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NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE

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

No. 85, VOL. 4] THURSDAY, JUNE 15, 1871

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BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The next Annual Meeting of this Association will be held at Edinburgh, commencing on Wednesday, August 2, 1871. President-elect Professor Sir WILLIAM THOMSON, D.C.L., LL.D., F.R.S., F.G.S., Professor of Natural Philosophy in the University of Glasgow. Notices of Papers proposed to be read at the Meeting should be sent to the Assistant General Secretary, G. GRIFFITH, Esq., M.A., Harrow. Information about Local Arrangements may be obtained from the Local Secretaries, 14, Young Street, Edinburgh.

UNIVERSITY COLLEGE, LONDON.

THE PROFESSORSHIP OF APPLIED MATHEMATICS AND MECHANICS is now vacant. In addition to the ordinary emoluments of the Chair, derived from Fees, the Professor will, for five years certain, receive an endowment of £200 per annum, provided by a Friend of the College. Applications for the appointment will be received up to Saturday, July 1st, at the office of the College, where further information may be obtained.

JOHN ROBSON, B.A., Secretary to the Council.

June 7th, 1871.

ANTHROPOLOGICAL INSTITUTE of GREAT BRITAIN and IRELAND, 4, St. Martin's Place, Trafalgar Square. Monday, 19th inst., at 8 P.M.

Papers to be read:—

I.—"Mode of Preserving the Dead among the Natives of Queensland." ALBERT MCDONALD, Esq.

II.—"Forms of Ancient Interment in Antrim." Dr. SINCLAIR HOLDEN.

III.—"Analogies and Coincidences among Unconnected Nations." HODDER M. WESTROPP, Esq.

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THURSDAY, JUNE 15, 1871

PRIMITIVE CULTURE*

I.

WHEN the commencement of Mr. Buckle's great "Introduction" appeared, some fourteen years ago, no small controversy arose as to the possibility of constructing a Science of History. On the one hand it was argued that for two or three centuries past every generation had demonstrated certain events to be regular and predictable, which previous generations had considered irregular and unpredictable; had generalised facts which it was supposed were incapable of being generalised; and had indicated the existence of order, method, and law, in events which earlier ages had regarded as regulated only by the fitful vagaries of a blind chance, or the inscrutable decrees of a supernatural interference. On the other hand, it was asserted that, even supposing the universal prevalence of law and order to be proved, our necessary nescience would still remain so totally unenlightened with regard to the operation of the law and the sequence of the order, that no ingenuity could achieve such a classification of human motives and actions as could justly be dignified with the name of a science. Since then we have passed through what amounts to a scientific revolution. Not only has archæology vastly extended the limit of its domain, but the doctrine of evolution—itself the most striking generalisation deduced from a comparison of the world's present with the world's past—points decisively to archæology as the most fruitful province of inquiry to the student of the science of History. Before Buckle wrote, archæology had indeed already discovered more than one new world for the conquest of modern science. In the last generation, the archæology of organic nature, brought to light by geology, had afforded a sure basis for the science of Comparative Anatomy; and in a precisely analogous manner the archæology of language and religious worship, revealed in the early literary monuments of India, Assyria, and Egypt, had more recently altogether regenerated the science of Comparative Philology, and created that of Comparative Mythology. But the value and importance of archæological research in other directions had not yet been understood and appreciated. It was not until the discoveries of human implements and remains in the drift and cavern deposits had directed attention to the multifarious problems presented by primitive culture, that investigators began to regard the sciences of Language and Religion as merely departments of the more general and comprehensive science of Comparative Civilisation, and to recognise the fact that the science of Comparative Civilisation is the very corner-stone of any real science of History. As indicating the direction of scientific research, it is significant that Mr. Darwin's last work, which surely should have been entitled the "Ascent" rather than the "Descent of Man," should be so closely followed by the volumes of Mr. Tylor on Primitive Culture. The main argument, indeed, of both writers is fundamentally the same. The difference between them is that Mr. Darwin traces it out in connection with what man *is*, Mr. Tylor in connection with what man *does*. One applies the theory of evolution to man in relation to organic nature, the other to man in relation to human culture. Both, too, have pursued the same method. It was no part of Mr. Darwin's design to write an exhaustive physical history of mankind, or of Mr. Tylor's to detail the history of civilisation. Each has selected the most salient and significant points to illustrate his argument, and has instanced only sufficient facts to supply a reasonable proof of the propositions enunciated.

It is not, however, merely as an exponent of the theory of development that Mr. Tylor has taken his work in hand. Leibnitz long ago pointed out the supreme importance of a study of mankind in connection with that of what he terms the natural history of the world, in order to ascertain what ought to be introduced and what banished from among men. This principle Mr. Tylor has recognised throughout, and the facts he brings forward have quite as often been selected for the light they throw on vexed questions of the day as for the illustration they afford of the theory of evolution.

One great stumbling-block in the way of the student of culture is the extreme imperfection of the only records to which he has access. The comparative anatomist, however, who is perhaps even more closely beset by the same difficulty, has pointed out the means by which it may to a great extent be effectually overcome. If analogy be as trustworthy in the one case as in the other, the historian of culture can study the past in the present with the same confidence as the anatomist, and can as readily reconstruct the shape of human society in primeval ages as his fellow-worker can restore the outward form of an extinct flora and fauna from their fossil remains. But is this analogy to be trusted? Can it be demonstrated that any such vital connection exists between antique and modern barbarism as will enable the inquirer to study prehistoric culture in that of still-existing races, savage, barbaric, or semi-civilised? Can it be proved that savage, barbaric, and civilised life are really correlated as various stages of growth and development? To these questions Mr. Tylor's work supplies a satisfactory answer. Carefully reviewing a number of the most important departments of culture, he proves the existence in all of innumerable relics—the fossils, as it were, of primeval thought and life—traces the modes of connecion of one age with another in progress, degradation, survival, revival, and modification, and demonstrates the utter inadequacy of any theory but one of development to explain the complex and varied phenomena of civilisation. Survival in culture, the origin of language, the art of numbers, mythology, religion, rites and ceremonies, are each in turn discussed, and it is not too much to say that the extent of research, the rare felicity of illustration, the breadth of view and signal originality which Mr. Tylor has brought to bear on these subjects really render the appearance of his work an epoch in the annals of the philosophy of history.

To follow Mr. Tylor through his entire argument, and the evidence he produces in support of it, would be to write a somewhat larger work than his own. We can here only indicate the general method he has pursued, and comment briefly on a few facts which he has collected. Commencing with a general survey of the science of culture, he proceeds to give a rough outline of the course of its development. In so doing, he necessarily touches

* "Primitive Culture: Researches into the Development of Mythology, Philosophy, Religion, Art, and Custom." By Edward B. Tylor, author of "Researches into Early History of Mankind," &c. Two vols. 8vo. (London: Murray, 1871.)

on the controversy between the upholders of the two theories of development and degradation, of whom Sir J. Lubbock and the Duke of Argyll are among the latest representatives. "The master-key," he well observes, "to the investigation of man's primeval condition is held by pre-historic archæology. This key is the evidence of the Stone Age, proving that men of remotely ancient ages were in the savage state." While he shows, however, that the study of archæology has gradually cut away the ground under the feet of those who, like Archbishop Whately and the Duke of Argyll, appear to consider that civilisation was originally created in a state of happy mediocrity, from which it has since more frequently fallen than risen, he is careful at the same time to recognise the agency of degradation as secondary only to that of progress. One circumstance in connection with this argument has perhaps hardly been sufficiently considered by the advocates of either side. The distribution of mankind over the face of the globe is an event for the most part belonging to pre-historic ages, but it is quite clear in some cases, and strongly probable in many others, that the occupation of new territories widely divided by the sea from the earlier inhabited portions of the world, was the result of seafaring disaster; that, in fact, the first denizens of many islands, and perhaps of some continents, were the shipwrecked crews of primeval canoes, cut off from further intercourse with their countrymen, destitute of all the materials and appliances of such rude culture as they may once have possessed, and ignorant of even the primitive industrial arts necessary to utilise them even if they were at hand. Under such circumstances—and a consideration of the actual distribution of mankind in historic times countenances the supposition that the contingency must have occurred over and over again—the march of degradation must have been certain and swift; and even allowing that in the case of mariners belonging to a somewhat advanced tribe, the degradation might be only temporary, the event would account for at least some portion of the diversity which is only less striking than the uniformity perceptible in the various civilisations of the world. Be this, however, as it may, the entire evidence available on the subject fully bears out Mr. Tylor's conclusion, that "throughout the whole vast range of the history of human thought and habit, while civilisation has to contend not only with survivals from lower levels, but also with degeneration within its own borders, it yet proves capable of overcoming both and taking its own course. History within its proper field, and Ethnology over a wide range, combine to show that the institutions which can best hold their own in the world gradually supersede the less fit ones, and that this incessant conflict determines the general resultant course of culture.

The next two chapters are devoted to "Survival in Culture," the strange permanence in the midst of a higher civilisation of certain customs, arts, opinions, &c., long after the real and earnest meaning has died out of them, which in a lower stage commended them to acceptance. Among these metamorphic remains of an earlier world are many, if not most, of the games, rhymes, proverbs, riddles, and minor social customs of civilised peoples. A notable instance is to be found in archery. "Ancient and widespread in savage culture, we trace the bow and arrow through barbaric and classic life and onward to a high mediæval level. But now, when we look at an archery meeting, or go by country lanes when toy bows and arrows are 'in' among the children, we see, reduced to a mere sportive survival, the ancient weapon which, among a few savage tribes, still keeps its deadly place in the hunt and the battle." In another passage Mr. Tylor remarks: "the practice of poisoning arrows after the manner of stings and serpents' fangs is no civilised device, but a characteristic of lower life, which is generally discarded, even at the barbaric stage." Perhaps one of the most striking instances of linguistic survival is to be found in the word "intoxication," derived from "toxicon," the material employed for poisoning the arrow. Among other instances of survival, Mr. Tylor quotes the custom of casting lots. It is noteworthy that both Wesley and Whitfield in certain cases employed this means of ascertaining what they considered the Divine will, and that even yet many Englishmen are to be found who attach under certain circumstances the old sacred significance to the process. That the theory of survival suggested by Mr. Tylor does really account for nearly all the otherwise utterly unaccountable customs and ways in vogue among civilised nations, will not be doubted by anyone who has taken the trouble to trace their history in any considerable number of cases. It is not, for example, many years since the present Lord Leigh was accused of having built an obnoxious person—one account, if we remember right, said eight obnoxious persons—into the foundation of a bridge at Stoneleigh. Of course so preposterous a charge carried on its face its own sufficient refutation; but the fact that it was brought at all is a singular instance of the almost incredible vitality of old traditions. The real origin of a story such as this dates from a time when the foundations of bridges, palaces, and temples were really laid upon human victims, a practice the tradition of which is handed down to us in the Romance of Merlin, and a thousand other legends old and new, to be finally embalmed for the benefit of posterity in Mr. Tylor's volumes. The most telling, however, of all Mr. Tylor's instances of survival are those which bear upon the history of modern spiritualism.

"Beside the question," he observes, "of the absolute truth or falsity of the alleged possessions, manes-oracles, doubles, brain-waves, furniture movings, and the rest, there remains the history of spiritualistic belief as a matter of opinion. Hereby it appears that the received spiritualistic theory of the alleged phenomena belongs to the philosophy of savages."

This conclusion may possibly astonish and even "exercise" the spirits of some of the faithful; but assuredly it is abundantly borne out by the evidence adduced, which parallels with most afflicting minuteness the various phenomena of spiritualism from mediæval story and tales of witchcraft, from classic fable and ecclesiastic miracle, from Chinese divination and Indian divinity, from the feats of North American mountebanks, the hocus-pocus of the angekoks in Greenland, the juggleries of the Siberian shamans. Even this array of evidence, however, is but a fraction of what might be produced. Mr. Tylor quotes Lucian's Hyperborean, who flew and walked on the water clad in undressed leather breeks, and who by the way is possibly only an allotropic form of our own Regnar Lodbrok; but he spares us that other

Hyperborean, Abaris, "the air-walker," to whom Pythagoras, the Miss Kilmansegg of antiquity, displayed his precious leg. In fact here, as elsewhere, Mr. Tylor has acted on the principle that the half is greater than the whole. He selects enough for his purpose, and resolutely declines to overburden himself with superfluous testimony. Fortunately there are two sides to the theory of survival. If on the one hand we have survivals of the type of modern spiritualism, we have on the other survivals of ideas, which, first broached in a stage of civilisation when they are considered foolish or mischievous, become in a higher stage the dominant influences which direct human opinion. To take a single case:—It is now near upon two centuries since Balthazar Bekker, a D.D. of Amsterdam, corrupted, may be, by certain impious notions propounded by the arch-infidel Descartes, published his "Monde Enchanté," a crime for which he was at once deprived of his benefice; since, as a learned Englishman remarked in reference to the case:—

Dæmonas ex mundo quisquis proscripserit audax,
Esse brevi nullum dicet in orbe Deum.

If the English reader of to-day will take the trouble to read this work—and it is worth the trouble—he can scarcely fail to be struck with the remarkable survival of the ideas contained in it, expanded, corrected, developed as they are in these chapters by Mr. Tylor. Not that Mr. Tylor has borrowed anything from Bekker, but simply that Bekker was the first, as Mr. Tylor is the last, to apply science systematically to the phenomena of sorcery, witchcraft, and spiritualism of his age. Survivals of this kind are indeed proofs as decisive of the vitality of civilisation as survivals of the other kind are of the vitality of barbarism.

In the following chapters on Language, emotional and imitative, Mr. Tylor makes out a strong case in favour of what Prof. Max Müller, with a felicity worthy of a better cause, has nicknamed the "pooh-pooh" and "bow-wow" theories. "It may be shown," he says, "within the limits of the most strict and sober argument, that the theory of the origin of language, in natural and directly expressive sounds, does account for a considerable fraction of the existing *copia verborum*, while it raises a presumption that, could we trace the history of words more fully, it would account for far more." Among other matters touched on in this inquiry, Mr. Tylor refers to the language employed in addressing beasts, particularly dogs and horses. Some curious samples of dog-language are to be found in the Book of St. Alban's, and, indeed, in almost every old treatise on hunting. Sir Tristram, however, the hero of the Arthurian cycle, who is generally considered the *rédacteur en chef* of this particular dialect, appears to have thought plain Norman French best adapted to the intelligence of greyhounds, and is very sparing in his use of mere "brutish interjections." Of horse-language one of the best examples is to be found in "The Enterlude of John Bon and Mast Person," a tract belonging to the middle of the sixteenth century. This is how John Bon addresses his team:—

Ha, browne done! forth that horson crabbe!
Ree, comomyne, garlde, with haight blake hab!
Have agayne, bald-before, hayght ree who!
Cherly boy, cum of, that whomwarde we may goo!

One branch of inquiry into which Mr. Tylor partly enters in these chapters and the following one on the Art of Numbers, appears to deserve closer attention than it has yet received. Considering the important part which gesture plays in all the lower languages, it is a fair hypothetical inference that, as language gradually became more and more developed, a number of words and phrases would creep into it, formed on the principle of translating gesture into phonetics. Thus, for instance, the universal gesture for "likeness" or "sameness" is to hold out both hands together. If, in several different languages, the words meaning "likeness" or "sameness" have an etymological connection with the word meaning "together," a strong presumption would be raised that they were translated from the gesture; and if any large number of correspondences of the same kind were detected, the presumption would be raised into a theoretical certainty. Whether such evidence exists of the translation of action into sound in general language, none could determine better than Mr. Tylor himself, whose essay on the gesture-language in one of his earlier works, forms really almost a complete handbook on the subject. That it does exist in language, as applied to numbers, is clearly shown in his chapter on the art of counting, where he traces the quinary, decimal, and vigesimal systems to their origin in the fact that the average man possesses five fingers on each hand, and as many toes on each foot. He perhaps, however, has not sufficiently noticed the further strong probability that the duodecimal system owes its origin to the circumstance that, in addition to his fingers and toes, a man possesses two hands and two feet—a consideration not without its bearing on the obscurity attending the numerals eleven and twelve in certain languages.

LEA'S UNIONIDÆ

A Synopsis of the Family Unionidæ. By Isaac Lea, LL.D. 4th edition. 4to. (Philadelphia, 1870.)

THIS work, by a veteran American conchologist, contains 184 pages, and is a memorial of his labour and zeal during a period of more than forty years. The *Unionidæ* are generally known as "fresh-water mussels." Their variability is notorious; for almost every river, lake, and pond yields different forms, which some writers call species and others call varieties.

Non nostrum est tantas componere lites.

But while giving Dr. Lea ample discretion to make as many species as he pleases, and full credit for his honest wish to keep down the number, it certainly strikes one as somewhat singular that he admits only "seven or eight species of the family *Unionidæ* living in Europe," when he enumerates 720 species as North American, of which latter number he has himself described no fewer than 582! According to Kreglinger's catalogue, which is the newest on the land and fresh-water shells of Europe, fifteen species of this family inhabit Germany. We have but five, including one debateable species of *Anodonta*. The total number of living species recognised by Dr. Lea is 1,069, besides 224 unknown to him or doubtful. To distinguish varieties from species is one of the great difficulties which perplex the naturalist; but the rule which I have adopted may serve the purpose to a considerable extent, viz., "that all distinct groups of individuals living together and having a common feeding-ground, and which are not connected

or blended with each other by insensible gradations, are *primâ facie* entitled to the rank of species." (British Conchology, vol. i., Introduction, p. xix). Now we may see several species of *Rissoa* living under the same stone between tide-marks, several species of *Limnæa* in the same stream or ditch, and more than one species of *Helix* feeding together on the same leaf. In such cases there is no fusion or confusion of species; each has its own definite limits, and retains its own peculiar characters. I say nothing of genera and more comprehensive groups which form communities in a still more diversified fashion, but are equally free from intermixture.

J. Gwyn Jeffreys

OUR BOOK SHELF

Echinides du Département de la Sarthe, considérés au point de vue zoologique et stratigraphique. Par Cotteau et Triger. (Paris: Bailliére, 1855-1869. London: Williams and Norgate.)

We fear that some time must elapse before science will resume its place in unhappy France; but in the meantime its professors, who are innocent of the mischievous and insane acts which have caused so much ruin, demand our heartfelt sympathy. M. Cotteau, of Auxerre, whose work we are about to notice, is well known to English geologists, and is highly esteemed by them for his long and conscientious labours in the field of Mesozoic echinology. His coadjutor, M. Triger, died during the progress of the work. It consists of two royal octavo volumes, one containing an account of Echinoderms found in the Jurassic and Cretaceous formations in the Department of the Sarthe, the other having sixty-five well-executed plates of species, besides several charts to show their geological and stratigraphical distribution. It appears from the preface that this most creditable production of French palæontology was commenced in 1857, and finished in 1869. We therefore regret to observe that M. Cotteau was not aware of Dr. Wright's admirable monograph on British fossil Echinodermata, which was published by our Palæontographical Society in 1856, and which goes over a great deal of the same ground as M. Cotteau. Had the latter author consulted it, he would probably have avoided some mistakes, *e.g.* in attributing the specific name of *Pseudodiadema hemisphæricum* to Desor instead of to Agassiz. A comparison of the figures of this and other species given in both works is decidedly favourable to the British artist (Mr. Bone) as regards accuracy and completeness, although MM. Levasseur and Humbert are deservedly eminent in their style of lithography.

The Echinoderms found in the Jurassic and Cretaceous formations must have inhabited a soft bottom in seas of considerable depth, judging from the present habits of allied species; and their variability was not less in those remote periods of the world's history than it was in the epochs which preceded and followed.

J. G. J.

LETTERS TO THE EDITOR

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

The Paris Observatory

Having read only yesterday the agonising account written by M. Marie-Davy and countersigned by M. Delaunay, descriptive of the Communists having made the Paris Observatory one of their chief strategical points, of the domes of the observatory having five hundred bullet-holes through them, and of the rabid attempts made by the citizens in arms, before retiring on the approach of the Versaillists, to burn or blow up the whole building, I am not a little surprised to find in Nature of June 8, received here this morning, a statement to the effect "that the Paris Observatory had suffered scarcely any injury up to the end of the second siege. No delegate of the Commune had presented himself either to take possession of it or to blow it up."

I presume that you wrote in ignorance of the real facts, and perhaps not without some intention of whitewashing the poor Communists from the exaggerated denunciations which have been poured on them since their fall; yet neither they nor you should object to true accounts of what they actually did while in power appearing before the world without menace and without favour.

The mere showing of the Commune during this second siege, and still more its international organisation, seems to have surprised most persons; yet the character of the association, and its imminence under the feet of all the Governments of Europe, was duly noted in the section on Metrological Legislation of my report presented to the Board of Visitors of the Royal Observatory, Edinburgh, in June 1870; the association, though political, having obtained mention there on account of its having adopted the scientific metrical system of weights and measures, and professing to find it a most efficient agent for assisting in breaking down the barriers between nations, and rooting up traditional customs and beliefs. I must confess, however, that I was not prepared for these revolutionaries taking up so very early in their outward career, as this their first and just-concluded essay in Paris, the chronological department of the metrical system, thereby repudiating, as the order found on General Delescluze indubitably shows, both the Christian Era and the accustomed months, for decimal periods of days and the era of the first French Revolution. In my book, "Our Inheritance in the Great Pyramid," published in 1864, I did indeed remind that that most revolutionary method in chronology was originally a part of the metrical system, and though deposed under Napoleon Bonaparte, might be expected to reappear when the present promoters of French metrology in this country had acquired more boldness; but here is the accomplished fact upon us at this very moment, and it would be well for all those metrical agitators who were so loud at the British Association last summer in Liverpool in their outcries to Government to make the metrical system compulsory throughout this country, now to declare honestly whether they are inwardly with the Communists in desiring ultimately the abolition of the Christian era and the destruction of the week of seven days.

C. Piazzi Smyth

15, Royal Terrace, Edinburgh, June 9

Science Lectures for the People

It is all very well to say, Let our children be taught science in the schools; but that does not meet the need of a large section of the nation, the product of the schools of a former generation. Many hard-worked men who had no scientific teaching whilst at school, have now acquired the wish to know more of nature's mysteries, but know not whither to turn for aid. Books are plentiful, but it is very tiresome to wade through dry pages, scientifically dried of their sap by the use of terms which are not commonly understood—especially after the wearying labours of the day. Experimental lectures, like those at the Royal Institution, but a little more specialised, are wanted for popular use; the question is, How are we to get them? Are we to go to Government for aid, or shall we bestir ourselves and voluntarily endow these lectures?

Surely Huxley or Tyndall would be quite as much sought after as Spurgeon if they came forward and announced a series of lectures; St. James's Hall would be as crowded as the Tabernacle if they held a weekly lecture; pew-rents would be as certain of collection from scientific as from religious devotees. Those busily engaged professors can indeed hardly be asked to undertake such a task as this; but any competent man of science, able to explain the facts of science in popular language, might reckon on public support if he made such a venture as this. Let him, for example, give a series of twelve lectures on Biology, as it affects our daily existence; not wandering into the remote regions of extraordinary phenomena, but simply expounding ordinary life laws. Here would be a subject refreshingly new and interesting to thousands of City-born and bred toilers.

The lectures, if on week days, must be after office hours—from nine o'clock to ten, say; and in some hall easily accessible, as St. James's.

George Fraser

169, Camden Road, N.W.

The Eclipse Photographs

IT would have given me much pleasure to have shown Mr. Winstanley the original negatives of the photographs of the late eclipse of the sun if he had called on me to see them, and by so doing he would have avoided falling into the mistakes which his letter contains.

At the time when the last photograph was taken the sky was perfectly clear, and unless Mr. Winstanley is in possession of exclusive information he has no right to assume that the American photograph was not taken under equally favourable conditions. Some of my photographs (which Mr. Winstanley cannot have seen) were taken through the edges of a cloud, the whole of which could be covered by the hand when held with the arm extended; and there was a perfectly cloudless sky near the sun excepting towards the east.

The imperfection in my No. 5 picture, which Mr. Winstanley's experienced eye detects, arose from the shaking of the telescope, caused by the high wind blowing at the time. Probably a single gust during the eight seconds while the plate was exposed caused the mischief, and this defect would never have been seen but for the extremely actinic power of the red prominences which leave their impression on the sensitive plate instantaneously. The moon's limb is perfectly sharp, excepting where the red prominences appear.

Let it be clearly understood that this "indifferent definition" refers to the moon's limb only; the details of the corona do not appear to have suffered; after the gusts of wind the telescope has returned to its proper position, and Mr. Winstanley must know from experience that the image of an object giving off feeble light would not be materially injured by a slight blow given to a firmly mounted camera.

Mr. Winstanley says that "the identity of the coronal rifts in the Cadiz and Syracuse photographs is not satisfactorily conclusive." Assertion is not proof. In NATURE of March 9 I gave evidence which appeared to me to be conclusive (I need not here refer to the opinions of others who are equally satisfied), and up to the present time no counter-evidence has been produced.

It is not for me to defend the American photograph. In due time we shall know all about how that was produced. But has Mr. Winstanley failed to notice that the light on the moon's disc does not extend all round and all over it as it would do if caused by our atmosphere? It is chiefly on the east and west sides. We may expect the explanation of this defect when we hear how it happens that the corona in this photograph is cut off instead of extending as in all the other photographs.

I fail altogether to see the connection between the solar corona and a lunar halo—the phenomena bear no resemblance to each other. The solar corona comes close up to the perfectly black disc of the moon. I never saw a lunar halo close up to the moon's limb. When seen through a mist or in a "sky burdened with innumerable clouds," there can be no doubt that the lunar surface is obscured by the moisture in our atmosphere.

A. BROTHERS

Ocean Currents

HAVING had occasion in the spring of 1868 to consider the subject of Ocean Currents as discussed by Captain Maury and Sir John Herschel, I was led to certain views respecting the origin of the oceanic circulation, which are briefly touched upon in a paper which appeared in the *Student* for July, 1868. At that time an experimental test of my theory (or rather of that portion of the theory I advocated, which was, as I judged, novel) occurred to me. The experiment might, I conceive, be very readily tried. It somewhat resembled that by which Dr. Carpenter illustrated lately at the Royal Institution his views respecting the influences of evaporation and polar cold; but as I wished specially to show how the westwardly equatorial current came about, the experiment was somewhat more complex. Let the circumference of a large and shallow cylindrical basin represent the equator and the central part the north polar regions. Within this cylinder let solid matter be so placed as to represent the northern halves of the continent, in such sort that the resulting configuration would correspond to that of a map of the northern hemisphere (say on the equidistant projection). Let sea-water be poured in to represent the northern portions of the terrestrial oceans. Now to represent the Arctic ice-fields, let lumps of ice be placed at the centre of the cylindrical vessel (they should be circled round by a wire-guard); and to represent the effects of equatorial heat, let a stout iron ring round and above the rim of the cylindrical vessel be heated. In this state of things the process of circulation, which actually took place in Dr. Carpenter's experiment, would take place after such modified sort as the contour of the continent masses permitted. Now suppose that the cylindrical vessel is set in steady and somewhat slow rotation about its axis. It is clear that on the currents flowing from the pole and polewards, effects will be produced which precisely resemble those due to our earth's rotation. If I am right in regarding these effects as the true cause of the direction in which the equatorial currents, the Gulf Stream, and in fact all the currents in open ocean are observed to flow, abundant evidence to that effect will be obtained. If no such evidence be obtained, the westwardly direction of the equatorial currents must, I imagine, be ascribed to the trade winds, as Franklin and Sir J. Herschel have maintained.

In the summer of 1868 I suggested to Prof. Pepper that such a contrivance as the above, if it worked as I judged (and still judge) that it would, would form an interesting and instructive addition to the models exhibited at the Polytechnic Institution. Dr. Carpenter has already proved that the vertical circulation takes place in an experiment of this sort. If the eastwardly and westwardly circulation takes place as I expect, the experimental illustration of oceanic circulation would be singularly complete. The circulation in the southern hemisphere could be illustrated in like manner.

I may note here that the vast distance separating the polar from the equatorial regions must not be overlooked in theories respecting oceanic circulation. The influence of arctic cold may be paramount in very high latitudes; but equatorial evaporation must, it should seem, be the prime moving cause in tropical and sub-tropical regions.

RICHARD A. PROCTOR

Brighton, June 6

Day Auroras

I HAVE read attentively the numerous letters which have appeared in your columns on this subject; but so far as I can discern it seems not to have occurred to any of your correspondents that the auroral force, whatever it may be, affects every kind of cloud as well as the cirrus. On June 15, 1870, at 9 A.M., I witnessed here as complete a display of auroral motions in the cirrus cloud as ever I beheld in a midnight sky; and from that date I dismissed in my own mind all doubt as to the identity of auroral force, whether seen by day affecting the cirrus cloud or appearing as streams and rays of light at night. On Thursday and Friday last I witnessed a configuration of cirro-stratus cloud, evidently the result of magnetic polarisation, which I have no hesitation in characterising as auroral. There were on Thursday two poles, both in the line of the magnetic meridian; but on Friday night, at nine o'clock, only one pole in the direction of the true meridian. The phenomenon to which I refer is of very frequent occurrence, especially before a track of fine warm weather; and without at present offering a theory on the subject of auroras, I venture to class polarisations of clouds, whether cirrus or not, as arising from the same cause as luminous aurora. The transverse or dia-magnetic lines are generally as well marked in cloud auroras, and it is an interesting task to watch the transformation of cirrus cloud from the meridional to the equatorial direction. I have also noted that when these auroral lines converge towards the magnetic pole, a steady barometer and fine weather ensue; but that when the transverse or equatorial lines predominate and continue long visible, rain soon follows. These transverse lines of cloud are always lower and seem to be dia-magnetic.

D. LOW

Burntisland, May 22

PERHAPS you will allow me to add my mite to the discussion which has been going on in your pages on the question of the visibility of the aurora in daylight.

On the 3rd of September in last year, when at Nairn in the north of Scotland, I witnessed an aurora, such as I never heard or read of, or saw before; and strangely enough it was not noticed, as far as I am aware, in any of the newspapers. I had gone down to the beach at about 10 15 P.M., and immediately noticed what appeared at first to be a kind of haze over the whole sky, which slightly dimmed the light of the stars.

For a few minutes I thought no more about it, but, happening to turn my eyes towards the zenith, there was a sight I never shall forget. A number of sheets of whitish light were con-

stantly darting with a flickering motion from the surrounding haze of similar light, and meeting in the zenith; the length of their course was as much as 15° to 18°; they appeared to proceed indiscriminately from all points in azimuth.

I immediately became aware that the whole sky, down to the very horizon, was illumined by a white, colourless aurora; but I was so fascinated by the incessant play of the streamers overhead, that for some time I could notice nothing else. At last I turned away in order to observe accurately the full extent of the aurora in all directions. I found that it reached quite down to the horizon all round, except in one place, viz., in the S.S.E., and at that point there was a symmetrical arc (of a great circle, as far as I could judge) the summit of which was about 7° or 8° above the horizon. This arc was perfectly well defined; within it was blue sky, and above and around, over the whole heavens, nothing but the auroral light, except in the gaps between the darting streamers in the zenith. I carefully took the bearings of this remarkable arc, and found by means of a compass the next day, that it was bisected by the magnetic meridian. The phenomena underwent no diminution during the time (an hour and a half) I was watching it. The sky appeared to be quite free from cloud.

I have often witnessed fine displays of aurora; one in the winter of (I think) 1848, in this county, the colours and streamers of which were magnificent, far finer than those I saw on the 24th and 25th of last October at Edinburgh; but I never before observed the stars to be so much dimmed as they were at Nairn in September, notwithstanding the light on that occasion was colourless. On other occasions, I have always thought the stars quite unaffected by the auroral light, both to the naked eye and in the telescope, but on this they were obviously dimmed as by a haze.

My impression is, that no aurora that I ever saw could be visible in daylight, with the exception perhaps of this last, and the only portion of this that could possibly be seen in daylight was the well-defined arc low down in the S.S.E. I think it is just possible that in a clear and cloudless sky such an arc as this might be visible. HENRY COOPER KEY

Stretton Rectory, Hereford, June 6

Red and Blue

I WAS much interested by the letter of Mr. T. Ward (NATURE, vol. iv. p. 68) describing the appearance of a blue colour when looking at white chalk marks on a black board while the sun was shining in the eyes, as I have frequently noticed a precisely complementary phenomenon.

While walking along the chalky roads of East Kent in bright sunshine, and reading under an umbrella, I have frequently noticed that the letters appear of a deep blood-red colour; the black colour of the type reappearing immediately on passing over the shadow of a tree on the ground, or on allowing the sun to shine directly on the book. This was so striking when first seen that I had to convince myself that the page was not printed in red ink. This is obviously the exact converse of the observation of Mr. Ward, who saw a blue colour from white marks on a black surface, while I saw a red colour from black marks on a white surface. A short time since I observed a precisely similar colour when looking down on the platform of a railway station with the setting sun shining on the eyes, the cracks between the boards also appearing red. HERBERT M'LEOD

Influence of Barometric Pressure on Ocean Currents

A LOW barometric pressure and an increased height of the ocean was, I believe, first assumed to stand in the relation of cause and effect by Mr. Piddington. The abnormally high tidal waves that sometimes rushed up the Hooghly during Calcutta hurricanes were ascribed to the low pressures which accompanied them. There is no doubt that unequal pressure is a true cause of currents in the ocean. But I think it, as well as difference in specific gravity, may be regarded as infinitesimal in amount, compared to the influence of the winds.

The high tidal waves at the mouth of Hooghly are not experienced during the first stage of the hurricane, or so long as the wind blows from a northerly quarter. The waters in the Bay of Bengal are then propelled towards the south. It is only after the wind changes to the south and the barometer is rising that the waters are driven against its northern shores. It is when the wind happens to change to the south at the time of the flow of the tide that great inundations occur in the Delta.

On the coast of the United States, however, there is apparently an intimate relation between low pressures and high tides. In general, so long as the barometer remains low, easterly winds are blowing on the coast and heaping up the waters in every bay. During the second stage of the storms the winds generally blow violently from the west or north-west, often at a right angle to the whole coast. These high westerly gales cause very low tides along the United States when the barometer is rapidly rising. But low tides are not experienced with high pressures if the air is calm.

High tides only occur on the coast of Europe after westerly winds have been blowing for some days in the Atlantic. It is a well-recognised fact among the fishermen on the east coast of Scotland that high tides are due to this cause. I think Hugh Miller was right in maintaining that the friction of the south-west winds on the wide surface of the Atlantic must be quite as powerful in maintaining the flow of the stream through the Florida Channel as the action of the Trade winds in forcing the tropical waters into the Gulf of Mexico.

Owing to the great rapidity with which barometric disturbances are propagated in our temperate latitudes, it is difficult to conceive how barometric pressure of itself can have an appreciable influence on the currents of the ocean. The rate of their propagation in winter is from thirty to sixty miles an hour. In the fourth number of the "Board of Trade Weather Report" an instance is given, in which the rate is affirmed to be upwards of seventy miles an hour. The velocity in this case, however, as I may try to show on another occasion, is estimated about ten miles an hour too high. But let us suppose that no winds accompanied these rapidly propagated depressions and elevations of the barometer. A difference of an inch of pressure existing between places on the ocean two or three hundred miles apart would create only a very slow moving current, even though the diminished area of pressure were stationary. But these low pressures pass so rapidly onwards that the *vis inertiæ* of the waters of the ocean would hardly be overcome before they were again subjected to the opposite influence of an increase of pressure.

The effect of barometric pressure on the level of inland seas, like the Baltic and Mediterranean, must be still less than in the open ocean. Winds are often localised, but great depressions of the barometer extend over immense areas; in most cases far larger than the area of the Baltic. Any higher level from this cause would be brought about by the flow of the waters from either end, as the pressure might be assumed to be the same on both sides of that narrow sea. The mere effect of changes of barometric pressure, it will be admitted, would be quite inappreciable in any inland lake in Britain. But any one who is in the practice of fishing in the smallest of our lakes may always observe that there is an under current or "drag" created when the wind blows strongly towards the shore, in consequence of the accumulation there of its waters. The Niagara is sometimes suddenly raised two feet by strong west winds blowing over lake Erie. It is long since M. Volney, as regards the Mediterranean, stated that east winds caused a rise or flood of from two to three feet in the harbour of Marseilles, and that westerly winds produced opposite effects. It was by a careful deduction of effects produced on a small scale that this acute observer was enabled to give a consistent outline of the causes which produced the ocean currents in general. The currents of the ocean may be regarded as coinciding very closely with the average force and direction of the winds over its surface. Since, however, Humboldt assures us that the surface water of the Gulf Stream in the Florida Straits is sometimes reversed by the force of the winter "northers," it does seem vain to attempt to trace permanent surface currents in any part of the North Atlantic, vexed as its surface is by winds so inconstant in their force and direction.

Pilmuir, Leven, Fifeshire R. RUSSELL

St. Mary's Loch, Selkirkshire

To the student of Nature it may seem easy to decide whether the water of any given lake is good for domestic uses. But as regards St. Mary's Loch, where the question has to be settled by dint of a squabble in the Auld Reekie municipality, with all its complementary dust, smut, and heat, the true aspects of Nature are liable to misrepresentation.

Although not resident in Edinburgh, nor subject to its prejudices and ratings, your correspondent has taken considerable

interest in the subject as discussed both locally and in Parliament. Last week he visited St. Mary's Loch, and took pains to compare it with its very various reputation. He was prepared to find it an oozy swamp, fed by a moorland drainage of bogs and peat mosses.

A true poet is credited with seeing clearer and telling better than other people can, and in this case the credit is fairly earned by Sir Walter Scott, poet laureate of Scottish scenery. In the "Lay of the Last Minstrel" we read of "Fair St. Mary's silver Wave." In "Marmion,"

Nor fen nor sedge
Pollute the pure lake's crystal edge.
Abrupt and sheer the mountains sink
At once upon the level brink,
And just a line of pebbly sand
Marks where the water meets the land.

In plain prose your correspondent saw as follows:—St. Mary's Loch, a practically inexhaustible natural reservoir; in a district pastoral, not moorland. The surface of surrounding hills and flats, formed of loose rock, shingle, or gravel, with sprinkling of light earth, the very type of natural draining to prevent or exterminate bog, morass, and swamp. Not a trace of peat, except peat-reek odour from Tibbie Shiell's chimneys. Tibbie burns peats got from exceptional points high among the hills. The various feeders of the loch run in pure as water can be. That the loch, bedded in a shingly, gravelly flat, and surrounded with bare, smooth, lawn-like hill-slopes, should *appear* to contain brown-tinted water, arises from three concurrent causes. First, the extreme purity of the water; second, the tawny-brown hue of aquatic growths, enveloping the shingle under water, by transmission; third, the pipe-clay whiteness of the dry shingle on the beach, by contrast. From the first-stated cause the water varies in apparent tint according to the bottom hues. Aside from chemical analyses, the relative physical features at once decide St. Mary's Loch to excel the famous Loch Katrine as a water source.

The Edinburgh people are about to celebrate the centenary of Sir Walter Scott. His evidence, before cited, and the occasion, may serve to excuse the spontaneous testimony of

A STUDENT OF NATURE

Sun Spots and Earth Temperatures

I NOTICED lately the deduction by Mr. Stone of a connection between Wolf's solar spot periods and the earth temperatures at the Cape of Good Hope: and now Professor Smyth, at Edinburgh, recalls to our attention the fact that his own investigations had, a year ago, led him to a similar conclusion.

Will you permit me to call attention to a further discussion of this subject, as contained in a short article, published in Silliman's "American Journal of Science." The compilations were mostly made in February, 1869, and afford interesting confirmation of the results, which I suppose to have been deduced by Messrs. Smyth and Stone.

CLEVELAND ABBE,
Director Cincinnatti Observatory,
Washington, May 6 Meteorologist to the Signal Office

Bessemer Bombs

ALLOW me through the medium of your columns to call the attention of scientific men to the significant inference which, it appears to me, is to be drawn from the formation of "bombs" in the Bessemer process, incidentally described by Mr. Williams in a recent number of NATURE.*

These "bombs" are minute hollow spherules; the smaller are for the most part perforated. These minute hollow spherules are formed of liquid incandescent matter, the smaller showing the true form—perforated spheres.

The point to which I wish to direct the attention of Mr. Williams and other scientific men is this:—May we not have here an experiment which supplements those ingenious ones of M. Plateau on revolving liquid spheres? Mr. Williams will perhaps kindly examine some of the most perfect of these bombs, and let us know whether he sees trace of revolution in their formation. I believe he will find such evidence, and that the revolution is about the perforation. C. E.

Brighton

* See NATURE, vol. iii. p. 410.

THE STRASBOURG MUSEUM

A BRIEF notice of this Museum may not at this time be devoid of interest. It occupies ten large rooms in the Academy House of Strasbourg. Two rooms are devoted to Comparative Anatomy, and eight to the Zoological, Geological, and Mineralogical collections. One large hall is exclusively devoted to a collection of species indigenous to Alsace, and here its flora and fauna, both fossil and recent, will be found well represented. The large hall of Mammals contains about 2,000 specimens belonging to between 600 and 700 species, among which may be noticed a fine series of Felidæ, including two specimens of the rare *Felis pardina* of Portugal. Among the Ruminants are a grand specimen of the *Ovis nivicola* of Kamtschatka; four specimens of Tragelaphus from the mountains of Constantine, a large series in all stages of growth of the *Antilope rupicapra* from Switzerland, the Carpathians, and the Pyrenees; *Capra semlaica* of the Nilgherries; six specimens of *C. ægagrus* from Kurdistan, of which two are magnificent adult males and the others females and young; *C. walee* from Abyssinia, male and female; nine specimens of *C. hispanica* from the Sierra Nevada; seventeen of *C. ibex*, representing it in all its ages and in all states of wool; not to mention excellent specimens of *C. pyrenaica*, *C. caucasica*, *C. altaica*, and *C. sinaica*; indeed, it may be doubted if there is in any Museum a more complete collection of this interesting group. Of the Antelopes the Museum also possesses a grand series, and the attention in this corner of the hall will be at once attracted by the case of Reindeer, containing eight perfect specimens, representing the wild race of Norway, the domesticated animal of Lapland, and the varieties from Siberia, Greenland, and Labrador. There are also beautifully stuffed specimens of the European and American Bison, and among the Cervidæ we noticed a most interesting little variety from Corsica of *Cervus elaphas*.

Among the Rodents the Collection of Hares and Rabbits from all parts of the world is very fine. The Collection of Madagascar Lemurs is nearly complete. There are also fine specimens of *Colobus ursinus* and *C. vallerosus* from the Gaboon, and a skeleton of the female Gorilla; one of the largest specimens known of the Walrus, and an immense series of Phocidæ from the North Seas. We have omitted to mention two nice specimens of *Chlamydophorus truncatus*.

The Bird Galleries are very extensive, and contain upwards of 5,000 species and nearly 14,000 birds. The Collection of Vultures is very rich; *Gypœtus barbatus* from Switzerland, Pyrenees, Sierra Nevada, the Atlas, and Abyssinia; *Aquila pelagica* from Kamtschatka. Of Strix there are about 200 specimens and 60 species. The Birds of Paradise are represented by perfectly fresh specimens of *Semiophora Wallacei*, *Paradisea alba*, *Craspedophora magnifica*, male and female; *Astrapia nigra*, male and female; good specimens of both species of *Cephaloptera*; *Turacus giganteus*; *Anas Stelleri*, male and female; *Alca impennis*, a very old specimen. Passing by the grand series of Pelicans, of Grouse we record magnificent specimens of *Oreophatis derlyanus*, *Lophalector Macartneyi*, male and female, *Balœniceps rex*, &c.

The Reptiles and Fishes occupy two large halls.

The Entomological Collection is very fine; a portion of it is exposed to the public in one of the halls; but the greater part is kept in the Cabinet Room. Nothing can surpass the beauty and freshness of the collection of Alsace Insecta. The collection of Coleoptera numbers about 8,000 species.

The Palæontological Collection is arranged according to the geological formations; and one must remark a magnificent example of *Teleosaurus Chapmani*, 12 ft. long; a grand mass of *Pentacrinus fasciculatis*, 5 ft. by 3, and containing 15 individuals established on a mass of oysters.

The fossil plants are, as might be expected, very numerous, and many of them are well known through the memoirs, as well as the fine monograph on Fossil Plants, by Dr. Schimper.

In thus noticing some of the chief objects which attracted our attention during a visit to this Museum in January last, it is well also to remember that this grand collection owes its very existence to the life-long labours of Dr. Schimper. Since 1838 he has been the Director of the Museum, which before that time existed only in name. Throughout the terrible bombardment the Museum escaped almost without any damage, and has now become one of the most valuable prizes of war gained by the conquerors. The thanks of the world of science are due to the excellent director of this collection, for all that he has done for it and for science, and we hope we are not wrong in here expressing the wish that, should Prof. Schimper, having been all his life a Frenchman, find it impossible to change his nationality and so continue to reside in Strasbourg, that that new rule which knows so well when it likes how to appreciate the man of science, will not forget to whose care it is indebted for the magnificent prize which it has won.

E. P. W.

DUST AND SMOKE *

AFTER a few preliminary experiments illustrative of the polarisation of light, Prof. Tyndall adverted to the polarisation of light by fine dust, by the sky, and by the coarser particles of smoke. In the former the direction of maximum polarisation, as in the case of the sky, is at right angles to the illuminating beam. In the latter, according to the observations of Govi, the maximum quantity of polarised light was discharged obliquely to the beam. Govi's observation of a neutral point in such beam, on one side of which the polarisation was positive and on the other side negative, was also referred to. The additional fact was then adduced that the position of the neutral point varied with the density of the smoke. Beginning, for example, with an atmosphere thickened by the dense fumes of incense, resin, or gunpowder, and observing the neutral point, its direction was first observed to be inclined to the beam *towards* the source of illumination. Opening the windows so as to allow the smoke to escape gradually, the neutral point moved down the beam, passed the end of a normal drawn to the beam from the eye, and gradually moved forward several feet down the beam. The speaker did not halt at these observations, they were introduced as the starting point of inquiries of a different nature, and after their introduction the discourse proceeded thus :—

But what, you may ask, is the practical good of these curiosities? And if you so ask, my object is in some sense gained, for I intended to provoke this question. I confess that if we exclude the interest attached to the observation of new facts, and the enhancement of that interest through the knowledge that by-and-by the facts will become the exponents of laws, these curiosities are in themselves worth nothing. They will not enable us to add to our stock of food or drink or clothes or jewellery. But though thus shorn of all usefulness in themselves, they may, by leading the mind into places which it would not otherwise have entered, become the antecedents of practical consequences. In looking, for example, at this illuminated dust, we may ask ourselves what it is. How does it act, not upon a beam of light, but upon our own lungs and stomachs? The question at once assumes a practical character. We find on examination that this dust is organic matter—in part living, in part dead. There are among it particles of ground straw, torn rags, smoke, the pollen of flowers, the spores of fungi, and the germs of other things. But what have they to do with the animal economy? Let me give you an illustration to which my attention has been lately drawn by Mr. George Henry Lewes, who writes to me thus :—

"I wish to direct your attention to the experiments of von Recklingshausen should you happen not to know them. They are striking confirmations of what you say of dust and disease. Last spring, when I was at his laboratory in Würzburg I examined with him blood that had been three weeks, a month, and five weeks, out of the body, preserved in little porcelain cups under glass shades. This blood was living and growing. Not only were the Amœba-like movements of the white corpuscles present, but there were abundant evidences of the growth and development of the corpuscles. I also saw a frog's heart still pulsating which had been removed from the body (I forget how many days, but certainly more than a week). There were other examples of the same persistent vitality or absence of putrefaction. Von Recklingshausen did not attribute this to the absence of germs—germs were not mentioned by him; but when I asked him how he represented the thing to himself, he said the whole mystery of his operation consisted in keeping the blood *free from dirt*. The instruments employed were raised to a red heat just before use, the thread was silver thread and was similarly treated, and the porcelain cups, though not kept free from air, were kept free from currents. He said he often had failures, and these he attributed to particles of dust having escaped his precautions."

Prof. Lister, who has founded upon the removal or destruction of this "dirt" great and numerous improvements in surgery, tells us of the effect of its introduction into the blood of wounds. He informs us what would happen with the extracted blood should the dust get at it. The blood would putrefy and become fetid, and when you examine more closely what putrefaction means, you find the putrefying substance swarming with organic life, the germs of which have been derived from the air.

Another note which I received a day or two ago has a bearing particularly significant at the present time upon this question of dust and dirt, and the wisdom of avoiding them. The note is from Mr. Ellis, of Sloane Street, to whom I owe a debt of gratitude for advice given to me when sorely wounded in the Alps. "I do not know," writes Mr. Ellis, "whether you happened to see the letters, of which I enclose you a reprint, when they appeared in the *Times*. But I want to tell you this in reference to my method of vaccination as here described, because it has, as I think, a relation to the subject of the intake of organic particles from without into the body. Vaccination in the common way is done by scraping off the epidermis, and thrusting into the punctures made by the lancet the vaccine virus. By the method I use (and have used for more than twenty years) the epidermis is lifted by the effusion of serum from below, a result of the irritant cantharadine applied to the skin. The little bleb thus formed is pricked, a drop of fluid let out, and then a fine vaccine point is put into this spot, and after a minute of delay it is withdrawn. The epidermis falls back on the skin and quite excludes the air—and not the air only, but what the air contains.

"Now mark the result—out of hundreds of cases of re-vaccination which I have performed, I have never had a single case of bloodpoisoning or of abscess. By the ordinary way the occurrence of secondary abscess is by no means uncommon, and that of pyæmia is occasionally observed. I attribute the comparative safety of my method entirely, first, to the exclusion of the air and what it contains; and, secondly, to the greater size of the apertures for the inlet of mischief made by the lancet."

I bring these facts forward that they may be sifted and challenged if they be not correct. If they are correct it is needless to dwell upon their importance, nor is it necessary to say that if Mr. Ellis had resigned himself wholly

* Lecture delivered at the Royal Institution, Friday evening, June 9, 1871.

to the guidance of the germ theory he could not have acted more in accordance with the requirements of that theory than he has actually done. It is what the air contains that does the mischief in vaccination. Mr. Ellis's results fall in with the general theory of putrefaction propounded by Schwann, and developed in this country with such striking success by Prof. Lister. They point, if true, to a cause distinct from bad lymph for the failures and occasional mischief incidental to vaccination; and if followed up they may be the means of leaving the irrational opposition to vaccination no ground to stand upon, by removing even the isolated cases of injury on which the opponents of the practice rely.

We are now assuredly in the midst of practical matters. With your permission I will recur once more to a question which has recently occupied a good deal of public attention. You know that as regards the lowest forms of life, the world is divided, and has for a long time been divided, into two parties, the one affirming that you have only to submit absolutely dead matter to certain physical conditions to evolve from it living things; the others, without wishing to set bounds to the power of matter, affirming that in our day no life has ever been found to arise independently of pre-existing life. Many of you are aware that I belong to the party which claims life as a derivative of life. The question has two factors: the evidence, and the mind that judges of the evidence; and you will not forget that it may be purely a mental set or bias on my part that causes me throughout this discussion from beginning to end, to see on the one side dubious facts and defective logic, and on the other side firm reasoning and a knowledge of what rigid experimental inquiry demands. But judged of practically, what, again, has the question of Spontaneous Generation to do with us? Let us see. There are numerous diseases of men and animals that are demonstrably the products of parasitic life, and such disease may take the most terrible epidemic forms, as in the case of the silkworms of France in our day. Now it is in the highest degree important to know whether the parasites in question are spontaneously developed, or are wafted from without to those afflicted with the disease. The means of prevention, if not of cure, would be widely different in the two cases.

But this is by no means all. Besides these universally admitted cases, there is the broad theory now broached and daily growing in strength and clearness—daily, indeed, gaining more and more of assent from the most successful workers and profound thinkers of the medical profession itself—the theory, namely, that contagious disease generally is of this parasitic character. If I had heard or read anything since to cause me to regret having introduced this theory to your notice more than a year ago, I should here frankly express that regret. I would renounce in your presence whatever leaning towards the germ theory my words might then have betrayed. Let me state in two sentences the grounds on which the supporters of the theory rely. From their respective viruses you may plant typhoid fever, scarlatina, or small-pox. What is the crop that arises from this husbandry? As surely as a thistle rises from a thistle seed, as surely as the fig comes from the fig, the grape from the grape, the thorn from the thorn, so surely does the typhoid virus increase and multiply into typhoid fever, the scarlatina virus into scarlatina, the small-pox virus into small-pox. What is the conclusion that suggests itself here? It is this:—That the thing which we vaguely call a virus is to all intents and purposes a *seed*: that in the whole range of chemical science you cannot point to an action which illustrates this perfect parallelism with the phenomena of life—this demonstrated power of self-multiplication and reproduction. There is, therefore, no hypothesis to account for the phenomena but that which refers them to parasitic life.

And here you see the bearing of the doctrine of Spontaneous Generation upon the question. For if the doctrine continues to be discredited as it has hitherto been, it will follow that the epidemics which spread havoc amougst us from time to time are not spontaneously generated, but that they arise from an ancestral stock whose habitat is the human body itself. It is not on bad air or foul drains that the attention of the physician will primarily be fixed, but upon disease germs which no bad air or foul drains can create, but which may be pushed by foul air into virulent energy of reproduction. You may think I am treading on dangerous ground, that I am putting forth views that may interfere with salutary practice. No such thing. If you wish to learn the impotence of medical science and practice in dealing with contagious diseases, you have only to refer to a recent Harveian oration by Dr. Gull. Such diseases defy the physician. They must burn themselves out. And, indeed, this, though I do not specially insist upon it, would favour the idea of their vital origin. For if the seeds of contagious disease be themselves living things, it will be difficult to destroy either them or their progeny without involving their living habitat in the same destruction.

And I would also ask you to be cautious in accepting the statement which has been so often made, and which is sure to be repeated, that I am quitting my own *métier* when I speak of these things. I am not dealing with professional questions. I am writing no prescription, nor should I venture to draw any conclusion from the condition of your pulse and tongue. I am dealing with a question on which minds accustomed to weigh the value of experimental evidence are alone competent to decide, and regarding which, in its present condition, minds so trained are as capable of forming an opinion as on the phenomena of magnetism and radiant heat. I cannot better conclude this portion of my story than by reading to you an extract from a letter addressed to me some time ago by Dr. William Budd, of Clifton, to whose insight and energy the town of Bristol owes so much in the way of sanitary improvement.

"As to the germ theory itself," writes Dr. Budd, "that is a matter on which I have long since made up my mind. From the day when I first began to think of these subjects, I have never had a doubt that the specific cause of contagious fevers must be living organisms.

"It is impossible, in fact, to make any statement bearing upon the essence or distinctive characters of these fevers, without using terms which are of all others *the most distinctive of life*. Take up the writings of the most violent opponent of the germ theory, and, ten to one, you will find them full of such terms as 'propagation,' 'self-propagation,' 'reproduction,' 'self-multiplication,' and so on. Try as he may—if he has anything to say of those diseases which is characteristic of them—he cannot evade the use of these terms, or the exact equivalents to them. While perfectly applicable to living things, these terms express qualities which are not only inapplicable to common chemical agents, but as far as I can see actually inconceivable of them."

Once, then, established within the body, this evil form of life, if you will allow me to call it so, must run its course. Medicine as yet is powerless to arrest its progress, and the great point to be aimed at is to prevent its access to the body. It was with this thought in my mind that I ventured to recommend, more than a year ago, the use of cotton-wool respirators in infectious places. I would here repeat my belief in their efficacy if properly constructed. But I do not wish to prejudice the use of these respirators in the minds of its opponents by connecting them indissolubly with the germ theory. There are too many trades in England where life is shortened and rendered miserable by the introduction of matters into the lungs which might be kept out of them. Dr. Greenhow has shown the stony grit deposited in the lungs of stonecutters. The black lung of colliers is another case in point

In fact a hundred obvious cases might be cited, and others that are not obvious might be added to them. We should not, for example, think that printing implied labours where the use of cotton-wool respirators might come into play; but I am told that the dust arising from the sorting of the type is very destructive of health. I went some time ago into a manufactory in one of our large towns, where iron vessels are enamelled by coating them with a mineral powder, and subjecting them to a heat sufficient to fuse the powder. The organisation of the establishment was excellent, and one thing only was needed to make it faultless. In a large room a number of women were engaged covering the vessels. The air was laden with the fine dust, and their faces appeared as white and bloodless as the powder with which they worked. By the use of cotton-wool respirators these women might be caused to breathe air more free from suspended matters than that of the open street. Over a year ago I was written to by a Lancashire seedsman, who stated that during the seed season of each year his men suffered horribly from irritation and fever, so that many of them left his service. He asked me could I help him, and I gave him my advice. At the conclusion of the season this year he wrote to me that he had simply folded a little cotton-wool in muslin, and tied it in front of the mouth; that he had passed through the season in comfort and without a single complaint from one of his men.

The substance has also been turned to other uses. An invalid tells me that at night he places a little of the wool before his mouth, slightly moistening it to make it adhere; that he has thereby prolonged his sleep, abated the irritation of his throat, and greatly mitigated a hacking cough from which he had long suffered. In fact, there is no doubt that this substance is capable of manifold useful applications. An objection was urged against the use of it: that it became wet and heated by the breath. While I was casting about for a remedy for this, a friend forwarded to me from Newcastle a form of respirator invented by Mr. Carrick, an hotel-keeper at Glasgow, which meets the case effectually, and, by a slight modification, may be caused to meet it perfectly. The respirator, with its back in part removed, is shown in Fig. 1. It consists of the space under the partition of wire-gauze *q r*, intended by Mr. Carrick for "medicated substances," and which may be filled with cotton-wool. The mouth is placed against the aperture *o*, which fits closely round the lips, and the air enters the mouth through the cotton-wool, by a light valve *v*, which is lifted by the act of inhalation. During exhalation this valve closes; another breath escapes by a second valve, *v'*, into the open air. The wool is thus kept dry and cool; the air in passing through it being filtered of everything it holds in suspension.*

We have thus been led by our first unpractical experiments into a thicket of practical considerations. In taking the next step, a personal peculiarity had some influence upon me. The only kind of fighting in which I take the least delight, is the conflict of man with nature. I like to see a man conquer a peak or quench a conflagration. I remember clearly the interest I took twenty years ago in seeing the firemen of Berlin contending for mastery with a fire which had burst out somewhere near the Brandenburger Thor; and I have often experienced the same interest in the streets of London. Admiring as I do the energy and bravery of our firemen, and having heard that smoke was a greater enemy to them than flame itself, the desire arose of devising a fireman's respirator. But before I describe what has been done in this direction, let me draw your attention to the means hitherto employed to enable a man to live in dense smoke. Thanks to the courtesy of Capt. Shaw, I am enabled to show you the action of the "smoke-jacket," known abroad as the "Appareil Paulin," from its supposed inventor. The jacket is of pliable cowhide. It has arms and a hood, with eye-glasses. With straps and buckles the jacket is tied round the wrists and waist, and a strap which passes between the legs prevents it from rising. On the left side of the jacket is fixed a screw, to which the ordinary hose of the fire-engine is attached, and through the hose air instead of water is urged into the space between the fireman's body and the jacket. It becomes partially inflated, but no pressure of any amount is attainable, because the air, though somewhat retarded, escapes with tolerable freedom from the wrists and waist. Hence the fireman, when his hose is long enough, can deliberately walk into the densest smoke or foulest air. But you see the use of the smoke-jacket necessitates the presence of several men; it also implies the presence of an engine. A single man could make no use of it, nor indeed any number of men without a pumping engine. Its uses are thus summed up in a communication addressed to me by Captain Shaw:—

"This smoke-jacket is very useful for extinguishing fires in vaults, stopping conflagrations in the holds of ships, and penetrating wells, quarries, mines, cesspools, &c.—any places, in short, where the air has become unfit for respiration.

"The special advantages of this jacket are its great simplicity, its facility for use, and the rapidity with which it can be carried about and put on; but its drawback is that it requires the use of an engine or air-pump, and consequently is of no service to one man alone. For this latter reason smoke-jackets, although very effective for enabling us to get into convenient places for extinguishing fires, have very rarely proved of any avail for *saving life*."

Now it is that very want that I thought ought to be supplied by a suitable respirator. Our fire-escapes are each in charge of a single man, and I wished to be able to place it in the power of each of those men to penetrate through the densest smoke into the recesses of a house, and there to rescue those who would otherwise be suffocated or burnt. I thought that cotton wool, which so effectually arrested dust, might also be influential in arresting smoke. It was tried; but, though found soothing in certain gentle kinds of smoke, it was no match for the pungent fumes of a resinous fire, which we employ in our experiments in the laboratory, and which, I am gratified to learn from Captain Shaw, evolves the most abominable smoke with which he is acquainted. I cast about for an improvement, and in conversing on the subject with my friend Dr. Debus, he suggested the use of glycerine to moisten the wool, and render it more adhesive. In fact, this very substance had been employed by the most distinguished advocate of the doctrine of spontaneous generation, M. Pouchet, for the purpose of catching the atmospheric germs. He spread a film of glycerine on a plate of glass, urged air against the film, and examined the dust which stuck to it. The moistening of the cotton-wool with this substance was a decided improvement; still the respirator only enabled us to remain in dense smoke for three or four minutes, after which the irritation became unendurable. Reflection suggested that in combustion so imperfect as the production of dense smoke implies, there must be numerous hydrocarbons produced which, being in a state of vapour, would be very imperfectly arrested by the cotton wool. These in all probability were the cause of the residual irritation; and if these could be removed, a practically perfect respirator might possibly be obtained.

I state the reasoning exactly as it occurred to my mind. Its result will be anticipated by many present. All bodies possess the power of condensing in a greater or less degree gases and vapours upon their surfaces, and when the condensing body is very porous, or in a fine state of division, the force of condensation may produce very remarkable effects. Thus, a clean piece of platinum-foil placed in a mixture of oxygen and hydrogen so squeezes the gases together as to cause them to combine; and if the experiment be made with care, the heat of combina-

* Mr. Ladd, of Beak Street sells these respirators.

tion may raise the platinum to bright redness, so as to cause the remainder of the mixture to explode. The promptness of this action is greatly augmented by reducing the platinum to a state of fine division. A pellet of "spongy platinum," for instance, plunged into a mixture of oxygen and hydrogen, causes the gases to explode instantly. In virtue of its extreme porosity, a similar power is possessed by charcoal. It is not strong enough to cause the oxygen and hydrogen to combine like the spongy platinum, but it so squeezes the more condensible vapours together, and also acts with such condensing power upon the oxygen of the air, as to bring both within the combining distance, thus enabling the oxygen to attack and destroy the vapours in the pores of the charcoal. In this way, effluvia of all kinds may be virtually burnt up, and this is the principle of the excellent charcoal respirators invented by Dr. Stenhouse. Armed with one of these, you may go into the foulest-smelling places without having your nose offended. Some of you will remember Dr. Stenhouse lecturing in this room with a suspicious-looking vessel in front of the table. That vessel contained a decomposing cat. It was covered with a layer of charcoal, and nobody knew until told of it what the vessel contained.

I may be permitted in passing to give my testimony as

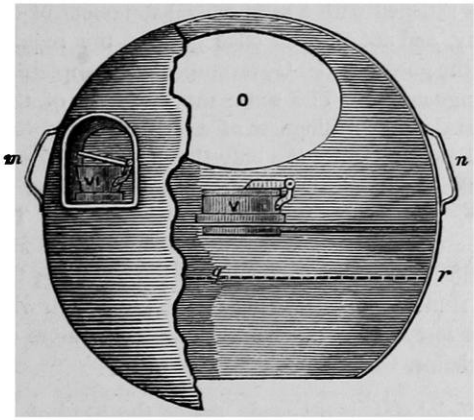

FIG. 1.

to the efficacy of these charcoal respirators in providing warm air for the lungs. Not only is the sensible heat of the breath in part absorbed by the charcoal, but the considerable amount of latent heat which accompanies the aqueous vapour from the lungs is rendered free by the condensation of the vapour in the pores of the charcoal. Each particle of charcoal is thus converted into an incipient ember, and warms the air as it passes inwards.

But while powerful to arrest vapours, the charcoal respirator is ineffectual as regards smoke. The particles get freely through the respirator. In a series of them tested downstairs, from half a minute to a minute was the limit of endurance. This might be exceeded by Faraday's method of emptying the lungs completely, and then filling them before going into a smoky atmosphere. In fact, each solid smoke particle is itself a bit of charcoal, and carries on it, and in it, its little load of irritating vapours. It is this, far more than the particles of carbon themselves, that produces the irritation. Hence two causes of offence are to be removed: the carbon particles which convey the irritant by adhesion and condensation, and the free vapour which accompanies the particles. The moistened cotton-wool I knew would arrest the first, fragments of charcoal I hoped would stop the second. In the first fireman's respirator, Mr. Carrick's arrangement of two valves, the one for inhalation, the other for exhalation, are preserved. But the portion of it which holds the filtering and absorbent substances is prolonged to a depth of four or five inches (see Fig. 2). On the partition of wire gauze *qr* at the bottom of the space which fronts the mouth, is placed a layer of cotton-wool, *c*, moistened with glycerine; then a thin layer of dry wool, *c'*; then a layer of charcoal fragments; a second thin layer of dry cotton wool, succeeded by a layer of fragments of caustic lime. The succession of the layers may be changed without injury to the action. A wire-gauze cover, shown in plan below Fig. 1, keeps the substances from falling out of the respirator. In the densest smoke that we have hitherto employed, the layer of lime has not been found necessary, nor is it shown in the figure; in a flaming building, indeed, the mixture of

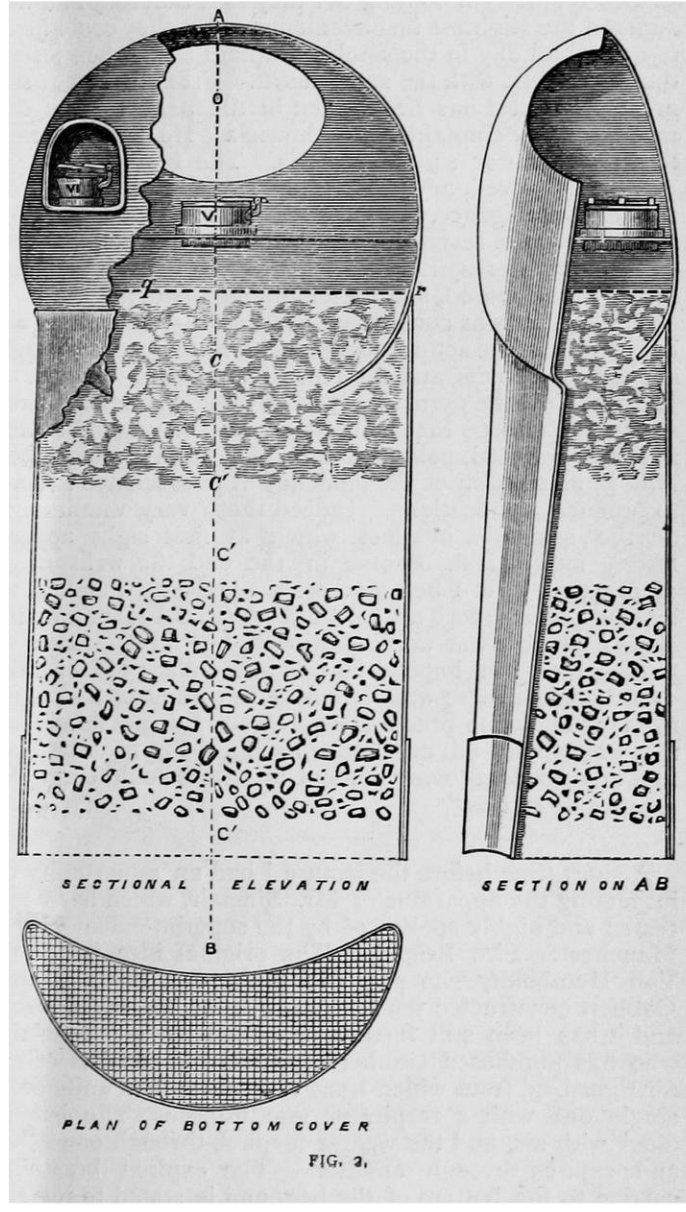

FIG. 2.

air with the smoke never permits the carbonic acid to become so dense as to be irrespirable. But in a place where the gas is present in undue quantity, the fragments of lime would materially mitigate its action.

In a small cellar-like chamber downstairs, with a stone flooring and stone walls, the first experiments were made. We placed there furnaces containing resinous pine-wood, lighted the wood, and placing over it a lid which prevented too brisk a circulation of the air, generated dense volumes of smoke. With our eyes protected by suitable glasses, my assistant and I have remained in this room for half an hour and more, when the smoke was so dense and pungent that a single inhalation through the undefended

mouth would be perfectly unendurable; and we might have prolonged our stay for hours. Having thus far perfected the instrument, I wrote to Captain Shaw, the chief officer of the Metropolitan Fire Brigade, asking him whether such a respirator would be of use to him. His reply was prompt; it would be most valuable. He had, however, made himself acquainted with every contrivance of the kind in this and other countries, and had found none of them of any practical use. He offered to come and test it here, or to place a room at my disposal in the City. At my request he came here, accompanied by three of his men. Our small room was filled with smoke to their entire satisfaction. The three men went successively into it, and remained there as long as Captain Shaw wished them. On coming out they said that they had not suffered the slightest inconvenience; that they could have remained all day in the smoke. Captain Shaw then tested the instrument with the same result. From that hour the greatest interest has been taken in the perfecting of the instrument by Captain Shaw himself. He has attached to the respirator suitable hoods. The real problem is practically solved, and I can only say that if a tithe of the zeal, intelligence, and practical skill were bestowed on the cotton-wool respirator that Captain Shaw has devoted to the fireman's respirator the sufferings of many a precious life might be spared, and its length augmented.*

The lecture was concluded as follows:—"Thus have we been led from the actinic decomposition of vapours through the tails of comets and the blue of the sky to the dust of London, from the germ theory of disease down to this fireman's respirator. Instead of this trivial example, I could, if time permitted, point to others of a more considerable kind in illustration of the tendency of pure science to lead to practical applications. Indeed those very wanderings of the scientific intellect which at first sight appear utterly unpractical, become in the end the wellsprings of practice. Yet I believe there is a philosophy embraced by some of our more ardent thinkers (who I fear on many points commit the well-intentioned, but fatal mistake of putting their own hopeful fancies in the place of fact) that would abolish these wanderings of the intellect and fix it from the outset on practical ends alone. I do not think that that philosophy will ever make itself good in the world, or that any freedom-loving student of nature could or would tolerate its chains."

A short time before the lecture I had an opportunity of inspecting the apparatus of Mr. Sinclair, which has been tested and highly spoken of by the superintendent of the Manchester Fire Brigade. The original idea is due to Von Humboldt, who proposed it for the Hartz mines. Galibert constructed the apparatus in an improved form, and it has been still further improved by Mr. Sinclair, who has purchased Galibert's patent. It consists of an air-tight bag, from which issue two tubes that unite on a single one with a respirator mouth-piece. The bag is filled with air, and the wearer inspires through one valve and expires through another. The expired breath is carried to the bottom of the bag, and is stated to remain there in consequence of the chilling experienced in its passage downwards. A bag of not inordinate size is stated to be sufficient to supply a man with air for twenty minutes. Mr. Sinclair's apparatus was exhibited during the lecture.

J. T.

* Mr. Ladd has also proposed a form of mouth-piece which promises well, and Mr. Cottrell has attached to it an ordinary fencing-mask. This will probably be the form of apparatus finally adopted.

NOTES

WE are able to state that the Council of the Royal Astronomical Society are considering the steps necessary to be taken to insure observations being made of the Total Solar Eclipse visible in Ceylon next December. We need scarcely remark that there is no subject which is at present engaging the attention of scientific men more important than that of the nature of the Corona, and it will be a disgrace to the science of the age if the next eclipse is allowed to pass over without every effort being made to increase our knowledge.

THE Astronomer Royal requests us to state that he will be obliged for the loan of any unpublished observations made during the recent total eclipse. Communications to be addressed to him at the Royal Observatory, Greenwich.

WE are glad to learn that the Right Hon. Mr. Robert Lowe has been elected a Fellow of the Royal Society. We have before in these columns stated our belief that Science has every reason to expect a favourable recognition of her claims from him as Chancellor of the Exchequer if proper claims are put forward in a proper manner, and we reiterate the assertion. It was unfortunate that the first grant of public money for which Mr. Lowe was asked, for scientific purposes, was allocated in a way which made Mr. Lowe somewhat indignant, a feeling which was however shared by many men of science. It was also unfortunate that the requirements of science in the matter of the Eclipse Expedition were not properly put before the Government in the first instance, but it is now a matter of history that Mr. Lowe was satisfied with a semi-official statement of the claims of Astronomy, and not only at once granted the required aid, but threw all the power of the Government into completing the necessary arrangements. The same may be said of the Dredging Expeditions. The willingness of a Chancellor of the Exchequer after all, however, is not the only thing requisite for State recognition of the claims of Science. We want a proper scientific organisation, and proper scientific representation. That Science here is in a chaotic state, is the well-founded opinion of many of our scientific men; and if this condition of things is allowed to continue, students of Science must expect that their wishes shall be ignored or lost sight of in the rush of other more emphatically asserted claims.

THE official statements made under the head of "University Intelligence" in the daily papers have been lately very remarkable. We noticed, not very long ago, that Prof. Max Müller was called Professor of Comparative Physiology! What will Dr. Rolleston say to this? A few days afterwards it was announced that Mr. Reinold, the Lee's Reader of Physics at Christ Church, would give a course of lectures on Statistical Electricity!! Surely no one but Mrs. Malaprop herself could have made such blunders; while to cap all, a day or two ago we were informed (again in the official "University Intelligence") that the Commemoration at Oxford was an "interesting event!" Surely this is rather hard on Alma Mater!

ASTRONOMY, may we say astrology, like many other things, is being put on a new footing at Constantinople. For many years the chief functionary in this department of science has been the Sultan's chief astrologer, but we believe he is now little called upon by Abdul Aziz to cast horoscopes for a lucky time, as the Sultan starts at a punctual hour, and the astrologer has chiefly to cast the ephemerides for the Salnameh, or official almanack, a periodical growing in respectability. Lectures in Physical Science are given in Turkish by Mussulman Professors at the Darul Funoun, or University, though there are godly men in Islam who maintain that such teaching is contrary to scripture. The time in Constantinople is a sore puzzle. As the day begins at sunset, and has to be divided into twenty-four hours, at sundown begins a general setting of watches, because steamboat departures and other incidents are regulated by Turkish time. The chief object for which expensive clocks and watches are bought by the Turks is for working out the canonical hours of

prayer. Now a reform is setting in, H. E. Halil Pasha, Director-General of Arsenals, brought up at Woolwich, the Rev. Mr. Gribble, F.R.A.S., H.M. Chaplain, and Mr. Coumbary, Director of the Meteorological Observatory, have set up a noon-gun at the Tophaneh Arsenal.

WE regret to have to record the death of M. Payen, Professor of Chemistry at the Conservatoire des Arts et Métiers. Although seventy-six years of age, he had enjoyed very good health, and died suddenly of apoplexy. He had been a member of the Academy for twenty-nine years. An address was delivered at the grave by M. Decaisne, and another in the Academy by M. Chevreul.

DURING the last siege of Paris many learned Frenchmen experienced heavy losses through the firing of private houses. M. Bertrand lost the manuscript of the third volume of his great Treatise "On the Differential and Integral Calculus." The amount of labour required for writing it a second time is immense. M. Bertrand had calculated many formulæ from new methods of his own invention. Many instances of similar misfortunes could be given, but altogether it is astonishing that the amount of mischief done was not even larger. During the whole of the rebellion the Academy, with only one exception, held its meetings regularly. No fact more honourable for the members can be written in the eventful history of the learned society.

WE congratulate Marlborough College on the determination of the head master, the Rev. F. W. Farrar, to introduce an adequate amount of natural science as a part of the school work; as well as on the selection he has made of Mr. G. Farrer Rodwell as Science Master, by whose appointment to Marlboro' a vacancy is occasioned in the post of science master at Clifton College.

THE Examiners for the Johnson Memorial Prize Essay at Oxford have awarded it to Mr. James S. Gamble, B.A., Magdalen College. *Proxime accesserunt:* Mr. J. P. Earwaker, Merton College; and the Hon. F. A. Russell, Christ Church. This prize is only awarded every four years, the subject this year being—"On the Laws of Wind; (1) with regard to Storms, (2) with regard to average Periodical Phenomena at given places on the Earth's Surface."

MESSRS. H. N. READ, SOLLAS, and YULE have been elected to exhibitions of 10*l.* each for merit shown in the annual college examination in natural science at St. John's College, Cambridge, in addition to the usual prizes in books conferred upon all of the first class in that examination.

HERBERT MOGG, from Clifton College, Bristol, and S. Cook, private tuition, have been elected to scholarships for Natural Science at Pembroke College, Cambridge.

A NATURAL SCIENCE DEMYSHIP, of the annual value of 80*l.* for five years, will be given in October next at Magdalen College, Oxford. The limit of age is twenty years, and a sufficient knowledge of classics to pass the College Matriculation Examination is also required. At the same time, and with the same papers, a Natural Science Postmastership, of the value of 80*l.* for five years, will be awarded at Merton. Each candidate will be considered as standing in the first instance at the college at which he has put down his name, and unless he has then given notice to the contrary will be regarded as standing at the other College also. The Examination will commence on October 3.

PROF. LIVEING gives notice that the chemical laboratory of the University of Cambridge will be open during the long vacation, as in Term time. The demonstrator (Mr. Liversedge) will attend to give assistance to students on mornings and afternoons alternately during July and August. Dr. Michael Foster also gives notice that the physiological laboratory will be open, and that, under his superintendence, Mr. Martin will give a course of instruction in practical physiology.

ON Wednesday, the 7th inst., a grace passed the Senate of the University of Cambridge, granting 200*l.* from the Worts' Fund to Mr. G. R. Crotch, who is about to proceed in the autumn to the United States of America, *en route* for the Sandwich Islands, New Zealand, and Australia, for the purpose of enabling him to collect and transmit to Cambridge specimens illustrative of the natural history of those parts of the world, and of any others he may visit, with the understanding that such specimens shall be the property of the University, and be accompanied by reports from time to time, which may hereafter be published, of the investigations he has made and the objects he has collected. Though Australia will be the basis of Mr. Crotch's operations, he does not intend to confine his researches to that continent, and should the opportunity offer itself of visiting from its northern settlements the Island of New Guinea, it is to be hoped he will be able to avail himself of it.

THE following have been elected honorary members of the Cambridge Philosophical Society:—Sir B. C. Brodie, Dr. W. B. Carpenter, Capt. Clarke, R.E., Prof. Huxley, Prof. Bartholomew Price, Mr. W. Spottiswoode, Prof. Argelander (Bonn), Prof. Clebsch (Göttingen), Prof. Des Cloiseaux (Paris), Prof. Helmholtz (Berlin), Prof. Wöhler (Göttingen).

IN the *Times* of last Monday Mr. F. Galton calls attention to the small extent to which the great public schools have availed themselves of the opportunity of competing for the medals offered by the Royal Geographical Society for the best candidates in physical and in political geography, and to the very unprepared state in which those candidates who do go up present themselves. He believes it is the Universities that stop the way of reform, and suggests that one branch of geography be included as a necessary subject in a matriculation examination before admission to the Universities.

ON Trinity Monday, according to ancient custom, the Provost and Senior Fellows of Trinity College, Dublin, proceeded to the election of a fellow and of fifteen scholars. Eight candidates had presented themselves for the Fellowship Examination. Mr. William F. Burnside was declared elected as fellow, Mr. G. S. Minchin obtained the Madden Premium; Mr. F. Purser was only half a mark below Mr. Minchin. The following were elected classical scholars:—Tyrrell, Hewitt, Wilson, Barry, Hill, Baker, H. W. White, Butler, and Roberts; and as science scholars:—Graham, Fitzgerald, Downing, Hackett, Byrne, and Adair.

AT the annual meeting of the Royal College of Surgeons of Ireland, held on Trinity Monday, Dr. J. H. Wharton was elected President, Dr. F. Kirkpatrick Vice-President, Mr. William Coles, Secretary; and on the Council:—Messrs. R. Adams, W. Colles, A. Carte, M.D., J. Denham, W. A. Elliott, A. H. Jacob, G. W. Hatchell, E. Hamilton, M.D., W. Hargrave, H. Irvine, W. Jameson, H. Labatt, E. Ledwich, R. Macnamara, J. Morgan, M.D., R. M'Donnell, M.D., F.R.S., B. M'Dowel, M.D., G. H. Porter, M.D., and A. J. Walsh. There was a severe contest for the Vice-Presidentship, in which Dr. Kirkpatrick defeated Dr. Mapother by a few votes.

THE *Gardener's Chronicle* publishes more recent intelligence of Dr. Hooker and his party under date "Camp, Atlas Mountains, May 19th." They had succeeded in reaching the top of the crest of the Atlas, nearly due south of Morocco, at an altitude of about 11,500 feet, the upper 3,000 feet of which were very steep indeed, very rocky and stony, with a good deal of snow, and the temperature 24° Fahr. The flora of this upper region appears to be excessively poor; they did not find a single really Alpine

plant, "and few plants of any kind; no gentians, primroses, anemones, ranunculi, or other types of an Alpine flora. The rocks were chiefly a very hard porphyry, red, black, and grey, with granite here and there, and beds of limestone, all hard and obnoxious to plants. Moreover, these steep upper cliffs of the Atlas are alternately roasted by a blazing sun, or parched by a Sahara sirocco, or swept by moist north-west Atlantic gales, which bring heavy snowstorms such as we experienced, probably throughout the year. The flora up to 7,000 feet, on the contrary, is exceedingly rich, varied, and beautiful;" and Dr. Hooker thinks that their collections will prove of very great interest and considerable extent. Many English plants find their southern limits here, and there is an abundance of roses, bramble, elder, honeysuckle, ivy, ash, poplar, &c.

A FRENCH physician, Dr. Brierre de Boismont, has discovered a new disease, a form of contagious mental alienation, from which, he states, the members of the Commune suffered during the late insurrection in Paris, and which he terms the *morbus democraticus*.

WE have received during the past week *Les Mondes* for March 23, and the *Moniteur Scientifique* for May 1 and 15, together with the *Comptes Rendus* to May 29, we trust an earnest of the re-opening of the scientific intercourse with Paris which has for long been so lamentably interrupted.

WE learn that the celebrated collection of Egyptian antiquities made by the late artist antiquary, Robert Hay, of Linplum, recently exhibited at the Crystal Palace, has been purchased by a well-known banker in Boston, U.S.A., and it is now being shipped for that city. We regret that so valuable a collection should be allowed to leave this country, and congratulate America on the acquisition of so important and in many instances unique an addition to its antiquities.

ON Saturday, June 10, the boys belonging to the Geology Class at Christ's Hospital went to some pits at Woolwich and Charlton, under the care of Professor Tennant. Unfortunately the rain detained them for an hour, but, notwithstanding the inconveniences caused by the wet, some interesting specimens were discovered, and a somewhat better idea of what geology really is was obtained from the practical work that they did.

IN a note in a recent number of the *American Naturalist*, Prof. Dawson repeats his assertion that his *Prototaxites Logani* of the Erian formation of Canada is a true exogenous tree, with bark, rings of growth, medullary rays, and well-developed, though peculiar woody tissue; and not, as Mr. Carruthers has maintained, a gigantic alga.

MR. F. G. SANBORN has been appointed instructor in Practical Entomology in the Bussey Agricultural Institution of Harvard University.

CONGRESS recently appropriated 40,000 dols. for the annual expenses of the U.S. Geologist, Dr. F. V. Hayden, who is surveying the Rocky Mountain region of Colorado.

PROF. HENRY, of the Smithsonian Institution, has received the decoration of "Commander of the Order of St. Olaf," from Charles, King of Sweden and Norway. A joint resolution has been offered in Congress to enable the Professor to accept the honour.

DR. WILLS DE HASS is about to start on an extended visit of exploration in the Valley of the Mississippi, with a view of determining the character of certain ancient works in the vicinity of St. Louis.

AT a meeting of the New York Lyceum, held on May 15, the president, Prof. Newberry, of Columbia College, gave a summary of what was being done in the line of geological exploration throughout America—a task he was well qualified to perform, from his intimate acquaintance with the subject, and from his own connection with one of the most important of these enterprises. He congratulated the Lyceum upon the prospect that what he called the Chinese puzzle of New England geology is in a fair way to be worked out during the present season by means of the concurrent labours of several eminent geologists. Among these he mentioned Sir William Logan, late director of the Geological Survey of Canada; Prof. C. H. Hitchcock, the State Geologist of Vermont; and Profs. Shaler and Hyatt, of Eastern Massachusetts. Prof. Dana also proposes to carry a geological section from the valley of the Connecticut to that of the Hudson. The following additional items were mentioned in the communication of Prof. Newberry: the geological survey of Canada will be continued under the direction of Mr. A. R. C. Selwyn, who succeeded Sir William Logan in its chief direction.

WE learn from *Harper's Weekly* that Prof. Winchell has resigned the directorship of the geological survey of Michigan; but the work will be carried on by the board of trustees, Major Brooks devoting himself to the iron region. Prof. Pumpelly declines to continue the survey of the copper district, and asks that the small appropriation may be turned over to Major Brooks. The current surveys of Indiana, Illinois, and Missouri are to be continued during the year, and a new survey has been authorised in Arkansas. No positive appointment of director for this work has yet been made, although the place has been offered to Prof. Orton, of the Ohio geological corps, and declined by him. Bills providing for surveys of Pennsylvania and West Virginia were introduced into the Legislatures of those States during the past winter, but failed to become laws.

A LABORATORY for the use of students in practical inorganic chemistry having been opened last September at the Oldham School of Science and Art, twenty-two *artisan* students presented themselves for examination by the Department on the 4th of May, and fourteen of them have passed.

*ON THE NECESSITY FOR A PERMANENT COMMISSION ON STATE SCIENTIFIC QUESTIONS**

THE duty of the Government with respect to Science is one of the questions of the day. No question of equal importance has perhaps been more carelessly considered and more heedlessly postponed than this. And now that a hearing has been obtained for it, neither the governing class nor the masses are qualified to discuss it intelligently. The governing class, because it is for the most part composed of men in whose education, as even the highest education was conducted thirty to fifty years ago, science occupied an insignificant place; and the masses, because they may be taken to be virtually destitute of scientific knowledge. Those who wield, and those who confer, the powers of government being alike incapable of dealing with this question, it devolves on another section of the community to urge its claims to attention.

The section qualified to do this is composed of scientific men, properly so called, of professional men, such as engineers, and certain manufacturers who are engaged in applying science practically, and of a limited number of officers in the naval and military services. This section is without much political influence, but its intellectual power is enormous, and this power has never been so strongly exerted, or so decidedly acknowledged, as at the present time.

A tangible acknowledgment of the claims of science consists in the recent appointment of a Royal Commission "on Scientific Instruction and the Advancement of Science," which is now sitting. The problem which this Commission is expected to solve is one of very great complexity, delicacy, and difficulty. It has to survey the whole world of scientific thought, and to construct a chart on which the districts that it is the duty of the State to occupy shall be clearly delineated, with boundary lines so drawn as not to trench upon tracts which may be best left to individual or corporate management. It has then to devise a form of government of which not a trace at present exists, fitted

* Abstract of a paper read at the Royal United Service Institution, by Lieut.-Colonel Strange, F.R.S.

to administer the affairs of the newly-acquired territories. Instruction in science is one thing, and, I admit, an indispensable thing, without which there can be no foundation for future scientific progress; scientific investigation is another and perfectly distinct thing, constituting the end to which instruction is the means. Each may be pursued separately and solely. But if instruction be scanty, investigation will be unsound; if investigation is neglected, progress must be impossible. It will be for the Royal Commission now sitting to point out the relation of instruction to investigation, and to decide how far and by what agency the Government may beneficially aid each.

The first report of the Royal Commission has been published. It deals with certain limited matters of detail only, relating to the occupation of some new buildings at South Kensington. Possibly the settlement of these details may have claimed immediate attention with reference to the arrangement of the buildings in question. This first report has therefore not touched the great problems above adverted to, which await the deliberation of the Commission, and an authoritative solution of which at its hands is anxiously expected by the scientific world.

It may be asked why, as a Royal Commission is investigating the relation of Science to the State, the subject of the present paper should be brought forward independently of that body. The reply is, first, that discussions of any of the questions on which the Royal Commission is deliberating can hardly fail to afford light and assistance useful to the inquiry; secondly, that the problem submitted to the Royal Commission is, "How should the State aid Science?" whereas the question on which I am to address you is totally different, namely, "How can Science aid the State?" Although this latter question may be considered by the Royal Commission, it is certainly not necessarily a part of their programme, and as it is a question of at least equal importance with the former one, it is most undesirable that it should be overlooked.

To the question, "How can Science aid the State?" I reply, "By means of a permanent scientific commission or council, constituted for the purpose of advising the Government on all State scientific questions."

In order to apprehend the aim of this proposal, its practical operation and probable results, it must be examined systematically and in detail. I propose to do this under the following heads:—

I. The scope implied by the term State scientific questions, and the importance of those questions.

II. How are such questions at present dealt with, and with what results?

III. What should be the constitution and functions of the proposed Council of Science?

IV. What objections can be alleged against the proposed council? . . . .

[On the second point we quote the following:—]

II. *How are such questions at present dealt with, and with what results?*—I wish to preface my remarks on this head by saying that they are not intended to apply to any particular party in politics. In speaking of the shortcomings of the Government, I mean to include ALL administrations, whatever political principles they may have represented. I cannot perceive any difference worth noting between different Cabinets as regards science. All have, in my opinion, displayed, in the most elaborate manner, their incapacity to grasp science as a national matter. I am not aware of a single attempt on the part of any Government that has ever existed in England to define its duties with regard to science, or to model any administrative agency for dealing with it in a rational, efficient, and comprehensive manner. It would be invidious and unjust to single out any set of Ministers as having been more negligent in this matter than others, where all have been to all intents and purposes equally indifferent to it.

How then are State scientific questions now dealt with? The answer is, desultorily, capriciously, inefficiently, irresponsibly, when they are dealt with at all, but in many instances of the greatest moment they are absolutely neglected. The number of questions involving science on which Government has to decide, are innumerable and never ending. Every day adds to their number and their urgency. This vast increase of such questions has taken place within a period which, in the life of a nation, is very brief. . . . . Our official scientific arrangements are substantially the same now as they were in the pre-scientific era—they may be more extensive in degree, but they are the same in kind—the butter may be spread further, but there is not more butter. The enormous scientific activity of the last 30 or 40 years does not seem to have struck the official world as a fact having a bearing on the humdrum routine of the Departments—more secretaries—more clerks—more subordinates of various kinds have been appointed to prevent accumulation of arrears; more committees of inquiry have sat, more scientific witnesses have been examined, more reports published, if not read. But not a single step has been taken towards the creation of an *organisation* capable of concentrating and directing all this scattered effort.

The example of foreign nations, the pressure of the public, and the demands of inventors, daily set before the Government scientific puzzles, which they are often, if not generally, at their wits' end to solve. It never seems to occur to them that these puzzles will never cease, and that they will increase in difficulty as a matter of absolute certainty. The attempt is made to stave off by temporary expedients work of a permanent character. The puzzles are guessed at, and the guess is oftener wrong than right. Problems too deep for guessing are either pushed out of sight or submitted to methods of investigation that end in a blunder, perhaps a catastrophe.

I do not wish either to declaim or to exaggerate. I will briefly indicate the provision that does exist for the solution of State scientific questions. It is of three principal kinds. First, official subordinates in various departments. Second, temporary and special Committees. Third, consultation with individuals eminent in science, or with scientific bodies. I omit debates in Parliament, because no scientific question ever was or will be solved by such an assembly, and I omit also the press, which is so influential in other respects, as altogether unreliable for such inquiries.

The objections to the first kind of provision, viz., official subordinates, are, that such persons have almost invariably other duties of an executive nature to perform, and have not therefore the leisure necessary for scientific investigation. Science, moreover, is now in a stage in which scarcely any one problem can be adequately grasped by a single mind; this remark particularly applies to State scientific problems, which are invariably of a mixed order, requiring a great variety of attainments for their perfect comprehension. Lastly, subordinates are disqualified for the office of advisers by the very fact that they are subordinates. No inferior can be expected to urge distasteful counsels on a powerful superior, and no superior can be expected to abandon his own preconceived ideas in consequence of the timid and feeble remonstrances of an inferior under his orders. Subordinates then are unfitted to be counsellors, because they must in the majority of cases be deficient in leisure, attainments, and independence.

One clear, decided example of the inadequacy of this source of scientific advice is as good as a thousand. [The loss of the *Captain* was then referred to.]

The second expedient—temporary Committees, has been very largely employed for the purpose of guiding the Government through their scientific difficulties. There are very serious objections to this expedient. First, there seems to be no rule, either for their appointment or for their composition. If the Government is much pressed by public opinion (which on such subjects is not over-well informed), or if it sees a difficulty ahead, which, however, it often fails to do, a Committee is the result. But there is no guarantee for the proper composition of the Committee. There always lurks about some of the names a suspicion either of incompetence, or of leaning towards the supposed foregone conclusion of the Government. But, passing by such suspicions, there remains the fact, that the members are selected either by some Minister who, not being a scientific man, probably knows nothing about the qualifications necessary for conducting the proposed inquiry, or by some outside and irresponsible person to whom the Minister has applied for help. It is quite overlooked that the selection of the proper persons for conducting any given inquiry can only be made by some one having a knowledge of the subject of the inquiry, or of subjects cognate thereto; the selection is in itself a scientific question. Though some temporary Committees have done good service, it may be safely declared that on the whole they have failed to give reasonable satisfaction.

A second objection to such Committees consists in the fact itself that they are temporary. As such they necessarily commence their labours, however well they may have been selected, with but a partial and confused knowledge of the question at issue, and much time is lost in gaining some insight into it. After much work and expense, they reach a certain stage in the inquiry at which a report is possible. Perhaps by that time the

public pressure, or other cause that led to their appointment, has died out, or action is necessary,—in either case the Committee is considered to have served its purpose, and is broken up; the members disperse, take up other duties, the knowledge of a particular subject which they gained in the course of their inquiry is lost to the country, and a scientific problem is left half solved, until at some future day it must be taken up again for completion, and the old work gone over *de novo*. The system of temporary Committees, in fact, implies a belief that finality is attainable in those mixed scientific problems in which chiefly the State is interested, or that such problems can advantageously be taken to bits and studied piecemeal; whilst the fact is, that no one such problem that can be mentioned ever has, or ever will, as long as human ingenuity survives, come to an end. Permanent arrangements alone can deal with the unbroken continuity and unceasing change of scientific development.

A third objection to such Committees consists in the fact that much of the investigation carried on by several Committees may be common to each. This involves the repetition of the same work, and great consequent waste of time, effort, and money. . . . .

I come now to the third source from which the Government draws its scientific inspiration, namely, individuals eminent in science, and scientific bodies. Recourse is had to such sources without any system whatever; there exists no rule, for instance, defining what cases should be submitted to an individual, what cases to a scientific society, and what cases to a temporary Committee. Nor is it possible to assess the degree of responsibility attaching to an individual or to a scientific society advising the Government. If the advice so obtained is rejected, nothing about it is known publicly; if it is adopted and turns out unsound, the right to blame the adviser is absent. It is impossible to ascertain when such consultations have occurred, and with what results. The probability is that they are not frequent. During the two years that I served on the Council of the Royal Society, I only remember one application from Government for advice. It was on some point connected with coppering ships. A committee was formed of the most competent persons, and probably very sound counsel was afforded. But it is evident that this is an expedient that cannot be frequently employed, as it would occupy too much of the time of the Society, which should be devoted to its legitimate objects. Advising the Government is certainly not one of these, nor should the Government of a great, powerful, and opulent nation like England be reduced to such makeshifts as private societies for direction in matters of such tremendous national moment.

Having shown, I trust, that Government is without recognised scientific advisers, I proceed to discuss:

III. *What should be the constitution and functions of the proposed Council of Science?*—The ground requires to be cleared before approaching this question. I have heard it urged that the various departments of the State should be complete in themselves, each with its own consultative element, as distinct from its executive. This appears at first sight a plausible arrangement, but it will not bear examination. Many of the scientific inquiries that devolve on the Government affect several departments, and in such cases it would be wasteful to have numerous repetitions of the same investigation when one would do; and if, under the supposed arrangement, one investigation of a given class of subjects was decided on, the selection of the particular department to which it should be referred would cause endless bickerings and jealousies,—the co-operation of departments being, like universal peace, a somewhat remote hope. Again several departments would require identical scientific advisers. . . . .

For these reasons I discard this suggestion, and revert to the proposal which forms the subject of this paper, namely, that there should be one permanent great council for advising and assisting the Government on all State scientific questions. This council should be purely consultative, not executive. All departments should equally be entitled to its assistance. The Council should not be expected to initiate questions, though it might occasionally see fit to propose certain investigations to the Government, without whose sanction, however, they should not be undertaken. The Government should not be bound on all occasions of scientific difficulty, either to resort to, or be guided by, the opinion of the Council; but it would of course become in either case absolutely responsible for all consequences. . . . .

The duties that would devolve on this Council, stated broadly, would be—

1st. To advise the Government on all qnestions arising in the ordinary routine of administration, submitted to it by the various departments.

2nd. To advise the Government on special questions, such as the founding of new scientific institutions, and the modification or abolition of old ones; the sanctioning of scientific expeditions, and applications for grants for scientific purposes.

3rd. To receive, consider, and decide upon inventions tendered to Government for the use of the State.

4th. To conduct or superintend the experiments necessary to enable it to perform the above duties.

As to the first branch of its duties little need be said. The number and variety of questions involving scientific considerations entering into the current work of the different departments are almost unlimited. A large proportion of them could be answered at once by competent persons, but there would remain many that require investigation, discussion, and often experiment.

The second branch, special questions, would not perhaps be so extensive, but it would be exceedingly important. At present there exists literally no provision for dealing with such questions. Sometimes one person, supposed to have a knowledge of the matter at issue, sometimes another is consulted, sometimes no one. At present the Royal Commission now sitting is probably dealing with the subject of existing and required scientific institutions. But supposing this body settles all such matters in the most satisfactory manner at the present time, a reconsideration of them will very soon be demanded by the rapid advance of science, and the perpetually changing relations of different lines and modes of physical inquiry. But the Royal Commission is a temporary body. Its functions will sooner or later cease, whilst the mutations and permutations of scientific thought are incessant. Questions relating to State scientific institutions require ceaseless watching,—never-ending modification. A permanent body, such as I propose, alone can preserve the national scientific establishments in a condition of vigorous efficiency on a level with the existing state of physical knowledge.

The sanctioning of special scientific researches and expeditions will be a very important duty, which there is at present no one qualified to perform. . . . .

Sanctioning of grants of money for aiding scientific objects comes under the same head as sanctioning expeditions. At present £1,000 per annum is granted by Government for such purposes, and it is distributed by the Government Grant Committee of the Royal Society. As a member of this committee I can testify to the extreme care, fidelity, and impartiality with which it performs this gratuitous duty, The amount of the grant might with advantage be much increased, as at present only small sums can be given out of it to each applicant; these are often quite insufficient, and as they must unavoidably be small, no application for aiding extensive and costly researches can expect efficient aid from so narrow a source. The proposed council would be a public body, precisely qualified to perform the duty now imposed on private individuals.

The third branch of duties devolving naturally on the council would be the dealing with inventions tending for the use of the State. . . . .

The fourth class of duties which the Council would have to perform would relate to the experiments and investigations necessary to enable it to perform the duties previously enumerated. Regarding the necessity for providing the Council with the agency, appliances, accommodation, and funds requisite for these purposes, there can hardly be two opinions. They are absolutely indispensable. I need not here attempt to define what would be wanted. Such details would follow naturally the affirmation of the great principle involved in the creation of the Council.

I come now to a question on which opinions may differ—namely, the question whether the Council should be a paid or an unpaid body. I say, unhesitatingly, that it should be handsomely paid. If the heads of duties to be performed, of which I have given but an outline, be duly considered, it will be seen that they will be laborious, responsible, and beneficial in the highest degree; and that they can only be adequately performed by highly qualified persons. It is idle to expect that such men as will be necessary, will devote themselves almost exclusively, as they will have to do, to such labour from pure love of science and of their fellow-creatures. The delights of philosophical speculation are one thing, carrying with them their own reward—a reward beyond any money consideration; downright official routine work is quite another thing. In no other professional

field is it unpaid; nor is it ever worth much if not paid for. It has hitherto been too much the custom to treat men of science as exceptions to all other professions; to assume that whilst it is quite proper to enrich and ennoble soldiers who fight for pay, lawyers who evade or apply the law according to circumstances; physicians who kill or cure as seemeth best to them; and even divines, whose mission to save souls might be deemed a sufficient privilege: the man of science who contrives the arms with which the soldier wins his fortune and his coronet, who surrounds the lawyer, the physician, and the divine with the luxuries which their superior privileges enable them to command, should work for love, and die, as he too often does, in poverty.

If the Council, the creation of which I now advocate, does its duty, it will confer benefits untold on every member of the community, from highest to lowest; from the military and naval appliances necessary to protect our unequalled national wealth, down to the smallest and least regarded necessaries of our ordinary life, the influence of this Council will be felt; and is it either just or wise to expect such benefits for nothing? . . . .

[The author then gives some indication of the mode of constituting the Council.]

IV. *What objections can be alleged against the proposed Council?*—Difficulties innumerable can of course be conjured up in this as in every case of reform, but I have only heard three definite objections raised that seem to me to deserve any notice. They are:—

1st. That this is a system of centralisation, and therefore objectionable.

2nd. That it will be liable to jobbery.

3rd. That it will be too costly.

I will touch on each of these briefly.

As to centralisation, I admit the impeachment, but claim it as an advantage, not an evil. Those who are scared by centralisation forget that it constitutes the very basis of civilisation and of stable efficient government. In primitive savage life there is no centralisation, no united effort for a common purpose. Each individual struggles single-handed for his rights. Civilisation teaches us to set apart certain members of the community for purposes beneficial to the whole, to form them into distinct bodies, having definite duties to be executed, under the direction of a head central authority. The army, the navy, the police, the post-office, are examples of such bodies, the animating and ruling law of which is centralisation. In the case of the police, we have local, in the other cases imperial, centralisation. The body we are considering will have to perform duties of a strictly imperial character, contributing directly to the efficiency of the defensive power of the empire, and to the security and well-being of every member of the community. It is a body which not only would not be effective, but which could not exist but in a centralised form.

As to the second objection, that the arrangement I have proposed would be liable to jobbery, I must own that, as I contemplate the employment of human beings only, I do certainly expect to see the operation of human motives. But if jobbery be a fatal objection to the scheme, then on the same principle we ought to have no army, navy, church, bench, magistracy, municipalities, or Parliament, for in each of these the discovery of some traces of jobbery will probably reward a diligent scrutiny. It is not apparent why a degree of purity not dreamt of in regard to any other profession should be insisted on when science is in question; nor is it clear why men of science should, *a priori*, be deemed more corrupt than their neighbours. Of course every precaution should be taken against corruption in so important a body, and the rest must be left to that sense of honour to be found in all other professions, and of which even men of science are perhaps not entirely devoid.

The third objection, undue costliness, is, in my opinion, as invalid as the other two. My proposal has two main objects—to increase efficiency, and to diminish blunders. Both are in the strictest sense economical objects. If it does not seem calculated to attain these objects, it should on no account be adopted. If it gives satisfactory promise of their attainment, no expenditure that it is likely to occasion will be too great in order to secure them. Let any one who is terrified by the cost, visit our ports, dockyards, and arsenals, and there see the ships that have been built which should not have been built, the cannons made that should never have existed, and the useless arms and equipments of the pre-scientific ages. Let him count the cost of these, and compare it with the probable cost of substituting for the reign of haphazard ignorance a reign of systematic intelligence. To take one example—that of Her Majesty's ship *Captain*. This vessel, with her armament and stores, probably cost the nation three or four hundred thousand pounds. Who shall assess in money the value of the 500 noble lives that perished with her? Would not the nation willingly give a million to have them back? If so, we have as the cost of one single blunder committed by one Department something like a million and a half of money, a sum that would go a long way to permanently endow a body which, had it existed a year ago, must have prevented that blunder. But if I dwelt on the preservation, prolongation, and increased comfort of civil life which such a Council would tend materially to secure, the cost of its maintenance would appear absolutely insignificant in comparison with the blessings it would shower on the nation. Against the cry of costliness I oppose the assertion, easily established, that nothing is so ruinous as disregard of the laws of nature, and nothing so profitable as intelligent obedience to them. Science, looked at in the dryest commercial spirit, must, in the long run, *pay*.

I must guard myself against the supposition that the proposal I have here advocated comprises all that is necessary for the efficient administration of scientific State affairs. It is only one part of a great system that has to be created. Other parts of the system will, no doubt, receive due attention from the Royal Commission now considering them. But there is one part so important that I feel called on to name it; I mean the appointment of a Minister of Science. He need not necessarily be exclusively devoted to science; he might, perhaps, with advantage, have charge of education and the fine arts also; but some one in Parliament directly representing the scientific branches of the national services has become absolutely indispensable. . . .

When we have all Scientific National Institutions under one Minister of State, advised by a permanent, independent, and highly qualified consultative body—when we have a similar body to advise the Ministers of War and Marine in strategical science—then the fact that, in accordance with our marvellous constitution, these Ministers must almost necessarily be men without pretension to a knowledge of the affairs which they administer, need cause us no alarm. When these combinations have been, as they assuredly will be, sooner or later, effected, the wealth, resources, and intelligence of the nation, having due scope, will render us unapproachable in the arts of peace, and unconquerable in war—but not till then.

In conclusion, I must claim for the proposal I have advocated that there is nothing revolutionary in its character.

I aim at creating no new principle. We have already, as an integral part of our administration, a body constituted on the very same principle as that now advocated. I allude to the Council of India. . . .

My proposal, therefore, I maintain aims at the creation of no new principle,—but only at the extension of one already existing, and universally approved after long experience. Nor do I aim at creating new labours. The work of which I have been speaking is now being done, or suppposed to be done, and it is paid for heavily by the nation, but it is not well done. I propose to improve its quality by improving the agency to which it is assigned. I propose to substitute concentration for scattered effort, system for chance, organisation for disorder. I propose neither to exact from the Queen's advisers new duties, nor to fix upon them new responsibilities. The end and aim of my proposal is to lighten their labours and anxieties by putting into their hands better arms than those with which they now vainly strive to uphold the power and glory of the nation.

A. STRANGE

SCIENTIFIC SERIALS

THE last part of the *Sitzungsberichte* of the Isis Natural History Society of Dresden contains the proceedings of the Society for the months of July, August, and September, 1870. In the section of Prehistoric Archæology, Dr. Mehwald described kitchen-middens on Zealand and Jutland, and on the Andaman Islands, and stated that M. Lorange of Fredrikshald, in Norway, has investigated a grave in that neighbourhood which he believes to have been a family grave, in which the bodies were deposited one above the other, the one first buried being probably at a depth of 600 to 700 feet.—Prof. Geinitz explained Delesse's Geological Map of the Department of the Seine, and remarked upon the occurrence in that district of the bones of extinct animals associated with artificial products and the remains of man. He also

glanced at the well-known phenomena of the same kind at St. Acheul and Schussenried, and gave a list of articles received by the Museum of Dresden from the pile-buildings of Robenhausen, in the Pfaffikon Lake. Prof. Geinitz also noticed the contents of some recent anthropological publications.—M. Klemm exhibited a ring of serpentine, measuring about two inches in diameter, found in the year 1835, in an urn in Lower Lusatia. —In the mineralogical and geological section, M. C. Bley noticed the occurrence of roestone in the neighbourhood of Bemburg, and ascribed the peculiar structure of the stone to the great amount of salt contained in the water from which the carbonate of lime for its formation was precipitated.—Prof. Geinitz referred to the discovery of a well-preserved molar of *Elephas primigenius* in the bed of the Elbe below Kötschenbroda, and also exhibited a great number of marly concretions and transported blocks from the loam pits between Strehlen and Mockritz. He also noticed some of the localities in which fossils are to be found in the Loess. M. H. Engelhardt communicated notices of some plants from the brown coal of Saxony, namely, *Anona cacaoides* Zenk. sp., *Gardenia pomaria* Schl. sp. (=*G. Wetzleri* Heer), *Livistona Geinitzi* n. sp., *Glyptostrobus europæus* Brongn. sp., and a species of *Carpolithes*.—Prof. Geinitz communicated a list of some corals from the Lower Pläner of Plauen, which had been determined by Dr. W. Bölsche; eleven species are enumerated of which six are indicated as new, namely, *Montlivaltia* (?) *tourtiensis*, *Thecosmilia* (?) *Geinitzi*, *Latimæandra*, *Fromenteli*, *Psammohelia granulata*, *Thamnastræa tenuissima*, *Dimorphastræa Dunkani*, and *Astrocœnia tourtiensis*.—M. Engelhardt communicated a paper on the Loess in Saxony, in which he described the general nature and mode of occurrence of the deposit, and the special peculiarities presented by it in particular localities. In connection with this paper and the concretions from the Loess exhibited by Prof. Geinitz at a previous meeting, M. Klemm presented a memoir on concretions and on the globular forms occurring in the minerals and rocks.—Dr. O. Schneider noticed the minerals occurring in the granite of the Königshayner mountains, and in the Zechstein of Niederludwigsdorf near Görlitz, and described some crystals of zircon received from Haddam in Connecticut.—Prof. Geinitz reported upon some fossils from a sandy deposit of Cretaceous age at Château de Meauene near Angers. The predominant form is *Siphonia pyriformis* Goldf. Three species of *Palmacites* are noticed, and one of them is described as a new species under the name of *P. Boxbergæ*— In the mathematical, physical, and chemical section, the only paper of which particulars are given is a description by Prof. Klein of an apparatus invented by him to enable the magnetic needle to be employed on board of armour-plated ships. The arrangement consists of a compass placed at the mast-head and connected with an electro-magnetic apparatus, by which an index is moved.—In the Zoological Section Prof. Günther gave a short exposition of the comparative anatomy of the brain in mammalia. —M. Engelhardt exhibited some corals and shells obtained from Guano.—Dr. Ebert remarked upon Huxley's *Bathybius*.—M. C. F. Seidel described the excrescences and other deformities produced on the stalk of the common cabbage by a small weevil, *Baris cuprirostris*.—Dr. Ebert referred to the support afforded to the theory of the evolution of organic types by the discovery of the curious lizard, *Hatteria punctata*, upon the anatomy of which Dr. Günther has given us such interesting information. Dr. Ebert tabulates the characters of the orders of reptiles to show in what a singular manner *Hatteria* combines their peculiarities.— Dr. Schneider noticed the scorpions collected by him in Egypt.— Dr. Mehwald noticed the occurrence of a snake (*Coronella lævis*) and of a lizard (*L. agilis ?*) as far north as 62° and 63° in Norway; and M. Kirsch gave some account of experiments with vipers and the common snake. According to the latter the bite of a new-born viper, five inches long, killed a mouse in a short time; snakes killed by decapitation exhibit irritability by galvanism for a very much longer time than those destroyed by poison; and the common snake (*Tropidonotus natrix*) is the only snake indigenous to Bavaria that attacks frogs.—The Botanical Section received from M. C. Wilhelmi an account of those Australian plants which may furnish nourishment to man. The abstract of this paper here published enumerates a considerable number of plants, parts of which are used as food chiefly by the natives.— The rest of the communications to this section require no mention, except a report by M. F. A. Weber upon Hildebrand's work on the sexual relations of the Compositæ.—At one of the general meetings Prof. Hartig reported upon the applicability of various kinds of wood to the manufacture of paper.

SOCIETIES AND ACADEMIES

LONDON

Zoological Society, June 6.—Mr. G. Busk, vice-president, in the chair. Prof. Owen, F.R.S., read a paper on Dinornis, being the seventeenth of his series of communications on these extinct birds. The present paper gave a description of the sternum and pelvis, and an attempted restoration of the whole skeleton of *Aptornis defossor*.—Prof. Flower, F.R.S., gave a description of a specimen of the so-called Risso's Dolphin which had been taken in a mackerel-net near the Eddystone Lighthouse, and of a second specimen of the same dolphin subsequently purchased in Billingsgate Market. After a searching investigation of the history of this supposed species, Prof. Flower came to the conclusion that the differences usually held to separate it from the *Delphinus griseus* of Cuvier were untenable, and that the species should be correctly designated *Grampus griseus*.—A second paper was read by Prof. Flower on a specimen of the Ringed or Marbled Seal, which had been obtained on the coast of Norfolk, being the first certain instance of the occurrence of this seal in the British seas. To this was added some remarks on the difficult questions presented by the synonymy of this species, which, after full consideration, Prof. Flower came to the conclusion ought to be called *Phoca hispida*.—A paper was read by Prof. W. Peters, giving a description of the Bats collected by Mr. F. Day, in Burmah. The collection contained a very interesting new form of *Rhinolophi*, which Dr. Peters proposed to call *Phyllorhina trifida*.—A communication was read from Dr. A. Günther, F.R.S., containing the description of a new species of Teius (*Teius rufescens*) from Mendoza, founded on five specimens of this lizard living in the Society's Gardens.—Mr. A. G. Butler communicated a Monograph of the Lepidoptera hitherto included in the genus *Elymnias*.—A second communication was read from Mr. Butler, containing a revision of the species of Butterflies formerly included in the genus *Terias* (*Pierinæ*).—A paper by Dr. J. E. Gray was read, containing a reply to Mr. Theobald's observations on Dr. Gray's paper on the families and genera of Tortoises, printed in a recent part of the Society's "Proceedings."

Chemical Society, June 1.—Prof. Frankland, F.R.S., president, in the chair.—The following gentlemen were elected Fellows: H. Adrian, H. Durham, G. Martineau, E. Neison.— Dr. Debus, F.R.S., delivered a lecture "On Ozone." The first who had observed that the passage of electric sparks through oxygen brings about a change in the properties of this gas was Van Marum. The next to take up the subject was Schönbein, in 1840. He ascribed the peculiar odour and the more energetic oxidising properties of the altered oxygen to a substance which he termed ozone. He also found that ozone may be prepared by many other methods. His experiments, however, led to no positive results, as regards the nature of ozone. It was through the researches of Marignac and De la Rive that ozone was shown to be nothing but an allotropic modification of oxygen. Dr. Debus then discussed the question whether there existed another modification of oxygen, called antozone, and answered the proposition negatively—the substance called antozone was only peroxide of hydrogen. The lecturer concluded by calling special attention to one of the characteristic reactions of ozone, viz., the decomposition of potassic iodide, which reaction is differently explained by the various observers. Schönbein has shown that potassic iodide protects free iodine against the action of potassic hydrate. It may be assumed that potassic hydrates and an iodine solution react upon one another thus:

$KHO + I_2 = KIO + HI$, and then $KHO + HI = KI + H_2O$;

if now an excess of potassic iodide be added, the potassic hypoiodite and potassic iodide produce again potassic oxide (which becomes in its turn a hydrate) and iodine, and the excess of iodide prevents the action of KHO on the iodine, but not that of the latter on starch.

Society of Biblical Archæology, June 6.—Mr. Samuel Birch, LL.D., F.S.A., president, in the chair. The following ladies and gentlemen were proposed by the council for ballot at the next meeting:—Rev. A. H. Sayce, Queen's College, Oxford, E. R. Hodges, late of Jerusalem, Mrs. J. W. Bosanquet, and Miss Dorothy Best, of Maidstone. Mr. George Smith (British Museum) read an elaborate and interesting paper "On the Early History of Babylonia." Commencing with a *résumé* of facts already ascertained by the labours of Sir Henry Rawlinson and

other *savans*, he proceeded to describe seriatim the principal localities where excavations had been already undertaken, and to identify them with many of the cities mentioned in the older Books of the Pentateuch. A chronological list of kings and a brief account of the military and political changes, including several new facts from contemporary inscriptions, concluded the first part of the paper. In its second division, the theology, the arts, the social and moral characteristics of the ancient Chaldeans were examined, and the examination was further illustrated by the exhibition of sundry casts of ancient bricks and cylinders, translations of which were also given.—Mr. J. W. Bosanquet, F.R.A.S., treasurer, read a paper "On the Date of the Nativity."

Linnean Society, June 1.—On the nomination of the President the following members of the Council were elected vice-presidents for the ensuing year:—Mr. J. J. Bennett, F.R.S., Mr. George Busk, F.R.S., Dr. J. D. Hooker, F.R.S., and Mr. W. Wilson Saunders, F.R.S.—The following papers were read:—"On some plants from North China," by Dr. Hance; "On South American *Hippocrateaceæ*," Mr. J. Miers, F.R.S. The history of this family shows the widely divergent opinions of numerous botanists in regard to its affinities, the absolute want of knowledge to guide these opinions at last culminating in the extinction of the *Hippocrateaceæ* by the authors of the new "Genera Plantarum," who have reduced it to a mere tribe of the *Celastraceæ*; and not only so, but have amalgamated the several genera previously established into 2, viz.: *Hippocratea* and *Salacia*. The large amount of evidence here presented will, however, show its right to stand as a distinct natural order, having in fact little connection with *Celastraceæ*. The chief characters in its floral structure consist in having five sepals, five alternate petals imbricated in æstivation, and only three stamens (very rarely five); the most important feature is the hypogynous disc, variable in shape, but constantly placed between the stamens and petals; the ovary is always superior, usually 3-locular, with definite anatropous ovules fixed in the axis. The mode of growth of the ovary varies greatly, dividing the family into three separate tribes. 1. *Hippocrateæ*, where, in the progress of growth, the axis of the ovary never lengthens, remaining completely atrophied, the cells growing upwards vastly, sometimes to 100 times the length of the axis at the maturity of the flower, thus producing three distinct capsules from a single ovary, which sometimes open 2-valvately, and have winged seeds, or are indehiscent with nuciform seeds borne upon a carinated ovular support; upon such differences five several genera are established. 2. *Tonteliceæ*, distinguished by a drupaceous fruit, often a large size, the growth of an ovary wherein the axis lengthens commensurately with the cells, the fruit being thus 3-locular, with several seeds, which in most cases are covered by an *arilline*, a fleshy complete coating, resolving itself into a mucilaginous pulp that envelopes the seeds; this tribe consists of eight genera. 3. *Kippistieæ*, remarkable for a floral development hitherto unknown among Dicotyledones, but long ago described by Robert Brown in Monocotyledones; here the stigmata, instead of alternating as usual with the stamens and standing opposite to the cells of the ovary, are opposite to the stamens and alternate with the cells of the ovary; the fruit is drupaceous, variable in the position of the seeds, but with characters resembling those of *Tonteliceæ*; this tribe consists of three genera. There are thus seventeen genera in all, with well-marked characters, which are separately illustrated by as many drawings, each amply explained by analytical figures. The numerous facts here shown in regard to structure are, for the most part, hitherto undescribed, many being derived from analyses made of plants in the living state. In summarising these details, the author points out the many salient points of distinction in the structure of *Hippocrateaceæ* and *Celastraceæ*. 1. In the former the stamens are generally anisomerous in regard to the petals (three to five); in the latter they are constantly isomerous with stamens equal to, or double the number of, the petals. 2. In the former the stamens are distinctly inserted *inside* the disc; in the latter they are invariably inserted *outside* of the disc. 3. In the former the anthers, generally of a peculiar form, are constantly *extrorse*; in the latter they are of the usually normal structure, and always *introrse*. 4. In the former the disc is generally elevated, and presents a free wall of separation between the stamens and more external parts; in the latter it is a mere expansion of the torus, intervening between the ovary and all other floral parts. 5. In the former the sepals, petals, stamens, and disc are persistent at the base of the fruit, and are never seen in such position in the latter family. 6. In the former, the superior ovary is always elevated above the torus and quite free from it; in the latter it is always more or less partially imbedded in the disc and half agglutinated with it. 7. The atrophied condition of the axis of the ovary, though not a constant feature, is one quite peculiar to the *Hippocrateaceæ*, and on the other hand, in *Celastraceæ*, we find no growth at all approaching the several kinds of large drupaceous fruits seen in the *Hippocrateaceæ*. 8. In the development of the seeds there is a constant distinction. In *Hippocrateaceæ* they are invariably without albumen, in the *Celastraceæ*, without exception, the embryo is enveloped in albumen, usually copious. In the former the cotyledons are often closely conferruminated in a solid mass, a circumstance quite unknown in the latter. 9. In the *Hippocrateaceæ* no trace of an arillus can be seen, in *Celastraceæ*, though not universal, a distinct arillus, in most cases, partially surrounds one extremity of the seeds. In the former, in one tribe, the seeds exhibit a greater or smaller expansion of the testa, in the shape of a large membranaceous wing, or a narrower alar keel, while in the two others they are invested by an *arilline*, an entire fleshy coating, the nature of which was explained many years ago, a feature seen in some other families, though too often unnoticed by botanists. 10. In the *Hippocrateaceæ*, the leaves, but more particularly the branches of the inflorescence, the pedicels, sepals, and petals, contain numerous white elastic threads, which hold the parts together when broken, and these spiral threads often extend to the pericarps, to the integuments of the seeds, and even occasionally to the fleshy cotyledons. Nothing of this kind has yet been observed in *Celastraceæ*. Any one of these peculiarities, by itself, would tend little to support any separation of these two families, but the sum of the whole tells powerfully to mark a great distinction in their organisation. The only arguments that have yet been urged for their near affinity are that both generally consist of arborescent plants with evergreen leaves, an axillary inflorescence, petals and sepals with imbricated æstivation, a three-celled ovary, a simple style and stigma; but these are all characters common to many other families distantly related, and wholly insufficient by themselves to establish any near affinity. The more probable inference is that these two families should be separated by a long interval.

DUBLIN

Natural History Society.—Prof. E. Perceval Wright, M.D., in the chair. Dr. A. W. Foot read a paper on a small collection of Hymenoptera, named for him by Mr. F. Smith. None of the species referred to were rare, and they had, for the most part, been collected in the counties of Wicklow and Kildare.—Mr. W. Andrews read "Notes on some Irish Saxifrages." Fine living specimens were exhibited of *Saxifraga geum*, and of its varieties *umbrosa*, *hirsuta*, and *elegans*. A coloured drawing by the late Mr. Du Noyer was also shown of a remarkable variety found at the Great Blasquet, in which the flowers presented a glandular disc surrounding the base of the pistil. Specimens of *S. Andrewsii* were also laid on the table. Mr. Andrews stated that he had lately given Mr. A. G. More the exact locality of this rare form, supposed by some to be a hybrid, and he fully expected that in the course of this summer Mr. A. G. More would be able to verify this as well as he had done other of his discoveries. He believed, judging from the structure of its ovaries, that this species had strong affinities with *S. nivalis*. Lastly Mr. Andrews exhibited some very remarkable specimens of *S. stellaris*, which very much resembled in shape *S. leucanthemifolia*, and indeed Mr. John Ball appears to regard this latter form as but a variety of the former.—A resolution was passed that Mr. R. J. Montgomery, Mr. R. P. Williams, Mr. A. Andrews, and Dr. A. Wynne Foot be a committee to have the museum of the society catalogued and arranged for sale, and that the committee be requested to report to the society in November as to any offers they may receive for it. The museum is very rich in Irish birds, containing some unique specimens; but the society not having a house of its own, and holding its meetings in the Royal Irish Academy House, has considered it advisable to dispose of its collections.

Royal Geological Society, May 12.—The Rev. Maxwell Close in the chair. Prof. Traquair exhibited a collection of Carboniferous Ganoid fishes, found in nodules of clay ironstone from Wardie near Edinburgh.—Mr. G. H. Kinahan read a paper on the Geological Drift of Ireland.—Rev. Prof. Haughton read some analyses made by the late M. H. Ormsby of the Geological Survey of India of Granitic Rocks and their Constituent Minerals, found in Lower Bengal and Ceylon. These analyses were made by Mr. Ormsby in 1868,

and in expressing his sense of their importance Prof. Haughton also expressed his deep regret, shared in by the Society, at the loss geological science had sustained by the untimely death of so promising a geologist and mineralogist as Mr. Ormsby.—Mr. Edward T. Hardman read a paper on an Analysis of a Trachyte porphyry from Tardree Quarry near Antrim. The paper gave tha result of a careful analysis of one of the two specimens of trachyte known to exist in the British Islands, and from it Mr. Hardman was able to come to such conclusions with regard to the age and altered state of the rocks as led him to controvert the theories of Cotta and Richthofen on the relative ages of basalts and trachytes. Prof. Haughton, who had seen the rock *in situ*, was able to endorse the view taken by Mr. Hardman as to the altered condition of it.

Royal Irish Academy, May 8.—Rev. President Jellett in the chair. Prof. J. M. Purser read a second report on the researches of Prof. Cohnheim on inflammation and suppuration, which was referred to the Council for publication. The secretary read a paper by Mr. Hyde Clarke, on the ancient name Hibernia. This paper was very severely criticised by several members of the Academy, the impression apparently being that the author had no true scientific basis for the conclusion at which he had arrived, and further that the method adopted by him was helping—if it had not already done so—to bring discredit upon this branch of Ethnology.

May 22.—Rev. President Jellett in the chair. The president read a paper on Saccharometing, with special reference to an examination of specimens of sugar beet grown in Ireland.—Prof. Sullivan read a paper on the comparative composition of ancient Bronzes in connection with the ethnology of the ancient people of Europe; also, one on the Great Dolomite Bed of the North of Spain in connection with the Lithonic stage of opal.

PARIS

Academy of Sciences, May 5.—M. Delaunay in the chair. M. Roulin, a member of the Institute, delivered an address, discussing the last communication from M. Ledillot on Arabic Etymology. The learned member contends that M. Ledillot is deceived by superficial and casual analogies, and gives too large a credit to the Arabic language in the formation of French. He frequently quoted the great Etymological Dictionary written by M. Littré, who is now a representative of Paris in the Versailles Assembly, and attempted to vindicate M. Littré's various etymologies.—M. Elie de Beaumont read a letter from M. Bertrand, now at Tours, where he is a delegate for teaching the pupils of the National Polytechnic School. M. Bertrand has worked out theoretically the assertions of M. Navier on the flight of birds. He asserts that the clever mathematician was deceived in supposing the birds exerted an immense force in flight. M. Navier's assertions, which were supposed correct for upwards of thirty years, were very often assailed on practical grounds, and almost generally supposed worthless. But it was necessary to revise his mathematical analyses. M. Bertrand's communication will be welcomed by people engaged in the construction either of flying machines or of apparatus for guiding aërostats.—M. Martins, director of the Montpellier Botanic Gardens, sent a communication on the extraordinary frost of last December. He showed by reliable observations that the temperature at Montpellier was lower by 4° C., than the temperature at Paris. If the Paris minimum is supposed to have been −12°, the Montpellier minimum must have been −16°. M. Martins explains the circumstance by the influence of the Gulf Stream, which diminishes the coldness of the air at Paris more than at Montpellier, owing to the greater distance of that southern station from the ocean.—M. Charles Emmanuel read a paper on certain movements of floating bodies, which he attributes to some electrical influences unnoticed and consequently unexplained hitherto.

May 29.—M. Marié Davy, director of the Meteorological service at the Observatory, read a paper on the effects of the two great atmospheric currents of the atmosphere; one of them north-east, and the second, opposite to the first, south-west. To recite the history of the struggle between these two primary currents would be to recite the eventful history of temperature. Judicious balloon ascents would greatly help meteorologists in executing useful work.—M. Yvon Villarceau gave some most interesting details on the state of things at the Observatory during the night of May 22. The Communists tried to set fire to the establishment, but succeeded only in burning down the wood casements, used to protect the instruments from shelling during the Prussian investment. One circle constructed by Rigault was destroyed. This circle was intended to be used as a mural circle for observations connected with the next international geodesic congress to be held at Vienna, in order to revise the determination of the earth's radius. M. Yvon Villarceau declares that in spite of this misfortune, the French Republic will be able to hold its ground on that pacific battle-field.—M. Chevreul read the speech delivered on his behalf at the funeral of the lamented M. Payen. The learned orator reviewed at full length the different processes resorted to in order to render edible different substances during the first investment of Paris. M. Payen was the originator of these ingenious processes. One of them will be largely used in naval expeditions for procuring fresh albumine for crews and passengers. Ordinary albumine, as it is used by dyers and photographers, is melted at a temperature of 100° C., and can be used for all the cooking purposes. Distant marine expeditions will always remember with gratitude the exertions of M. Payen and his associates for feeding 2,500,000 people surrounded during months by an hostile overpowering force.—M. Chevreul gave some interesting details on the protection of the Museum, and the losses experienced by the great Gobelins' conflagration.

BOOKS RECEIVED

ENGLISH.—Hours of Exercise in the Alps: Prof. Tyndall (Longmans).—Astronomy Simplified for General Reading: J. A. S. Rollwyn (Tegg and Co.)

FOREIGN.—Verhandlungen der k.k. zoologisch-botanischen Gesellschaft in Wien: Trübner.

DIARY

THURSDAY, JUNE 15.

ROYAL SOCIETY, at 8.30.—On the Fossil Mammals of Australia. Part V. Genus Nototherium.—Contribution to the Fossil Botany of the Coal Measures. II.: Prof. W. C. Williamson, F.R.S.—On Cyclides and Sphero Quartics: Dr. Casey.—On a Law in Chemical Dynamics, and other Papers: Dr. Gladstone, F.R.S., and A. Tribe.

SOCIETY OF ANTIQUARIES, at 8.30.—On a Reliquary of Sculptured Ivory of the Sixth Century: A. Nesbitt, F.S.A.

LINNEAN SOCIETY, at 8.—On British Spiders: Rev. O. P. Cambridge.—On a Luminous Coleopterous Larva: Dr. Burmeister.

CHEMICAL SOCIETY, at 8.—An Experimental Inquiry as to the Action of Electricity upon Oxygen: Sir B. C. Brodie, Bart.

FRIDAY, JUNE 16.

ROYAL INSTITUTION, at 9.—On the Esquimaux and Ice of Greenland, illustrated by Drawings and Photographs: Mr. William Bradford, Artist, of New York. (Extra meeting.)

MONDAY, JUNE 19

ANTHROPOLOGICAL INSTITUTE, at 8.—Mode of Preserving the Dead among the Natives of Queensland: Albert M'Donald.—Forms of Ancient Interments in Antrim: Dr. Sinclair Holden.—Analogies and Coincidences among Unconnected Nations: Hodder M. Westropp.—Peruvian Antiquities: Josiah Harris.

TUESDAY, JUNE 20.

ZOOLOGICAL SOCIETY, at 9.—Report on Additions to the Society's Menagerie in May: The Secretary.—On some Arachnida, collected by Cuthbert Collingwood, M.D., during rambles in the China Sea: Rev. O. P. Cambridge.—Notes on some Rodents from Yarkand: Dr. J. Anderson.

WEDNESDAY, JUNE 21.

METEOROLOGICAL SOCIETY, at 7.—Anniversary Meeting.

ROYAL SOCIETY OF LITERATURE, at 8.30.—On the Life and Writings of William of Malmesbury: Mr. W. Birch.

GEOLOGICAL SOCIETY, at 8.—Notes on the Geology of Part of the County of Donegal: A. H. Green, F.G.S.—On some Supposed Vegetable Fossils: W. Carruthers, F.R.S., F.G.S.—Memoranda on the Most Recent Geological Changes of the Rivers and Plains of Northern India, to show the Practical Application of Mr. Login's Theory of the Abrading and Transporting Power of Water to effect such Changes. T. Login, C.E.

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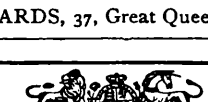

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