshine. Rain begins to fall in June. The rainfall of July is the heaviest in the year. In August the rain begins to abate; but clear skies and bright sunshine cannot be reckoned on till September, when the shortened days and the sun's declination have much reduced the solar heat. The crops in the meantime, arrested in their progress, are not the better for two months' slumbering under the clouds They have summer rain in excess, and too little sunshine. From this it will be seen that the character of the Irish climate is, that under it everything grows well, but that the process of ripening is painfully slow and uncertain. Now, to cultivators of the cereals the success of this process is of the utmost importance. The corn harvest in Ireland falls late in the year, in September and October, when the days are short and nocturnal frosts not unfre-

* By an experimental study of this subject, it may be discovered how far these eddies extend with different velocities, which may throw light on the proper length of the after portion of ships intended for different speeds.

quent. The plains of Southern Russia, or of the Red River in Canada, with a comparatively rigorous climate, far excel Ireland as wheat-producing countries, because their short summer is one of uninterrupted fierce sunshine; their vegetation suffers no check; the grain is ripened all at once, and the harvest gathered without delay or difficulty. The deficiency of ripening power in the Irish climate produces a secondary defect, which meets with less attention than it deserves. The grain which lingers on the stem two or three months before it hardens is sure to be unequally ripened; some of it is immature, while more is tending to decay. Consequently, it is bad seed, and the Irish farmer habitually sows perhaps six or eight times as much as Mr. Mechi would deem requisite. Under these circumstances, it is evident that the Irish farmer ought to cultivate cereals no further than is requisite for the economy of his farm, and to look to other productions for his profit. Fortunately, there is a husbandry for the pursuit of which he enjoys peculiar advantages. In green crops no country can compete with Ireland, where, nevertheless, they are still little known or esteemed by the multitude. From this it may be inferred that sheep and cattle ought to be the chief objects of Irish husbandry. In truth, the Green Isle, under proper management, could easily supply England with beef, mutton, poultry, milk, and butter, and grow rich by giving abundance at a cheap rate to her neighbours. But then this could be effected only under a system of large farms. The grazier and cattle dealer, to make their business profitable, must do it on a large scale. Butter of the best quality cannot come from a small dairy. The improvement of Ireland, therefore, as dictated by climate and natural capability, can be effected only under a system of large farms. The popular wish, however, is for small holdings. It is thought that the country, when divided into potato gardens and all covered with cottages, will be a paradise. But this poor man's paradise, beginning with a few years of felicity, will assuredly lead to the pauperism of ages. The Legislature cannot countenance schemes opposed to the wholesome development of society, and which would make poverty an institution; neither can it prevent their diffusion; but it may counteract them by spreading enlightenment and by presenting plain truths to the common sense of the community. This might be done by the publication of some statistics, showing the relative amount of cost and production of wheat and of green crops in England and Ireland, with some illustrations of the gain derivable from large farms and the use of machinery. W. D. C.

THE STONE AGE IN EGYPT

AT a recent meeting of the French Academy, two communications were read relatve to the discovery of relics presumably belonging to the Stone Age in Egypt. The one of these was merely a claim on the part of M. Arcelin to priority in the discovery of various localities abounding in such remains. The other, by Messrs. Hamy and Lenormant, while according priority in the discovery to M. Arcelin, gives a list of the various spots at present known in Egypt on which the manufacture of flint implements was carried on in early times—or where *ateliers de fabrication* have been discovered. For the benefit of our countrymen travelling in Egypt, we here reproduce the list, arranged in the order in which the places occur in travelling southwards.

1. SAQQARAH, where have been found "scrapers" and other worked flints.

2. NEG-SALMANI, a small *atelier* in the desert, at some distance from the Libyan chain, and to the north of the ruins of Abydos. Flakes of whitish flint have been observed here.

3. HARABAT-EL-MADFOUNEH, another small *atelier* to the west of the great temple of Seti I., at the foot of the mountain. The worked flints, principally flakes, are of a fine texture, and pink in colour.

4. BAB-EL-MOLOUK, at the entry of the Valley of the Tombs. M. Arcelin here found flakes, "scrapers," &c.

5. GEBEL-QOURNAH. Here are traces of the manufacture on a large scale of worked flints of various types. Among these are said to be "lance-heads" of a curious character, like some of those from the Valley of the Somme, and the Cave of Le Moustier, arrowheads, knives with or without a shoulder, "scrapers," hammer-stones, and nuclei, not unlike those of Pressigny. The flint is brown or blackish, and fine in texture.

6. DEIR-EL-BAHARI, and 7, DEIR-EL-MEDINEH, at the foot of the mountain of Thebes. Nuclei and flakes, like those of Gebel-Qournah, are found here occasionally, and it is suggested may have come from some unexplored locality on the summit.

8. EL-KAB, where, at the foot of the cliff, flakes, arrowheads, and other forms have been found.

Besides these localities, where worked flints occur on the surface of the soil, there is ABOU-MANGA, where the containing bed is not superficial, and some spots in the plain of Thebes, where MM. Hamy and Lenormant have found implements comparable in type with those of St. Acheul, and in connection with the old alluvia of the Nile, the relative date of which has, however, not been fixed.

It is stated that the instruments are not all of flint, but in some cases of porphyry, amphibolic rock, or other hard kinds of stone. J. EVANS

THE PROJECTED CHANNEL RAILWAYS

III.

WE have already considered two modes of crossing the English Channel by a railway, viz. one above the water by a bridge, and another below the water by a tunnel through the chalk. The two shores might be also connected by a submerged roadway passing direct through the water. It might be constructed either on the bottom of the channel or at a certain distance below the level of the sea. Submerged roadways have been proposed, some of iron, others of concrete; of the former of these we shall only consider such schemes as appear to have received sufficient attention from their originators.

These structures may be simply called tubes, because of their circular shape, which is, we all know, the most favourable form to resist pressure against collapse. The various propositions for the construction of iron tubes may be divided in two classes, viz.: 1st, schemes in which the parts of the proposed submerged tube are to be constructed on shore in certain lengths, afterwards to be united under water to form the permanent structure. 2nd, Schemes in which the whole tube is to be at once built in deep water.

Among the designs which belong to the first class, the best and most elaborate is that of the late Mr. Chalmers. His design is well known from his publication on the Channel Railway, which we consider a meritorious and ingenious production. He proposes a line of tube between the South Foreland and Blanc-Nez on the French coast, with a gigantic tower—or ventilator, as he terms it—midway in the channel in thirty fathoms of water. Having made this tower, he proposes to construct wrought-iron tubes on shore, each about 400 feet long, closed at both ends by watertight bulkheads. These tubes are to be floated, one by one, to the tower, and to be there submerged, "being drawn down by means of endless chains passing round pulleys or drums attached to massive anchor boxes on the bottom of the Channel." The separate parts to be submerged at one operation are to have each a floating-power equal to about 100 tons. A short description is also given how the ends of the tube about to be submerged should be drawn and attached to that part already permanently secured to the tower and the bottom of the Channel.

The deep sea tower or ventilator is probably not practicable, but we consider it does not form an essential part of the scheme. The whole tube might be formed of 240 separate pieces, each 400 feet long, and submerged without the tower by working from one shore end. The submerging and joining together of these parts in deep water would, however, be a perilous operation. No doubt this is the main difficulty of every plan of this class of scheme. In the present case it must be overcome and the operation 240 times successfully repeated, in order to complete the structure, and we may accordingly appreciate the chance in favour of the completion of this kind of submerged roadway.

Of the second class of works, viz. building the whole tube in deep water, we have but one scheme. It is the more satisfactory to observe that, of all the schemes which have been proposed with a view to establish a permanent railway communication between England and France, it is the most elaborate and complete, offering a solution on all material points in connection with this subject. The authors of this project—Messrs. Bateman and Révy—have published a full account of their scheme, and we cannot do better than refer to their work for a short description of the plan they adopt.

Our object has been to devise a scheme by which all difficulties of operating in water should be avoided. We propose to lay a tube of cast iron on the bottom of the sea, between coast and coast, to be commenced on one side of the Channel, and to be built up within the inside of a horizontal cylinder, or bell, or chamber, which shall be constantly pushed forward as the building up of the tube proceeds. The bell or chamber within which the tube is to be constructed will be about 80 ft. in length, 18 ft. internal diameter, and composed of cast-iron rings 8 inches thick, securely bolted together. The interior of the bell will be bored out to a true cylindrical surface, like the inside of a steam cylinder. The tube to be constructed within it will consist of cast-iron plates in segments 4 in. in thickness, connected by flanges, bolted together inside the tube, leaving a clear diameter of 13ft. when finished. Surrounding this tube and forming part of it, will be constructed annular discs or diaphragms, the outside circumference of which will accurately fit the interior of the bell. These diaphragms will be furnished with arrangements for making perfectly water-tight joints for the purpose of excluding sea water and securing a dry chamber, within which the various operations for building up the tube, and for pressing forward the bell as each ring of the tube is added, will be performed. Within this chamber, powerful hydraulic presses, using the built and completed portion of the tube as a fulcrum, will, as each ring is completed, push forward the bell to a sufficient distance to admit the addition of another ring to the tube. The bell will slide over the water-tight joints described, one of which will be left behind as the bell is projected forward, leaving three always in operation against the sea. The weight of the bell and of the machinery within it will be a little in excess of the weight of water displaced, and therefore the only resistance to be overcome by the hydraulic presses when pushing forward the bell, is the friction due to the slight difference in weight and the head or column of water pressing upon the sectional area of the bell against its forward motion. In like manner, the specific gravity of the tube will be a little in excess of the weight of water which it displaces; and in order to obtain a firm footing upon the bottom of the sea, the tube will be weighted by a lining of brick in cement, and for its further protection will be tied to the ground by screw piles, which will pass through stuffing boxes in the bottom of the tube. These piles will, during the construction of the tube within the bell chamber, be introduced in the annular space between the outside of the tube and the inside of the bell, and will be screwed into the ground as they are left behind by the progression of the bell. The hydraulic presses and the other hydraulic machinery, which will be employed for lifting and fixing the various segments of the tube, will be supplied with the power required for working them from accumulators on shore, on Sir William Armstrong's system, and the supply of fresh air required for the sustenance of the workmen employed within the bell and within the tube will be insured also by steam power on shore. As the tube is completed, the rails will be laid within it for the trains of waggons to be employed in bringing up segments of the rings as they may be required for the constructions of the tube, and for taking back the waste water from the hydraulic presses, or any water from leakage during the construction.

The tube will be formed of rings of 10 feet in length, each ring consisting of six segments, all precisely alike, turned and faced at the flanges or joints, and fitted together on shore previous to being taken into the bell, so that on their arrival the segments may, with perfect certainty and precision, be attached to each other. The building of the tube will be commenced on dry land above the level of the sea, and will be gradually submerged as the tube lengthens. The operations on dry land will be attended with more difficulty than those under water, but all these circumstances have been carefully considered and provided for.

The precise line to be taken betwixt the English and French coasts can hardly be determined without a more minute survey of the bottom of the Channel than at present exists. It will probably be between a point in close proximity to Dover on the English coast, and a point in close proximity to Cape Grisnez on the French coast. On the line suggested the water increases in depth on both sides of the Channel more rapidly than elsewhere, although in no instance will the gradient be more than about 1 in 100. The tube at each end would gradually emerge from the water, and on arriving above the level of the sea would be connected with the existing railway systems, so that the same carriage may travel all the way from London to Paris, or, if Captain Tyler's anticipations be realised, all the way from John O'Groat's to Bombay.

The distance across the Channel on the line chosen is about 22 miles. The tube as proposed is large enough for the passage of carriages of the present ordinary construction, and to avoid the objections to the use of locomotives in a tube of so great a length, and the nuisance which would be thereby created, and taking advantage of the perfect circular form which the mechanical operation of turning, facing, &c., will insure, it is proposed to work the traffic by pneumatic pressure. The air will be exhausted on one side of the train and forced in on the other, and so the required difference of pressure will be given for carrying the train through at any determined speed. Powerful steam-engines, with the necessary apparatus for exhausting and forcing the air into the tube, will be erected on shore at each end; and supposing one tube only to exist, the traffic will be worked alternately in each direction.

It has been found by calculation, that, for moving a large amount of tonnage and a great number of passengers, the most economical arrangement will be to send combined goods and passenger trains through the tube at 20 miles an hour, with occasional express trains at 30 miles an hour. Thus, an ordinary or slow train would occupy about 66 minutes in the transit, and a quick or express train about 45 minutes. In this way the tube, if fully worked, would permit the passage of 16 ordinary slow trains (8 each way), and 6 express trains (3 each way), each conveying both goods and passengers. About 10,000 tons of goods per day, or upwards of 3,000,000 per annum, and 5,000 passengers, or nearly 2,000,000 per annum, might be taken through, or a less amount of goods and a larger number of passengers, or *vice versâ*, if circumstances rendered other proportions necessary or desirable.

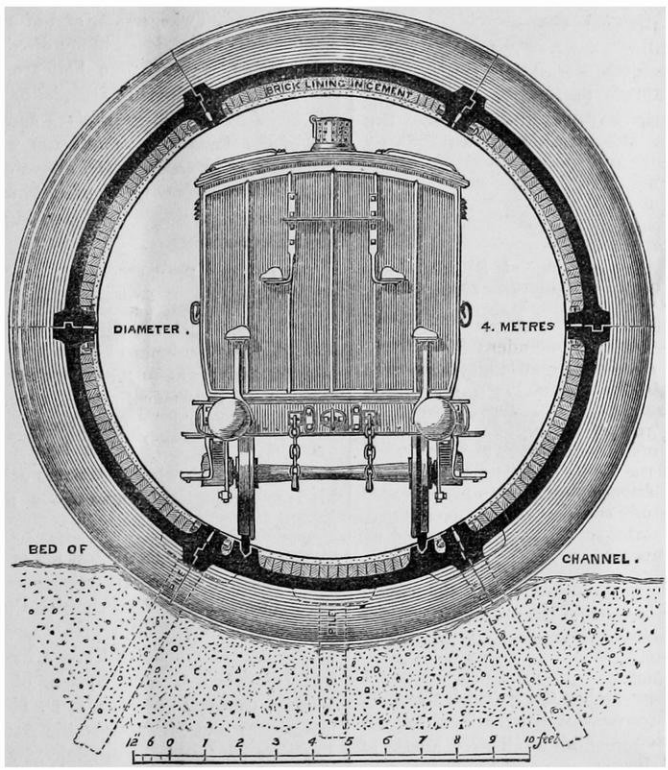
The horse power required for working the traffic with the above number of ordinary and express trains will be, on the average, 1,750 indicated, or about 400 nominal horse power at each end.

We should gladly have referred to many other interesting and important statements contained in this work, but our limited space does not admit of our doing so. A general idea of the proposition may be gathered from the above description of the authors, taken from the popular part of their work. The Appendix, which really contains the substance of the scheme, is too elaborate and technical for the general reader, without devoting special study and attention to it. Suffice it to state, that the amount of information conveyed in those 40 pages of close print is very great, being an account of a succession of results of elaborate investigations of physical, mathematical, and even of a chemical nature. One gains confidence from the mere fact, that in treating the subject the authors are evidently "at home," and do not evade a difficulty.

The general principle of the scheme, as invented and elaborated by Messrs. Bateman and Révy, may be easily understood by the ordinary reader. He can, however, have little idea how the practical difficulties attending the execution of such immense works have been overcome by these engineers. Take, for example, the first sentence or two we have quoted above. The general proposition is this: "A tube of cast iron to be built up inside a horizontal cylinder or chamber."—No doubt this may appear simple enough, but when we come to consider what the operation of *building* means,—when we come to consider that no part of the tube to be so built up weighs in one piece less than *ten tons*,—that those solid pieces of iron could not even be stirred by the power of scores of men, much less lifted or deposited in the right place—that this "building up" is to take place in a comparatively small space, not exceeding 13 feet in diameter, the larger part of which is already occupied by the very plate weighing 10 tons;—we may in a measure realise what the word "building" under these circumstances signifies.

But we have further to bear in mind, that it is not enough that we should be able somehow to "build up" the tube inside that chamber, but that it must be done quickly, without delay or a hitch, and that unless it could be so done the operation of "building up" would take generations in crossing the Channel, and make the whole proposition, though practicable in every detail, yet a forlorn hope, because of the length of time. If thus we come to consider, that the authors have not contented themselves with saying that "their tube is to be built up in that chamber," but have given us the precise designs and the exact mode of proceeding to be adopted; that the designs and arrangements are so complete that they might be forthwith placed in the hands of a contractor; that these mechanical arrangements would enable a boy of ordinary intelligence to take hold, lift, and place, and finally deposit these monster plates with the same ease, quickness, and certainty as a bricklayer would lay his brick in the construction of an arch, we venture to say the authors have made out their case.

We believe it is the first time that any of the projectors or designers of Channel railways have paid serious attention to the important question, how such a submerged railway or tunnel could be used and worked to advantage for the enormous traffic between England and France. Most of them seem to assume, as a matter of course, that such a tunnel of iron or brick would be worked as ordinary railways. It appears, however, from the investigations of Messrs. Bateman and Révy that there is but one way of working such a tunnel to advantage, and unless the arrangements and the construction of the works be kept in accordance with that mode of working the traffic, the tunnel, when completed, would be of no use for practical purposes. The authors find that the power for the propulsion of trains must be pneumatic pressure; not as applied in the old-fashioned style above ground, and known by the name of atmospheric railways, but a pressure of air applied by powerful pumps directly upon the train, which would form a kind of loose piston inside the tube. On the old plan, the train was outside a little tube; on the new plan, the train is inside a large tube; and with this simple alteration all the difficulties which led to the abandonment of the former, disappear on the latter plan. The difficulties of the old atmospheric railways were: (1) mechanical difficulty of connecting the piston of the little tube with the train outside it; (2) The high pressure required on the small area of the piston for the propulsion of the train, and consequent development of an excessive amount of heat within the pumps, leading to their rapid destruction and great loss of power by subsequent cooling of the air. By the new mode of atmospheric propulsion all these difficulties are done away with, for there is no connection



SECTION OF THE TUBE.

between a piston and the train wanted, and the pressure of the air over the large sectional area of the tube required for propulsion is but a small fraction of that formerly employed; there is, consequently, no heating, no inordinate wear and tear, and no loss of power. Equally ingenious is the construction of the proposed air pumps. Very large volumes of air are wanted to accompany and press forward the train—several hundred thousand cubic feet per minute. And what is the nature of the pumps to supply these? Are they to be blast engines? No; they are to be air pumps, in the shape of gasometers. We are all familiar enough with the sight of gasometers, but their application for such a purpose is certainly new.

We find throughout the work the same invincible spirit which seems to seek a difficulty for its immediate destruction. That a permanent railway across the English Channel will be built, we doubt not; we are equally confident that Messrs. Bateman and Révy's scheme is a practicable solution of the problem. No less an authority than the Emperor Napoleon III., after mature consideration of the scheme, wrote to say:—"*C'est le seul realisable*," and as the design is one that belongs essentially to England, His Majesty's opinion acquires enhanced value and importance. Let us, then, hope that the engineering and enterprising powers of this eminently engineering country will heartily support, advance, and improve the plan, which seems to ensure inestimable advantages to England and France.

NOTES

THE Secretaries of the Royal Astronomical Society have circulated the following notification. "We are instructed to communicate to you the following Resolution, which was passed at a Committee of the Council held yesterday, April 8th:—Resolved—'That the Fellows be informed that there is a possibility of the Government providing means of transit to and from stations on the Mediterranean for about sixty observers, who may be willing to take part in the Observation of the Total Eclipse of December 22, 1870; and that persons willing to undertake a portion of the Observations on a plan to be arranged by the Council, be invited to send their names to the Secretaries, and also to state the branch of observation which they would be prepared, or prefer, to undertake, and the instruments they would be willing to contribute.' It is desirable that the names of those who are willing to take part in the observation of the Eclipse should be sent in, if possible, before the next meeting of Council, May 13."

WE are informed that M. Fahnehjelm, the Swedish Commissioner for the forthcoming series of Annual International Exhibitions, has applied for permission to exhibit a full-sized model of a school-room, just as it exists in the country parishes in Sweden, with all the books, maps, apparatus, forms, desks, &c., in order to give a complete idea of the Swedish system of elementary instruction. Her Majesty's Commissioners will, there can be no doubt, gladly place a sufficient space at the disposal of the Swedish Commissioner for so interesting an exhibit. It is to be hoped that encouragement will be given to other countries to follow this excellent example. An easy comparison of international appliances for educational purposes would be most useful to visitors to the Exhibition, and would be beneficial and stimulating to the countries exhibiting.

YET another contribution to Mr. De Morgan's "Budget of Paradoxes." A pamphlet reaches us under the title of "The New System of Astronomy" by "Incognito" (Spon, Charing Cross), reviving, as "more in accordance with ascertained observations, and more capable of exact proof than any yet propounded," the old idea that the earth is the centre of our system, the sun revolving round it in an orbit intermediate between those of the Moon and Mars, with Mercury and Venus as his satellites.

PROFESSOR H. J. CLARK, of Lexington University, Kentucky, sends us a paper entitled "Polarity and Polycephalism, an essay on Individuality." He applies the term "polarity" to the tendency of the vertebrate individual to arrange its organs in two opposing sets, cephalic and caudal, and again dorsal and ventral. An individual is generally understood to be a monocephalic being. In the case of so-called "alternation of generation" among the Acalephic, since the sexual and sexless are necessary to make up a distinct organism, *i.e.*, vegetative and reproductive, the one a completement of the other, neither alone can represent the individual unit or whole cycle of life; and cephalism is therefore, Professor Clark contends, a better term to indicate the potentiality of these subdivisions to live apart.

MR. T. PAYNTER ALLEN reprints from the "Journal of the Society of Arts" an Inquiry into the existing state of education in Richmond, Twickenham, and Mortlake. He finds that of the whole number of children in the district, one-third are absolutely uninstructed, scarcely one half are in average attendance at school, one-fifth alternate attendance at school with fluctuating labour injuriously to themselves and to the school; one-sixth are of the maximum school age without having reached the maximum of proficiency, and above one-half are children of eight years, and therefore in training in infant or mixed schools, the classification, methods, and teaching power of which are very imperfect and inferior.

PROFESSOR PIAZZI SMYTH publishes "A Poor Man's Photography at the Great Pyramid in the year 1865." The "poor man" is Professor Smyth himself, who details the difficulties encountered in pursuit of his undertaking in the face of a "coalition of rich ones against him." Whatever may be thought of Professor Smyth's theory of the object for which the Great Pyramid was built, there can be no question that he has brought to the subject an immense amount of patient self-denying research which demands acknowledgment, and some of his meteorological observations may yet lead to important results.

MESSRS. LONGMAN'S latest list of forthcoming works includes the following, in different departments of science:—The Origin of Civilisation, and the Primitive Condition of Man, by Sir John Lubbock; Other Worlds than Ours, by R. A. Proctor; The Historical Geography of Europe, by E. A. Freeman; Le Maout and Decaisne's General System of Descriptive and Analytical Botany, translated by Mrs. J. D. Hooker; Researches on Diamagnetism and Magnecrystallic Action, by Professor Tyndall; Lectures on Surgical Pathology, by James Paget; A Course of Elementary Problems in Practical Plane Geometry, by John Lowres; Principles of Mechanism, by Professor Willis; Smoking Fires—their Cause and Cure, by Rev. A. C. Ainslie; On the Manufacture of Beet-root Sugar in England, by W. Crookes; and A Handbook of Dyeing and Calico-printing, by the same author.

THE continental subscription list on behalf of the late Professor Sars now exceeds 10,000fr. A young naturalist, Mr. C. Jobert, called a public meeting at Havre in its support, which was a great success, the mayor granting free use of a room in the Hotel de Ville, and the printer refusing to be paid for printing the circulars: a worthy example for imitation.

Apropos of Professor Tyndall's "Dust and Disease," we extract the following from the *Scientific American*:—"The dust obtained from the places of amusement in New York has recently been analysed by the scientific officers of the Metropolitan Board of Health. Over one hundred speci-

mens of the particles floating in the air, and falling as dust, were collected on plates of glass, and were examined under the microscope. The proportions of the different ingredients varied, but the same substances were found in all the specimens. The composition of the matter subjected to the microscope was as follows:—'The dust of the streets in its finer or coarser particles, according to the height at which it had been collected, with a large proportion of organic elements; particles of sand, quartz, and feldspar; of carbon, from coal-dust and lampblack; fibres of wool and cotton of various tints; epidermic scales; granules of starch of wheat, mainly the tissues of plants; the epidermic tissue, recognised by the stomata or breathing pores; vegetable ducts and fibres, with spiral markings; vegetable hairs or down, either single or in tufts of four or eight, and of great variety, and three distinct kinds of pollens. Fungi were abundant, from mere micrococcus granules to filaments of mould. When water was added to a portion of dust from whatever source, and exposed in a test tube to sunlight or heat for a few hours, vibriones and bacteria made their appearance, and the fungous elements sprouted and multiplied, showing that they maintained their vitality, and proving that the germs of fermentation and putrefaction are very widely diffused.'"

IT is said that Professor Nordenskiold is organising another Polar Expedition for 1871-2, and that he intends, amongst other things, to attempt to reach the North Pole by starting from Spitzbergen, or its neighbourhood, in the spring, and travelling by sledge over the frozen sea. It is reported that he intends to visit Greenland this year to procure dogs for his enterprise. We fear that if he relies upon dogs, he will not succeed better than his predecessors, and he may even experience great difficulty at the outset in obtaining the requisite number for his purpose; for, by the latest accounts from Greenland, the disease among the dogs in that country (which proved such a hindrance to Mr. Whymper in his attempt to penetrate to the interior in 1867) has spread, in spite of all efforts to check it, from one district to another, and is still continuing its fatal ravages.

THE new number of the *Proceedings of the Royal Institution*, commencing the sixth volume, includes Professor Tyndall's lecture "On Dust and Disease," Professor Odling's "History of the Scientific Work of the late Professor Graham," and Dr. Carpenter's lecture on the "Temperature and Animal Life of the Deep Sea," with briefer notices of the other Friday evening discourses before Easter.

AT the meeting of the French Academy on the 11th inst., Marshal Vaillant communicated the curious fact that Cuvier's name was not *George*, but *Jean Leopold Nicolas Frederic*. According to M. Dumas, this circumstance was well known to persons familiarly acquainted with Cuvier, but no reason is given by him for such a singular change of name.

THE second of Sir Edward Sabine's conversaziones as President of the Royal Society will be held on Saturday evening next.

THE *Engineer* states that a new method of warming first-class carriages in express trains has been adopted in Bavaria: a special van is attached to the train and contains a powerful "calorifere," and the heated air is conveyed to all the carriages of the train by means of india-rubber tubes. The experiment with first-class carriages is reported upon so favourably that the authorities have determined to apply it to all the carriages on the Bavarian lines, and it is expected that it will soon be adopted on all the German railways.

THE herbarium of the late Von Martins, which was offered to and refused by the Bavarian Government, has been purchased for 30,000 fr. by the Belgian Government to form the basis of a national collection, to be located at Brussels. It consists, 1st, of the general herbarium, containing 60,000 species, represented by 300,000 specimens, nearly half of which are Brazilian; 2nd, of the great collection of palms; 3rd, a collection of fruits and seeds; 4th, a series of woods; 5th, a collection of drugs and economic specimens, in great part formed by his brother Theodore Martins, Professor of Pharmacy at Erlangen.

ACCORDING to the *Photographic News*, the oft-reiterated statement that the eye of a dead animal has impressed upon it an image of the last object seen in life has been the subject of serious investigation in Germany. Americans have gone so far as to state that the eye of a murdered man had been found in which a portrait of the murderer was distinctly traceable. In the investigation in question the eyes of thirty different animals, all of which had been killed with a view to subsequent examination, were carefully inspected, but in no case was there any evidence discovered to warrant the statement referred to.

A COMPACT and valuable little "Route-map and Index to the more interesting objects in the Royal Gardens, Kew," is about to be issued under official sanction by Messrs. Macmillan and Co It contains an excellent map of the gardens, and index to some o the more interesting plants: and as it is to be sold for the low price of *2d.* it will doubtless have a very large circulation.

DR. E. SYMES THOMPSON, Gresham Professor of Physic, will deliver his two courses of three lectures each at the Gresham College, Basinghall-street, after Easter. The first course on April 22nd, 23rd, and 24th, will be on Cough, on Tonics, and on Climate and Health Resorts. The second course, on June 2nd, 3rd, and 4th, on the Epidemics of the Middle Ages, on Sedatives, and on Narcotics. The Lectures are illustrated with diagrams, and chemical experiments, and are free to the public. They commence at 7 o'clock.

DR. CLARK, assistant to the late Dr. Penny, who continued the winter course of lectures on Chemistry after that gentleman's death, will deliver the summer courses. Further arrangements are dependent upon the proposal of Mr. Young, the President, to endow a chair of Technical Chemistry.

THE statistics of the American Pennsylvania crude oil industry for the past year are now published. The total production of the year was the enormous amount of 4,215,142 barrels, being a daily average of 11,548 barrels. The production of 1868 was 3,715,741 barrels, the increase during 1869 over the previous year thus being 499,401 barrels, or about 1,460 barrels per day.

PROF. H. WURTZ has presented to the New York Lyceum of Natural History a report of an extraordinary outburst of gas in the township of West Bloomfield, co. of Ontario, State of New York. It issues from a bore-hole in the solid rock, about five inches in diameter, and when burning, gives in a still atmosphere a flame some thirty feet in height, the flow amounting to 400,000 cubic feet per day, which has now been going on for more than four years, without any perceptible diminution of rapidity. The density is 0·693, and the result of several analyses shows the following composition:—

Marsh gas	82·41 per cent.
Carbonic acid	10·11 ,,
Nitrogen	4·31 ,,
Oxygen	0·23 ,,
Illuminating hydrocarbons . .	2·94 ,,
	100·00

The most remarkable feature of the discharge is the lack of diminution of the flow for so long a time in connection with the low pressure indicated, corresponding to that of but a few inches of water. Dr. Stevens has examined the geological formation of the rock from which the oil proceeds, and finds it to belong to the Hamilton Group, the gas proceeding doubtless from the "Marcellus Shale," which is highly charged with bitumen and

carbonaceous matter, and flames on ignition. The four great gas-producing strata of New York, Pennsylvania, and Ohio thus all belong to the Palæozoic formation.

THE quinquennial prize of 5000fr. of the physical and mathematical sciences of the Belgian Academy has been awarded to Prof. Plateau for his researches on the figures of equilibrium of a liquid mass without weight; a fitting sequel to 26 years' unremitting work, the professor being now blind. The Argenteuil prize of 12,000fr. has been bestowed on M. Champonnois, inventer of the method of distilling beet-root.

THE Council of the Entomological Society offers two prizes, of the value of five guineas each, for essays, of sufficient merit, drawn up from personal observation in the anatomy or economy of any insect or insects; the essays to be sent in before the end of November next.

NOTWITHSTANDING the numerous investigations that have been made upon the process of gastric digestion, the ulterior changes that the food undergoes in the alimentary canal exclusive of the action of the pancreatic and biliary fluids, in other words, the action of the fluid secreted by the walls of the alimentary canal itself on the various constituents of our food, admitted on all hands to be considerable, has received but little attention. In the "Untersuchungen aus dem Institut für Physiologie" in Graz, edited by Prof. Rollett, an essay appears written by Dr. Alexis Dobroslawin of St. Petersburg on this subject. In order to obtain the intestinal juice, he made a fistulous opening into an isolated portion of the intestine and inserted a canular into the orifice, which was properly secured. The dog was fed with a pound of horse-flesh and a single supply of water daily. Investigations were in the first instance made with a view of ascertaining the quantity of intestinal secreted juice. The material obtained consisted of a thin fluid and of a mucous portion, the relative proportion of which varied to a considerable extent under different circumstances, but from an isolated portion of intestine (having a length of 13 centim.) in one dog he obtained 34 grains, and in another, where the isolated portion of intestine had a length of 17 centim. 28 grains per hour. The results of electrical excitation by means of induction currents were very similar to those previously obtained by Thiry, and showed a considerable increase in the amount of the secretion during the passage of the current, and further researches showed that the secretion thus obtained did not differ materially from that produced in the healthy and uninjured animal by the application of electricity to the freshly-exposed intestinal tract. The most interesting part of his researches, however, bears upon the action of the intestinal juice on starch, albumen, and fat respectively. In regard to the former, he was able to convince himself, in opposition to the statements of Thiry, that the intestinal juice possesses a distinct power of converting starch into sugar, and this occurred in whatever state the juice might be, whether clear, or troubled, or filtered, or mingled with flocculent masses of mucus. The time required was in all instances nearly the same, or about two hours. In one instance, evidence of the presence of sugar was obtained in a quarter of an hour. In regard to albumen, his experiments were made with portions of raw fibrin of blood. These were kept at a temperature of about 100° Fahr., in contact with some of the recently-obtained intestinal juice, and it was found that a solvent action did occur, but with great slowness, from twenty to forty, or even forty-eight hours being required. The dissolved fibrin underwent conversion without the development of any putrefactive odour into peptones, as was demonstrated by the action of a series of tests. The researches made with a view of ascertaining the action of the juice on fats, as olive oil and butter, had a negative result; he was never able to discover any of the fatty acids.

IN the last part of Schultze's "Archiv. für Mikroskopische-Anatomie," M. Schwalbe describes the lymphatic spaces of the eye. In this paper he shows that there is a large space comparable to a lymphatic sac lined by nucleated epithelium, as shown by the action of nitrate of silver situated between the choroid and sclerotic coats. When injected with a coloured fluid the injection escapes from the globe by channels surrounding the venæ vorticosæ, and then distends the space known as the capsule of Tenon. From thence the fluid passes backwards through a sheath surrounding the optic nerve, and so penetrates into the arachnoid space of the brain.

THE Rev. W. P. Clarke, vice-president of the Royal Society of New South Wales, sends us an interesting paper on the Causes and Phenomena of Earthquakes, especially in relation to shocks felt in New South Wales and in other provinces of Australasia.

IN a letter to *Hardwicke's Science Gossip*, Mr. W. W. Spicer states that the colour of insects is greatly influenced by the length of time during which they have remained in the chrysalis condition, well-marked varieties being produced by preserving the chrysalis in a state of abnormal torpidity through the autumn and winter, which can be done by keeping it in ice.

THOSE of our readers who are interested in the theory of vision will find an instructive paper by Mr. G. Joseph Towne, in the last issued volume of the "Guy's Hospital Reports" (1870). It deals chiefly with the subject of binocular vision, with a criticism on the views recently promulgated by Professors Hering and Helmholtz, and at the conclusion of his essay he makes the following statements:— "That the images of all objects placed within the transverse visual plane are referred to the opposite side of the field; that is, to the side of the field opposite to that occupied by the object viewed, and we remark that this phenomenon is special to the transverse visual plane. That in selecting the transverse visual plane as the region for his experiments, and in having applied to the field generally the exceptional phenomena special to this region, Hering has committed an error, which is fatal alike to the consistency of his experiments and to the soundness of his conclusions. That the phenomena on which Hering has based his theory are inseparably connected with a near convergence of the eyes, and it may be asserted that similar phenomena cannot occur, the field being viewed with the optic-axes parallel." Mr. Towne's statements are supported by much ingenious reasoning, and references to numerous experiments, some of which are illustrated.

LARGE beds of rock-salt have been discovered by borings, in the neighbourhood of Middlesborough-on-Tees, and shafts are now being sunk with a view to work the valuable deposits. In this we have another example of the mineral character of that north-east corner of Yorkshire. Iron ore and smelting furnaces abound. Mineral waters well-up in sundry places. Alum used to be made at Guisborough, near the foot of Rosebury Topping; and now the rock-salt offers a new resource to a large and busy port, which, forty years ago, was a wild waste with two or three houses only.

IT is perhaps a sign of a wider awakening interest in geology among the Italians, that a new journal—*Bolletino R. Comitato Geologico d'Italia*—was brought out at Florence, at the beginning of the present year. The second number has just appeared. It contains papers and notices on geological and mineralogical subjects, illustrated by engravings, and so far fulfils its purpose of making "better known than hitherto the geology and topography of Italy." We are glad to welcome this new periodical; for the more the Italians become acquainted with the natural resources of their country, the better will it be for all concerned.

BOTANY

Variegation of Leaves

M. EDOUARD MORREN attributes the variegation of leaves to a disease which is contagious and which may also be communicated from one species to another by inoculation, as by the grafting of a variegated plant on to a healthy stock, or even from the stock to a healthy graft. The discoloured or variegated portions of a leaf have lost their power of reducing carbonic acid, the plants are generally weaker and smaller, their flowers and fruit inferior, and they are more liable to be injured by cold. It is the sign of an organic disease produced by various causes, as the deterioration of the seeds, dampness of the ground, want of light, &c. None of the higher classes of plants can exist if entirely deprived of chlorophyll, except such as are parasitic. Some of our common variegated cultivated plants, such as *Pelargonium zonale* and *Hydrangea*, sometimes put out branches which are entirely colourless, but these only live a parasitic life on the rest of the plant. That the disease is an individual one is shown by the fact that it can be propagated by buds, layers, or grafts, even by the insertion of the petiole of an infected leaf beneath the bark; while the seeds of variegated individuals will generally produce healthy and fully-coloured plants. A. W. B.

Dimorphic Leaves of Water-plants

FOLLOWING out his observations on the leaves of *Marsilia* (see NATURE, No. 11 p. 293) Prof. Hildebrand finds that some other water plants exhibit a similar peculiarity, as, for instance, *Polygonum amphibium*, and the common arrow-head, *Sagittaria saggitifolia*, frequently producing, when growing in very deep water, floating leaves of a different form from the ordinary leaves, and exhibiting also differences in structure and in the arrangement of the stomata. In the latter species the floating-leaves are round and heart-shaped, similar to those of a water-lily, instead of arrow-shaped. A. W. B.

THE MARQUIS DE POMPIGNAN asserts that a remarkably fine quality of truffle is cultivated in the vicinity of the Garonne, on a district almost solely arenaceous.

PHYSICS

Phosphorescence of Gases

IT is a well-known fact, the discovery of which appears due to Geissler, of Bonn, that certain highly attenuated gases have the power of remaining luminous for a short time after the interruption of an electric current by which they have been traversed. M. Becquerel attributed this phenomena to the presence of oxygen, either free or combined; M. Morren has since denied that pure oxygen itself can exhibit the electric phosphorescence, but that it does so when mixed with other gases, more particularly nitrogen. Such being the state of the question, M. de la Rive requested M. Edouard Sarasin to execute a series of critical experiments, an account of which appears in the Archives des Sciences physiques et naturelles [135, p. 243] and is summarised in the following paragraphs.

The experiments were made in a large glass jar, 20 centimetres in diameter and 30 centimetres high, which was placed on the platinum plate of a Babinet's air-pump, capable of giving a vacuum of half a millimetre. The electrodes consisted of two brass stems, to the extremities of which were screwed two thin disks of either brass, platinum, or silver. One of them was fixed on the brass screw-plate in the centre of the platinum, the other occupied the middle of the flat glass cover of the jar. They were also connected with the two poles of a Ruhmkorff's coil of medium size, traversed by the current from four Grove's cells. The interior of the jar communicated with (1) a desiccating apparatus, through which the gases were introduced; (2) a manometer reading to 0·04 millimetre, and (3) a brass tube in which were placed chemically pure gases, contained in bulbs which could be broken in a vacuum.

A number of experiments were made with oxygen, both as prepared from potassium chlorate and as yielded by electrolysis. Closing his eyes during the intense and blinding glow of the continuous discharge, and suddenly opening them on the interruption of the current, the observer witnessed, in every case, a pale, whitish glimmer, directed, though but momentarily, over the path of the preceding display. At and below a pressure of three millimetres, but especially at two millimetres, this light fills the whole jar. Simultaneously with this occurrence, ozone is produced, as proved by testing with finely divided silver; whence, as might be expected, the phosphorescence is considerably diminished by employing electrodes of silver. No gas, other than oxygen, exhibits this property. Hydrogen, nitrogen, chlorine, iodine-vapour, ammonia, coal-gas, hydrogen chloride, and even atmospheric air, alike failed to produce it.

When highly concentrated hydrogen sulphate was placed in a capsule on the platinum plate, and nitrogen, air, nitrous oxide, carbon moxide or dioxide was admitted under the usual conditions, a phosphorescence was obtained of greater intensity and larger duration than in any of the other experiments. Here, also, ozone was formed. The presence of silver diminished, the presence of hydrogen entirely obliterated the phenomenon.

Sulphur dioxide gave a feeble but decided phosphorescence. Hydrogen nitrate and nitrogen peroxide showed a weak effect. Carbon monoxide and dioxide were very perceptibly phosphorescent, and still more on the introduction of hydroge sulphate. It was noticed that the addition of this sulphate invariably diminished the conductibility of the gas.

The most curious results were observed with nitrous oxide. During the passage of the spark, at ten millimetres (and even higher) pressure, a narrow jet appears, of a bright rose colour, and exhibiting fine clear striæ. Surrounding the jet is a sheath of the most brilliant yellow mist of eight to ten millimetres in thickness, and perfectly defined. As the jet grows with diminishing pressure, this sheath loses its brilliancy, advances farther in the jar, and, at two millimetres, fills it entirely. At half a millimetre, there is a large rosy jet, with enormous striæ extending to the walls of the jar, all the interstices being filled with yellowish mist. Nitrous oxide shows a phosphorescence at all pressures below ten millimetres. At first this is very bright but only instantaneous, occupying exactly the place previously assumed by the yellow sheath. As the vacuum improves, the phosphorescence becomes more permanent; and ultimately, at one millimetre, and after the interruption of the spark, a yellow mist is visible for three seconds, and is bright enough at first to illuminate surrounding objects very evidently.

The preceding experiments lead the author to infer that oxygen is the sole cause of the phosphorescence in question, which is also and necessarily produced by most oxygenated gases.

SCIENTIFIC SERIALS

Berg-und huttenmannische Zeitung. The last number of this journal contains the following account of a new locality for the mineral Knebelite, by L. J. Igelström, of Filipstadt. For some time Knebelite was only known as occurring at Ilmenau and then it was afterwards discovered at Danemora. During a journey in the year 1866 he discovered it at the Hilläng iron mine in the parish of Ludovika, province of Dalarne, Sweden. It is found there in great quantities, sometimes in masses twelve feet thick. It occurs in the hälleflinta, the ore-bearing rock, in connection with magnetic iron limestone and traces of magnetic pyrites, with all of which it is impregnated. The mineral from Ilmessau and Danemora has a pretty constant composition, containing 30—32 silica, 32—34 protoxide of iron, and 34—35 protoxide of manganese (*vide* Dana, 1868). The composition of the Knebelite from Hilläng, which is somewhat different, is as follows:—

Silica	33·14	with	16·74	Oxygen
Protoxide of iron .	40·96	,, 9·09	15·38	,,
Protoxide of manganese	19·35	,, 4·42		,,
Lime	6·55	,, 1·87		,,
	100·00			

This difference may, perhaps, have been caused by the mineral not being entirely free from intermixed magnetic iron. There is, nevertheless, no doubt whatever, if one compares the external characters, that the Hillängs mineral is the same as that of Danemora, and, indeed, it was this identity of external appearance which occasioned its discovery at Hillängs. Both varieties of the mineral have the characteristic of gelatinising with hydrochloric acid.

IN *The Journal of the Quekett Microscopical Club* for April, is the commencement of an article by Mr. M. C. Cooke, on Microscopic Moulds, restricting the term "moulds" to the *Hyphomycetes*, and including all those filamentous fungi which bear

naked spores (sporiferous, in contradistinction to sporidüferous) at the apex of simple or branched threads. It promises to contain much valuable information. Other interesting papers are by Dr. Braithwaite, on the Geographical Distribution of Mosses; M. de Brebisson, on French Diatomaceæ; and Mr. B. T. Lowne, on the Cornea of the Bee.

THE *Journal of the Ethnological Society* for April contains a valuable report by Lieut. Oliver, R.A., illustrated by several very beautiful lithographs, on the present state and condition of Pre-historic Remains in the Channel Islands. Notwithstanding the wholesale and wanton destruction of these monuments in the Channel Islands within the last half-century, there are nevertheless few localities, Brittany excepted, in which the sepulchral stone structures of the neolithic period can be studied with greater advantage. Lieut. Oliver describes in detail the monuments still remaining in Guernsey, Herm, Serk, Jersey, and Alderney; and notes the remarkable resemblance borne by them to the monoliths and stone tombs of Madagascar, erected by the hill-tribes of Hovas even at this very day. Mr. C. T. Gardner contributes an essay on the Chinese Race, their Language, Government, Social Institutions, and Religion; Mr. G. Busk, a description of, and remarks upon, an ancient *Calvaria* from China, which had been supposed to be that of Confucius; and Mr. H. H. Howorth, a continuation of his article on the Westerly Drifting of Nomades, from the fifth to the nineteenth century.

Geological Magazine, vol. vii. No. 4, April 1870.—This number opens with the first of a series of notices of eminent living geologists, and the editor's choice has worthily fallen upon the veteran Professor Sedgwick. Professor Huxley has a paper, illustrated with a plate, on the milk-dentition of *Palæotherium magnum*. From Professor Rupert Jones we have a series of notes on the Tertiary Entomostraca, containing supplementary remarks and corrections to his monograph of those minute fossils published by the Palæontographical Society in 1856, and including a revised list of the species. The other papers are, an article on the superficial deposits of Belgium, illustrated with a map prepared by Mr. H. M. Jenkins for his paper on Belgian agriculture, published by the Agricultural Society; a notice of the Basaltic Rocks of the Midland Coalfields, by Mr. S. Allport; a note on the Middle Drift-beds in Cheshire, by Mr. J. E. Taylor; and an extract from a letter of Mr. F. B. Meek to Dr. Bigsby, giving an account of the fossils found in some silver-bearing rocks near Central Nevada, which appear to be of Devonian age. The number contains the usual notices, reviews, reports, and miscellaneous matter.

THE *Revue des Cours Scientifiques* for April 9th is occupied by a sketch of the biological labours of the late Prof. Sars, by Emile Blanchard; a translation of Mr. Andrews' paper, read before the Royal Society, on the continuity of the liquid and gaseous states of matter. The number for April 16th contains a translation of the Anniversary Address before the Hunterian Society by H. J. Fotherby; and a report of a lecture by Claude Bernard on Blood and its General Properties.

IN the *Monthly Microscopical Journal* for April we find a description (with illustrations) by Dr. Carpenter of some peculiar fish's ova, the peculiarities having reference to the shape of the ova, the mode of their attachment to the surface of the shell, and the position and remarkable distinctness of the micropyle; and a description (with plate), by Mr. C. A. Barrett, of a new tube-dwelling stentor, found on a piece of weed taken from the Thames at Moulsford; an article on the polymorphic character of the products of development of Monas lens, by M. Johnson, with others of less importance.

THE *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, vol. 5, section 1, contains several very interesting papers of travel. An Ascent of the Peak of Teneriffe, by E. Häckel, Sketches of a Journey from Chartum to the Gazelle River, by G. Schweinfurth, both these articles being abundantly full of valuable natural-historical details; a report of the Western-Australian Expedition, by Mr. Forrest, in search of traces of Leichardt; an account of Dr. Nachtigall's Journey to Tibesti, and other shorter articles.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 7.—"On supraannual cycles of temperature in the earth's surface-crust." By Prof. C. Piazzi Smyth, F.R.S. The author presents and discusses here the completely reduced observations, from 1837 to 1869 inclusive, of the four great earth-thermometers sunk into the rock of the Calton Hill, at the Royal Observatory, Edinburgh, by the late Principal Forbes, pursuant to a vote by the British Association for the Advancement of Science. Leaving on one side the several Natural-Philosophy data which have been investigated from smaller portions of the same series of observations both by Principal Forbes and Sir William Thomson, the author applies himself solely to trace the existence of other cycles than the ordinary annual one, in the rise and fall of the different thermometers. Of such cycles, and of more than one year's duration, he considers that he has discovered three; and of these the most marked has a period of 11·1 years, or practically the same as Schwabe's numbers for new groups of solar spots. Several numerical circumstances, however, which the author details, show that the sun-spots cannot be the actual cause of the observed waves of terrestrial temperature, and he suggests what may be; concluding with two examples of the practical use to which a knowledge of the temperature cycles, as observed, may at once be turned, no matter to what cosmical origin their existence may be owing.

"On the Constituent Minerals of the Granites of Scotland, as compared with those of Donegal." By the Rev. Samuel Haughton, M.D., Dubl., D.C.L. Oxon., Fellow of Trinity College, Dublin. This paper contains analysis of Orthoclase from the following localities:—

No. 1. Stirling Hill, Peterhead. Occurs in an eruptive Granite, in veins, in well-developed reddish pink opaque crystals, encrusted with crystals of Albite.—No. 2. Rubislaw, Aberdeen. Large beautiful reddish pink opaque crystals, in veins, associated with white Mica. The Granite of Rubislaw is of metamorphic origin, and different in character from the eruptive Granite of Peterhead. No Albite has been found in it.—No. 3. Peterculter, Aberdeen. In Metamorphic Granite; white, translucent, large crystals.—No. 4. Callernish, extreme west of Lewis. In Metamorphic Granite; in large grey crystals, with a slight shade of pink, translucent.—The Granites of central and western Scotland are metamorphic rocks, like those of Donegal and Norway, with which they are geologically identical; and truly eruptive Granite occurs at only a few localities, as, for example, near Peterhead. The second felspar, associated with Orthoclase in the Metamorphic Granites, is Oligoclase, as in Donegal; while the second felspar associated with Orthoclase in the eruptive Granites, is Albite, as in Mourne, Leinster, and Cornwall. The fact thus indicated by the Scotch Granites is completely in accordance with the mode of occurrence of Oligoclase and Albite in the Irish Granites. (Then follow analyses of two Oligoclases.)—No. 1. This Oligoclase occurs in the Granite of Craigie Buckler, near Aberdeen; it is white and opaque, and so much resembles Cleavelandite in appearance as to have been mistaken for that variety of Albite; its analysis proves it to be Oligoclase. The crystals do not exhibit striation.—No. 2. From the Granite of Rhiconich, in the west of Sutherlandshire; it is greyish white, semitranslucent, in large striated crystals, and resembles the Oligoclase of Ytterby, in Sweden.—Analysis of an Albite which occurs at Stirling Hill, near Peterhead, in eruptive Granite, and is found associated with red Orthoclase in veins. It encrusts the large crystals of Orthoclase, and is semitranslucent; and is generally stained on the surface by peroxide of iron. This mineral is evidently a typical albite. There are two kinds of mica found in the Scotch granites, and both micas resemble very closely the corresponding minerals of the Donegal granites. The specimen of mica analysed came from veins in the granite quarry of Rubislaw, near Aberdeen, and occurs in large plates, associated with red orthoclase. It was carefully examined for lithia, but no trace of this alkali could be found in it. The angles of the rhombic plates were 60° and 120° exactly, and the angle between its optic axes was found to be 70° 30′. The black mica, in large crystals, is very rare, but it seems abundantly disseminated, in minute scales, through most of the Scotch granites. An analysis was made on specimens found near Aberdeen by Professor Nicol, and kindly forwarded to me by him, for the purposes of this paper. This mica was carefully examined for fluorine, and found not to contain any.

Researches on Vanadium. Part III.—Preliminary Notice. By Henry E. Roscoe, B.A., F.R.S.—1.—Metallic Vanadium.—II.—Vanadium and Bromine.—1.—Vanadium Tribromide, VBr_3, molec. wt. = 291.3.—2—Vanadium Oxytribromide, or Vanadyl Tribromide, $VOBr_3$, molec. wt. = 307·3.—The specific

gravity of the oxytribromide at 0° is 2·967.—3.—Vanadium Oxydibromide, or Vanadyl Dibromide, $VOBr_2$, molec. wt. = 227·3.—III.—Vanadium and Iodine.—Iodine-vapour does not attack either the trioxide or the nitride at a red heat, both these substances remain unchanged, and no trace of vanadium can be detected in the iodine which has passed over them.—IV.—The Metallic Vanadates.—Sodium Vanadates.—1.—Ortho- or Tri-Sodium Vanadate, $Na_3\ VO_4 + 16H_2\ O_2$.—2.—Tetrasodium Vanadate, $Na_4\ V_2O_7\ 18H_2\ O$.—Lead Vanadates.—1.—Tribasic or Ortho-Lead Vanadate, $Pb_3\ 2(VO_4)$.—2.—Vanadinite, the Double Orthovanadate and Chloride of Lead, $3Pb_3\ VO_4 + Pb\ C.l_2$.—3.—Basic Dilead Vanadate, $2(Pb_2\ V_2O_7) + Pb\ O$.—Silver Vanadates.—1.—The Ortho-silver Vanadate, $Ag_3\ Vo_4$.—2.—The Tetrabasic Silver Vanadat, $Ag_4\ P_2\ O_7$.

Anthropological Society, April 5.—Captain Bedford Pim, R.N., V.P., in the chair. A paper, by Mr. Hodder M. Westropp, was read, on Phallic Worship. The author, after asserting the spontaneity and independence of certain beliefs and superstitions in the human mind, at all times and in all climates, proceeded to trace out the rise and development of phallic worship as one of the most ancient of those religions that have extensively prevailed among various sections of the human race. In the earlier ages the operations of nature made stronger impressions on the mind of man than in the later periods of his history. There were two causes which must have engaged the attention of the savage observer of nature, the generative and the productive, the active and passive. The author then described what he conceived to have been the process of thought, founded on analogies from the observation of the great forces of nature by the Egyptians, Assyrians, Hindus, Chinese, Phœnicians, Greeks, Romans, the aborigines of America, Australasia, and Polynesia, and on the unquestioned evidence of phallic worship in its various phases belonging to those peoples. That worship was always, among the ancients, of a purely reverential kind, and partook of nothing obscene, either in its teaching or its observance; it was a homage paid to the most potent and most mysterious of the powers of nature.—Mr. C. Staniland Wake then read a paper on the Influence of the Phallic idea in the Religions of Antiquity.

Chemical Society, April 7.—Prof. Williamson, president, in the chair. The following gentlemen were elected Fellows:—F. Andrews, jun., W. Martindale, and A. H. Palmer.—Dr. Divers concluded a paper, commenced in a previous meeting, "On the combination of carbonic acid with ammonia and water." The elaborate and very extensive memoir does not permit of any convenient abbreviation.—Dr. Gladstone communicated a paper "On the refraction equivalents of the aromatic hydrocarbons, and their derivatives." In a previous paper it was shown that the refraction values of organic compounds may easily be calculated when the refraction equivalents of the constituent bodies are known. The present paper enumerates a large number of substances which do not conform to the rule. The so-called aromatic hydrocarbons give, by experiment, higher figures than required by calculation. Dr. Gladstone accounts for this anomaly by regarding the nucleus phenyl, $C_6\ H_5$, as an entity having, like some elements (for instance, iron and phosphorus), the peculiarity of changing its refraction value.—Mr. Hunter, of Belfast, communicated a paper "On Deep-Sea waters," a sequel to a note read before the society in December last.—Messrs. Bolas and Gloves read a note "On Bromopicrin" and announced also the discovery of tetrabromide of carbon.—Prof. How, of Nova Scotia, reports of a feed water occurring at Stellarton, N.S., which contains traces of free oil of vitriol.—For the meeting on April 21st a lecture "On Vanadium," by Prof. Roscoe, is announced.

Ethnological Society, April 12.—Professor Huxley F.R.S., president, in the chair. It was announced that Dr. Bonavia had been elected a member of the Society; Dr. Carl Semper, of Würzburg, an honorary foreign member; and Lieutenant S. P. Oliver, R.A., a corresponding member.—An interesting paper by Hodder M. Westropp, Esq., described very fully the ancient tribal system and land tenure in Ireland under the Brehon laws, and gave rise to a spirited discussion which was sustained by Mr. G. Campbell, Colonel Lane Fox, the president, Dr. Hyde Clarke, and Mr. McLennan.—A communication was then read "On the Danish Element in the population of Cleveland in Yorkshire." The author pointed out that not only many words in the Cleveland dialect and a very large proportion of personal and local names in the district are of Scandinavian origin, but also that many of the idioms in use are markedly Scandinavian. He also sought to trace an old Anglian element in the population. Mr. Jón. Hjaltalin (an Icelander,) Dr. Hyde Clarke, the Rev. Dr. Nicholas, and Col. Lane Fox, took part in the discussion which followed the reading of this valuable communication.

Entomological Society, April 4.—Mr. Alfred R. Wallace, F.Z.S., &c., president, in the chair. Exhibitions were made of *Coleoptera* by Mr. Jenner Weir and Mr. Janson; of *Lepidoptera* by Mr. Jenner Weir and Mr. Howard Vaughan; of *Hymenoptera* by Mr. F. Smith; and *Orthoptera* by the secretary.—The ravages committed in granaries by *Calandra granaria* and *C. oryzæ*, and the means of preventing the same, were the subject of a lengthy discussion, in which Messrs. Jenner Weir, Vogan, Janson, Westwood, McLachlan, F. Smith, and the president took part.—Mr. Albert Müller read a note on the odour of certain *Cynipidæ*, and Mr. G. R. Crotch communicated some observations on British species of *Dasytidæ*.

Birmingham

Natural History Society.—Geological Section.—A paper on the Igneous Rocks of the Midland Coalfields was read by Mr. S. Allport, F.G.S. The author had examined carefully the mineral constitution of the igneous rocks of the Shropshire, Staffordshire, and Warwickshire coalfields, and also the so-called loadstone of Derbyshire, and was of opinion that they all belonged to the carboniferous age, and in the case of the traps of the coalfields he had no doubt the said traps were contemporaneous and not intrusive. These rocks, now found in patches over the several coalfields of the Midlands were probably all derived from one source, just as the coalfields themselves were probably only remnants of a coalfield of great extent. In conclusion the author made some reference to the nomenclature of igneous rocks, which he said at present was in a very unsatisfactory state.

Cambridge

Philosophical Society, March 21.—Communications made to the society: 1. By Mr. Röhrs (Jesus College) "On carmine and the colouring principles of cochineal." The author described the process which he had followed in some experiments in making carmine. He found that the presence of carbonate of lime in the water used was essential to success. The hard and shelly (Mexican) cochineal, of a colour inclining to foxy red, made the best carmine. Whitening was a most important ingredient in the process. He then discussed the theory of this, and inferred that two colouring principles existed in cochineal—purpureo-carminic and coccineo-carminic acid, whereof the latter was unstable.—2. By Mr. Lewis (Corpus Christi College), "On a Roman Lanx and other antiques found at Welney." The lanx was found about four feet below the surface. It was a specimen of the flat dish bearing this name, which often was of great size. Pliny mentions one weighing 500lbs. The metal of that exhibited (according to an analysis made by Prof. Liveing) was 80 per cent. tin, 18·5 per cent. lead. In the centre was an elaborate pattern in a circle, with letters at equal distances in angles of the pattern. This had been read "VTERE FELIX." The reading, however, was doubtful. The author then commented upon other antiques of bronze, stone, and horn, from the same neighbourhood.

Derry

Natural History and Philosophical Society, March 4.—William Harte, C.E., F.R.G.S.I., president, in the chair. Mr. Harte communicated some observations on a remarkable meteor which passed over Donegal on the night of the 27th of December last; also a notice of a beautiful Aurora Borealis.—Mr. C. W. Dugan, M.A., read a paper on the "Gold Antiquities of Ireland," illustrated by drawings. In this paper he endeavoured to controvert some views adverse to the very early civilisation of Ireland; also some opinions advanced as to the source of gold from which the massive and gorgeous ornaments brought under notice had been fashioned. In connection with this paper there were exhibited some specimens of Irish ring money, &c., as also some splendid amber beads found on the property of Dr. Forsythe, and now in his possession.—Mr. Harte exhibited and made a few observations upon some beautiful cinerary urns found at Grange, near Strabane, and at Malins, Donegal. It is remarkable that a large urn and a small one were found together. These specimens are in good preservation. The black burnt ashes were adhering quite fresh to the sides of one of them.

EDINBURGH

Scottish Meteorological Society, March 30.—Admiral Sir William Ramsay in the chair. Dr. Keith Johnston read a paper "On the temperature of the Gulf Stream in the North Atlantic Ocean." He began by saying that he had read a paper on the Gulf Stream at the half-yearly meeting of the society in January 1862, which embodied the results of observations made in the Iceland seas by Captain Irminger, of Denmark. That paper attracted the attention of meteorologists, and the result was that new stations had been established by the society in Iceland and the Faroe Islands, each of them supplied with the best instruments, placed at the disposal of the council by the Board of Trade. The Meteorological Institute of Norway has, during the past three years, made observations of the temperature of the sea at the lighthouses round the coast as far north as 71°·6′ lat. N., and on board ships engaged in the Arctic fisheries. From these observations, together with those made at different stations off the Scottish coast, in Faroe, and in Iceland, Professor Mohn of Christiania, has just published a memoir on the temperature of this part of the Atlantic, illustrated by five charts for the four seasons of the year. The five charts exhibited were based on Professor Mohn's. The singular distribution of the temperature of the sea between Iceland, Scotland, and Norway must, as M. Mohn observes, be regarded as the best representation of the course and the extent of the Gulf Stream in these parts. The line designated as the thermal axis indicates the direction of the principal axis of the current. It is along this axis that the warm waters of the Gulf Stream are pushed forward by the current to the latitude of the North Cape and Spitzbergen. At the same time, the water is cooled as it advances, either from the effect of latitude or from the loss of heat experienced on both sides in beating the coast of Norway and in melting the ice of the sea between Greenland and Spitzbergen. The distribution of temperature during the summer months, being dominated by the solar heat, the isotherms of the sea have a greater tendency to follow the parallels of latitude. The thermal axis is, as it were, thrown on the shores of Norway, where it may be followed to the west coast of Spitzbergen and Nova Zembla. The distance of the thermal axis of the Gulf Stream from the west coast of Norway being not more than 125 miles, its effect on the climate of that country must be very remarkable. Thus we find that the west coast during winter has a temperature of the air which surpasses by from 40° to 50° that due to corresponding latitudes, if there were no current of warm water. On the shores of Norway round to the frontiers of Russia, the current of the sea is directed generally towards the north and east; and, carried by the current to this far northern region, products of the vegetable kingdom are often found which had their origin in the West Indies—a fact which proves beyond all question the existence of a north-eastern branch of the Gulf Stream thus far into the Arctic Ocean. Mr. Buchan said that, to illustrate the effect of winds upon the currents, he had looked into the question of the temperature of the air at various stations as compared with that of the sea. Over the whole of Scotland and as far west at least as Faroe, the winds were south-west in winter, there being very few easterly or north-easterly winds. In Iceland a different state of things prevailed, the mean direction of the wind being east-north-east. On the west coast of Norway, the prevailing direction was uniformly south-east, or south-south-east, that is to say the winds blow to a considerable extent off the land, where at that season the temperature is exceedingly low. In summer the winds in Iceland continue easterly, with some northing in them; but in the north of Scotland they prevail more from the west. On the coast of Norway, the summer winds take the opposite direction to those prevailing in winter. The same holds good in the south and north of Norway, where the difference was 4° in favour of the sea.—Mr. Buchan read a paper on the cold weather of May 1869. Mr. Buchan said the temperature of Scotland during May 1869, was 45·1°, which was 4·7° below the average of May in the past thirteen years, and 2½° lower than any previous May recorded.

Royal Society, March 21.—Prof. Kelland in the chair. Dr. Keith Johnston communicated a paper by Mr. Keith Johnston, jun., on the "Lake Region of Eastern Africa." See abstract of this paper in NATURE, No. 24, p. 607.

Royal Physical Society, March 23.—Professor Duns, D.D., president, in the chair. The following communications were read:—On *Crocodilus biporcatus* (Cuvier), the Muggar. By Professor Duns, New College, Note on the Capture of the Grey Seal (*Halichœrus grypus*) in the Firth of Tay. By Professor Turner. Note on the Preservation of Minute Animals in Acetic Acid. By T. Strethill Wright, M.D. Notice of an instance of Double or Vertical Hermaphrodism in a Cod Fish (*Gadus morrhua*). By John Alex. Smith, M.D.

Botanical Society, March 10.—Sir Walter Elliot, president, in the chair. On the Formation of a Museum of Vegetable Materia Medica. By William Craig, M.B. and C.M. On the Fructification of *Griffithsia corallina*, with a notice of the other *Algæ* found in Shetland, not mentioned in Edmonston's Flora. By C. W. Peach, A.L.S. On Two New British Hepaticæ. By Dr. B. Carrington. On the occurrence of *Luzula arcuata* and *Buxbaumia indusiata*, in Inverness-shire. By Dr. Buchanan White. On some recent Additions made to the Flora of Canada. By Mr. Sadler. Report on the Open-air Vegetation at the Royal Botanic Gardens. By Mr. M'Nab.

GLASGOW

Natural History Society, April 5.—Prof. J. Young, M.D., president, in the chair. The following papers were read:—1. "On shell mounds at the Machar Grogary, South Uist," by James A. Mahony. This paper was illustrated by a large collection of objects, chiefly shells of various kinds, bones of a number of animals, some of them drilled with holes, others split longitudinally, stone knives or scrapers, pieces of rude pottery, and other articles of a like nature, usually found in these refuse heaps. At the close of the paper, Prof. Young dwelt at some length in comparing these Hebridean mounds with what had been examined in the Eastern counties, especially in Caithness. 2. "On the sea anemones of the shores of the Cumbraes," by David Robertson, F.G.S. The author gave a complete list of the species taken by himself in that most interesting locality, and exhibited several living anemones in illustration of his paper.

MANCHESTER

Literary and Philosophical Society, April 5.—Dr. J. P. Joule, F.R.S., president, in the chair.—"Description of a New Anemometer," by Mr. Peter Hart. It consists first of a base board furnished with levels and levelling screws; to this is hinged the board carrying the U tube, which may be called the sloping base; on this sloping base is secured the U tube furnished with a scale and vernier capable of being read to the $\frac{1}{100}$ inch. By means of a screw passing through the sloping base, and resting on the lower base board, the former can be made to assume any angle with the latter, the angle being determined by a quadrant fixed to the lowest base board.

Mr. W. Boyd Dawkins, F.R.S., described the results of the preliminary investigation undertaken by the Settle Cave Exploration Committee. Mr. W. L. Dickinson read a paper "On the Eclipse of the Sun, Dec. 21—22." A paper was also read "On the Influence of Changes in the character of the Seasons upon the Rate of Mortality," by Joseph Baxendell, F.R.A.S.

PARIS

Academy of Sciences, April 11.—A memoir, by M. C. Antoine on screw propellers, was presented by M. Laugier. The author examined the two main questions relating to the employment of the screw-propeller, viz., the number of turns obtained by means of a given motive power, and the advance made by the vessel for each turn of the screw.—M. Cahours presented a note by M. L. Daniel, on the action of magnetism upon two currents passing simultaneously through rarefied gases. The author found that when the currents are passing in opposite directions magnetism separates them even in capillary parts of the tubes; when they are in the same direction, they are attracted or repelled like a single current. The magnetic properties of the gases have nothing to do with the condensation of the light by the magnet, which acts upon the current itself.—Notices of the Aurora Borealis of the 5th April were communicated:—From Angers by M. C. Dechanne, from Paris by M. Tremeschini, from Le Mans by M. Charault, from Louvain by M. Terby, from Auvers by M. Geslin, from Vendôme by M. Guerreau, from Betz by M. Fortier-Garnier, from Rohrbach by M. Gramant, from St. Lo by M. Lepingard, and from Loget-sur-Seine by M. Lagoret.—A memoir by M. C. Flammarion on the law of the movement of rotation of the planets, was communicated by M. Delaunay. From his calculations the author deduced the following as the law of the diurnal rotation of the planets:—*The time of rotation of the planets is a function of their densities.*

The rotatory movement of the planets upon their axis is an application of gravitation to their respective densities, and is equal to the time of revolution of a satellite placed at a distance 1, multiplied by a co-efficient of resistance representing the density of the planetary body, which is at the same time the square root of the relation of its weight to the centrifugal force. The squares of these co-efficients are equal to the cubes of the distances at which satellites would gravitate in the period of rotation of each planet, and the distance at which a synchronous satellite would gravitate round each planet is the cube root of the centrifugal force, and marks the theoretical limit of any atmosphere. By applying his law to the planets Uranus and Neptune, the author deduced a diurnal rotation of $10^h\ 40^m$ for the former, and of $10^h\ 58^m$ for the latter.—Facts towards the history of nitric acid by M. E. Bourgoin, were commnnicated by M. Bussey. The author described the decomposition of nitric acid at different degrees of dilution by the galvanic current. He regarded the formula of nitric acid as NO^5, $2\ H^2O^2$. With the acid in a very diluted state, only hydrogen was evolved from the negative pole; as the strength of the solution was increased the hydrogen evolved reacted upon the nitric acid, and caused the production of ammonia, free nitrogen, deutoxide of nitrogen, and nitrous acid, according to circumstances. With 15 equivs. of water nitrous acid remains in solution.—M. H. Sainte Claire Deville presented a note by M. Deschamps, on the metallic tartrates, in which the author described the preparation and characters of a double tartrate of sesquioxide of manganese and potash, having the formula: $Mn\ ^2O^3\ KO$, $C^8H^4O^{10}$, 4 HO.—M. P. Duchartre read some observations on the turning of certain fungi. The author described a case in which numerous examples of an agaric (probably *Coprinus radians*, Desmaz.) grew in perfect darkness from the bottom of a water tank, and consequently in a reversed position. They were all upon the southern portion of the tank, but their stems sloped towards the north, and in the mature examples were bent upwards at an angle towards their summits, so as to bring the head into its natural position with the hymeneal lamellæ downwards. The author cited also some experiments made with *Claviceps purpurea*, specimens of which placed in a reversed position curved upwards towards maturity, and thus brought their heads into the natural position. He considered these observations, especially the former, to be strongly opposed to the mechanical theories of the direction of growth in plants.—A note was read by M. H. Baillon, on the dissemination of the stones of *Dorstenia contrayerva*. The author noticed the structure of the fruit in *Dorstenia* and the allied plants, which he stated to consist of a number of small drupes. He stated that the parenchyma of each drupe is much more developed towards the base, and that the cells composing it acquire a great amount of elasticity, which, acting upon the stone when this is set free by the lesion of their upper part, projects it to a considerable distance.—M. Dumas in presenting M. Pasteur's great work on the diseases of silkworms, gave an excellent summary of its contents; and M. Guyon accompanied the presentation of his natural history of the chigoe (*Rhynchoprion penetrans*, Oken), with an elaborate analysis of the work.—M. Roulin communicated a note containing observations on the chigoe, supplementary to M. Guyon's remarks.—M. A. Duméril presented an account of the production of a white race of axolotls at the menagerie of the Museum, with some remarks on the transformations of those batrachians. The white race of axolotls has been established by breeding from ordinary females with an albino male, and again breeding from pale-coloured females thus produced with the same male. Some of the white individuals have undergone their complete transformation. The author stated that hitherto the transformed axolots (*Amblystoma*) have never propagated, and that an examination of their sexual organs showed ova and spermatozoids in plenty, but not in the perfect condition. The generative products seemed to have undergone an arrest of development at the metamorphosis.—A note by M. E. Duchemin was read, describing a singular cause of the death of carp in a piece of water at Montigny. The fish thrive in this water, but every spring a considerable number are found dead, and all these are blind. This blindness is ascribed by the author to the attacks of toads, which fix themselves upon the heads of the fish, and do not quit their hold even when taken out of the water. As remarked by the Secretary of the Academy, this habit of the toad has been long known.—M. C. Robin presented a note by M. Legros on the real origin of the secretory canals of the bile.—M. Guyon presented statistics of the cases of hydrophobia observed among Europeans in Algeria from 1830 to August 1851.—A note on the operation of artificial pupil, by M. Liebreich, with figures of an instrument employed in the operation, was communicated.—Of several other papers no particulars are given.

Brussels

Royal Academy of Belgium, March 5.—The following papers were read:—1. On the Aurora Borealis in the months of January and Febuary 1870, by M. A. Quetelet.—2. On commensalism in the animal kingdom, by M. P. J. Van Beneden. The author distinguishes under the name of commensalism those cases in which one animal lives upon another, but not at its expense. In the present paper he described some new examples of this phenomenon. On the authority of M. Alex. Agassiz, he noticed a *Lepidonotus* which lives near the mouth of *Asteracanthion ochraceus*, Brandt, a small *Clupea* which resides among the fringes of a Pelagian Medusa (*Dactylometa quinquecina*, A. Agass.), a species of Hirudinea which lives in a Beroid (*Mnemiopsis Leydii*), a *Philomedusa*, (named *Biccidium* by L. Agassiz) which haunts the buccal fringes of the great *Gauea arctica*, a *Hyperina* which infests the disc of the American *Aurelia*, and a *Planaria* (*P. angulata* Müll,) which attaches itself to the lower surface of the King Crab, near the base of the tail. M. Agassiz also states that the young *Comatulæ* like to affix themselves to the basal cirri of the adults. M. Van Beneden also noticed, on the authority of Risso, that the Fishing Frog (*Lophius*) lodges a species of Muræenid (*Apterichthys oculata*) in its great branchial sac. He referred to the polype, which so generally coats specimens of *Hyalonema*, as furnishing an example of commensalism, and in connexion with *Hyalonema* as a Sponge reaffirmed his opinion that Sponges represent the polype type reduced to its simplest expression; a notion very like that which has lately been put forward by Häckel.—3. Remarks on the equation $x^m - 1 = 0$, by M. E. Catalan.—4. Note on the nature of the sun, by M. G. Bernaerts, in which the author maintained that the sun consists of a gaseous nucleus covered with a thin, incandescent liquid layer and luminous clouds.—5. On the meteoric stone which fell at Saint Denis-Westrem, near Ghent, on the 7th June 1855, by Dr. Stanislas Meunier. The author stated that the material of this meteorite, of which a portion, weighing 723 grammes, was picked up, is identical with that of many others, including the meteorite of Lucé (1768), whence he proposes to call it *lucéite*. He gave the analysis of another stone, which fell in the Lower Pyrenees in 1868, and remarked upon the occurrence of *lucéite* in various brecciiform meteorites, associated in some with an oolitic mass which he denominated *montrejite*, from the stone of Montrejeau (1859), and which, in other meteorites occurs alone. The author maintained that the formation of meteorites is due to the natural breaking up of larger celestial bodies at the close of their development, and that the moon is now approaching this stage of its existence.—6. On Bryonicine, a new nitrogenous substance extracted from the roots of *Bryonia dioica*, by MM. L. de Koninck and P. Murgart.—This was described as of a very pale, yellow colour, crystallising from dilute alcohol in slightly flattened and irregularly intermixed needles, neutral, insoluble in cold water, potash, ammonia and dilute mineral acids, soluble in alcohol, ether, &c., and in glacial acetic acid, and concentrated sulphuric acid, with the last giving a blood-red solution. The formula was stated to be $C^{19}H^{16}N^2O^9$.—7. Investigations on the embryogeny of the Crustacea, by Dr. E. Van Beneden.—In this paper the author described in detail the development of the genera *Anchorella*, *Lerneopoda Brachiella and Hessia*, the last-named a new genus.—8. Discovery of a deposit of phosphate of lime beneath the town of Louvain, by Prof. G. Lambert. This bed was discovered in 1869, in boring an artesian well; it commenced at a depth of 105-50 mm., and was 5 mm. in thickness, containing nodules of phosphate of lime like those worked for manure in this country.

Vienna

Imperial Academy of Sciences, Feb. 17 (continued from p. 618).—11. Prof. Brücke communicated the results of his investigations of the digestive products of the albuminous bodies.—12. Experimental investigation on the diffusion of the gases without porous septa by Prof. Loschmidt. The author had investigated the rapidity of diffusion of two gases superimposed in layers and in contact upon a horizontal plane. His experiments related to air and carbonic acid, carbonic acid and hydrogen, and hydrogen and oxygen. Their chief result is the law of the proportionality of the constants of diffusion with the

squares of the respective absolute temperatures.—13. Project for preliminary operations in connection with the transit of Venus in 1874, by Dr. G. Neumayer, in which the author discussed at considerable length the measures to be taken in the observation of that important phenomenon.—14. Prof. E. Ludwig noticed an investigation made by himself and Dr. C. Graebe upon some derivatives of napthaline allied to the chinones.—In presenting the fourth part of Dr. Manzoni's "Bryozoi fossili Italiani," Prof. Reuss noticed its contents, which include the descriptions of twenty-four species of fossil *Chilostomatous Bryozoa*, partly from the pliocene of Calabria and Castellarquato and partly from the miocene of Turin, &c. Nine species are described as new. This part also contains a critical examination of all the Italian fossils of this class. The report of the observations made during February at the Central Institution for Meteorology and Terrestrial Magnetism was communicated.

Imperial Geological Institution, March 16.—M. C. Griesbach, in a letter dated Port Natal, January 3, 1870, relates that he found fossils in the sandstone of the Table mountain. On a journey into the Griqua-land, he discovered also a large series of very well-preserved fossils, which he thinks belong to the Tithonic series.—Baron O. Petrino, On the origin of the Löss. Researches in the territories of the Dniester, the Pruth, and the Sereth rivers have led the author to the following conclusions:—(1) The Löss is the product of slowly running rivers, deposited from the upper part of the mass of water which during inundations overflows the surrounding country; (2) the time of its formation begins with the end of the glacial period, and has continued up to the present day; (3) within the löss-deposits layers of different periods are, locally, easily to be distinguished. The old river terraces and banks of pebblestone and sand are the product of quicker running rivers, which excavate their bed more rapidly. They are contemporaneous with the löss-deposits.—Dr. Bunzel exhibited a series of fossil bones from the upper chalk formation of Grünbach, near Neunkirchen in Austria. They form one of the most interesting palæontological discoveries which we have met with in the last few years. Dr. Bunzel recognised among them remains from animals of the families of the *Crocodilians*, *Lacertilians*, *Dinosaurians*, and *Chelonians*. The *Lacertilians* are especially represented by a new genus very nearly allied to the gigantic *Mosasaurus* from Mästricht, which genus has received the name *Danubiosaurus*. To the *Dinosaurians* belongs a new species of *Iguanodon*, *I. Suessi* Bunz. A very peculiar type is indicated by a skull of a saurian, in many respects resembling that of a bird, which he has called *Struthiosaurus*.—Charles von Hauer, On the deposit of Potassium-salts at Kalusz (Galicia). They form a layer seventy feet thick. The whole mass contains on an average 15·5 per cent. potassium, and consists of a mixture of the mineral species, kainit, sylvin, and salt. The presence of sulphuric acid renders it more suitable for all industrial purposes than the well-known layer of Stassfurth, Prussia.—D. Stur has shown by an accurate examination of a large series of fossil plants, that the red sandstones of the Banat belong to the Permian (Dyas) formation, and that the coal-measures below it belong to the fifth or fern-zone (Geinitz) of the carboniferous formation.

Anthropological Society, March 22.—Prof. Bokitansky in the chair. Prof. Müller on the origin of the writing of the Malayan peoples. The author argued against the views defended especially by the English ethnologist, Crawfurd, the famous Malayan scholar, that the Malayan alphabets (the writing of the Battak, the Redschang, Lampong, Bugi, Makassar, and Tagulo peoples) are an independent invention. By the form of the single letters, as well as by the manner used to indicate the vowels, he proved that these alphabets originate from the old Indian writing which is to be found in the Buddhistic inscriptions. In connection with this question he spoke also of the origin of the Indian writing generally, and by a comparison of the old Indian with the Malayan alphabets, he comes to the conclusion that the Indian writing originated from an old Semitic alphabet. He remarked especially on the close relation between the language and the writing, and pointed out the progress which the people made by developing the writing with syllables (Silbenschrift) to a pure sound-writing (Lautschrift).—Franz v. Hauer offered to the society a large series of pre-historic archæological objects found in different parts of the Austro-Hungarian monarchy. Of very high interest among them are stone (Obsidian) implements, recently discovered by H. Wolf in the environs of Tokaj (Hungary). They have been found in many different spots, partly actually on the surface, partly in a particular stratum, covered with a bed eight feet thick of quicksand. The implements are not polished, they are accompanied by fragments of very rude vessels, by bones, and rarely by metal objects. The analysis of one of the latter, made by A. Patera, gave in 100 parts 63·75 silver, 32·5 copper, 2·0 tin, 0·125, gold, and traces of iron. The collection contains further perfectly well preserved rude vessels from Morovan near Pistyan in Hungary, fragments of similar vessels from Waitzen on the Danube, many objects from Olmütz, &c., Von Hauer remarked besides that all the remainder belong to the alluvial period, and that we have hitherto possessed very few indications of the existence of man in the diluvial (postpliocene) period in Austria. Count T. Wilczek dedicated to the society a sum of 2,000 flor. (200 l. sterl.) for excavations in the celebrated sepulchral field of Hallstatt, and for an exploration of the lakes of Upper Austria for pile-buildings.

DIARY

THURSDAY, April 21.

Linnean Society, at 8.—On the Vertebrate Skeleton: Mr. St. George J. Mivart.
Chemical Society, at 8.
Numismatic Society, at 7.

FRIDAY, April 22.

Quekett Microscopical Society, at 8.

MONDAY, April 25.

Royal Geographical Society, at 8.30.
London Institution, at 4.

TUESDAY, April 26.

Royal Institution, at 3.—On Moral Philosophy: Prof. Blackie.
Ethnological Society, at 8.—On the Philosophy of Religion among the Lower Races of Mankind: Mr. E. B. Tylor.—On the Brain in the Study of Ethnology: Dr. Donavon.
Society of Antiquaries, at 2.—Anniversary Meeting.

WEDNESDAY, April 27.

Society of Arts, at 8.
Geological Society, at 8.

THURSDAY, April 28.

Royal Institution, at 3.—Electricity: Prof. Tyndall.
Royal Society, at 8.30.
Zoological Society, at 8.30.

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