NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE

"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH

No. 23] THURSDAY, APRIL 7, 1870 [PRICE FOURPENCE

Registered for Transmission Abroad]

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THE SOCIETY OF ARTS CONFERENCE

THE Society of Arts is entitled to the thanks of the community for the service it performs in holding from time to time conferences for the discussion of public questions of immediate interest. Technical education, street tramways, the sewage question, and the Channel-spanning problem, have all been recently discussed in this way. Last Thursday another national movement, of greater importance than even any of those we have named, was brought under discussion at one of these useful gatherings, namely, the Relation of the State to Science,—a movement that could not have a more natural or more influential supporter than the Society whose special province it is to advance the practical application of science to the needs of our daily life.

The Conference was opened by a paper by Colonel Strange, "On the proposed inquiry, by a Royal Commission, into the Relation of the State to Science." The part which deals with the scope of the intended inquiry we reproduce in another column: we published some time ago a narrative of events.

It is easy to see that in the paper which formed the subject for debate, the writer aimed at giving to the discussion a practical direction, calculated to assist those interested, including the Government, in determining what objects should claim the attention of the Royal Commission which will probably soon be issued. The Conference, though not numerously attended, included many of our most eminent men of science, and the speakers were all of that class. Professor Williamson, of University College, and Dr. Miller, of King's College, addressed themselves chiefly to the educational side of the question, and insisted on the rights of independent teaching of which they are the recognised champions—rights which Colonel Strange in his paper mentions prominently as demanding examination. Professor Williamson forcibly deprecated any cut-and-dried scheme, thus endorsing Colonel Strange's recommendation that the fullest possible inquiry into all existing scientific agencies should be made first and foremost. Dr. Balfour Stewart suggested a very comprehensive classification of scientific work into Observational work, Experimental work not involving time as an essential element, and Experimental work involving time as an essential element. Of these, he stated that the first and last require the permanence and continuity of State institutions, and have been much neglected in England, while the second can to a great extent be achieved by individuals labouring independently. No doubt this classification will more or less form the basis of the scientific system of the future.

The Astronomer Royal, speaking with an evident sense of the weight that must attach to his opinions on such a subject, and in a tone that might almost be called official, announced his belief that much good would come of the proposed Royal Commission. He illustrated the confused state of our scientific officialism by a humorous description of the accounts of the Royal Observatory, of which three distinct sets were required, one for the Admiralty, another in a different form for the Treasury, and a third "to reconcile the other two." He considered that the present movement tended to the creation of a salaried Academy, to which he did not seem opposed, though he pointed out that there are some kinds of inquiry which such a body would never have initiated, as for instance the discovery of Neptune, and Mr. Lockyer's solar researches. Dr. Mann, Mr. De la Rue, and the Rev. Arthur Rigg warmly supported the recommendation that the inquiry should be full. Mr. Edwin Chadwick particularly dwelt on the advantage of official concentration in science, in a speech full of practical sagacity. The discussion was summed up most ably by the chairman, Lord Henry Lennox, President of the Society of Arts, who, in responding to a pointed appeal made to him by Mr. Chadwick, told the meeting how, on one occasion, desiring to ask in the House of Commons a question regarding some scientific matter, he found that it affected four different departments, and should therefore elicit a quadruple reply, the horrors of which he evaded by most informally putting the inquiry to the Premier himself. He did not add that his desire for information was gratified.

The proceedings of the Conference were brought to a practical issue by the following resolution:—"That this Conference desires emphatically to affirm the conclusion of the British Association for the Advancement of Science, that a Royal Commission to inquire into the relations of the State to Science is very desirable, and to recommend that the scope of the inquiry be made as wide as possible." This motion obviously conveyed the sense of the meeting with accuracy, and it was carried unanimously. The chairman announced that the resolution and a full report of the conference would be forwarded by the Council of the Society of Arts to the Government.

Armed with so competent and united an expression of opinion, following up that already given by the British Association, the Government will, no doubt, invest the Commission with very full powers. A little consideration, indeed, will show that the wider the scope given to the inquiry, the more easy will it be to conduct it. Nothing would be so difficult as to confine inquiry to selected portions of such a subject, all the parts of which are so intimately connected as to preclude the possibility of entering on one without trespassing on those which surround it. The whole field of science must be submitted to a comprehensive survey, before any project for its effectual cultivation can possibly be devised. The plain assertion made in Colonel Strange's paper, that at present we have not even the nucleus of a scientific system, received the tacit assent of the Conference, no speaker thinking it worth while to do more than incidentally illustrate its truth. Comprehensive confusion needing comprehensive remedies must first undergo comprehensive examination. We agree with those who think it will be difficult for the Commission to construct a new and complete system. A good and durable system must, as Dr. Mann expressed it, be built up by degrees—brick by brick, as it were. This work is administrative, not deliberative, and should therefore properly devolve on the Minister entrusted with the Department of Science. If, with the materials furnished by the Royal Commission to his hand, he cannot work them into shape, the course is simple—change him!

OUR NATIONAL DRINK

Strong Drink and Tobacco Smoke: the Structure, Growth, and Uses of Malt, Hops, Yeast, and Tobacco. With 167 original illustrations, drawn and engraved on steel by Henry P. Prescott, F.L.S. Pp. 71. (London: Macmillan and Co. 1869.)

Burton-on-Trent: its History, its Waters, and its Breweries. By William Molyneux, F.G.S. Pp. 264. (London: Trübner and Co. Burton-on-Trent: Whitechurch.)

WHEN Mr. Gladstone, some years ago, inaugurated a new era, and opened British ports to wine which could not be brought here previously on account of its value being actually less than the duty it was subject to equally with wine of the most costly sort, it was believed by many that a serious blow had been dealt against a branch of home industry—the production of malt liquor—which is probably more peculiar to this country than any other.

The fact that there has always been a host of poetic and jubilant notions associated with the name of wine, as well as the enhanced estimation of a thing not easily obtainable, may have seemed good reasons for anticipating a very general desertion of beer in favour of cheap wine; but when the inaccessibility which lent enchantment to the name of wine was replaced by the sour reality of shilling hock or claret, the halo of imaginative recommendation was soon dispelled; consequently, these beverages have been very generally classed among things to be avoided, and even "Gladstone" sherry is regarded with profound suspicion. Meanwhile, our national drink has maintained its supremacy, and though its prospects were for a time clouded by the advent of cheap wine, it may safely be said that while the beer-drinking class in this country is quite as large as ever, the amount of malt liquor consumed has scarcely been affected by the introduction of cheap wine.

One of the works referred to at the head of this article gives some account of the materials used in the production of beer, and of the operations they are submitted to; the other contains a history of a town which is now famous as one of the chief seats of the brewing trade, together with an account of the topography and geological features of the neighbourhood. There is also a good description of the breweries, and of the enormous extent to which the industry has grown, with much interesting information as to its origin and development.

The beer-consuming propensity of the Briton is not a characteristic exclusively his own. The Germans, Russians, and Belgians, have long been famous for their cerevisial devotion, and even the Frenchman is rapidly acquiring a taste for beer which demands satisfaction in spite of national tradition and fiscal regulations. At the same time, though the general excellence of British beer has so long been notorious throughout Europe, and the later fame of bitter beer has now become familiar in all parts of the world, it is not without a rival in the beer of Bavaria and Austria; and, while the stupendous proportions of British breweries as well as our vast trade in beer may have hitherto justified the belief that this country was without a competitor in the art of brewing, the rapid development of this branch of industry in Germany and Austria within the last few years is well calculated to suggest the question whether we may not before long find that in this art, as in most others, we no longer occupy a position of secure pre-eminence, but have to contend with other nations for a place in the markets of the world, if not in that of our own country.

The beer of Austria is already imported here and sold in London. It is largely consumed in Paris, where it excited quite a *furore* during the Exhibition of 1865. Moreover, the Austrian breweries, though of comparatively recent origin, are on a scale approaching that of our own great beer-producing establishments. Down the whole length of the Lower Danube, beer-brewing has become a settled and lucrative business. On the shores of the Black Sea and even in Constantinople this is also the case. Almost every town of any importance has its brewery, or several of them, where excellent beer is made. The proximity of these countries to grain-producing districts, as well as the extension of agriculture in the plains of Hungary and elsewhere, are all circumstances in favour of the development of this industry, and the opening of a means of transport to India and China by the Suez Canal may well afford an opportunity for future competition with this country in the supply of beer to those large markets which it has hitherto been our exclusive privilege to provide with beer.

Here, then, is a possibility of British beer finding a rival much more formidable than cheap wine is at home, and in this view of the subject it may be interesting to the readers of NATURE to know something more of the peculiarities of German beer. With the exception of Belgium, where inferior kinds of beer have long been made, the chief seat of beer production, until within the last few years, was Bavaria, and the beer made there was celebrated throughout the Continent. This beer is made by a method different from that practised in this country, and the difference consists chiefly in conducting the fermentation at a very low temperature. Under this condition the yeast that is produced does not collect as a scum at the surface of the fermenting wort, as is the case in our system of brewing; but it separates as small clots or flocculi, which fall to the bottom of the liquor, leaving the surface freely exposed to the atmosphere. The beer brewed in this way is less liable to become sour when kept than beer brewed by the method of frothing fermentation, and this is one of the special characteristics of Bavarian beer. Liebig, who has devoted much attention to the subject, explains this difference as resulting from the facility afforded by sedimentary fermentation for atmospheric oxidation of the soluble gluten, or that constituent of beer wort from which yeast is produced by oxidation. In frothing fermentation this action of the atmosphere is prevented by the layer of yeast collecting at the surface of the liquor. The formation of yeast then takes place by abstraction of oxygen from sugar, and consequently, since beer wort contains more soluble gluten than is requisite for converting the sugar into alcohol, the proportion of sugar to gluten is still further reduced in that way; so that after fermentation has ceased, some of the gluten still remains unaltered in the beer, and, by a subsequent slow fermentation, is capable of determining the conversion of alcohol into acetic acid. In sedimentary fermentation, on the contrary, the unimpeded action of atmospheric air has the effect of separating the whole of the gluten from the wort

by converting it into yeast without any decomposition of sugar, otherwise than into alcohol and carbonic acid.

The brewing of beer on this system has latterly extended beyond Bavaria, and it is now extensively practised in Austria and the Rhine district, where the frequent occurrence of basalt and other porous volcanic rocks presents great facilities for making brewing vaults and cellars, in which a low temperature can be maintained. The various details of the art of brewing have also been carefully studied by chemists with Government support, and the rapid progress of this industry in Germany serves well to illustrate the great advantages resulting from the application of scientific skill to practical subjects. There are not a few of our own industrial arts that would be, in like manner, benefited by a better appreciation of the aid which science is capable of rendering them; not a few that are sorely in need of this aid to enable them to keep abreast of the progress made in other countries.

BENJAMIN H. PAUL

OUR BOOK SHELF

Handbuch der Allgemeinen Himmelsbeschreibung. Von Hermann J. Klein. Das Sonnensystem. (Braunschweig, 1869.)

THIS work professes to combine a full account of the most recent physical discoveries in astronomy, with an exact statement of all those points which are commonly met with in handbooks of the science. The present volume, as will be gathered from the title, deals only with the solar system. Certainly it cannot be said to bear out in full the promise of the author. We are particularly struck by the almost entire absence of reference to the labours of English spectroscopists within the bounds of the solar system. Mr. Huggins's researches on cometic spectra are briefly referred to; but his observations on the spectra of the planets are passed over in silence, while place is given to the comparatively less valuable researches of the Padre Secchi on the same subject. We should be far from desiring to undervalue the researches of the eminent Italian astronomer; but no one who is acquainted with the circumstances under which Mr. Huggins and Father Secchi have respectively observed the planetary spectra, could think (we imagine) of comparing the Italian with the English series of observations. A similar remark applies to the solar researches of Father Secchi, which have not been made with sufficient dispersive power to be fairly comparable with the researches of Mr. Lockyer. Yet the labours of the last-named observer are passed over unnoticed, not only in the body of the work, but in an appendix, wherein the author treats specially of recent solar observations. In a note, a brief and inexact account is given of Mr. Lockyer's discovery that the bright lines of the prominence spectra can be seen when the sun is not eclipsed. After this, it is surprising to find that a full account is given of Professor Tyndall's ingenious theory of comets.

The treatise is one, however, we can on the whole recommend. The arrangement of the chapters on the planets is particularly clear and satisfactory. It is noteworthy that the author, with praiseworthy exactness, gives the secular variations of the planetary elements to the term involving the square of the time.

We were inclined to take exception at the manner in which Professor Adams's labours on the planet Neptune are left to the very end of the chapter on the planet; and we still think that their proper place would have been immediately after the account of Galle's detection of Neptune. This, however, is perhaps a small matter; and the statement of the relative claims of Adams and Leverrier is in pleasing contrast with the unjust account which some continental astronomers have not scrupled to give of the matter. Not only does Herr Klein recognise the claims of Adams, but he assigns the just and sufficient reason for putting the two astronomers on the same level, that "Leverrier can no more deserve credit because Neptune was actually discovered before the end of September 1846, than Adams can deserve blame because Challis, up to that very time, though he had indeed found Neptune, had not yet recognised the planet."

R. A. PROCTOR

St. Pierre's Dictionary of Botany.—*Nouveau Dictionnaire de Botanique.* Par E. Germain de Saint Pierre, avec 1,640 figures. Pp. 1,388. (Paris: J. B. Baillière et fils, 1870. London: Williams and Norgate.)

WHEN it is recollected that this bulky volume is the product of a single mind, the industry, no less than the encyclopædic knowledge of its author, strikes the reader with astonishment. Whether it is desirable in the interests of science that a publication of this kind should be the work of one man is another question. The system pursued in the compilation of cyclopædias, of relegating each separate article of importance to the man who has paid special attention to that particular subject, has its advantages, and what is lost in unity is gained in exactness and thoroughness. In these days of subdivision of scientific labour, even a man of M. Germain de St. Pierre's vast erudition cannot be the highest authority in every branch of his science, and accordingly we find the articles of very unequal interest and value. Thus, under the head "Herborisation" occurs a list of plants gathered in the environs of Paris by Cornuti, in 1635, valuable, no doubt, in its way, but altogether out of place in a botanical dictionary. On the other hand, so many interesting observations have lately been made on the physiology of climbing plants by Mr. Darwin and others, that we turned with interest to this volume to acquaint ourselves with the newest researches on the subject. The heading "Liane" does not appear at all, while under "Grimpant" there are just a dozen lines, and no reference to any other article. Dissertations on the relative advantages of living in Paris and in the country like that under "Laboratoire du Botanique" might have been altogether spared. Other objections might readily be made to the plan of the work. A short description of the leading characters of each natural order is useful, but the utility would have been increased by inserting the Latin names of the orders, with a reference from them to the French names, as from *Ranunculaceæ* to "*Renonculacées*," or from *Umbelliferæ* to "*Ombellifères*." The selection of a few genera and even species for description does not commend itself in the same manner, and the selection must necessarily be arbitrary and partial. Nevertheless, with these defects, we have in the work before us a most useful and valuable cyclopædia, containing an immense mass of information on every branch of botany, which cannot fail to be almost a necessary book of reference alike to the man of science and the student. On those subjects in particular in which M. St. Pierre is an acknowledged authority second to none, the work is especially valuable. The illustrations are copious and admirable.

A. W. B.

THE second fasciculus of the twelfth volume of the *Atti della Societa Italiana delle Scienze Naturali*, which has lately reached us, contains only two zoological papers. The most important of these is a systematic catalogue of the testaceous mollusca of the neighbourhood of Spezia and of its gulf, by Dr. C. T. Canefri, which will be of value to the student of geographical distribution. The other includes the first century of South American Coleoptera, by Prof. P. Strobel, with descriptions of numerous new species by Dr. E. Steinheil.

THE ABUSE OF WATER

THOSE who have travelled in remote districts, even at home, cannot fail to have experienced at some time or other a keen sense of the fact that water is one of the most peremptory necessities of life, one which Nature generally supplies so freely and bountifully that habitual familiarity with the gift sometimes tends to lessen its appreciation. Moreover, the utility of water in various ways as a source of power, a means of communication, or a material of manufacturing industry, has led to its application for a multitude of purposes besides the daily wants of life, and in many cases, unfortunately, this has been done in a way that has been attended with very serious consequences as regards the condition of natural sources of water supply.

To take, for instance, the case of our largest river whence the inhabitants of London chiefly derive their supply of water. It became apparent some 20 years ago that the condition of the water, resulting from a variety of polluting influences, was so bad, that the river within the boundary of the metropolis was no longer a fit source of water-supply for domestic use. The commissioners appointed at that time to inquire into and report on the subject, stated as the result of their inquiry that they doubted whether the existence of organic contamination from town drainage was then perceptible in the water of the Thames above the reach of the tidal flow, or that it amounted to a sensible evil, although, as the main drain of a large and populous district, the Thames was at all seasons polluted by surface drainage, and by the sewage of several considerable towns, there being then a population of more than three-quarters of a million on the banks of the river above Kingston. They supported this conclusion by referring to the probability that the large dilution of the sewage with the well-aërated water of the river was attended with such an effect as to cause the disappearance of impurities and their conversion into harmless products of decomposition. But, at the same time, they added that, since the contamination of the water by sewage could not fail to become considerable and offensive with the increase of population and the more thorough and general drainage of towns, it appeared to them only a question of time when the sense of this violation of the purity of the river should decide the public mind to the entire abandonment of the Thames as a source of water supply, unless, indeed, artificial means of purification should, in the meantime, be devised and applied.

Since the date of this report the application of the system of water-carriage removal of excrementitious material from dwellings has been extended in the towns situated in the upper valley of the Thames, and consequently the discharge of such contaminating material into the river, as sewage, has become more direct and more abundant. Hence we find that on several subsequent occasions the foregoing view of this subject has been strongly urged by other authorities, with the addition of warnings that the evil, merely apprehended before, had actually come into existence. Thus in 1858 the first report of the Royal Commissioners on the sewage of towns represented the increased pollution of rivers as an evil of national importance urgently demanding remedial measures, notwithstanding the natural agencies at work to effect the purification of flowing water. Moreover, the influence of water, thus polluted, as a source of disease, was earnestly dwelt upon. Their second report, in 1861, stated that the still increasing pollution of rivers had become so great and general that, besides being in some instances a nuisance and rendering the water utterly unfit for drinking, it was a general source of serious danger of infection for persons consuming even water that presented no appreciable sign of such pollution. Again, in 1866 and 1867 the reports of the Rivers Commission, dealing chiefly with the Thames basin above Hampton and that of the Lea, illustrated very forcibly the abominable effects of the discharge of sewage into these rivers, which are the chief source of metropolitan water supply. Referring to the spontaneous purification of flowing water by atmospheric oxidation—alleged by some to be adequate to render polluted water free from any objectionable character—these reports state that, though the process tends to purification, it is no sufficient guarantee for the water being purged of injurious sewage taint;—that, though the water supplied to London usually contains but a very limited amount of organic impurity, even that fact is, under existing circumstances, no satisfactory ground of assurance that the metropolitan supply of water is wholesome, or that the London drinker of water may not be drinking with it some remnant of the filth of other towns.

The report just issued by the Rivers Pollution Commission reveals the existence of a still more frightful state of rivers in the manufacturing district of Lancashire, where the pollution of the water has reached such an extent that, as compared with the Thames at London Bridge, the rivers are in several instances mere open sewers. That such should be the case is not indeed surprising, when it is considered that in this locality there is an enormous demand for water for all kinds of industrial purposes; that the water generally becomes fouled by such use, and, moreover, that the population has, in some parts, increased fourfold during the last seventy years. This latter circumstance has a much greater influence as a cause of pollution than has been supposed; but the effect of the use of water for manufacturing purposes alone has been, in the words of the Commissioners' Report, "to absorb the whole of the stream, which is the outlet of the drainage of the country, and to apply it to manufacturing purposes solely, so as to throw out of sight altogether the right of the dweller on the bank of a stream to the use of the water of that stream, and, gradually, to assume that the extent of the evil, or the magnitude of the profits which arise from the *abuse* of water in various processes of manufacture, is sufficient justification of the course followed up to the present time."

The Lancashire rivers present a peculiar form of pollution, resulting from the discharge of manufacturing refuse into them. Among the materials thus introduced into river water is arsenic, which is largely used in the calico-printing works. The foul water running from one company's works was found to contain as much as ·042 lb. of arsenous acid in 100,000 lb. Several of the rivers in the Mersey and Ribble basins are thus becoming contaminated with arsenic; and though it appears that the arsenic is, in some respects, gradually got rid of and deposited in the mud, this probably is not always the case. Arsenic is also contributed by aniline colour works and woollen manufactories. In the latter case, its source is ultimately the iron pyrites now so largely used for making sulphuric acid. Taking the quantity of pyrites imported for this purpose to be 400,000 tons a year, and the amount of arsenic it contains at a moderate average, we thus import 1,600 tons of arsenic, of which, there is reason to believe, a large proportion ultimately finds its way into our rivers and streams. In its course there it is sometimes met with in soap, as well as washing soda, and in the soda-ash used for making them. In this way it is met with in London sewage at Barking to the extent of ·004 parts in 100,000.

The Commissioners do not take an alarmist view of this wide distribution of arsenic, for since they find it in appreciable quantity in the rain falling in London, they consider it would also be met with in the case of most large towns as derived from coal smoke; but they suggest that care should be exercised in alkali works to prevent its unnecessary introduction into manufactured products, and they consider that might be easily done.

As regards that pollution of rivers which is due to

admixture of human excretal refuse with their water, it has long been maintained by the local authorities of many parts of Lancashire that the evil was less in that district than elsewhere, in consequence of the system adopted there for dealing with such refuse not affording such facility for its discharge into rivers as the water carriage system. On this ground the introduction of the water system of sewerage has been strenuously opposed. The report of the Commission, however, dispels this illusion by evidence which is conclusive in proving that the use of the old form of closets with ash pits, earth closets, &c., affords no protection to rivers. From a long series of analyses of sewage from towns where such closets and middens are used, it appears that, as compared with the sewage from towns where water-closets are used, the composition of both are remarkably similar. Besides the nuisance and other inconveniences of the dry closet system, it appears that the pollution of rivers is but very slightly prevented by it. On the other hand, while the advantage gained by that system consists merely in the retention of a small proportion of the excreta in a state to be available for agriculture, the treatment to which that portion is subjected renders its value as manure very small. Moreover, this is usually effected only at the expense of great risk to public health, and at a cost which is on the average double the money return obtained. The Commissioners, therefore, come to the conclusion that the retention of solid excreta in middens is not attended with any considerable diminution in the strength of the sewage, though the volume is somewhat reduced. On that ground they consider it hopeless to anticipate any substantial reduction of sewage pollution of rivers by dealing only with the solid residue of excreta. At the same time they point out the fact that the discharge of excretal refuse into rivers is not a necessary part of the water-closet system.

As to the influence of the dry closet system on health, the Commissioners refer to the returns of the Registrar-General, and to other evidence, as showing that typhoid fever, scarlatina, diarrhœa, and other epidemic diseases, commit fearful ravages amongst the populations exposed to the pestiferous influences it exercises, and they express the opinion that to it may be attributed much of the responsibility for the high death-rate of South Lancashire towns. They have, however, been unable to obtain conclusive evidence of this owing to the incompleteness of the health statistics. They express astonishment at the frequent inability of Health Boards to inform them of the death-rate in their districts, still less to give information as to particular parts of them.

It is a very general opinion of medical men that the presence of an extremely minute amount of organic impurity may, under certain obscure conditions, render water unwholesome, and capable of causing or propagating disease, especially if that impurity be of animal origin. Sewage is the source from which such impurity is most likely to originate in a specially dangerous form, and it appears the amount capable of causing injury may be so small as to have no influence on the outward appearance of the water. To the smell, sight, and taste all may seem innocuous, and yet there may be present an infinitesimal portion of substance rivalling in potency the most virulent poison.

That water subject to such contamination is thereby rendered unfit for human use, and repugnant to every sense of decency, can, it is believed, require no arguments to be admitted. That the use of such water is, moreover, dangerous and unwholesome, would seem to be suggested by a knowledge of the changes which excretal refuse naturally undergoes, and of the circumstances attending those changes. The medical officers of Her Majesty's Privy Council, after specially studying numerous instances of the outbreak of typhoid fever and cholera, have almost invariably found that the prevalence of these and other epidemic diseases was accompanied by the use of water that had been polluted with drainage from cesspools or sewers. But at the same time it has been impossible to detect or demonstrate, by chemical analysis, the presence in the water of anything to which a fatal influence or the production of disease can be ascribed. This fact, however, does not in any degree, afford a ground for regarding the water as free from suspicion. Such reasoning would apply with equal force to sewage itself, for chemical analysis does not indicate the presence in it of anything specially noxious.

It has indeed often been alleged that if sewage be mixed with twenty times its volume of river water, the organic matter which it contains will be oxidised completely while the river is flowing a dozen miles or so. Considering the importance of the subject, it is surprising that this assertion, though confidently made in many instances, should hitherto have rested upon no more solid foundation than mere opinion. But at last the test of positive inquiry has been applied by the Rivers Pollution Commissioners. The composition of the water of the Irwell, the Mersey, and the Darwen at various points in the course of these rivers has been ascertained with due regard to complications introduced by the influx of unpolluted affluents. The results have shown that when the temperature is not above 64° F., a flow of from 11 to 13 miles produces but little effect upon the organic material dissolved in the water. Examination of the gases dissolved in water containing an admixture of sewage led to the same result. Lastly, experiments devised to augment the effect of atmospheric oxidation on such water, so as to represent a flow of from 96 to 192 miles in a river at the rate of 1 mile an hour, showed that the reduction of organic carbon in the water amounted to only 6·4 and 25·0 per cent., that of organic nitrogen to 28·4 and 33·3 per cent., though the temperature was 68° F. Thus whether we examine the organic pollution of water at different points of a river, or the rate of disappearance of the organic material of sewage mixed with water and agitated in contact with air, or the rate at which dissolved oxygen disappears in water polluted with 5 per cent. of sewage, we are in each case led to the inevitable conclusion that the oxidation is very slow—so slow in fact that it is safe to infer there is no river in the United Kingdom long enough to effect the complete transformation of sewage in that way.

These results are further confirmed by evidence as to the state of the rivers in the Mersey and Ribble basins; they are consistent with the opinions of chemists, and they are opposed only by dogmatic assertions destitute of proof.

To illustrate the extent to which the polluted state of Lancashire rivers is a disadvantage to manufacturers, the Commissioners state that thirty-nine of the firms who are carrying on different branches of trade in the basins of the Mersey and Ribble, estimate the benefit they would derive if the river water were fit for their use at no less than 10,157*l.* a year, while one calico-printing firm estimates the gain to them at 3,000*l.* a year. The number of manufacturers who have given these estimates form only a small fraction of the total number in the district.

MAGNETIC AND SUN SPOT PHENOMENA FOR FEBRUARY, 1870.

(*As recorded at the Kew Observatory.*)

ON February 1st about 5 p.m. there occurred a very considerable disturbance of the three magnetic elements, which lasted until about 2 o'clock in the early morning of the next day. The tendency of this disturbance was to diminish the declination and the horizontal force, while on the other hand the vertical force was increased during the first half of the disturbance and diminished during the second. The oscillations of the declination were very large. The disturbance was accompanied with

an aurora, which was widely observed, and also with earth currents affecting the telegraphic wires. From the appearance of the traces one is inclined to associate the aurora and earth currents with the oscillations of declination rather than with those of the other elements.

On February 11, a little after 6 p.m., another disturbance took place, which continued more or less for thirty hours. As in the previous case the oscillations of the declination were most marked, but these were not so excessive as for the previous disturbance. An aurora was visible at 8 50 p.m. of February 11, and one was said also to have been observed on February 12.

The following is the record of sun-spots derived from the pictures taken :—

February 5	... 4	small groups	2 large ones
,, 6	... 5	,,	1 rather large, 1 very large
,, 8	... 5	,,	2 large, 1 very large
,, 10	... 3	,,	4 large, 1 very large
,, 11	... 4	,,	2 very large
,, 15	... 5	,,	1 large, 2 very large
,, 20	... 7	,,	1 large
,, 21	... 5	,,	1 large
,, 22	... 5	,,	
,, 24	... 4	,,	
,, 25	... 3	,,	
,, 26	... 4	,,	

THE EXISTENCE OF MAN IN THE TERTIARY EPOCH

IN the *Bibliothèque Universelle et Revue Suisse* for the 15th February, M. Favre, in an article on the above subject, remarks that for some years the discovery of traces left by man of the pre-historic age on the earth have multiplied with a rapidity only explicable on the supposition that the population inhabiting a certain region of the globe was formerly abundant, and that numerous observers have recently applied themselves to the subject with extraordinary energy and zeal. He takes up the question whether the age of stone does or does not extend back to the tertiary period, and he thinks it will prove interesting to give a *résumé* of the various observations tending to show that man inhabited the earth at an epoch anterior to the great extension of the glaciers southwards, and during the tertiary epoch. On *à priori* grounds no substantial reasons can be advanced against the existence of man at the latter period. The temperate zone was then somewhat warmer than at present, and the temperature of Greeenland and Spitzbergen sufficiently agreeable to be adapted to the development of terrestrial mammals. But it is difficult to represent the duration of the period that elapsed between the end of the tertiary deposits and the termination of the glacial epoch. The portion of the quaternary period characterised by the enormous extension of the glaciers was very protracted, and many ages must have elapsed before the glaciers of the Alps were so large as to be able to transport erratic boulders to the height of 1352 metres on the Jura (near Soleure), and the glacier of the Rhone approximated the Rhine, or perhaps even reached it by passing across the cantons of Valais, of Vaud, of Freibourg, of Berne, of Soleure, and of Aargau. The form of the earth's surface must have presented to the eye of such old world inhabitants a very different aspect from that exhibited at present, and if they already existed in the middle tertiary period, they would have been contemporary with the upheaval of the Alps, and with an almost entirely distinct flora and fauna. Under these circumstances man would have to be included amongst the creatures who have survived two geological periods. M. Favre then proceeds to review the evidence that has at present been collected, embracing the following points :—First, the observations of M. Desnoyers in 1863 made at Saint-Prest near Chartres, but previously (1848) known to M. Boisvillette, and (1860) to MM. Langel and Lartel. Here, in a pliocene formation, were found the bones of the *Elephas meridionalis*, *Hippopotamus major*, *Equus arnensis*, *Cervus carnulorum*, and two other species of *Cervus*, *Bos*, *Trojonotherium Cuvieri* (a kind of large beaver), striated in such a manner as to convince M. Desnoyers that the markings were the effects of the handiwork of man. This conclusion has, however, been contested by Sir C. Lyell ; but in 1867 arrow or lance-head flint instruments were found in this spot by M. l'Abbé Bourgeois, one of which appeared to have been subjected to the action of fire, though this might have resulted from exposure to forests burning by the action of lightning. Soon afterwards M. Delaunay discovered markings of an analogous nature to the former, on the bone of a Halitherium at Pouancé (Maine et Loire) in a miocene formation containing the bones of Dinotherium. About the same time M. Bourgeois found similar flints in a still older formation (the calcareous strata of Beauce) at Thênay, and at Billy near Selles-sur-Cher. Some differences of opinion exist as to whether these flints are really worked by the hand of man ; but the majority of those who have seen them, and are competent to judge, is decidedly in favour of that view. Nevertheless, M. Fraas observes that he has himself seen a lamina of silex become detached from a mass by the action of the sun's rays alone in Egypt ; Livingstone and Dr. Wetzstein seem to have observed similar phenomena ; and a point that now demands intelligent observation is the greater or less similarity such fragments detached by natural causes bear to the flint instruments or the masses from which they have been detached. He refers also to two fragments of the jaw of a *Rhinoceros pleuroceros* found in the lacustrian chalk of Limaque, and which appear to have been grooved by man, which, however, he admits to be doubtful ; and to the observations of Whitney in California, which tend to show the existence of man anterior to the glacial epoch and to the period of the mastodon and elephant, at an epoch since which vertical erosion of the surface has taken place to the extent of two or three thousand feet of hard and crystallisable rocks. Finally he refers to the observations of M. Issel in Piedmont.

MODIFICATIONS IN THE CONSTRUCTIONS OF THE NEST OF THE SWALLOW

IN the tenth number of the *Comptes Rendus* for the present year, is a paper by M. Pouchet, on the Modifications of the Nests constructed by the common Swallow, (*Hirundo urbica* Linnæus,) in which he remarks that it is evident the mode of life of certain animals, far from being persistent and invariable, undergoes modifications under different terrestrial conditions, and that, in many instances, their habits are different from what they were in former ages. Spallanzani indeed remarks in one of his remarkable memoirs on the swallows, that the shape and structure of the nests of birds are interesting features in their history, and that each species constructs its habitation on a plan peculiar to itself, which never changes, and is continued from one generation to another. And this opinion is shared by many naturalists ; observations, however, when sufficiently close and attentively made, show that it is erroneous. We do not indeed see any modifications of those of their habits which are associated with their biology, so that the arboreal species seek to form for themselves a subterranean nest, or rear their young ones in dwellings adherent to the coigns of our houses, but it nevertheless is ascertained that in a succession of years, each learns to improve the construction of his residence. Certain birds work up only the products of our own handiwork, and would necessarily employ natural substances if these were deficient. Thus, as may be seen in the museum of Rouen, the Loriot of Europe sometimes forms its nest with thread ends under the

branches of trees, which cannot possibly be the natural method. For several centuries the common swallow has disported itself in our crowded cities, and with its friendly masonry attached itself to our houses. The chimney swallow, still more familiar and audacious, often builds in the smoky shafts of our domiciles, or even in the noisiest factories, undisturbed by the din or the fires or the movement around them. Such habits must form a strong contrast with those of their predecessors in times long gone by. When we ourselves wandered untutored savages in the prehistoric times, or when still later we constructed lacustrine towns, or megalithic monuments, the habits of the birds can scarcely have been identical with those of to-day, for such human edifices afforded little security or shade. They must then have built amongst rocks. Nearly the same remarks apply to the storks, which have not remained stationary, but have preferred to their less commodious dwellings those offered to them by man. These changes in the industry or the manners of birds are perhaps even more rapid than we might at first sight suppose ; and M. Pouchet's observations have demonstrated to him that notable improvements have been adopted by swallows in their modification during the first half of the present century. Having directed a number to be collected for the purpose of having drawings made from them, M. Pouchet was astonished to find that they did not resemble those he had collected some forty years ago, and which were still preserved in the museum of Rouen. The present generation of swallows have notably improved on the architecture of their forefathers, amongst those still building in the arches and against the pillars of the churches. Some, however, still adhere to the old methods, or such nests may possibly have been old ones which have undergone reconstruction. In the streets, on the other hand, all the nests appeared to be constructed on the new method. And now for the differences observed. The old nests show, and all ancient writers as Vieillot, Montbrillard, Rennie, Deglaud, &c., describe the nest of the house-swallow as globular, or as forming a segment of a spheroid with a very small rounded opening, scarcely permitting the ingress and egress of the couple that inhabit it. The new nests, on the contrary, have the form of the quarter of a hollow semi-oval (le quart d'un demi-ovoide creux), with very elongated poles, and the three sectional surfaces of which adhere to the walls of edifices throughout their whole extent, with the exception of the upper one, where the orifice of the nest is situated ; and this is no longer a round hole, but a very long transverse fissure formed below by an excavation of the border of the section, and above by the wall of the building to which the nest is attached. This opening has a length of nine or ten centimetres and a height of two centims. M. Pouchet considers this new form affords more room for the inmates and especially for the young which are not so crowded, whilst they can put out their heads for a mouthful of fresh air, and their presence does not interfere with the entrance and exit of the parents. Lastly, the new form protects the inhabitants of the nest better than the old one, from rain, cold, and foreign enemies.

THE ROTUNDITY OF THE EARTH

A RECENT number of the *Field* contains an account of a very amusing investigation which has been recently conducted on the Bedford Level to settle the question whether the earth is a globe or not! It appears that a Mr. Hampden threw out a challenge by which he offered to pay 500*l.* to anyone who would prove the rotundity, which challenge has been taken up by Mr. A. R. Wallace, who has lodged a similar sum with the Editor of the *Field*. To test this point, six miles of the Bedford Level were used, three signals, each 13 feet 4 inches above the water level, being put up three miles apart. Mr. Wallace asserted that if he were correct the central signal would appear elevated about 5 feet above the line joining the other two ; Mr. Hampden holding, of course, that they would all be in the same straight line. It is needless to say what the result was, but we now come to a part of the story which is not so amusing, and here we quote from the *Field* :—

Both Mr. Hampden and Mr. Carpenter assented to the details of this experiment in our presence as conclusive, although we regret to say that Mr. Carpenter alleged his opinion was founded upon theory alone, and that it had never, as far as he knew, been tried. Now, the fact really is, that in a little treatise published by "Parallax," and which we have now in our possession, with Mr. Carpenter's name on the title-page, in his own handwriting, an experiment similar in its nature is described as having been made on the very same piece of water as that on which we were then occupied, with a result exactly the reverse of that which recently occurred. Mr. Carpenter was, in fact, engaged to decide a disputed question of which he and his principal professed to be practically ignorant, although it was in print on the authority of the head of their sect that it had already been tried in the same locality ; *and this must have been then known to Mr. Carpenter, and has since been admitted by him in our presence.* The good faith and perfect fairness of Mr. Carpenter were not, therefore, quite of the nature we then believed them to be, and we have no hesitation in affirming that he was a most improper person to be selected to act as referee in such a matter. The deception was, to say the least of it, "unscientific;" yet Mr. Carpenter and his master, "Parallax," both profess to be ardent in the cause of science ; and that it has recoiled upon their heads can cause no regret to anyone who values the truth.

Although the diagrams of what was seen by the telescopes used at both ends, and acknowledged to be correct by Mr. Carpenter and Mr. Hampden, show the central signal more than 5 feet above the line of the two extremes, these gentlemen coolly claim the victory, and threaten to bring an action against the Editor of the *Field* (who was appointed umpire by Mr. Hampden himself) for fraudulently deciding against them.

LETTERS TO THE EDITOR

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

On Prof. Tyndall's Exposition of Helmholtz's Theory of Musical Consonance

IN NATURE for March 3 you published a letter of mine, in which I stated that the exposition of Helmholtz's theory of musical consonance given in Prof. Tyndall's lectures on Sound was both "radically different from the original, and erroneous." I supported my assertion by a series of arguments which, both to myself and to other competently informed persons, appeared conclusive.

Prof. Tyndall has taken no notice, public or private, of my letter, although he has since its publication written in your columns on another subject.

Your readers, as well as myself, are surely justified in calling on Prof. Tyndall either to rebut my argument or admit my conclusion.

Trinity College, Cambridge, March 29 SEDLEY TAYLOR

[Prof. Tyndall's Lectures on Sound have been translated into German, and the following is a verbatim copy of the "Vorwort des Herausgeber":—

"Die Vorlesungen welche Herr Tyndall als Nachfolger der grossen Naturforscher Davy und Faraday in dem Wintermonaten vor den gebildesten Kreisen Londons in der Royal Institution über die verschiedenen Theile der Physik zuhalten pflegt, haben in England allzeitige Anerkennung gefunden. Herr Tyndall besitzt in ungewöhnlichem Grade die Gabe, durch die glückliche Vereinigung einer eben so klaren wie eleganten Darstellung, mit vortrefflich ersonnenen und schlagenden Versuchen selbst die schwierigeren Lehren der Physik dem gebildeten Publikum zugänglich zu machen. Eine Herausgabe seiner Vorlesungen in deutscher Bearbeitung dürfte desshalb auch bei uns nicht wenig zur Verbreitung physikalischer Kenntnisse in weiteren Kreisen beitragen. Die Unterzeichneten haben

daher, wie schon früher die Vorlesungen über die Wärme, so auch jetzt die vorliegenden Vorträge über den Schall unter ihrer besonderen Aufsicht übersetzen lassen, und die Druckbogen einer genauen Durchsicht unterzogen, damit auch die deutsche Bearbeitung den englischen Werken ihres Freundes Tyndall nach Form und Inhalt möglichst entspräche.—H. HELMHOLTZ, G. WIEDEMANN."

Prof. Tyndall's work, his account of Helmholtz's Theory of Dissonance included, having passed through the hands of Helmholtz himself, not only without protest or correction, but with the foregoing expression of opinion, it does not seem likely that any serious damage has been done.]

Apparent Size of Celestial Objects

ABOUT fifteen years ago I was looking at Venus through a 40-inch telescope, Venus then being very near the Moon and of a crescent form, the line across the middle or widest part of the crescent being about one-tenth of the planet's diameter. It occurred to me to be a good opportunity to examine how far there was any reality in the estimate we form of the apparent size of celestial objects. Venus through the telescope, with a magnifying power (speaking from memory) of 135, looked about the size of an old guinea, *i.e.*, of a crescent cut off from that coin. The Moon, to my naked eye, appeared the size of a dessert plate. Having fixed their apparent dimensions in my mind, I adjusted the telescope so that with one eye I could see Venus through the telescope, and with the other the Moon without the telescope, and cause the images to overlap. I was greatly surprised to find that Venus instead of being about one-sixth of the diameter of the Moon was rather more than double its diameter, so that when the adjustment was made to bring the upper edge of the Moon coincident with the upper point of the crescent of Venus, the opposite edge of the Moon fell short of the middle of the crescent, a very palpable demonstration of the fallacy of guesses at size, when there are no means of comparison.

On another occasion a lady was looking at Jupiter through my telescope, and having first put on a power of 60 I changed it for one of 140. To my question, what difference she observed in the size of the planet, she answered, I see no difference in size, but a good deal in brightness. Here the area of the one image was more than five times that of the other.

The fallacy of guesses at size without objects of comparison is most strikingly shown in the ordinary expression of an ignorant observer looking at objects by day through a spy-glass. If you ask, as I have often done, a person unacquainted with optics whether he recognises any difference in size between an object, say a horse or a cow, seen with or without a telescope, he will always answer No, but it (the telescope) brings it much nearer. This, of course, is really an admission of increased magnitude, but the observer is unconscious of it; a horse to him is as big as a horse, no larger or smaller, whatever be the distance.

The assistance which may be derived from the degree of convergence of the optic axes alluded to by your correspondent "T. R." may be something when we know what the object is, or when it is moved to and fro, but if the object be unfamiliar, and there be no standard of comparison, I doubt whether any fair guess could be made.

Suppose all objects had never been seen but at one and the same distance, then an observer looking at a given object without any external standard of comparison, would probably make a fair guess at its size, for the picture on his retina would have a definite size, and his mind would estimate it by relation to other pictures of known objects which he had seen at other times; but as we see all the objects with which we are familiar at all degrees of distance, we have no standard of comparison for an image on the retina.

The common phantasmagoria effect where a figure appears to advance or recede from us though it really does not change its position, but its size is one of the many illusions produced by representing things as they are seen under certain circumstances which have become habitual, and habit interprets the vision. So if one lie on his back in a field, and throwing the head back, look at distant trees or houses, they will appear to be in the zenith, because when we ordinarily look at the zenith the head is thrown back.

Is the apparent size of the Sun or Moon, as expressed in common parlance, anything more than a reference to some standard which we have early adopted, and which, not having any means of rectifying, we assume. To me the Moon at an altitude of 45° is about 6 inches in diameter; when near the horizon, she is about a foot. If I look through a telescope of small magnifying power (say 10 or 12 diameters), so as to leave a fair margin in the field, the Moon is still 6 inches in diameter, though her visible area has really increased a hundred-fold.

Can we go further than to say, as has often been said, that all magnitude is relative, and that nothing is great or small except by comparison? W. R. GROVE.

115, Harley Street, April 4

An After Dinner Experiment

SUPPOSE in the experiment of an ellipsoid or spheroid, referred to in my last letter, rolling between two parallel horizontal planes, we were to scratch on the rolling body the two equal similar and opposite closed curves (the *polhods* so-called), traced upon it by the successive axes of instantaneous solution; and suppose, further, that we were to cut away the two extreme segments marked off by those tracings, retaining only the barrel or middle portion, and were then to make this barrel roll under the action of friction upon its bounding curved edges between the two fixed planes as before, or, more generally, imagine a body of any form whatever bounded by and rolling under the action of friction upon these two edges between two parallel fixed planes; it is easy to see that, provided the centre of gravity and direction of the principal axes be not displaced, the law of the motion will depend only on the relative values of the principal moments of inertia of the body so rolling, in comparison with the relative values of the axes of the ellipsoid or spheroid to which the *polhods* or rolling edges appertain; and consequently, that, when a certain condition is satisfied between these two sets of ratios, the motion will be similar in all respects to that of a free body about its centre of gravity.

That condition (as shown in my memoir in the Philosophical Transactions) is, that the nine-membered determinant formed by the principal moments of inertia of the rolling body, the inverse squares and the inverse fourth powers of the axes of the ellipsoid or spheroid shall be equal to zero—a condition manifestly satisfied in the case of the spheroid, provided that two out of the three principal moments of inertia of the rolling solid are equal to one another.

My friend Mr. Froude, the well-known hydraulic engineer, with his wonted sagacity, lately drew my attention to the familiar experiment of making a wine-glass spin round and round on a table or table-cloth upon its base in a circle without slipping, believing that this phenomenon must have some connection with the motion referred to in my preceding letter to NATURE: an intuitive anticipation perfectly well founded on fact; for we need only to prevent the initial tendency of the centre of gravity to rise by pressing with a second fixed plane (say a rough plate or book-cover) on the top of the wine-glass, and we shall have an excellent representation of the free motion about their centre of gravity of that class of solids which have, so to say, a natural momental axis, *i.e.* (in the language of the schools) two of their principal moments of inertia equal. For greater brevity let me call solids of this class uniaxal solids. I suppose that the centre of gravity of the glass is midway between the top and bottom, and that the periphery of the base and of the rims are circles of equal radius. These circles will then correspond to *polhods* of a spheroid, conditioned by the angular magnitude and dip of the spinning glass; to determine from which two elements the ratio of the axes of the originally supposed but now superseded representative spheroid is a simple problem in conic sections; this being ascertained, the proportional values of the moments of inertia of the represented solid may be immediately inferred. The wine-glass itself belonging to the class of uniaxal bodies, the condition that ought to connect its moments of inertia with the axis of the representative spheroid (in order that the motion may proceed *pari passu* with that of a free body) is necessarily satisfied.

The conclusion which I draw from what precedes is briefly this—that a wine-glass equally wide at top and bottom, and with its centre of gravity midway down, spinning round upon its base and rim in an inclined position between two rough but level fixed horizontal surfaces, yields, so long as its *vis-viva* remains sensibly unaffected by disturbing causes, a perfect representation, both in space and time, of the motion of a free uniaxal solid, as *e.g.* a probate or oblate spheroid, or a square or equilateral prism or pyramid about its centre of gravity, and

conversely that every possible free motion about its centre of gravity of every such solid admits of being so represented.

To revert for an instant to the general question of the representative rolling ellipsoid, I think it must be admitted that the addition of the time element to the theory and the substitution of a second fixed plane in lieu of a fixed centre, considerably enhance the value and give an unexpected roundness and completeness to Poinsot's image of the free motion of rotation of a rigid body, of which so much and not altogether undeservedly has been made. From an idea or shadow Poinsot's representation has now become a corporeal fact and reality, as if, so to say, Ixion's cloud, in the moment of fruition, had substantified into a living Juno. I heard the late Professor Donkin, of revered and ever-to-be-cherished memory, state that when as a referee of the Royal Society he first took in hand my paper on rotation, he did so with a conviction that all had already been said that could be said on the subject, and that it was a closed question; but that when he laid down the memoir he saw reason to change his opinion. I owe my thanks to M. Radau and the editors of the Annals of the Ecole Normale Supérieure for having been at the pains to disentomb the little-known conclusions therein contained from their honourable place of sepulture in the Philosophical Transactions. J. J. SYLVESTER

K House, Woolwich Common, April 2

The Principle of the Conservation of Force and Mr. Mill's System of Logic

WILL you permit me briefly to point out, what has not, as far as I am aware, been yet noticed—the very important modifications of the logical theory of induction resulting from the consideration in reference thereto of the physical theory of the correlation of forces?

As I believe the subject is now more ripe for discussion than it was when, some dozen years ago, I first began to work out the bearings of the higher results of physical research on the general theory of causation, logical, and metaphysical; the following questions which, in the course of a correspondence on this subject, I submitted to Mr. Mill so long ago as 1863, may, perhaps, contain suggestions of thought not unwelcome to some students of NATURE.

"How then," I wrote, "do our new views of force affect the established theory of causation? Now I would rather, if you will allow me, submit the whole subject interrogatively to you, than give dogmatically my own thoughts. And, more particularly, allow me to submit to you these two questions—1st, Whether the physical theory of transformation (and identity) does not necessitate all such logical changes of expression, at least, as may be implied in the abolition of the conceptions of "permanent causes," and of "kinds," as real and absolute existences? And, 2ndly, whether—"if, as I have endeavoured to show, the inductive facts on which are based the principles of conservation and correlation lead to such a more general principle as may be thus expressed, *every existence has a determined and determining co-existence*,—whether, I say, "we are not justified in enunciating such a principle as the complement of that fundamental axiom of our present logic, 'every effect has a cause'?"

I believe I am at liberty to say that, though affirmative answers to these questions would necessitate very important changes in the "system of logic, inductive and ratiocinative," Mr. Mill, as to the first, admitted the necessity of certain changes of expression, at least, and generously encouraged me in the prosecution of the researches indicated by the second question.

Of the results of these researches I shall here only say that, as the axiom, "every effect has a cause," is the foundation of a logic which must be distinguished as a *logic of sequence*, the new axiom above stated may be shown to be the basis of a *logic of co-existence*, of which *Geometry* appears as an example. But as to this, as to the conception of force implied in this idea of co-existence, and as to the bearing of this new conception of force on the speculations with regard to space of a fourth dimension, perhaps I may have another opportunity of addressing you.

J. S. STUART GLENNIE

Athenæum Club, March 30

Dust and Germs of Life

PROF. TYNDALL'S exceedingly interesting article in No. 20 of NATURE seems to me to leave unexplained a fact very familiar to naturalists. It is well known that collections of natural history, say a Herbarium or an Entomological cabinet, will, if left undisturbed for a number of years, and unpoisoned, become infested with animal life, chiefly Acari and larvæ of Coleoptera; and that the surest way of preventing such attacks is thorough ventilation. Now if the floating matter in the air settles so readily after only a few days' stillness, as Prof. Tyndall's experiments seem to indicate, and does not even enter into an uncorked flask, it is out of the question that it can penetrate through the keyholes or chinks of our cabinets. Setting aside the theory of spontaneous generation, we are then forced to the conclusion that this life must arise from germs already existing in the specimens when they are preserved, or in the very limited amount of atmosphere originally confined in the cabinet. Is either of these explanations tenable? A strong argument against the former alternative seems presented by the fact that, as far as I am aware, the same species of Acarus infests plants in a Herbarium brought from the most widely diverse localities, an inland meadow or the seashore, the plains of England or the Alps of Switzerland. Can any of your physiological readers throw light on this subject? F. L. S.

Catkins of the Hazel

WHILE looking at some hazel bushes to-day, I noticed that where the red tuft of stigmas was protruded, the male catkins adjacent on the same twig were immature; while, on the other hand the stigmas had fallen, and the fruit was already swelling, where the scales of the male flowers were open to show the stamens.

A week or two back (in another locality) I could not find a single female catkin which had not lost its stigmas; while nearly all the male catkins had opened, and many had shed their pollen.

Is this always the case with the hazel? If so, it would be a striking illustration of Darwin's aphorism, "Nature abhors perpetual self-fertilisation."

I ought to add, that my observations are not confirmed by the illustrations in the books to which I have access, namely, Balfour's "Class Book," Lindley's "School Botany," and Lemaout and Decaisnes' "Traité de Botanique." In all these, a female catkin with its tuft of stigmas is represented on the same twig as a bunch of fully developed male catkins.

Will some one of greater experience inform me if I am in error as to the above facts? MARCUS M. HARTOG

University College, London, March 24

ANCIENT BRITISH LONG BARROWS

II.

THE chambered long barrows of North Wilts, Somerset, and Gloucestershire differ, as a rule, but slightly in external form from the simple or unchambered long barrows of South Wilts and Dorset. They are, however, generally of somewhat smaller dimensions, being from about 120 to 200 feet in length and from 30 to 60 feet in breadth. The side ditches characteristic of the unchambered barrows are seldom to be met with, but the margin of the grave-mound is, or rather was, usually defined by a low wall, built of loose tile-shaped fragments of oolitic stone. In some cases, as at West Kennet (see fig. 1), there is good evidence that the mound was originally surrounded by a series of obelisks of sarsen stone, the intervals being filled up with the usual dry walling just described. Sometimes, too, large monoliths or triliths are found at the broad end of the tumulus. As regards orientation, or position in reference to the points of the compass, the direction of east and west commonly observed in the simple barrows prevails in four out of five cases with the chambered barrows; and as in the former class of monument the interments were at the eastern end, which is also the higher and broader, so likewise do we find that the stone chambers or cists occupy the same position in the chambered barrows.

In internal structure the chambered barrows exhibit many varieties, but three principal types are recognised by Dr. Thurnam, viz.—(1) those in which the chamber

opens into a central passage or covered way ; (2) those with chambers opening externally ; (3) those containing cists instead of chambers. The essential distinction between a chamber and a cist is, that the former is entered by a lateral aperture, whilst a cist can only be opened by removing the covering stone from above. The views and plan in figs. 4 and 5 of the chamber and gallery of the great tumulus at West Kennet already alluded to will show the reader at a glance the nature of the simpler specimens of the first and most characteristic type of structure. It is only necessary to add that the West Kennet chamber was covered by three very large blocks of sarsen stone, and that its dimensions were as follows : length 8 feet, breadth 9 feet, height 8 feet. Some of the barrows of the first type—as, for example, those of Stoney Littleton and Uley—are of much more complicated internal structure than that of West Kennet ; but they all possess in some form or other the central gallery or avenue,

Every one familiar with the surface geology of the two districts will, however, at once admit the validity of Sir Richard Hoare's statement, that the absence of the stone structures in the South Wiltshire long barrows is simply due to the want of the necessary material. Referring in connection with this subject to the South Wiltshire Downs, Dr. Thurnam writes :—"Scattered blocks of silicious grit or sarsen stone are indeed found here and there on the surface, but they are neither numerous nor large enough for this purpose. In North Wiltshire and the adjacent part of Berkshire the case is different, and sarsen stones of large dimensions and in great numbers are found in the hollows of the higher chalk downs. From these were derived the immense stones of the circles and avenues of Avebury ; and as most geologists and antiquaries believe, those out of which the great trilithons, and mortised uprights and imposts of Stonehenge itself, in South Wilts, were formed."

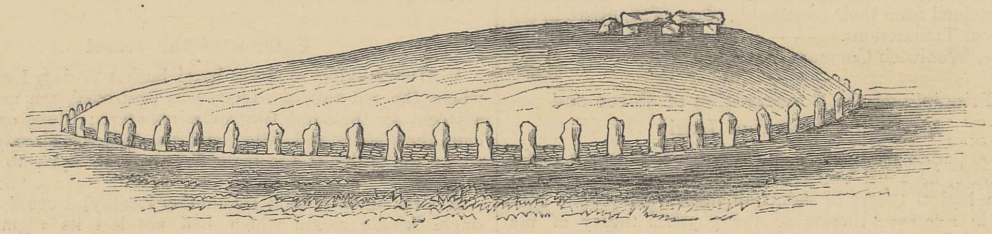

FIG. 1.—LONG BARROW AT WEST KENNET (PERISTALITHS AND WALLING RESTORED)

ingeniously supposed by Nilsson to be the homologue of the passages to the caverns which probably served as the first dwelling-places of man.

It must not be supposed that chambered barrows are confined to North Wilts, Somerset, and Gloucestershire ; but those in distant counties appear to differ from

The implements and pottery of the chambered barrows agree very closely with the specimens derived from the simple earthen tumuli. The infrequency and rude character of these objects, especially when compared with the comparatively abundant and highly-finished weapons and tools yielded by the chambered tumuli of Scandinavia

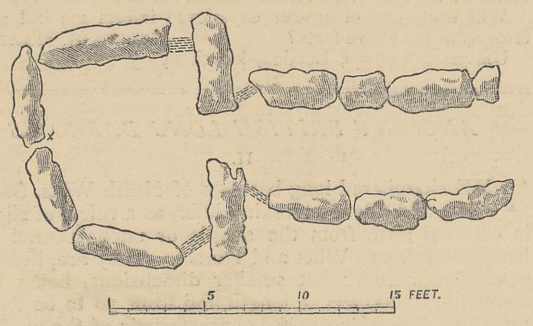

FIG. 2.—PLAN OF CHAMBER AND GALLERY

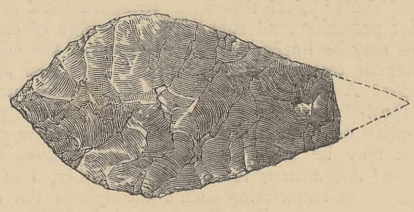

FIG. 3.—FROM FYFIELD LONG BARROW

those of the districts above referred to in certain respects, and especially in being usually circular in form. The sepulchral stone chamber, universally known under the name of "Wayland's Smithy," though situated in Berkshire, is close to the confines of North Wilts, and was originally covered by a true long barrow. Dr. Thurnam surmises that the barrow was removed, or at least the chamber disclosed, at an early date, as he finds that the name "Welandes Smiththan" was applied to it so long ago as the middle of the tenth century, a name very unlikely to have been used so long as the barrow was intact.

It might seem at first sight that the presence of megalithic chambers in the tumuli of North Wilts, Somerset, and Gloucestershire is a characteristic which entirely differentiates them from the simple earth mounds of South Wilts, and that we should be warranted in assigning the two classes of monuments to different peoples, or at all events to different stages in the history of the same people.

and Brittany, are sufficiently remarkable. Perhaps the fact that our chambered barrows have been so generally searched by treasure-hunters in various ages may serve to some extent to explain the almost entire absence of polished stone implements. Such objects would probably have attracted the attention of persons of that class ; the ruder objects, having no value in their eyes, would be left in the tombs. The delicate leaf-shaped arrowheads alluded to in our former article as found in unchambered tumuli also occur, though rarely, in the chambered barrows. Fig. 3 will show that the manufacturers (whoever they may have been) of these weapons were possessed of no mean skill in the fashioning of flint ; and it may perhaps be allowable to infer from the rarity and perfection of these objects, as contrasted with others obtained from long barrows, that they were obtained from tribes in a somewhat more advanced stage of civilisation. It is a singular circumstance that all the leaf-shaped arrowheads have

one or both ends broken off. The breaking of the point of the dead warrior's spear was probably a solemn ceremony, and contrasts agreeably with repulsive funereal practices to which we shall presently refer.

The bones and teeth of animals apparently used for food, are found in considerable numbers. The remains of *Bos longifrons* and *Cervus elaphus* are, however, less frequent than in the unchambered barrows, whilst those of the wild boar are much more abundant.

We have already in our first article alluded to the important evidence which the critical study of the human remains from the long barrows is calculated to afford us, but in our remarks thus far we have purposely refrained from entering into the details of this subject. Although certain of the chambered barrows have afforded numerous skeletons, these monuments have been so frequently disturbed by treasure-seekers in bygone times, that our information as to the mode of interment is not so satisfactory as could be wished. There seems, however, to be little doubt that the bodies were placed round the walls of the chambers in a crouching or squatting posture, a favourite attitude for the dead both among early races and existing savages. The primary interments in the simple unchambered barrows consist either of a single or two separate skeletons, or of a number of bones promiscuously interred. In the latter case the bones are frequently found huddled together in so narrow a compass as to preclude the idea of the corpses having been buried entire. This is most reasonably accounted for by the practice known to prevail among savage races of burying the dead in or near their huts, and subsequently disinterring the bones for the purpose of burying them in the cemetery of the tribe. Canon Greenwell, so well known for his explorations in the Wolds of Yorkshire, thinks that some of the bones from long barrows examined by him indicate the horrible practice of cannibalism. Dr. Thurnam endorses Mr. Greenwell's opinion on this point in the following words: "Altogether I see no difficulty in acceding to the conclusion of Mr. Greenwell, that in the disjointed, cleft, and broken condition of the human bones in many of the long barrows, and especially in those examined by him at Scamridge, near Ebberstone, and near Rudstone, Yorkshire, we have indications of funeral feasts, where slaves, captives, and others were slain and eaten."

In a large proportion of the long barrows of the South-West of England, many of the skulls have been found to be split open apparently by some such weapon as a stone axe. The sharpness of the fracture seems to leave no doubt that the injuries were inflicted during life, or at all events before burial. It is inferred from the frequency of these cleft skulls, and the direction in which they are split, that they are those of victims immolated at the burial of a chief. Sometimes one skull is found uninjured while all the others are injured. In the light of what has come down to us from classical writers of the customs of Western Europeans at the beginning of our era, we see no reason to doubt Dr. Thurnam's conclusions on this point, although we should have liked to have more precise information of the relative number of cleft and uninjured skulls in particular barrows.

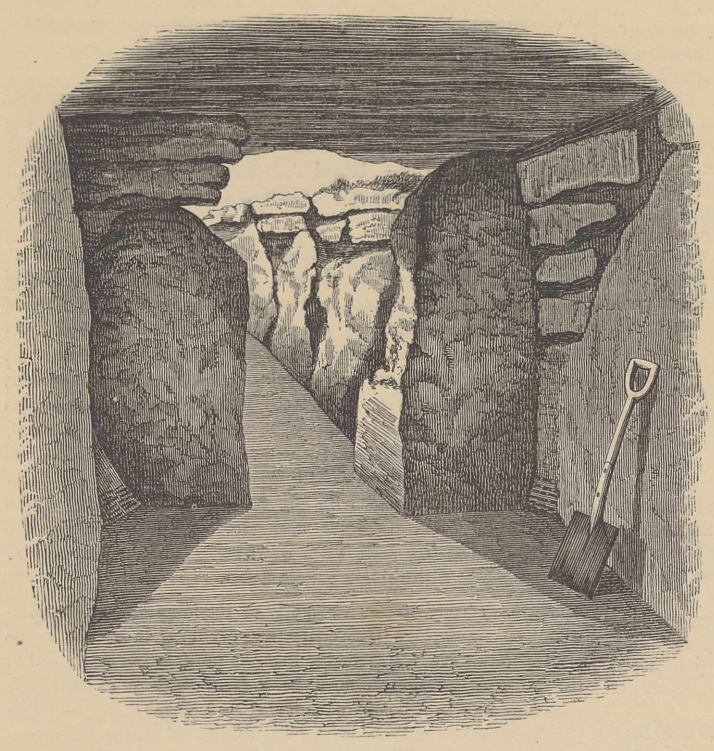

FIG. 4.—VIEW IN THE CHAMBER, LOOKING THROUGH THE ENTRANCE

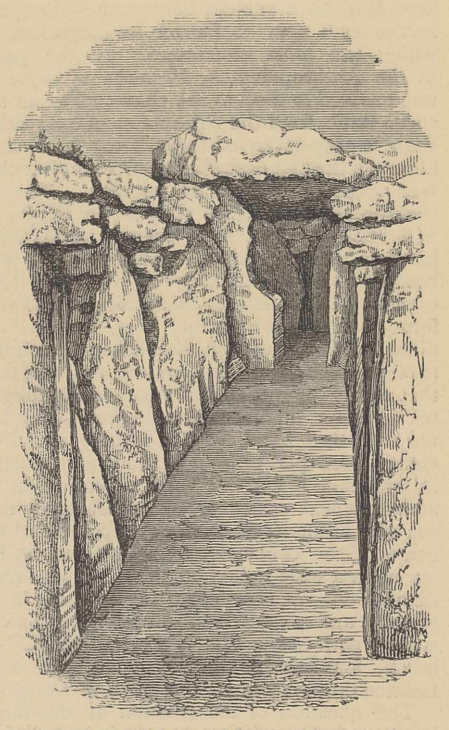

FIG. 5.—GALLERY LOOKING TOWARDS THE CHAMBER

The question how far the human remains, more especially the skulls, enable us to determine the race characters of the people or peoples who lie buried in the tumuli of Britain, has been discussed with great care and at considerable length in two papers by Dr. Thurnam, published in the Memoirs of the Anthropological Society for the years 1864 and 1870. In the first of these papers the conclusions, based on the examination of a very considerable number of skulls and limb bones, were maintained that the people whose remains are found in the long barrows were a short, long-

headed race, with small features, whilst those from the round barrow were a tall, short- or round-headed race, with larger and more prominent faces. There was nothing new in this statement that the skulls of the ancient Britons of the later or Bronze age were usually of rounded form ; the chief novelty was the fact deduced by Dr. Thurnam from his explorations in the primeval long barrows, that the skulls from that form of tumulus are of extreme length, such as now prevails only in far distant lands, as for example in India, Africa, and Australia.

Dr. Thurnam's general conclusions as to the skull-forms from the barrows, were concisely expressed by him in the formula — "long barrows, long skulls : round barrows, round skulls." This coincidence between the form of the barrow and the shape of the skulls which it contained, appeared to be so strange to some minds that they hesitated to give full weight to the statistics brought forward in support of it. The unfavourable reception which Dr. Thurnam's conclusions met with in certain quarters, however disagreeable to him at the time, can now only be a subject of congratulation, as it no doubt served as a spur to further investigation, the results of which are most conclusive. In the paper published in the Anthropological Memoirs of 1870, Dr. Thurnam was enabled to discuss the character of as many as sixty-seven skulls from the two classes of long barrows, no fewer than twenty-seven of them being from simple barrows, although the first described skull from that class of tumulus was obtained so recently as 1863. The results of the measurements of these sixty-seven skulls, as contrasted with those derived from seventy skulls from the round barrows, may readily be made evident to those of our readers who are least acquainted with the technicalities of craniology. Skulls are now usually classed according to the form of the brain case, as "long," "short," and "intermediate," the limits of each class being accurately defined. Of these sixty-seven skulls from long barrows, then, it is found that eighty-two per cent. are technically long, and eighteen per cent. intermediate ; not one technically short or round. On the other hand, of the seventy round barrow skulls, eighty-three per cent. are short, and seventeen per cent. intermediate ; not one long. Bearing in mind that the archæological evidence has satisfactorily established the superior antiquity of the long as compared with the round barrows, the conclusions here arrived at, based as they are upon a wide induction of instances derived from one district and one class of monuments, are a clear gain to science, and are not for one moment to be compared with such hypotheses as that of a primitive short-headed population, founded by Retzius upon the examination of isolated crania from various parts of Europe.

The question of the relation of the men of the long barrows to the existing people is one of great difficulty. It might seem natural to infer that the skulls recognised by some excellent observers, such as Dr. Beddoe, as Keltic skulls, are the modern representatives of the ancient long heads. They seem to us, however, to differ in many essential particulars, especially in the important element of height. Dr. Thurnam appears to have been impressed with certain historical evidence favourable to the notion of the Iberian origin of the long barrow people, and he has accordingly carefully studied the large series of Basque skulls in the museum of the Anthropological Society of Paris. The results of the comparison between the two classes of skulls do not, however, seem to go far towards supporting the Iberian theory. We are inclined to think that Dr. Thurnam should have turned to the north rather than to the south of Europe for the representatives of the primitive long-headed population of Britain. He readily allows that certain skulls obtained from ancient cemeteries (grave-rows) in northern Germany closely resemble those of the long barrow folk, but he seems to have been deterred from following up the clue by the fact that these grave-row skulls are of the iron period, and probably of post-Roman date. Since the date of Dr. Thurnam's paper, however, skulls of the same long and high form have been found in Rheinhessen, in graves assigned by the eminent archæologist Lindenschmidt to a date 500 years before Christ. Similar skulls have also been discovered in Bohemia with weapons of stone and bronze.

We have devoted so much space to the archæological and craniological portion of Dr. Thurnam's paper, that we are unable to notice in detail the admirable way in which the physical facts observed are reviewed in the light of historical evidence. It must suffice to say that the men of the long barrows are identified with those "described by Cæsar under the name of *Interiores Britanni*, as forming the aboriginal population," whilst those of the round barrows are inferred to be the Belgæ, who, according to Cæsar's account, passed over to Britain from the Continent, in immediately pre-Roman times, for the purpose of plunder and making war.

NOTES

We are glad to be able to state that energetic steps are now being taken in the matter of the Expedition to view the approaching Eclipse of the Sun. We believe that Mr. Lassell, the President of the Royal Astronomical Society, will call attention to the subject at the meeting of the society to-morrow evening.

Mr. Lockyer, in his third lecture on the Sun, delivered at the Royal Institution on Saturday last, showed an interesting experiment with a candle, which gives a good general idea of the solar phenomena as observed by his new method. As round the sun Mr. Lockyer can spectroscopically detect an ordinarily invisible hydrogen envelope which is rendered evident by bright lines only as contrasted with the nearly continuous spectrum given by the white light of the surface of the sun, so also there is an ordinarily unnoticed envelope (of sodium vapour) round a common candle flame which gives a bright line spectrum as contrasted with the continuous spectrum of the flame itself. Mr. Lockyer also showed that some of the phenomena he has seen when watching a solar storm may be reproduced by disturbing a candle flame.

We have heard so much recently of the long-delayed determination of Cambridge University to apply itself in earnest to the cultivation of Natural Science, that the information contained in the following paragraph must be a blow to those of its friends who hoped to see that it was entering on a new course :—"The Syndicate appointed to consider the means of raising the necessary funds for establishing a Professor and Demonstrator of Experimental Physics, and for providing buildings and apparatus required for that department of science, and other wants of the University, have made a report to the Senate, in which they state that they have addressed a communication to the several colleges of the University, to inquire whether they would be willing, under proper safeguards for the due appropriation of any moneys which might be entrusted to the University, to make contributions from their corporate funds for the above-mentioned objects. The answers of the several colleges, except that of King's, which has not yet been received, have been fully considered by the Syndicate. They indicated such a want of concurrence in any proposal to raise contributions from the corporate funds of colleges, by any kind of direct taxation, that the Syndicate felt obliged to abandon the notion of obtaining the necessary funds from this source, and accordingly to limit the number of objects which they should recommend the Senate to accomplish. They confined their attention, therefore, to the means of raising sufficient funds

only for carrying out the recommendations of the Physical Science Syndicate in their report dated Feb. 27, 1869. These were to provide the stipends of a Professor of Experimental Physics, of a Demonstrator and an attendant, requiring altogether a sum of 660*l.* per annum; also to provide a capital sum of 5,000*l.* for a new building, and 1,300*l.* for apparatus. The Syndicate are of opinion that these sums may be raised from the ordinary sources of revenue of the University, and that a small addition (viz., 2*s.* a head) to the amount of the annual capitation tax will suffice for the purpose. They think, also, that there are circumstances connected with the fixing the amount of the capitation tax by the Grace of May 31, 1866, which in themselves justify some increase, and they mention the increased payments of late required for the town improvements. They think that the buildings may be erected from the existing building funds, and apparatus purchased by money belonging to the chest, and now invested." Was ever a more lame and impotent conclusion? It makes us seriously think whether the time has not come when the State should exercise more control over the enormous revenues of these old colleges, which seem determined to go on in the old track.

An important zoological discovery has just been made in Australia. Mr. Gerard Krefft, the energetic curator and secretary of the Australian Museum, Sydney, has sent to the Zoological Society of London an account of a new and very singular freshwater fish recently discovered in Queensland, which united the external form of *Lepidosiren* with other characters belonging to the extinct Ganoid fishes of the genus *Dipterus* and its allies, and seems to form a connecting link between the *Dipnoi* and the *Ganoidei*. Mr. Krefft proposes to call this fish *Ceratodus forsteri*, after Mr. William Forster its discoverer. His paper on this subject will be read at the next scientific meeting of the Zoological Society on the 28th inst.

In calling attention to a paper read before the Society of Arts on Thursday last, an abstract of which will be found in another column, we cannot avoid contrasting with the fact that our Legislature is now for the first time directing its attention to the question whether the State ought to recognise Science, the support which the French Government is at the present moment actually giving to scientific researches of the highest importance. In the Budget for 1870 there is a grant of 60,000 fr. for the meteorological observatory at Montsouris; one of 12,000 fr. for the publication of Delaunay's Lunar Tables (to be the first of five similar annual grants); one of 100,000 fr. (to be followed by one of 300,000 fr. in 1871), for the Ecole pratique des hautes études; one of 500,000 fr. for technical instruction; and one of 60,000 fr. for the observatory at Marseilles; while primary instruction finds its true level in a supplementary grant of 1,112,000 fr. for the necessary expenses during 1869 and 1870. In contrast with this, it is doubtful whether the grant of 4,000*l.* voted by Parliament some years ago for a botanical museum at the Glasnevin Gardens, Dublin, may not actually be withdrawn.

We hear from Edinburgh that there is much excitement amongst the supporters of the Lady Medical Students, on account of the Professor of Chemistry refusing to accord one of the Hope Scholarships to Miss Edith Pechey, who is studying medicine at the university in that town, and who, by the number of marks gained, is entitled to a junior scholarship. The case is stated thus. Many years ago a Dr. Hope, amidst great opposition, opened a chemistry class for ladies. The movement was then so unpopular that he admitted these students through a window, as they were not allowed to pass through the gateway of the college. At his death all the fees he had obtained from this class, amounting to about 1,000*l.*, he left to found the Hope Scholarships. These scholarships consist of four, two senior and two junior. The rule is as follows:—"The class honours are determined by means of written examinations held during the session. The four students who have received the highest marks are entitled to have the Hope Scholarships to the laboratory of the University." This passage from the university calendar certainly gives us the idea that *any* student who has passed the written examinations is entitled, if a sufficient number of marks be obtained, to the benefit of it. Dr. Crum-Brown proposes to give Miss Pechey one of the bronze medals, but declines to give her the junior Hope Scholarship she has obtained, and which entitles her to six months' free admittance to the laboratory. Out of 234 men and six women, Miss Pechey comes third: the two men above her were last year's students, so that of this year's students Miss Pechey stands pre-eminently first. As she is a matriculated, registered, medical student, her supporters contend that she can legally claim the honours due to her. We believe, however, that the matter is to be put before counsel, so that a legal opinion may be obtained on the subject. We are informed, also, that Miss Sophia Jex-Blake's name has come out in the first-class honours list in chemistry; so the lady doctors may fairly be congratulated on the results of their first session in Edinburgh.

The Senate of the University of London has appointed to the new office of Assistant-Registrar Professor T. A. Hirst, Ph.D., F.R.S., Professor of Mathematics in University College, London, and one of the permanent secretaries to the British Association.

The new building of the University of London, in Burlington Gardens, will be opened by the Queen in person on Wednesday, May 11. Her Majesty, accompanied by the Prince and Princess of Wales and the Princess Louise, will be received at the entrance of the building by the Chancellor (Lord Granville), the Vice-Chancellor (Mr. Grote), the member for the university (the Chancellor of the Exchequer), and the Chairman of Convocation (Dr. Storrar), and be conducted to the Senate Room, from whence Her Majesty will pass to the larger rooms in the building, and finally to the large theatre, where an address will be presented. The Queen will then declare the building opened, and leave by the principal entrance. As many visitors as can conveniently be accommodated in different portions of the building will be invited, including the Premier, some of the Secretaries of State, the Lord President of the Council, representatives from the sister universities, the learned bodies and affiliated colleges, with the examining staff of the university.

The chair of Natural History in the Royal Agricultural College, Cirencester, lately vacant by Prof. Thistleton-Dyer's removal to Dublin, has been filled by the appointment of Dr. W. R. M'Nab, of Edinburgh.

The University of St. Andrews has conferred the honorary degree of LL.D. on Mr. J. T. Boswell-Syme, well known as the editor of the last edition of "Sowerby's English Botany," and the author of many valuable contributions to botanical science.

The origin of the minute discs termed red blood-corpuscles, which float in our circulating fluid in such countless millions, communicating to it its rich opaque hue, is still a matter of question amongst physiologists, though most are inclined to believe that they proceed from the nuclei of the white corpuscles. But even supposing this to be the case, the question immediately arises, whence come the white corpuscles? and the reply is, from the lymphatic glands, and those large organs which for want of a better term are called ductless glands, of which the spleen, the thymus, and thyroid glands are examples; this reply being grounded on the fact that large numbers of white corpuscles are found distributed in the interior of the glands, whilst the blood returning from them contains more such corpuscles than the blood running towards them. Still the mode

of origin of the white corpuscles in these glands and elsewhere is unknown. A recent investigation by Dr. Klein, of Vienna, appears to furnish some clue to the discovery of this point, for he has demonstrated that a process of division of white corpuscles may, under favourable conditions, be observed to occur, a statement which, if corroborated by further researches, will prove of much importance both in physiology and pathology. In the blood of the water-newt, he remarks, three kinds of colourless cells may be distinguished, though their differences are not very strongly marked. In one of these forms the clump of protoplasm, of which the corpuscle is formed, assumes an hour-glass form, and with the performance of the liveliest movements in each half, ultimately divides into two, in each of which a nuclear structure is visible. In a second kind the protoplasm forms a flat transparent disc, from the border of which a projection containing a distinct nucleus forms and gradually becomes detached. In a third form a kind of pinching off occurs of a minute portion from the general mass. The primary corpuscles may divide twice or thrice.

Les Mondes for March 31st contains a translation of Prof. Tyndall's article in NATURE for the 17th of the same month, on Floating Matters and Beams of Light.

MESSRS. W. & A. K. JOHNSTON are preparing a series of Botanical Diagrams for Schools and Colleges, uniform with their "Illustrations of Natural Philosophy," 50 in. by 42 in. A good series of diagrams is very much wanted by botanical lecturers; the parts should be on a larger scale than in the late Prof. Henslow's diagrams published under the authority of the Government School of Science and Art, and the series more complete than that issued by the Christian Knowledge Society, which is very good as far as it goes, and remarkably cheap.

THE Marlborough College Natural History Society has published its report for the half-year ending Christmas 1869, from which we gather, that beyond all question a real taste for science is taking firm root at Marlborough, though here and there, in the various papers, we get all too glowing descriptions, instead of the sober evidence of the keen eye of the observer. Here, for instance, is a description of the cuttle fish:—"And while I enumerate the greatest oddities to be seen in the 'motley crew' of fishes, shall I forget thee, O cuttle, that lookest so innocent and harmless, till some white-waistcoated visitor takes thee up condescendingly, when with one mighty effort thou contractest thy muscles, and in an instant sendest a mighty stream of thy own peculiar ink over that erst virgin waistcoat? Oh, the inimitable look of pity and contempt then depicted on the faces of the natives! If by thy squirts and fliks, O cuttle, thou hast made an enemy, thou hast made one that will never molest thy inky tribe again. It is interesting to know that these murky creatures are provided with backbones which have the peculiar quality of ink-erasing."

THERE is in the West Riding a Geological and Polytechnic Society, which publishes an annual report of proceedings. In that for 1869 an account is given of the meeting held at Wakefield, together with a number of papers on the history, antiquities, and mineral products of the county. The author of "On the Rocks of the neighbourhood of Pontefract," shows that there is coal enough along the line of the Lancashire and Yorkshire Railway, to yield nearly ten million tons a year for 489 years: and that the prospect of getting further supplies below the Magnesian Limestone and the New Red Sandstone is very promising. The Rev. Scott F. Surtees contributes an argumentative paper to prove that the memorable battle between Harold of England and Harold of Norway was fought, not at Stamford Brig, but at Pontefract, and that the memory thereof is preserved by the name Ponte-fract—broken bridge. Other papers contain notices of the extinct fauna of Yorkshire, of flint implements, and of certain singular ancient pits in the neighbourhood of Ripon.

A PARAGRAPH appears in a recent number of the San Francisco *Bulletin*, stating that deer, antelope, bear, and elk constitute the large game of California. Deer are found in great abundance, and many hundreds are killed yearly on Tamalipas. The deep gulches, woods, and covers of Marin County afford excellent sport to the deer hunter. Elk do not range nearer than the Oregon line, but a few are still met with on the banks of the Sacramento and San Joaquin rivers, where in former years they were so abundant. The brown and black bear are also hunted in Marin County, and along various parts of the coast range. White and grey geese are found in all the bay counties, on the lakes, and up the rivers in abundance. Duck are shot in the same localities, of which the most valued is the mallard, which remains and breeds in the country. Then come the redhead, springtail pigeon, wood duck, blue and green winged teal, broadbill, spoonbill, sawbill, whistler, butterball, fantail, or Dutchman, and Cadwell's. Quail abound in the surrounding counties. In the immediate neighbourhood of the city quail are scarce, being trapped and slaughtered for the markets so earnestly, that here they are now almost exterminated. Rabbits are also found in the quail grounds. The English or jack snipe are shot in the freshwater marshes on the San Joaquin and Sacramento rivers, in the Amador, Gilroy, and Santa Clara valleys. Of the bay snipe there is an abundant variety, such as curlew, willet, whitewings, plover, yellowlegs, robin, doewitch, ringneck, and sandpiper. The grouse, one of the finest game birds, frequents Mendocino and the upper counties of the State; several attempts have been made to stock the lower counties with these birds, but with little success. Trout abound in all the rivers running into the bay, and are taken with both bait and fly, but principally the former.

REMARKABLE SPECTRA OF COMPOUNDS OF ZIRCONIA AND URANIUM

THOUGH the spectra of different salts of bases which show well-marked absorption bands often differ in detail, yet they generally resemble one another so much that there is no difficulty in recognising each element. Judging from facts hitherto known, it was more probable that spectra of the new type described in my former paper* were due to a new element than that they were merely due to a combination of zirconium with uranium, and that there seemed to be no reason for suspecting a few special compounds of uranium would give spectra with bands unlike all others. Uranic salts, when in a state of moderately fine powder, give a spectrum not only showing absorption-bands, but also those which depend on fluorescence, and are characteristic of light reflected from the powder.† These two kinds of bands can be easily distinguished by means of a plate of deep blue cobalt glass, which proves that the abnormal bands seen in the spectra of the compounds of zirconia with the oxides of uranium are due to genuine absorption and not to fluorescence.

In studying the spectra of crystalline blow-pipe beads, it seemed desirable to examine those made with carbonate of soda, with or without a little borax. Though beads of carbonate of soda crystallise on cooling, so as to be only partially translucent, yet with strong direct sunlight well-marked spectra may be seen. For example, in the oxidising flame uranic oxide is easily dissolved by carbonate of soda alone, and when quickly cooled an orange-coloured bead is obtained, probably containing uranate of soda in a vitreous condition. It gives a single well-marked absorption-band in the green, with so small a quantity of the oxide, that in a bead $\frac{1}{8}$ inch in diameter $\frac{1}{2000}$ grain shows the spectrum to the best advantage, and even $\frac{1}{10000}$ grain can be easily detected. In examining the various products from jargons in order to study the supposed new earth in a state of purity, a small quantity of a dark-coloured substance was obtained, apparently zirconia, containing some oxide which communicated a green tint to a glassy, borax blowpipe-bead, but yet not sufficiently

* Proceedings of R. S. vol. xvii. p. 511.
† See Stokes's paper, Phil. Trans. 1852, p. 463 and 1853, p. 392.

distinct to show that it was due to uranous oxide. Though the presence of zirconia prevented solution by pure carbonate of soda, the addition of a little borax enabled me to prove that uranic oxide is really present in some jargons. Such then being the case, it seemed desirable to ascertain whether the oxides of uranium would give rise to any special spectra when present along with zirconia in crystalline blowpipe-beads. To my astonishment I found that the spectra were precisely the same as those obtained in the case of what I had thought to be an approximately pure new earth.* Hence the very abnormal spectra, which seemed sufficient to establish the existence of a new earth, are really due to compounds of zirconia with the oxides of uranium, which have such a powerful action on light, that an almost inappreciable amount is sufficient to produce the spectra to great perfection—in fact so small an amount, that the total quantity which misled me was only a few thousandths of a grain; and its presence might easily have remained unsuspected, if I had not discovered the carbonate of soda test just named. In the case of transparent blowpipe-beads of borax with microcosmic salt, it is requisite to have as much as about $\frac{1}{50}$ grain of uranous oxide to show faintly the characteristic absorption-bands, whereas, when present along with zirconia in the crystalline beads, $\frac{1}{500}$ grain gives an equally well-marked spectrum; and $\frac{1}{2000}$ grain shows it far better than a larger quantity, which makes the beads too opaque. These very minute quantities were obtained by the repeated division of a small known weight, either before or after fusion with borax. This spectrum also differs very considerably from the spectra of the usual salts or blowpipe-beads of uranous oxide. On comparing them side by side, the only common peculiarity is the fact of there being numerous absorption-bands distributed over a large part of the spectrum; but they do not correspond in either number or position. On the contrary, they differ almost as much as possible; and the darker bands in the spectrum of this zirconia compound occur where the transmitted light is the brightest in other cases. One of the most striking peculiarities of the spectrum of some jargons is, that when light passes in a direction perpendicular to the principal axis of the crystal, and the spectrum is divided by means of a double-image prism into two spectra, having the light polarised in opposite planes, though some of the absorption-bands are of equal intensity in both images, yet others are comparatively absent, some in one and some in the other; whereas, in the case of other dichroic crystals, all the absorption-bands are usually more distinct in one image, and fainter, or even comparatively absent, in the other. The general character of the spectrum was entirely unlike that of all the known compounds of uranic oxide. Instead of the moderately broad absorption-bands in the blue end, ignited jargons give a most unusually large number of narrow black lines, extending from the red end, so that nearly all occur in that part of the spectrum which is entirely free from bands in all previously known compounds of uranic oxide. Besides uranium, and several of the more common earths and oxides, I have detected in some zircons erbium, didymium, yttria, and another substance which exists in such small quantity that I have not yet been able to ascertain whether or no it is the suspected new earth. These accidental constituents do not indeed occur in sufficient quantity to be of importance, except as modifying the physical and optical properties, the didymium giving the usual characteristic absorption-bands (zircons from Sveneroe, Norway), and the manganese, the same spectrum as that of garnets (zircons from an unknown locality in Siberia†). The oxide of uranium is so easily reduced at a high temperature to the state of protoxide in a borax-bead, with excess of boric acid, and is so readily peroxidised at a dull-red heat, when crystallised along with borate of zirconia, that there seemed good reason to refer the change in the spectra to temperature rather than to the state of oxidisation, until after it was found that they were due to uranium. By gently flaming the crystalline bead, the spectrum is entirely altered, and presents five well-marked absorption-bands, all of which occur at the red end, where no trace of bands exists in the case of ordinary uranic salts. I have not found any other element besides zirconia which causes uranium to give similar abnormal spectra, at all events in similar conditions. A few have special characters, but the majority exert little or no influence. Even when the blowpipe-beads are crystalline, they show only the usual spectra of the oxides of uranium. Moreover no such great change in the character of the spectra of other elements which give absorption-bands is to be seen when they are combined with zirconia. So far as my present experience goes, it seems as if such very abnormal spectra were met with only in the case of these remarkable compounds of zirconia with the oxides of uranium. These facts now put us in a position to explain why certain zircons give three different spectra. Some jargons (usually those of a green tint) contain a little uranium so combined that the characteristic spectrum is only faintly visible, whereas, after ignition, the intensity of the absorption bands is permanently increased often to a very great extent, and this more powerful action on light is accompanied by an increase in hardness and in specific gravity, sometimes as much as from 4·20 to 4·60. These changes are approximately proportional to the amount of uranic oxide in the various specimens, as shown by comparing the spectra of the blowpipe-beads. On the whole, since this abnormal type of spectrum is so characteristic of combination with zirconia, it appears probable that the effect of a high temperature is to cause the uranic oxide to combine more specially with the zirconia, as though the greater part existed naturally as a silicate, but after ignition as a zirconiate. We may also apply the same explanation in the case of zircons, more or less strongly coloured by other oxides, which become almost colourless when heated; and this unexplained peculiarity of zircons may depend on the fact of zirconia being able to play the part of both a base and an acid, which as compared with silica has an affinity for bases varying according to the temperature. The brown-red zircon from Ceylon, named at page 514 of my former paper, gives a spectrum precisely like that of the borax blowpipe-beads crystallised after treatment in the deoxidising flame. No doubt it contains uranous oxide. These facts thus clearly show that the various spectra which seemed to indicate the presence of a new element existing in three different physical conditions, are in reality only characteristic of the two oxides of uranium combined with zirconia, or not in combination. Perhaps some may think that my having been thus led astray shows that little or no reliance can be placed on the method of investigation employed, but I contend that the mistake was due to its being such an unexpectedly delicate test for uranium; moreover, the error was ultimately corrected by a further development of the same method. As far as the interests of science are concerned, there is no need to regret the general result. We have lost what appeared to be good evidence of a new earth, but have gained an almost entirely new system of blowpipe testing, which enables us to detect such a minute quantity of some substances as could not be recognised by the ordinary means.

H. C. SORBY

* Figs. 1 and 2 of my former paper.

† For both of these I am indebted to my kind friend Mr. David Forbes.

THE RELATION OF THE STATE TO SCIENCE

WE have referred in another column to Lieut.-Colonel Strange's valuable paper, read before the Society of Arts. The following is a report of the more important part of it. After giving a sketch of the history of the movement in favour of a recognition by the Government, of the necessity of defining the relations which should subsist between the State and scientific education throughout the country, commencing with the meeting of the British Association at Norwich in 1868, Colonel Strange proceeds to state the points which he thinks should be especially kept in view in the proposed inquiry. These are:—

1. The scope which the inquiry should include.
2. Some of the probable results of the inquiry.
3. The constitution of the Commission itself.

1. *The Scope of the Inquiry.*—The first thing to do will certainly be to take stock of what is now done by the State for advancing science. A reference to the parliamentary votes shows a considerable expenditure on science, in some form or other. The British Museum receives upwards of 100,000*l.* a year, the South Kensington Museum 92,000*l.*, and the Science and Art Schools 74,000*l.*, but in these cases a large proportion goes to art, not wholly to science.* The Royal Observatories of Greenwich, Edinburgh, and the Cape of Good Hope, the Royal School of Mines, the Ordnance Survey, the Hydrographic Department of the Admiralty, are all scientific branches of the admi-

* The total amount voted in the Estimates, for 1869-70, to maintain the "Science and Art Department of the United Kingdom" was 225,253*l.*

nistration, supported by the State at considerable cost. Enormous sums of money have been spent on special inquiries of a scientific character, such as those on armour-plate structures, ordnance, ammunition, small arms, explosive agents, and projectiles. The Parliamentary votes show also 10,000*l.* a year as given for meteorological observations. We also find a large number of small sums, forming, however, a considerable aggregate amount, given in aid of the funds of various colleges, universities, and museums; in some instances towards the salaries of specified professors, in others towards general purposes. The Royal Gardens of Kew receives 22,075*l.*; the Botanical Gardens of Dublin and Edinburgh receive respectively 1,931*l.* and 1,893*l.*; 20,900*l.* is spent on geological, and 92,790*l.* on the Hydrographic Department and naval surveys, besides very large sums on other miscellaneous objects.* Some of the institutions above named issue reports, from which the results of the expenditure on them may be inferred. In other cases this is not done. The wording of the votes seldom conveys any useful information on the subject whatever, and sometimes conveys incorrect information. The grant of 1,000*l.* a year distributed by the Royal Society is an example of such inaccuracy. This is said, in the words of the vote, to be given to the Royal Society "to enable the society to carry on certain experiments for public objects," whereas, instead of being given, as here stated, to the Royal Society, or for public objects, it is given to the community at large, and a committee of the Royal Society undertakes gratuitously the very laborious task—which does not even receive nominal acknowledgment—of distributing it with the strictest economy and impartiality, to such persons, whether belonging to the Royal Society or not, as may prove their ability to make good use of the aid they solicit in prosecuting scientific research.

Now, the results supposed to be obtained by the large expenditure recorded in the estimates may be thus enumerated:—(1). The maintenance of the efficiency of the public services in matters of a scientific nature. (2.) The teaching of science, directly, as by payment of professors, or indirectly, as by the maintenance of museums, botanical gardens, and the like. And (3), direct or indirect scientific progress, whether observational or experimental. What is wanted is, a clear statement of the degree in which these several results are attained in each particular case. With this information before us, we shall be in a position to arrive at trustworthy conclusions as to whether the money brings in each case an adequate return; whether the inadequacy of the return is due to defective organisation or to abuse; and whether, therefore, a more satisfactory result may not be obtainable in each case by a process of remodelling, without increased expenditure. We shall also ascertain, probably, that the whole expenditure in some particular case is needless, and is at present absolutely wasted. We shall learn, too, no doubt, that there is much divided, and probably much utterly undefined, responsibility in many of the cases in which large sums of public money are spent. Another fact, already patent, will be brought out prominently, namely, the entire absence of any pervading system by which the expenditure on scientific objects is regulated. Finally, it will clearly appear that the expenditure is very partially distributed, some branches of science receiving a very large amount of assistance from the public purse, whilst others, of equal importance to the community, receive none at all. This taking stock of our present scientific arrangements, it can hardly be doubted, is an absolute necessity to the success of the proposed inquiry.

Much of the information above adverted to will bear more or less on the question of "the higher scientific education." But in indicating the scope of the inquiry in this direction, it is very desirable that a clear conception should be formed of the meaning of this phrase. My own conception of it is this. Public opinion has decided that science should form part of the general education given at large and public schools, and at the universities. Such scientific education should comprise the elements of scientific knowledge, and the results of scientific labour, so far as these results are generally accepted as settled. Teaching of this kind forms, in my opinion, a portion of the great educational question which has been for some time occupying public attention, and which is now in a fair way of being put on a satisfactory footing. To impose on the Royal Commission the consideration of such teaching would be doing the same work twice over, and adding, therefore, unnecessarily to their already most laborious inquiry. But beyond the scientific teaching of schools and universities, there is much to be done in order to train advanced students to become investigators and observers, and this I conceive to be the object intended to be described by the phrase "higher scientific education."

It is maintained by very high authorities that it is beneficial intellectually to the investigator himself to have to teach, on account of the mental discipline and the habit of precise thought which it imposes on him. At present, unquestionably many of our best investigators are teachers also, and in all Continental scientific systems the two functions are combined. Two conditions seem important. First, that an investigator should not be required to impart the mere rudiments of scientific knowledge, but that his students should be far advanced before they come under his tuition; they should, in fact, be men who had already gained some distinction at the universities or elsewhere, and who had resolved on following science as a profession. The second condition is that the labour of teaching should engross only a moderate portion of the time of the investigator, leaving him ample leisure and spare energy for original research. At present, this latter condition is precisely reversed in the cases of most of our professors engaged in investigation, and we accordingly only reap the benefits of a mere residuum of their highest faculties.

Another matter connected with scientific teaching is considered by persons engaged in that important occupation to require attention, namely, the possible effect on independent educational institutions of rival State schools of science. The apprehended interference with such interests may perhaps be obviated by restricting State aid to the "higher" teaching which I have attempted to define, leaving the preparation of students for such higher teaching to the universities and other institutions of an independent character. But before any rules on this subject can be laid down, it is obviously necessary that the exact amount and kind of action now taken by the State in respect of teaching, and the effect of that teaching, both on scientific progress and on independent interests, should be ascertained with the utmost care.

It is also desirable that the Commission should collect the fullest possible information regarding all foreign scientific systems, down to the latest period. I by no means consider that any of these systems in particular is so perfect as to justify our creating a servile imitation of it. But it is only the part of wisdom, before organising our own scientific administration, to examine carefully the results attained abroad by nations whose experience in such matters is now very extensive. This examination will suggest many arrangements that we may safely adopt, and, no doubt, some that we should do well to reject. Not even the nucleus of a scientific system at present exists in England, and we are therefore the more free to shape, on the best available models, the organisation which a full inquiry will undoubtedly show to be necessary.

A great mass of facts connected with both scientific teaching and scientific investigations having been thus accumulated, the next step will be to digest and analyse them. The result of this most important process will be to show—first, what is redundant; secondly, what is imperfect; and thirdly, what is altogether wanting. It will indicate cases in which separation is desirable, as, for instance, cases where the concurrent cultivation of two or more branches of science, not naturally allied, tends to impede the growth of each. Cases will also occur in which combination would be beneficial. But one of the most important results of the analysis will be the bringing to light the scattered character of our scientific efforts; almost every department of the State having charge of some scientific institution—the Admiralty of one, the War Office of another, the Board of Trade of a third, and so on, a dispersion which is absolutely prohibitive of harmonious system, of progressive improvement, of efficient superintendence, of economy in expenditure, and of definite responsibility.

The final process will be to reduce to order the chaos of which I have merely attempted a broad indication. This will probably consist in a total re-arrangement of the internal organisation and the official distribution of our scientific institutions, with a view to concentrated superintendence and responsibility. It will also involve a revision of scientific staffs and salaries, with all the attendant questions of patronage, promotions, distinctions, privileges, and pensions.

2. *Some of the Probable Results of the Inquiry.*—The first of these will be the accumulation of a vast amount of facts and opinions, collected from every available source, and from the most competent authorities, regarding an extensive variety of

* The amounts above given are quoted from the Civil Service Estimates or 1869-70, those for the present year not having yet been published.

subjects of which we are at present in a state of comparative ignorance. If the inquiry produced no other immediate fruits than these, it would have performed a priceless service. Another result will be that we shall see for the first time what are the principles which should determine the action of the State for the advancement of science. At present there exists the most violent conflict of opinion on this subject, from those who hold that State intervention in science is unjustifiable and disadvantageous, to those who desire such intervention to be universal. Between these extremes there lies the middle and more reasonable section of thinkers, who recognise in the State simply a machinery for doing, on the part of the community, whatever is generally advantageous to the great mass of the people, but which transcends the power of individuals to perform. To discriminate fairly between the branches of scientific exertion which should devolve on the State and those which should be left to private energy, is one of the most valuable results that can be expected from the inquiry.

We may hope, as another most important result, that a central ministerial administration of scientific affairs will be shown to be necessary. In all other civilised countries a Minister of State is charged with this duty. It seems absolutely impossible to organise or maintain in an efficient state anything like a harmonious scientific system, without a dominant authority presiding over the whole. There are already indications of a coming Minister of Public Instruction, to administer the proposed national system of primary education; it can hardly be doubted that he should also have charge of whatever relates to State intervention in science.

The creation of such new scientific institutions as may be proved to be necessary, is another result that may be looked for. Though I have long been of opinion that the want exists, I do not think that the time has yet arrived to indicate how it should be supplied. The inquiry will develope clearer and more consistent estimates of the extent of the want, and of the best mode of meeting it, than, in the absence of full information regarding existing institutions, anyone can now hope to form. The cost of new scientific institutions alarms many persons who have only superficially examined such questions, but it will be probably found that increased expenditure in some directions may be met by retrenchment in others, and that no great change in the aggregate outlay on science will have to be made. On the other hand, we may feel sure that no outlay whatever will be recommended by a Royal Commission, unless it be incontrovertibly proved that such outlay will be beneficial to the nation.

Eventually, the responsibility of sanctioning increased expenditure for scientific purposes must rest with Parliament, by whom any proposals of that kind will be most scrupulously examined.

3. *The Constitution of the Commission.*—This is of vital importance. If its constitution be not such as to command, not only the confidence of the public generally, but also that of men of science, it cannot hope for success. The necessary elements in such a body seem to be administrative capacity, impartiality, and varied scientific knowledge. The first two elements will be secured by the nomination of persons versed in public affairs, and of high and independent station; the last by the due representation of the main branches of scientific activity. Probably four scientific members will suffice, to represent respectively, (1) Mathematics, including Astronomy; (2) Chemistry; (3) Physics; and (4) Natural History. To give a decided preponderance to either one of these great subdivisions will create strong and well-founded dissatisfaction. However lamentable the fact, it is certain that men engaged in one branch of science are very apt to underrate the importance of all others. The decision of a physiologist on an astronomical inquiry, or that of a mathematician on a matter connected with biology will be received with jealousy, a jealousy not by any means in most cases destitute of reasonable foundation. The subjects which will come before the Commission will be so difficult and so various, that four of the ablest men of science in their different departments will not be found more than will be necessary to give weight to the conclusions at which the Commission may arrive, and they should be men admittedly representative of their respective departments.

In the remarks which I have ventured to make, I have not dwelt on the importance to a civilised nation of progress in scientific knowledge. I have felt that I might safely take this for granted in addressing the Society of Arts, a society whose efforts have been during so long a period devoted to the promotion of such progress, and who do not require to be told that our commerce, our arts, our national supremacy on land and at sea, and our everyday conveniences are, more or less, dependent on our application of the laws of nature and the properties of matter. Whether or not an exhaustive inquiry into the state of science in England is imperatively needed, and what should be the scope of that inquiry, are the questions which, I believe, we have to-day met to discuss. It appears to me that the time for such an inquiry is opportune.

At no period of our history has there been so great a readiness to place administrative power in the hands of the Government. Public opinion acts now so energetically and effectually in the legislature, that the old jealousy of Government interference has been almost entirely dispelled. The tendency of the day is rather to impose fresh duties on the Government than to restrict its action. Men's minds, at the present time, view without apprehension, and examine with more impartiality and a higher discrimination than at any former period, proposals for radical changes. The nation has, moreover, been roused from the apathy with which it used to regard the ignorance of the masses, and is prepared for measures to redress the evil which, even ten years ago, would not have been listened to. It cannot be doubted that an equal readiness will be shown to examine with calmness and candour well-considered proposals to place on a proper footing a department of the State's duties which has never as yet undergone a strict and methodical examination. The nation requires primary education, and will enforce it upon those whom it is to benefit; it insists on the teaching of science in schools and universities; will it not approve of measures without which that teaching must be comparatively fruitless—measures calculated to attain the ends to which teaching is but a means—a more perfect knowledge of nature, and more absolute sway over her forces and her laws?

SCIENTIFIC SERIALS

THE *Student and Intellectual Observer*, New Series, No. 2, for April, contains an article entitled "Animals as Fellow-Boarders," being a translation of Von Beneden's valuable paper on *Commensalisme*, read before the Belgian Academy, describing the habits of creatures who may be said to board together, but whose association is distinct from that of victim and parasite. They are of two kinds, Free Fellow-Boarders, such as the tiny pea-crab, which lives in mussel-shells; and the Fixed Fellow-Boarders, like the barnacles which cover the skin of whales.

THE *Journal of Botany, British and Foreign*, New Series, No. 2 (double number for March and April) contains the following original articles: On two new British *Hepaticæ*, by Dr. Carrington; a fifth decade of new Chinese plants, by Dr. Hance; on *Rosa sepium*, by Mr. J. G. Baker; Addenda to the "Cybele Hibernica," by Mr. Ralph Tate; notes on Ray's "Hortus Siccus," by Dr. H. Trimen, with other shorter papers; also reports of recent additions to our moss and lichen flora, by Dr. Braithwaite and Rev. J. M. Crombie; a continuation of Mr. Baker's Review of the genus *Narcissus* from the *Gardener's Chronicle*, with other extracts and translations, reviews of new publications, proceedings of societies, &c., &c.

THE *Revue des Cours Scientifiques* for March 26 contains report of a Lecture by M. Paul Bert, on Sympathetic Nervous Actions, an article by Alph. Favre on the Existence of Man in the Tertiary Epoch, and a notice of Prof. Harkness's Spectroscopic Observations. The number for April 2nd is almost entirely filled by a translation of Prof. Tait's lecture before the University of Edinburgh, on the characters of a true science; and report of a lecture by M. Lorain at the Hospital Saint Antoine at Paris, on Scientific Medicine.

IN the *Deutsches Archiv für Klinisches Medicin* (xiii. and xvii. Heft. 1, received March 12), Liebermeister, of Basle, describes a very ingenious apparatus, constructed under his superintendence, for determining quantitative variations in the production of carbonic acid by man, and gives several examples of the results obtained. Amongst other conclusions he shows that the increase of carbonic acid in reading and singing is only to a small extent attributable to increased exertion consequent on fuller ventilation of the lungs, but is essentially due to the increased muscular energy exerted in the performance of those acts.

REICHERT and Dubois Reymond's *Archiv für Anatomie und Physiologie*, Heft. vi., 1869, is almost entirely occupied with a

valuable contribution by Dr. Gustav Fritsch, assistant in the anatomical museum at Berlin, on the comparative anatomy of the hearts of amphibia, illustrated by four plates and many drawings.

THE *American Naturalist* for March contains several interesting articles. The longest is by Mr. E. G. Squier, "On the Primeval Monuments of Peru compared with those in other parts of the world." He describes a class of stone structures in Peru belonging to what is regarded as the earliest monumental period, coincident in style and character with the cromlechs, dolmens, and "sun" or "Druidical" circles of Scandinavia, the British Islands, France, and Northern and Central Asia. Considerable aboriginal Peruvian tribes once lived in houses built on piles, or on floats in the shallow waters of the Andean lake. The remnants of such a tribe still live in this manner, and bear the name of Antis; they spoke and still speak a language differing equally from the Aymara and Quichua, called Puquina. Early chroniclers speak of them as extremely savage, and calling themselves, not men, but *Uros*. Whole towns of them, it is said, lived on floats of *tortora* or reeds, which they moved from place to place according to their convenience or necessities.—Prof. Joseph Leidy contributes remarks on some curious sponges; and Mr. W. W. Bailey a sketch of the Truckee and Humboldt valleys between the Sierra Nevada and the Rocky Mountains.

Silliman and Dana's American Journal of Science and Art for March contains the following articles:—Photometric Experiments, Part I., by O. N. Rood. Contributions to the Chemistry of Copper, Part I., by T. Sterry Hunt. Notice of a recent Land-slide on Mount Passaconaway, by G. H. Perkins. On the Silver Mines of Santa Eulalia, Mexico, by J. M. Kimball. Machinery and Processes of the Industrial Arts, and Apparatus of the Exact Sciences by F. A. P. Barnard. On Norite or Labradorite Rock, by T. Sterry Hunt. On the Cause of the colour of the water of Lake Leman, by A. A. Hayes. On the Potassio-Cobaltic Nitrite known as Fischer's Salt, by S. P. Sadtler. Notice of some Fossil Birds from the Cretaceous and Tertiary formations of the United States, by O. C. Marsh. Descriptions of Shells, from the Gulf of California, by A. E. Verrill. Notice of Dr. Gould's Report on the Transatlantic Longitude. Meteors of November, 1869, by Prof. H. A. Newton.

SOCIETIES AND ACADEMIES

LONDON

Ethnological Society, March 22.—Prof. Huxley, F.R.S., president, in the chair. Mr. R. S. Newall was announced as a new member.—A paper was read on current British Mythology and Oral Tradition, by Mr. J. F. Campbell (of Islay). After explaining the sources whence his popular tales of the Western Highlands had been derived, he referred to the traditional character of myths, and expressed an opinion that many genuine British traditions orally preserved in Celtic may probably be old Aryan myths, mingled perhaps with pre-Aryan myths. Popular oral history must be founded on a real event, but minor details gradually drop out, while the most conspicuous incidents approach each other. The author showed how a legend sprouts from a fact which, being at first accurately told, passes into a tradition, while the dates and persons and localities become uncertain. Poetry is a good vehicle for preserving facts, and many current traditions carry with them a rhyme or a proverb to aid the memory. Hence, too, historic events are readily preserved in the ballad form. The president, Dr. Archibald Campbell, and Mr. Bouverie Pusey spoke upon this communication.—Dr. Campbell then read a note by the Rev. R. J. Mapleton on a Cist with Engraved Stones on the Poltallock Estate, Argyleshire.

Zoological Society, March 24.—Dr. E. Hamilton, V.P., in the chair. Mr. P. L. Sclater exhibited a coloured drawing received from Dr. Salvadori, of Turin, of a bird which Dr. Salvadori had proposed to describe as a new genus and species, but which was evidently referable to the singular pigeon recently named by Mr. Gould as *Otidiphaps nobilis*.—Mr. W. B. Tegetmeier exhibited and made remarks on a living specimen of an Axolotl (*Siredon pisciformis*) which had undergone the change into the Salamandroid form recently described by Professor Dumeril, of Paris.—A third letter was read from Mr. W. H. Hudson, containing remarks on the ornithology of the vicinity of Buenos Ayres.—Mr. Osbert Salvin read a paper on the birds of Veragua, based on large collections recently formed by Enrique Arce in that country, and in continuation of a former memoir on the same subject. The present communication contained an account of 214 species not given in the former list, and made altogether 434 species now known to occur in this limited district. Of these additional species several were stated to be new to science and of great interest.—Mr. P. L. Sclater read a notice of two rare species of pheasants from Upper Assam recently added to the society's living collection. These were a Monaul (*Lophophorus sclateri*) and a Tragopan (*Ceriornis blythii*), both lately described as new by Dr. Jerdon. For these specimens, both of which were in fine plumage and of very remarkable beauty, the society was indebted to the liberality of Major Montagu, of the Bengal Staff Corps.—Mr. P. L. Sclater read some further notes on the cuckoos of the genus *Coccyzus*, in continuation of a former paper on the same subject.—A communication was read from Professor J. V. Barboza du Bocage, containing a description of a new species of pelican from Angola, proposed to be called *P. sharpii*.—A communication was read from Dr. J. C. Cox, giving descriptions of eight new species of shells from Australia and the Solomon Islands.—A communication was read from Mr. Jonathan Couch, of Polperro, describing a new species of *Aplysia* or sea-hare, which had recently occurred on the coast of Cornwall, and which he proposed to call *A. melanopus*.

Chemical Society, March 17.—Prof. Williamson, F.R.S., president, in the chair. The following gentlemen were elected fellows: D. Brown, A. Muirhead, T. L. Patterson, D. Penny, S. T. Smith. The first paper read was on artificial alizarine, by W. H. Perkins, F.R.S. The lecturer commenced by sketching the history of the researches which had finally led to the artificial production of alizarine. This colouring matter was first obtained by Robiquet and Colin from madder root, and investigated by Schunk, who assigned to it the formula $C_{14}H_{10}O_4$; it will subsequently be seen how very near this formula comes to the truth. Strecker and other chemists had reasons to write $C_{10}H_6O_3$ as the composition of alizarine, relating it to the compound $C_{10}H_5ClO_3$ which Laurent had produced from naphtaline, and which Strecker regarded as chloralizarine. A few years since Graebe, when investigating a hydrocarbon known as quinone, $C_6H_4O_2$, found it to be a benzol in which two atoms of hydrogen were replaced by the group $[O-O]''$. A derivative of this body, the chloranil, $C_6Cl_4[O_2]''$ yields hydric chloranilate on successive treatment with caustic potash and hydric chloride. This reaction induced Graebe to view the chloride of Laurent's chloroxynaphtalic acid as the dichlorinated quinone of naphtaline,—

$C_{10}H_8$	$C_{10}H_4Cl_2[O_2]''$
Naphtaline.	Chloride of chloroxynaphtalic acid or Dichlornaphtoquinone.

and indeed when this naphtaline derivative is acted upon successively by potash and hydric chloride, it furnishes chloroxynaphtalic acid. After it had thus been shown that chloroxynaphtalic acid, Strecker's chloralizarine, was a quinone acid, Graebe and Liebermann thought it probable that alizarine might also be the quinone acid of some hydrocarbon, and it was now only necessary to know this hydrocarbon. On reducing a specimen of natural alizarine, a substance of the composition $C_{14}H_{10}$ was obtained; but this is the formula of anthracene of coal tar, and indeed the substance obtained by the reduction of alizarine possessed all the properties of anthracene. This fact led Graebe and Liebermann to assume alizarine to be the quinone acid of anthracene,—

$C_{14}H_{10}$	$C_{14}H_8(O_2)''$	$C_{14}H_6\begin{cases}(O_2)''\\HO\\HO\end{cases}$
Anthracene	Quinone of anthracene or Anthraquinone.	Anthraquinonic acid or Alizarine.

Having obtained anthracene from alizarine, it now remained to produce alizarine from anthracene. For this purpose it was first required to have the quinone of anthracene. Graebe and Liebermann found the desired substance in the oxygenated compound, $C_{14}H_8O_2$, which had been obtained by Laurent from anthracene. They heated this anthraquinone with bromine, acted upon the dibromanthraquinone thus gained with potash, and decomposed the potash salt thus obtained by hydric chloride. The product of these successive reactions was alizarine. But to turn this beautiful discovery to practical account, it was necessary to replace the bromine required in the process by some cheaper re-agent. A good substitute has been found in sulphuric acid.

When anthraquinone is heated with oil of vitriol, disulphoanthraquinonic acid is formed, and this decomposed by caustic potash yields the potassium salt of alizarine, from which hydric chloride liberates the alizarine. Artificial alizarine is entirely identical with the colouring matter obtained from the madder root. Both of these products crystallise in needles which are usually curved, especially when small. They dissolve in caustic alkalis, forming violet solutions of the same tint. When applied to mordanted fabrics, they produce exactly the same colours, bearing the treatment with soap equally, and resisting in the same degree the influence of light. Their alkaline solutions show identical absoption bands in the spectrum. Both yield phtalic acid when treated with hydric nitrate. As a substitute for madder, artificial alizarine has been objected to, on the ground that pure alizarine alone will not produce the madder colours, other colouring matter being required. But Schunk says that, after a long course of experiments, he has been led to the conclusion that the final result of dyeing with madder is simply the combination of alizarine with the mordants employed; and he recommends extraction from madder prints as the easiest method of preparing pure alizarine on a small scale. Artificial alizarine, as sent to the dyer and printer, is not exactly pure alizarine, and generally produces, with alumina mordants, a somewhat redder shade than madder. This is due to some impurities whose nature is, as yet, not known. A good deal has been said about the supply of anthracene. It must be remembered, however, that tar-distillers have as yet but little experience in separating this substance. Mr. Perkin's investigations on this matter have led him to believe that coal-tar contains considerable quantities of this hydro-carbon. No doubt, the kind of coal used, as well as the temperature employed in the gas-works, influences the quality of the tar as a source of anthracene; but upon these points no definite information has yet been obtained. Mr. Perkin illustrated his interesting lecture by exhibiting samples of fabrics dyed and printed with artificial alizarine, and also by projecting the spectra of some alizarine solutions upon a screen. By producing alizarine from anthracene, Graebe and Liebermann have given the first instance of the artificial formation of a vegetable colouring matter. The way by which the beautiful discovery has been arrived at proves decisively, as the president pointed out, the high importance of studying the molecular arrangements of chemical compounds.

Entomological Society, March 21.—Mr. H. W. Bates, vice-president, in the chair. The first part of the "Transactions" for the present year was placed on the table. The attention of the meeting was devoted exclusively to *Lepidoptera*. Specimens were exhibited by Messrs. Howard, W. J. Vaughan, Bond, Frederick Smith, and Stainton. An interesting discussion on dimorphic forms of the larva and imago was participated in by Messrs. Albert Müller, A. G. Butler, Pascoe, J. Jenner Weir, Stainton, McLachlan, and the chairman. The paper read was by Mr. W. F. Kirby, "Notes on the butterflies described by Linnæus."

BRIGHTON

Brighton and Sussex Natural History Society, March 10.—The president, Mr. T. H. Hennah, in the chair. A report from the committee was received, urging the advisability of forming a microscopical section. On the motion of Mr. Hazlewood, seconded by Mr. Wonfor, it was resolved that the report of the committee be received, entered on the minutes, and approved, the effect of which is to establish a microscopical section, and instead of one meeting on the second Thursday in each month, to have a second meeting for strictly microscopical objects on the fourth Thursday in each month.—A paper by Mr. Clifton Ward, F.G.S., "A sketch of the Geological History of England, so far as it is at present known," was read by Mr. Wonfor, hon. sec., in which, from the earliest dawn of the Cambrian period down to the present day, the changes produced by depression, deposition, elevation, denudation, &c., together with an account of the various types of animal and vegetable life during each period, were graphically described, and the amount of land above water in England at each period was represented by a series of fifteen charts.—It was announced that the Bryological Flora of the county of Sussex would soon be ready for distribution, the Society having determined to publish it at once, instead of waiting for the issue of the annual report in September.

EDINBURGH

Royal Physical Society, February 23rd.—Mr. C. W. Peach, president, in the chair. The following papers were read:—

1. Note on the Klipspringer Antelope (*Oreotragus saltatrix*). By Mr. D. R. Kannemeyer. A skin of this antelope was exhibited, and its various peculiarities pointed out and described—the long, wiry, and close hair with which it was covered, and the remarkable structure of its strong limbs and feet. Major Harris, in his work on the wild animals of South Africa, described it as having jagged edges to its hoofs; there was really a long, narrow depression or oval-shaped hollow on each of the divisions of the hoof. These peculiarities were admirably suited to the habits of the animal, which lived on the tops of high mountains, and was remarkable for the speed, agility, and sureness of foot with which it could leap from rock to rock up and down the face of inaccessible precipices; and also for the great distance of its leaps, and the small surface of some projecting ledge or pinnacle of rock upon which it could suddenly arrest its course, even when in full career. Mr. Kannemeyer described the various enemies the animal had to defend itself from—the eagle, the panther, and man—and referred to the manner in which it was hunted by the colonists, and his own experience in stalking it.

2. On the Deposits of Clay in the Neighbourhood of Stirling. By Rev. James Brodie, A.M., Monimail.

3. Specimens of Polyzoa, &c., from the Faroe Islands, were exhibited and described by Mr. C. W. Peach, A.L.S., &c. The author stated that the specimens were from Stromoe, one of the Faroe Islands, and not gathered by himself, but were given to him by a person who had been there. They consisted of sixteen species of Polyzoa, four of Mollusca, three of Hydrozoa, two Sponges, three Annelide cases, with Foraminifera and Diatomacea. A portion of one of the shells shows the marks of rasping by limpets when feeding on the leathery disks of Hydrozoa. He remarked on this as a curious instance of vegetable-eating animals being able to put up with such tough and hard fare when out of their native home, and thus accommodating themselves to their changed circumstances. He considered that the specimens were not got in deep water, nor far from land, as not a single really deep-sea form occurred amongst them. All of the species are to be got in our own seas, and with two exceptions (at present northern forms from Shetland and Wick, N.B.) have been collected by the author from Land's End to John o' Groats.

4. Dr. J. A. Smith exhibited a head of a red deer, the property of Mr. T. O. Horne, which was killed in the end of January near Kingussie, Inverness-shire. Instead of the usual well-developed brow and bez-antler which marked the red deer, this animal had on the right side two small and very short antlers springing close to the root of the horn, and on the left side a very small brow-antler, and then a large second antler springing from near the root of the horn, and running nearly parallel to the beam. It measured about a foot in length. The beam of the same horn measured one foot ten inches long, terminating in a couple of forked antlers above. The other horn was rather shorter, and also terminated in two antlers. The variety was probably due to some local injury sustained by the deer when the horns were beginning to sprout, the soft horn of the left side having apparently been split in two. Dr. Smith stated he was indebted to Mr. Muirhead, Queen Street, for recently sending him a specimen of the *Ballan Wrasse*, measuring 18½in. in length, taken in the Firth of Forth, where it is by no means common; also, a very large specimen of the Lump-sucker or Hen-padle, *Cyclopterus lumpus*. The fish was full of roe; it measured 20½in. in length by a foot in depth, and weighed 10lb. 13oz. He also noticed the very large male salmon taken on the 11th February. Mr. Anderson informed him it weighed a little over 56lb., and measured 4ft. 2in. in length by 2ft. 7in. in greatest girth. The salmon was taken along with several others at Mr. Anderson's fishing station, near Stirling.

PARIS

Academy of Sciences, March 28.—M. Darroux communicated a paper on Equations, with partial derivations of the second order, and M. Tisseraud a note on a point in the differential calculus.—A memoir was read by M. J. Jamin, on the employment of the electric current in calorimetry, in which the author described a method of applying the heat produced by an electric current to the determination of the specific heat of various bodies.—M. Jamin also communicated, on his own behalf and that of M. Amaury, a memoir on the specific heat of water between zero (32° F.) and 100° C. (212° F.) The authors showed that the specific heat of water undergoes no particular alteration about 39·6° Fahr., and that from upwards it

increases with the temperature.—M. A. Trécul presented the sixth portion of his memoir on the position of the tracheæ in ferns, in which he described the ramification of the petioles in various plants of that group, including several species of *Asplenium*, *Aspidium*, and *Polypodium*. — A note was read on the organs and phenomena of fecundation in the genus *Lemanea*, by M. Sirodot. The *Lemaneæ*, although among the highest of the fresh-water Algæ, were described by M. Rabenherst in 1868 as producing "spores germinating without fecundation." The author described what he regards as antheridia in two species (*L. catenata* and *L. fluviatilis*), and indicated the mode of fecundation as observed by him. — M. Ducharter communicated an abstract of two Greek papers by M. Koressios, in which the author expressed the opinion that the disease now ravaging the vines in France attacks them from the roots, and recommended a certain mode of treatment.—M. Leymerie presented, through M. Elie de Beaumont, some observations on the conclusions lately put forward by M. Magnau, with regard to the lower cretaceous formation of the Pyrenees. He maintained that there is no evidence of the existence of the Albian stage in the Pyrenees, and also objects to the admission of the Muschelkalk as existing in the Zechstein in the departments of the Tarn and Aveyron. The same author addressed a note on the fragmentary state of the higher summits of the Pyrenees, in which he maintained that the broken state of the rocks forming these summits must be due to the effects of the force exerted during their elevation, and concluded therefrom that the summits of these and other mountains cannot have lost much of their original heights by subaerial action. M. Elie de Beaumont made some remarks on the permanence of artificial earthworks, as confirmatory of the author's views.—Papers on medical subjects were also read.

PHILADELPHIA

American Philosophical Society, February 4.—Pliny E. Chase presented tables of rainfall, and described them. The most interesting deductions were, as far as related to Philadelphia, that the spring and summer will be alike, and the autumn and winter alike. The tables are for 45 years up to date, from observations at the Pennsylvania Hospital. Dr. Brinton made observations on the zealous and long-continued studies of the language of the Choctaw Indians, made by the missionary Mr. Byington, who died a year ago. Dr. Brinton has a list of over 75 works, including the Bible, printed in Choctaw. Mr. Byington's Choctaw Grammar has been revised four times, and at his death he had progressed with his fifth revision. The MS. of this work was in Dr. Brinton's hands, and was presented to the Society for publication.

February 18.—Prof. Cope read a paper intitled, "Fourth contribution to the Fauna of the Miocene period in the United States." He exhibited the periotic bones of a large whale from the miocene of North Carolina, which had been discovered by Prof. W. C. Kerr, State Geologist. The part of the skeleton found consisted of the left side of the cranium to the temporal fossa, mandible, and many vertebræ, ribs, &c. It was found 30 feet below the surface in the bank of a stream. It represented a type near the true *Balænæ*, but partaking of the characters of the *Balænopteræ*. One peculiarity was the enormous thickening of the supraorbital process of the frontal, which was 17 inches deep. This individual was 17 inches deep. Vertebræ of two other individuals were found in other places, and a complete vertebral column of the same extended across a stream 20 miles distant from Kerr's specimen. Vertebræ taken from the last, referred it to the same species. This specimen was 50 or 60 feet long, and extended across the stream in such a way as to serve as a foot-crossing when the water was very low. The species was named *Mesoteras kerrianus*. Prof. Cope mentioned the discovery of the genus *Sus* for the first time in the United States, in the neighbourhood of Squankum, N.J. He said it agreed with the occurrence of the dugong noticed by himself and the rhinoceros by Marsh in giving an Asiatic character to that extinct Fauna. The hog he called *Sus vagrans*, and said it was as large as the common *S. scrofa*. He called attention to the abundance of the species of the *Pythonomorpha* in the United States, and described two new species from New Jersey, viz., *Mosasaurus fulciatus* and *M. varthrus*. The first with round curtra and an additional rib on the asquadratum, the second with depressed ceutra, and a quadrate bone more like that of *M. dekayi* than *M. depressus*. He said he knew 27 species of *Mosasauroids*. In the last work on the subject, only three species were described.

DIARY

THURSDAY, April 7.

Royal Society, at 8.30.—On supra-annual Cycles of Temperature in the Earth's Surface Crust: Prof. Piazzi Smyth.—Researches in Animal Electricity: Dr. C. B. Radcliffe.
Society of Antiquaries, at 8.30.
Linnean Society, at 8.—On new species of Annelids, &c.: Dr. Baird — On Algæ from the North-Atlantic Ocean: Dr. Dickie.
Royal Institution, at 3.—Chemistry of Vegetable Products: Prof. Odling.
Chemical Society, at 8.—On the Analysis of Deep-sea Water: Dr. John Hunter.—On the refraction equivalents of the aromatic Hydrocarbons and their derivatives: Dr. J. H. Gladstone.—On an acid Feed-water from the Coal-fields of Shellarton, N.S., and the results of its use: Prof. How.
London Institution, at 7.30.—Geology: Dr. Cobbold.

FRIDAY, April 8.

Royal Institution, at 8.—Pedigree of the Horse: Prof. Huxley.
Royal Astronomical Society, at 8.
Quekett Microscopical Society, at 8.

SATURDAY, April 9.

Royal Institution, at 3.—The Sun: J. Norman Lockyer, F.R.S.

MONDAY, April 11.

London Institution, at 4.—Chemistry: Prof. Bloxam.
Royal Geographical Society, at 8.30.
Royal Institute of British Architects, at 8.

TUESDAY, April 12.

Ethnological Society, at 8.—On the Danish Elements in the population of Cleveland: Rev. J. C. Atkinson.—On the Ancient Tribal System of Ireland: H. M. Westropp.—On the Brain in the Study of Ethnology: Dr. Donovan.
Photographic Society, at 8.
Institution of Civil Engineers, at 8.—Dressing of Lead Ores.—Maintenance and Renewal of Railway Rolling Stock: Mr. R. Price Williams.

WEDNESDAY, April 13.

Royal Geological Society, at 8.—On the Fossil Remains of Mammals found in China: Prof. Owen, F.R.S., F.G.S., &c. — Further Discovery of the Fossil Elephants of Malta: Dr. A. A. Caruana. Communicated by Dr. A. Leith Adams, F.G.S.—Brief preliminary Notes on a large Coal-measure Reptile from the Low Main Coal Shale: T. P. Barkas, F.G.S.
Royal Microscopical Society, at 8.

THURSDAY, April 14.

Mathematical Society, at 8.—On the Mechanical Description of a Nodal Bicircular Quartic: Prof. Cayley.

BOOKS RECEIVED

English.—Birds of Marlborough: E. F. Im Thurn (Marlborough, Perkins; London, Simpkin and Marshall).

Foreign.—Die Alterthümer unserer heidnischen Vorzeit, vols. i. and ii. (Mayence, V. V. Zabern).—Journal für Ornithologie, Jan. 1870.—Om Vegetationsforholdene ved Sognefjorden: A. Blytt (Christiania, J. Dahl).—Lichenes Daniæ, eller Danmarks Laver: J. G. Deichmann Branth og E. Rostrup (Copenhagen, Gads). — Undersogelser over Christiniafjordens Dybvandsfauna: G. O. Sars (Christiania, Dahl).—Zeitschrift für Parasitenkunde, vol. ii. pt. i. (Jena, Mauke).—Naturwissenshaftliche Reisen im tropischen Amerika: Dr. Wagner (Stuttgart, Cotta).—Archivio per la Zoologia l'Anatomia e la Fisiologia, Series ii. vol. i. (Turin, Loescher).—Reisen im Archipel der Philippinen: Dr. Semper, Æolidien (Wiesbaden, Kreidel).—Through Williams and Norgate.

CONTENTS

Errata.—In No. 21, page 539, first column, line 21 from bottom: for "Perth," read "Pesth."—In No. 22, page 557, first column, line 3 from bottom: for "Sir Sidney Smith," read "Mr. Sidney Smith."

Printed by R. CLAY, SONS, & TAYLOR, at 7 and 8, Bread Street Hill, in the City of London, and published by MACMILLAN & Co. at the Office, 16, Bedford Street, Covent Garden.—THURSDAY, April 7, 1870.