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

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A DEDUCTION FROM DARWIN'S THEORY

THERE is one important consequence deducible from Darwin's profound theory which has not yet been noticed so far as I am aware. The theory is capable under certain reasonable conditions of accounting for the fact that the highest forms of civilisation have appeared in temperate climates.

Although some apparent exceptions might be adduced, it is no doubt true that man displays his utmost vigour and perfection, both of mind and body, in the regions intermediate between extreme heat and extreme cold, allowance being made for the reduced temperature of elevated mountain districts. The explanations hitherto given of this fact are of a purely hypothetical and shallow character. It is said, for instance, that the prolific character of the tropical climate too easily furnishes man with subsistence, so that his powers are never properly called into action. On the other hand in the Arctic regions nature is too sterile and no exertions can lead to the accumulation of much wealth. This explanation obviously involves the gratuitous hypothesis that man has been created with powers exactly suited to be called forth by just that degree of difficulty experienced in a temperate climate. There are those even who maintain our peculiar British climate to be the very best possible, because it taxes our powers of endurance to the last point which they can bear, and thus calls forth the greatest amount of energy. But here again is the assumption that the British people and the British climate were specially created to suit each other.

The theory of natural selection, on the other hand, represents that great method by which infinitely numerous adaptations will always be produced throughout time. Whatever happens in this material world must happen in consequence of the properties originally impressed upon matter, and our notions of the wisdom embodied in the Creation must be infinitely raised when we understand, however imperfectly, its true method. The continual resort to special inventions and adaptations must surely be below the greatness of a Power which could so design and create matter from the first that it must go on thenceforth inventing and adapting forms of life without apparent limit, in pursuance of one uniform principle.

I conceive it to be the essential consequence of Darwin's views that no form of life is to be regarded as a fixed form; but that all living beings, including man, are in a continual process of adjustment to the conditions in which they live. If this be so, it will of necessity follow that the longer any race dwells in given circumstances, the more perfectly will it become adapted to those circumstances. A migratory race, on the contrary, will always be liable to enter climates unsuited to it, and less favourable to the development of the greatest amount of energy. Negroes can bear a tropical heat simply because the race has grown more accustomed to it than Europeans, who bring with them indeed a superior degree of energy and intellect, but soon sicken and fail to reproduce themselves in equal perfection.

The intellect of man renders him far more migratory than most other animals, and when we look over long periods of time we must regard him as in a constant state of oscillation between the equator and the borders of perpetual snow. It will of necessity follow that the race, as a whole, will be better adapted to a medium than to an extreme climate. Not only may the same race have passed alternately through colder and hotter climates, but it is obvious that the tribes which intermix and intermarry in temperate regions will have come, some from a hotter and some from a colder region. The amalgamated race will therefore be precisely adapted to a medium climate. The inhabitants of the Arctic regions, on the contrary, must have come entirely from a warmer climate, and those of a tropical region from a colder climate, so that ages must pass before either re-adapts itself perfectly to its new circumstances.

It is hardly to be expected that history can afford complete corroboration of this theory; but I do not think that historical facts can be adduced in serious opposition to it. The progress of archæological and linguistic inquiry shows more and more clearly that the civilised parts of the earth have been inhabited by a succession of different races. A really aboriginal and indigenous people, growing upon a single island or spot of ground without kinship with other races, is not known to exist; and it is almost certain that all races have descended from a few stocks, if not from a single one. The evidences of extensive and frequent migrations are thus most complete, even if we had not distinct historical facts concerning the rapid and extensive movements of the Goths, Huns, Moors, Scandinavians, and many other races.

If the historical evidence disagrees with the theory in any point, it is that the migrations from temperate to extreme climates greatly over-balance any opposite movement. It would hardly, perhaps, be too much to represent the temperate regions of the Old World as the birthplace of successive races, which have diverged and died away more or less rapidly in distant and extreme climates. But if such be the conclusion from historical periods, it would only indicate that the human race had already acquired, in prehistoric times, a constitution displaying its greatest vitality in temperate regions. There can be no doubt that, were the rest of the world uninhabited by man, a very inferior race, such as the negroes of tropical Africa, would gradually re-people it; but they cannot do so in the present state of things, because they come into conflict with races of superior intellect and energy.

I would add in conclusion that the utmost result of speculations of this kind, supposing them to be valid, would consist in establishing a *general tendency*, so that the probabilities will be in favour of a great display of civilisation occurring in temperate climates rather than elsewhere. I do not for a moment suppose that any common physical cause, such as soil, climate, mineral wealth, or geographical position, or any combination of such causes, can alone account for the rise and growth of civilisation in Assyria, Egypt, Greece, Italy, or England. Material resources are nothing without the mind which knows how to use them. No physiology of protoplasm, no science that yet has a name, or perhaps ever will have a name, can account for the evolution of intellect in all its endless developments. The vanity of the Comtists leads them to suppose that their philosophy can compass

the bounds of existence and account for the evolution of history; but the scientific man remembers that however complicated the facts which he reduces under the grasp of his laws, yet beyond all doubt there remain other groups of facts of surpassing complication. Science may ever advance, but, like an improved telescope in the hands of an astronomer, it only discloses the unsuspected extent and difficulty of the phenomena yet unreduced to law.

W. STANLEY JEVONS

THE STATE TELEGRAPHS

OUR Government—always the last among European Governments to endow the nation with any benefit resulting from the advance of science—has at length awakened to the fact that the electric current is the scientific modern equivalent for the ancient post-boy, and we are to have a State Telegraph as we have a State Postal system.

As early as 1854, Mr. Thomas Allan, the electrician, published a paper entitled "Reasons for the Government Annexing an Electric Telegraph System to the General Post Office," in which he recommended the adoption of a shilling rate, for messages of twenty words, throughout the United Kingdom. This paper was published a second time in 1863. In 1856, Mr. Baines, an officer in the General Post Office, submitted to the Lords of the Treasury a plan for the annexation of the telegraphs, and a general charge of sixpence for messages of twenty words. In 1861, a memorandum by Mr. Ricardo, chairman of the Electric and International Telegraph Company, recommending the transfer of the telegraphs to the Government, was forwarded to the Chancellor of the Exchequer. Late in the year 1865 the proposition was again brought forward in the report of a committee appointed by the Edinburgh Chamber of Commerce "to consider the present condition of telegraphic communication in the United Kingdom, with a view to its improvement." In June 1866, Mr. Edwin Chadwick also forwarded a like scheme to the Chancellor of the Exchequer. The substance of all these papers was to the effect that the existing charges were too high, that the rapidity of transmission of messages was bad, that improvements are slow where they have to be made by competing companies fighting for high dividends, and that telegraphing in consequence was in a more backward state in the United Kingdom than in Switzerland and Belgium.

In September 1865, Mr. Scudamore was requested by the Postmaster-General to take the whole subject into consideration, and to report thereon. His first report was presented in July 1866, followed by a second in February 1868. These reports set forth that before December 1862 messages of twenty words were transmitted for fifteen pence to or from any part of Belgium, in which country the telegraphs are under the control of the State. At the end of 1862 the charge was reduced to tenpence, and in December 1865 the charge was still further reduced to fivepence. The hours of business in the telegraphic offices in Belgium are much the same as those adopted in England. The clerks have the power, which they use largely, of altering the wording of messages so as to make them read clearer, and to prevent mistakes—a plan which manifestly would not work in England, and which would lead to many legal and other difficulties. The result of the reductions in charges was, that in 1860 one telegram was transmitted in Belgium to every 218 letters passing through the post; in 1863, one message was transmitted to every 114 letters; and in 1866, the proportion was one telegram to every 37 letters. He also reported that the charge for the transmission of messages of twenty words between any two towns in Switzerland was tenpence. In 1860, one telegram was transmitted in Switzerland to every 84 letters; in 1863, one telegram to every 74 letters; and in 1866, one telegram to every 69 letters. In the United Kingdom the proportion of telegrams to letters was, in 1860, one to 296; in 1863, one to 197; and in 1866, one to 121. At the close of the year, the telegraphic systems of Belgium and Switzerland had been in operation about fifteen years, and the working expenses during that period had amounted in the case of Switzerland to about 68 per cent., and Belgium 62½ per cent. of the total revenue during the period. At the end of the year 1866, both Governments had a good surplus on hand from the telegraphic departments. The post offices of Switzerland and Belgium have less work than that of the United Kingdom, as shown by the following table, giving national statistics for the year 1865:—

Nation.	Number of Inland Telegrams.	Number of Inland Letters.
Belgium , . .	332,718	24,530,688
Switzerland . .	364,118	25,183,136
United Kingdom	4,662,687	706,057,667

From these figures, Mr. Scudamore concluded that the use of the telegraphs was in a more backward state in the United Kingdom than in Switzerland or Belgium; and he recommended their transference to the Government. One principal reason urged by him to prove that the Government could better afford to send messages at a lower rate than the companies was, that the post offices could spare for the use of the telegraph 12,000 offices rent-free, and a large staff of officials at present engaged, but not all of them fully employed throughout the whole of their hours of duty.

He therefore recommended the purchase of the telegraphs by the State. In August last an Act of Parliament was passed by the late Government sanctioning the plan, and authority was given to buy up the telegraphs by paying the companies £5,715,048 8*s.* 11*d.* (The odd elevenpence shows the extreme nicety of the calculation.) The Electric International Telegraph Company will receive £2,938,826 9*s.* 0*d.*; the British and Irish Magnetic, £1,243,536; Reuter's Telegram Company, Limited, £726,000; the Universal Private Telegraph Company, £184,421 10*s.*; the London and Provincial Telegraph Company, Limited, £60,000; and the United Kingdom Telegraph Company, Limited, £562,264 9*s.* 11*d.*

At the present time everything relating to the transfer of the telegraphs to the Government is in a transition state, very many of the arrangements not having as yet been completed. It is intended, if possible, to effect the transfer on the 1st of January next; but so much preliminary work remains to be done, that it is doubtful whether all will be ready by that date. A large room has

been fitted up in the General Post Office, with telegraphic instruments, in order that the clerks on the premises may learn to work them; and "dummy" instruments for the use of learners have been sent to the post offices in the provinces. The apparatus for common use will be the Morse printing telegraph and the single needle instrument; a wise selection, for long experience has proved them to be the best to place in the hands of unscientific clerks. They are not very liable to get out of order, and are very certain in their indications.

The following are among the changes that will be gradually made, some of them, however, at so distant a date that even the preliminaries have not been arranged as yet. The nine large district post offices in London will be made central stations, and each one will be connected by wire with the subordinate offices in its district. The chief post office in each of the largest provincial towns will be made a central telegraphic station, and the chief provincial towns will be placed in direct communication with three of the largest central London offices, namely, those in the West Central, Western, and South-western districts, in addition to the chief office in the East Central district. Suborbinate offices will be opened throughout the kingdom at the money-order offices in all places having a population of 2,000 persons and upwards. Messages will be received at all post offices for transmission by hand in the ordinary way to stations in connection with the telegraphic lines; pillar boxes will be places of deposit for messages written on stamped paper; and, as a rule, all messages will have to be paid for in stamps. The charge for transmission of a message of twenty words from any one part of the United Kingdom to any other part will be one shilling; but when it has to be delivered at a considerable distance from the nearest terminal station, it will be forwarded from that station by post for a penny, or by special messenger at sixpence per mile. Facilities will be given for the transmission of money-orders by telegraph, and as soon as possible the charges for messages to foreign parts will be reduced. Such are the plans which will be carried out, some of which will be in a very forward state in a few weeks' time.

THE GOLD FIELDS OF VICTORIA

The Gold Fields and Mineral Districts of Victoria. By R. Brough Smyth. (Melbourne: J. Ferres; London: Trübner and Co.)

II.

ALTHOUGH large quantities of gold are obtained from the detrital accumulations which overlie the palæozoic rocks of Victoria, there can be no doubt that they have come originally from the decomposition and removal of the auriferous quartz veins by which these rocks are traversed. The gold is simply a part of the detritus, in the same way that the fragments of quartz, sandstone, and slate are. Each nugget and bit of gold is only a more or less water-worn pebble, its edges being, as a rule, less worn, and its size larger, the nearer it is found to its parent reef. Yet some writers have endeavoured to show that the nuggets really grow by a kind of accretion, each fragment of gold becoming larger by successive depositions of the metal held in solution in the water percolating through the gravels. Mr. Brough Smyth, in discussing these and other disputed questions, usually avoids the expression of any decided opinion of his own. He treats them very much as a judge treats the evidence at a trial, and he leaves the decision to the jurymen, his readers. Yet we can very commonly guess what his opinions are, though he may not expressly state them. He gives us a tolerably copious account of opinions which have been published relative to the origin of quartz veins, and among these a valuable series of notes and sections specially made for him by a mining engineer of repute in the colony. The whole of this subject is, he says, involved in obscurity; "and though it is not possible for any one who has given attention to it to attach equal weight to the several theories which have been proposed, he would do wrong rashly to dismiss any of them as altogether improbable." Perhaps a judicial summing-up of this kind was, in the circumstances, better than the keen advocacy of any one theory. What is of value to the engineer in the colony is, to know what has really been written about the veins; and this he can learn with ease and satisfaction from Mr. Smyth's pages.

Allusion was made, in the previous notice of this volume, to the excellence of the geological and mining sections. It is rare to meet with such sections, so clearly conceived, so tastefully drawn, and carrying with them such conviction of their truth. The plate illustrative of the Ballarat gold fields is quite a model of clearness and clever drawing. No colour is used, but the various rocks are sharply defined, while, by the kind of drawing given to each, the internal structure of the mass is felicitously rendered. In the way of illustrations, the book seems to have only one failing, but it is a serious one: there is no geological map of the colony. The map at the end does not supply the want. A little coloured sketch-map, giving a general outline of the distribution of the geological formations, would have been an invaluable addition to the book, and would have certainly been worth a whole chapter of description.

One of the most striking facts brought out by the data compiled by Mr. Smyth is the high geological antiquity of the present land-surface of Victoria, or, in other words, the immense period during which that surface has remained above the sea. The palæozoic strata form the framework out of which the contour of the land has been moulded. These strata have been curved and folded, thrown on end, inverted, fractured, and upheaved. But the surface outlines are not found to bear any close relation to the direction of the subterranean movements. "There is scarcely one range in the colony which is not due to denudation, and those following lines of upheaval have been so modified by the action of water, through countless ages, as to make it difficult to determine where and how the elevating forces have operated." The palæozoic rocks were carved out into systems of valleys by the descent of rain-water from the watersheds to the lower grounds. Along these valleys river-gravels were laid down. In later times many volcanoes broke out, and thick streams of basalt rolled into the valleys and buried the ancient river-courses. Thus, in many places, the surface and the drainage of wide areas were wholly changed. New streams began to flow and to excavate new channels, which often flowed across the trend of the older valleys lying buried beneath them. By slow degrees these later valleys sank deeper into the frame-

work of the country, often cutting down through the older water-courses. Speaking of Gippsland, the author remarks that the streams "have scooped out deep valleys. The lofty hills have not been upheaved in isolated masses, but are the remains of formations which have been swept away by the slow action of water. If all the rock-formations could be restored and placed in the positions which they once occupied, Gippsland would be an immense nearly level plateau. As a familiar illustration, we may liken the mountains formed of palæozoic rocks to the humps of earth left by the navvy when he digs a cutting The grass on the surface of the hump shows what was once the height of the ground which has been removed; and the recent tertiary formations on the tops of the hills in Gippsland are evidence of the original height of the whole area. The rocks which once occupied the intervening spaces have been eroded by water; and the height of the hills above the valleys affords some hint as to the vertical extent which has been cut away." The author believes that Victorian surface-geology affords "an answer to those geologists who have urged that the greater amount of erosion everywhere has been effected by marine agency, and not by rivers, rains, and the wasting action of the atmosphere." And, indeed, no one can study the maps and sections in this volume without being convinced that the erosion of the present and of the old valley-system has been wholly a sub-aërial process.

Mining operations have done a good deal towards elucidating the older system of water-courses which were overflowed and buried beneath basalt. These water-courses or "leads," as the miners call them, contain richly auriferous "drifts," and they are accordingly explored and ransacked by shafts and adits. Thus, at Ballarat, the river Yarrowee must have had its course shifted considerably eastward by the overflow of basalt. Its old winding channel has been explored under the overlying basalt, and the channels of its tributary rivulets from the east have been followed under the bed of the present river.

From the shafts and the natural sections along the sides of the valleys, we learn that the volcanic phenomena continued to manifest themselves for a prolonged period. Showers of ashes and streams of basalt were thrown out at long intervals, during which gravel and sand were accumulated in the water-courses above the last erupted materials. Hence we now find sections where sheets of basalt alternate with stream-gravel and with layers of clay and ancient soil. As in Auvergne, the lapse of time which separated the oldest from the most recent volcanic rocks cannot but have been great. On the one hand, some of the basalt plateaux have been trenched by valleys several hundred feet deep, and fragments of the plateaux have been left isolated; on the other hand, there occur craters and cones of ash so fresh that not many centuries may have passed away since they ceased to be in eruption.

But the changes of level effected by the outpouring of volcanic rocks at the surface have not been the only causes at work in greatly modifying the drainage of the country. In comparing the water-courses with the quantity of water flowing in them, still more in examining the endless lines of water-course in which there is no water at all, we are forced to conclude that the rainfall must be much less now than it was in a very recent geological period. Over a large part of Victoria the ground is low and sandy; and there the streams which come down from the hills, after wandering hopelessly about among pools and scrub, disappear altogether, being partly evaporated and partly absorbed into the parched soil. Mr. Smyth mentions an interesting fact when he says that the old drainage system of the country can often be traced only by the vegetation. "The Murray pine, in the midst of small Eucalypti, marks distinctly the line of the ancient water-courses." "The beds of old lakes and tributary creeks can now be discovered in some places only by the timber which they bear." This general desiccation of the country points to some wide-spread geological cause. Possibly it may be due—in part at least—to a comparatively recent elevation of the northern part of Australia, whereby the northerly winds, having a broad belt of land to pass over, lose much of their moisture before they reach the high lands of Victoria and New South Wales. The want of an abundant and constant supply of water is in some parts of the colony a serious obstacle to improvement. In particular, it operates most prejudicially upon gold-mining: no pains ought to be spared, therefore, to prevent the destruction of timber, and to take every opportunity of planting it where it is likely to be of service.

In conclusion, the volume which Mr. Smyth has produced, though too bulky and too detailed for general readers, is a storehouse of information on the subject of which it treats, and will undoubtedly take its place as one of the standard works of reference for all that relates to the occurrence and the mining of gold. ARCH. GEIKIE

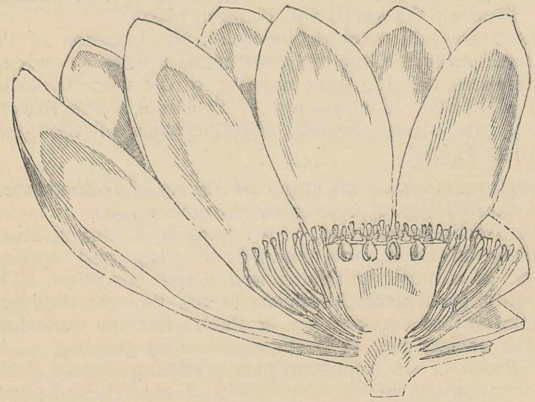
OLIVER'S INDIAN BOTANY

First Book of Indian Botany. By Daniel Oliver, F.R.S., F.L.S., Keeper of the Herbarium and Library of the Royal Gardens, Kew, and Professor of Botany in University College, London. With numerous Illustrations. Small 8vo. pp. xii. and 394. (London: Macmillan and Co. 1869.)

THE want of special works introductory to the study of the botany of the principal tropical and southern countries of the globe has long been felt. The medical man, the student, and the amateur resident or travelling in India and our principal colonies, find it hard work to keep up or get up their botany by introductions and class-books founded on British plants, whilst the schoolmaster would find himself very much abroad who should attempt to teach his pupils Australian Botany by Henfrey's or Balfour's Introductions, or by Oliver's Elements. Hence the need of a series of works devoted to the teaching of botany with a special reference to the wants of the sojourners in foreign parts, and illustrated by the common plants to be found therein. With the exception of the admirable text-books of American Botany, of Asa Gray, we know of no work of the nature indicated, illustrative of any extra-European Flora. There was, indeed, some talk a few years ago of a series of such works, embracing all departments of Natural History, being authorised by the local governments of India,—but nothing has come from that quarter: and much as we then regretted the supineness of the Indian authorities in the matter, we no longer do so; for India could assuredly never have produced a work of so high an order as that whose title stands at the head of this notice, for a better considered

and better executed work of the kind it has never been our good fortune to meet with, and it at once places its author first in the rank of English writers of Botanical Class-books.

Professor Oliver states in the preface that his book is in substance his "Lessons on Elementary Botany," adapted for use in India: but we find that it is this and a great deal more; for after following that excellent model in the part that relates to the structure of plants and the functions of their organs, a larger portion of the book is taken up with concise descriptions of 116 principal natural orders of India, illustrated by a clear analysis of the parts of a very common Indian flower, insomuch that, if we were asked what is the best text-book for a student in this country who wishes to acquire more knowledge of botany than is needful for a mere pass examination, without at all setting aside



Vertical Section of flower of *Nelumbium*, showing the hypogynous stamen and carpels singly immersed in a turbinate receptacle

the former work just mentioned, we do not know any to which we could so conscientiously direct attention, as almost all the plants in question may be easily found in any good botanic garden. Attached to each of the descriptions is a schedule of the floral characters on Henslow's plan, and a brief sketch of the principal matters of interest, structural, physiological, and economic, to be observed in Indian plants of the order, whilst the greater part are further accompanied by beautiful and original drawings and diagrams by Fitch, which delineate the floral organs graphically and naturally. We may add, too, that the more advanced and inquiring student has his attention occasionally directed to matters on which additional information is desired; as, for example, in the genus Drosera, where our author writes: "Some species exhibit a low sensibility or irritability in the leaves, which curl upon particles placed on their glandular hairs. Is this the case with Indian species? and do they appear to discriminate between organic and inorganic matter offered to them?"

Or, again, in Campanulaceæ: "Two small flowered Campanulas of Northern India exhibit the curious phenomenon of dimorphic flowers. Besides the flowers of usual form, there are smaller ones about the size of coriander seeds, which never open, but which nevertheless mature abundant seed. The latter must necessarily be self-fertilised, while the flowers of ordinary form are often, if not always, crossed by the pollen of other flowers of the same species. The part which these hermetically-sealed flowers play in the economy of plants is not yet well made out. They are found in isolated species and genera belonging to widely different natural orders, and it would be worth while to look for fresh examples amongst Indian weeds."

Sacred Lotus (*Nelumbium speciosum*), about one-tenth to one-fifteenth natural size

We consider such suggestions of extreme importance, as some stimulus of this kind is wanted to urge students to something more than the requirements of the passing time. It is notorious that though great acuteness is often shown amongst the higher proficients in botany who come before public examiners, not one in a hundred goes a step beyond what is wanted to secure a certain class or scholarship. There must, we imagine, be something in the style of public teaching on such subjects which seems to check all real interest, much less to excite a spirit of love or enthusiasm for science itself, without which it is quite certain that we shall have no new fellow-workers.

In conclusion, we would recommend a close study of the precision of our author's descriptions, and the clearness and terseness of his diction, to the writers of

Screw Pine (*Pandanus*), showing aërial adventitious roots

botanical text-books, as worthy of their imitation. These are qualities which improve the mind of the pupil more

than is usually supposed. They are conspicuously present in French class-books, but their absence is too often as conspicuous in English ones.

The author states in his preface that his chief difficulty has been in the selection of suitable plants to illustrate the natural orders, especially as types which are common in some parts of India, are absent in others. We think, however, that he has been extremely judicious in his selection, which certainly required no little local knowledge, and he has very properly recorded his obligations in this respect to our two great authorities on Indian botany, Dr. Hooker and Dr. Thomson.

If we were required to point out the especial part of the volume in which we think the author's tact has been more peculiarly developed, we would instance that in which he might be supposed to be least familiar. We have read with pleasure the observations on the cryptogamic orders, in admiration of the immense mass of information which is condensed within a short compass, and of its intrinsic value. We are glad to observe that some definitions are to be found in the very copious index, which did not come within the author's views in the text, and it would add greatly to their value if in a future edition little illustrations of such matters could be added in the margin. We have selected some woodcuts which are fair specimens of the 240 engravings in the book.

M. J. BERKELEY

OUR BOOK SHELF

Literature of Natural History.—*Bericht über die wissenschaftlichen Leistungen in der Naturgeschichte der niederen Thiere während der Jahre* 1866 *und* 1867. Von Dr. Rudolph Leuckart. (Berlin, 1869. London: Williams and Norgate.)

NOW that original observers in every branch of natural history are to be found in all civilised countries, it is only by means of such reports as this that the working naturalist can keep himself acquainted with the actual state even of that department of his science which he himself more particularly cultivates. When, as in the present case, a man of real eminence as a naturalist has at his command all the chief languages of Europe, and gives us year by year no mere dry list of papers but full analyses accompanied by critical remarks, we feel that it is not easy to exaggerate the importance of his labours as affecting the general progress of zoology. For the sake of any worker who may be unacquainted with Prof. Leuckart's reports, we may mention that they embrace the groups Vermes, Echinodermata, Cœlenterata, and Protozoa, as defined by German writers. The Rotiferi and Bryozoa are included under the Vermes.

Parsons on the Rose. *A Treatise on the Propagation, Culture, and History of the Rose.* By Samuel B. Parsons. Pp. 215. Illustrated. (New York. London: Trübner and Co.)

THE horticultural portion of this work, occupying its first nine chapters, is a digest of some of our best English authors on the subject. Chapter IX., on the Diseases and Insects attacking the Rose, is confessedly little more than a reproduction of the writings of Harris on the same topic, and of use *only* to the American cultivator.

The historical part, contained in Chapters X. to XV., exhibits a remarkable collation of gleanings from history—ancient, mediæval, or modern—of legends, fables, ceremonies, &c., all having some connection (although in some instances rather remote) with the rose. R. C. K.

The Romance of Natural History. By Philip Henry Gosse, F.R.S. 1st and 2d series. (London: James Nisbet and Co.)

THE popularity of these well-known volumes may be looked upon as a standing protest against the common opinion that the exact study of natural objects is inimical to a poetic conception and romantic love of nature. We know of no more delightful New Year's gift for an intelligent boy than Dr. Gosse's eloquent and well-illustrated work.

Our Dumb Neighbours; or, Conversations of a Father with his Children on Domestic and other Animals. By the Rev. T. Jackson. (London: S. W. Partridge and Co.)

THIS is a first-rate picture-book of animals for children. The text is not up to the level of the woodcuts.

Gedächtnisrede auf Alexander von Humboldt. Von H. W. Dove. (Berlin: Harrwitz und Gossman, 1869.)

Alexander von Humboldt. Festrede von Dr. A. Bastian. (Berlin: Wiegandt and Hemfel, 1869.)

THESE are addresses delivered, on the occasion of the recent Humboldt Centenary, before the Prussian Academy of Sciences, and the joint meeting of the scientific societies of Berlin. The memoir of Professor Dove records many interesting personal characteristics of the great German *savant*.

Monthly Bulletin of the Imperial Society of Acclimatation Second Series, January to November 1869.

THE Acclimatation (or, as we term it, Acclimatisation) Society of Paris, was founded in 1854, and appears to be in a most flourishing and active condition. The beautiful gardens of the society in the Bois de Boulogne are known to every visitor of Paris; but the work done by the society can be best judged of by glancing at its "Bulletins." An important part of the operations of the society consists in the distribution of animals and plants to its members, who may wish to experiment in endeavouring to acclimatise such useful species as the society may obtain. Pisciculture of all kinds, marine and fresh-water, occupies a large share of the attention of the society: ostreo-culture also and the coral-fisheries—which the French Government has most anxiously fostered on the coast of Algeria—are noticed in articles giving account of recent progress in these departments of industry. The cultivation of the silkworm, however, calls forth the most notable exertions of the society. Large districts in the south of France are given up to this employment. On some of the limestone plateaux north of Nimes—which are bare for miles and present no soil—holes are excavated, and the necessary earth in which to place the mulberry-trees which are to feed the crops of silkworms reared by the inhabitants of this district is fetched from thirty miles' distance—so valuable is the crop of silk when obtained. To these "Bulletins" we shall return as they make their monthly appearance. At present, on glancing through the year's accumulation, we find, amongst other facts of more than economical interest, an account of the introduction of the salmon of the Rhine into the Lake of Geneva. It has always been held doubtful as to whether salmon could thrive when access to the sea was impossible. The great length of the Rhone, and the overpowering force of its waters at the spot near Bellegarde, called *la perte du Rhône*, renders the Lake of Geneva practically closed from communication with the sea for all icthyological purposes. Hence it is exceedingly interesting to find that success has attended the efforts of Dr. Chavannes and others to introduce the Rhine salmon to this area. Specimens, put in among many thousand others in 1857, have been recaptured, weighing over four pounds, and with roe; whilst others, evidently the offspring of these, have been also taken. Further experiments are being made on an *actually* closed lake.

A PLEA FOR THE MATHEMATICIAN

[At the request of the Editor, Professor Sylvester has furnished the following abridgment of his opening address to the Mathematical and Physical Section of the British Association at Exeter, with some supplemental notes appended in the course of its passing through the press.—ED.]

I.

IT is said of a great party leader and orator in the House of Lords that, when lately requested to make a speech at some religious or charitable meeting, he declined to do so on the ground that he could not speak unless he saw an adversary before him—somebody to attack or reply to. In obedience to a somewhat similar combative instinct, I set to myself the task of considering certain recent utterances of a most distinguished member of this Association, one whom I no less respect for his honesty and public spirit than I admire him for his genius and eloquence, but from whose opinions on a subject which he has not studied I feel constrained to differ. Göthe has said—

> "Verständige Leute kannst du irren sehn
> In Sachen nämlich, die sie nicht verstehn."

Understanding people you may see erring—in those things, to wit, which they do not understand.

I have no doubt that had my distinguished friend, the probable President-elect of the next Meeting of the Association, applied his uncommon powers of reasoning, induction, comparison, observation, and invention to the study of mathematical science, he would have become as great a mathematician as he is now a biologist; indeed he has given public evidence of his ability to grapple with the practical side of certain mathematical questions; but he has not made a study of mathematical science as such: and the eminence of his position and the weight justly attaching to his name, render it only the more imperative that any assertions proceeding from such a quarter, which may appear to be erroneous, or so expressed as to be conducive to error, should not remain unchallenged or be passed over in silence.

He says "mathematical training is almost purely deductive. The mathematician starts with a few simple propositions, the proof of which is so obvious that they are called self-evident, and the rest of his work consists of subtle deductions from them. The teaching of languages, at any rate as ordinarily practised, is of the same general nature—authority and tradition furnish the data, and the mental operations are deductive." It would seem from this that, according to Prof. Huxley, the business of the mathematical student is from a limited number of propositions (bottled up and labelled ready for future use) to declare any required result by a process of the same general nature as a student of language employs in declining and conjugating his nouns and verbs: that to make out a mathematical proposition and to construe or parse a sentence are equivalent or identical mental operations. Such an opinion scarcely seems to need serious refutation. The passage is taken from an article in *Macmillan's Magazine* for June last, entitled "Scientific Education—Notes of an After-dinner Speech," and I cannot but think would have been couched in more guarded terms by my distinguished friend had his speech been made before dinner instead of after.

The notion that mathematical truth rests on the narrow basis of a limited number of elementary propositions, from which all others are to be derived by a process of logical inference and verbal deduction, has been stated still more strongly and explicitly by the same eminent writer in an article of even date with the preceding, in the *Fortnightly Review*, where we are told that "Mathematics is that study which knows nothing of observation, nothing of experiment, nothing of induction, nothing of causation." I think no statement could have been made more opposite to the facts of the case: that mathematical analysis is constantly invoking the aid of new principles, new ideas, and new methods, not capable of being defined by any form of words, but springing direct from the inherent powers and activity of the human mind, and from continually renewed introspection of that inner world of thought of which the phenomena are as varied and require as close attention to discern as those of the outer physical world—to which the inner one in each individual man may, I think, be conceived to stand in somewhat the same general relation of correspondence as a shadow to the object from which it is projected, or as the hollow palm of one hand to the close fist which it grasps of the other: that it is unceasingly calling forth the faculties of observation and comparison, that one of its principal weapons is induction, that it has frequent recourse to experimental trial and verification, and that it affords a boundless scope for the exercise of the highest efforts of imagination and invention.*

Lagrange, than whom no greater authority could be quoted, has expressed emphatically his belief in the importance to the mathematician of the faculty of observation:† Gauss has called mathematics a science of the

* The annexed instance of Mathematical Euristic is, I think, from its intrinsic interest, worthy of being put on record. The so-called canonical representation of a binary quartic of the eighth degree I found to be a quartic multiplied by itself, together with a sum of powers of its linear factors, just as for the fourth degree it was known to be a quadric into itself, together with a sum of powers of its factors: but for a sextic a cubic multiplied into itself, with a tail of powers as before, was not found to answer. To find the true representation was like looking out into universal space for a planet desiderated according to Bode's or any other empirical law. I found my *desideratum* as follows: I invented a catena of morphological processes which, applied to a quadric or to a quartic, causes each to reproduce itself: I then considered the two quadrics and two quartics to be noumenally distinguishable (one as an auto-morphic derivative of the other), although phenomenally identical. The same catena of processes applied to the cubic gave no longer an identical but a distinct derivative, and the product of the two I regarded as the analogue of the before-mentioned square of the quadric or of the quartic. This product of a cubic by its derivative so obtained together with a sum of powers of linear factors of the original cubic, I found by actual trial to my great satisfaction satisfied the conditions of canonicity, and it was thus I was led up to the desired representation which will be found reproduced in one of Prof. Cayley's memoirs on Quantics and in Dr. Salmon's lectures on Modern Algebra. Here certainly induction, observation, invention, and experimental verification all played their part in contributing to the solution of the problem. I discovered and developed the whole theory of canonical binary forms for odd degrees, and, as far as yet made out, for even degrees too, at one evening sitting, with a decanter of port wine to sustain nature's flagging energies, in a back office in Lincoln's-Inn-Fields. The work was done, and well done, but at the usual cost of racking thought—a brain on fire, and feet feeling, or feelingless, as if plunged in an ice pail. *That night we slept no more.* The canonisant of the quartic (its cubic covariant) was the first thing to offer itself in the inquiry. I had but to think the words "Resultant of Quintic and its Canonisant," and the octodecadic skew invariant would have fallen spontaneously into my lap. By quite another mode of consideration M. Hermite subsequently was led to the discovery of this, the key to the innermost sanctuary of Invariants—so hard is it in Euristic to see what lies immediately before one's eyes. The disappointment weighed deeply, far too deeply, on my mind, and caused me to relinquish for long years a cherished field of meditation: but the whirligig of time brings about its revenges. Ten years later this same canonisant gave me the upper hand of my honoured predecessor and guide, M. Hermite, in the inquiry (referred to at the end of this address) concerning the invariantive criteria of the constitution of a quintic with regard to the real and imaginary. By its aid I discovered the essential character of the famous amphigenous surface of the ninth order, and its bicuspidal universal section of the fourth order (otherwise termed the Bicorn), as may be seen in the third part of my Triology, printed in the Philosophical Transactions.

† I was under the conviction that a passage to that effect from Lagrange had been cited to me some years ago by M. Hermite of the Institute of France; on applying to him on the subject, I received the following reply:—

"Relativement à l'opinion que suivant vous j'aurais attribuée à Lagrange, je m'empresse de vous informer qu'il ne faut aucunement, à ma connaissance, l'en rendre responsable. Nous nous sommes entretenus du rôle de la *faculté d'observation dans les études que nous avons poursuivies de concert pendant bien des années*, et c'est alors, sans doute, que je vous aurai conté une anecdote que je tiens de M. Chevreul. M. Chevreul, allant à l'Institut dans la voiture de Lagrange, a été vivement frappé du sentiment de plaisir avec lequel ce grand géomètre lui faisait voir, dans un travail manuscrit, la beauté extérieure et artistique, si je peux dire, des nombreuses formules qui y figuraient. Ce sentiment nous l'avons tous éprouvé en faisant, avec sincérité, abstraction de l'idée analytique dont les formules sont l'expression écrite. Il y a là, n'est-il point vrai, un imperceptible lien qui rattache au monde de l'art le monde abstrait de l'algèbre et de l'analyse, et j'oserai même vous dire que je crois a des sympathies réelles, qui vous font trouver un charme, dans les notations d'un auteur, et dans les répulsions qui éloignent d'un autre, par l'apparence seule des formules."

I am, however, none the less persuaded that on one or more than one occasion, M. Hermite, speaking of Lagrange, expressed to me, if not as I supposed on Lagrange's, then certainly on his own high authority, "that the faculty of observation was no less necessary for the successful cultivation of the pure mathematical than of the natural sciences."

eye, and in conformity with this view always paid the most punctilious attention to preserve his text free from typographical errors: the ever to be lamented Riemann has written a thesis to show that the basis of our conception of space is purely empirical, and our knowledge of its laws the result of observation; that other kinds of space might be conceived to exist, subject to laws different from those which govern the actual space in which we are immersed; and that there is no evidence of these laws extending to the ultimate infinitesimal elements of which space is composed. Like his master Gauss, Riemann refuses to accept Kant's doctrine of space being a form of intuition,* and regards it as possessed of physical and objective reality. I may mention that Baron Sartorius von Waltershausen (a member of this Association), in his biography of Gauss ("Gauss zu gedächtniss"), published shortly after his death, relates that this great man was used to say that he had laid aside several questions which he had treated analytically, and hoped to apply to them geometrical methods in a future state of existence, when his conceptions of space should have become amplified and extended; for as we can conceive beings (like infinitely attenuated book-worms in an infinitely thin sheet of paper) which possess only the notion of space of two dimensions, so we may imagine beings capable of realising space of four or a greater number of dimensions.† Our Cayley, the central luminary, the Darwin of the English school of mathematicians, started and elaborated at an early age, and with happy consequences, the same bold hypothesis.

Most, if not all, of the great ideas of modern mathematics have had their origin in observation. Take, for instance, the arithmetical theory of forms, of which the foundation was laid in the diophantine theorems of Fermat, left without proof by their author, which resisted all the efforts of the myriad-minded Euler to reduce to demonstration, and only yielded up their cause of being when turned over in the blowpipe flame of Gauss's transcendent genius; or the doctrine of double periodicity, which resulted from the observation by Jacobi of a purely analytical fact of transformation; or Legendre's law of reciprocity; or Sturm's theorem about the roots of equations, which, as he informed me with his own lips, stared him in the face in the midst of some mechanical investigations connected (if my memory serves me right) with the motion of compound pendulums; or Huyghen's method of continued fractions, characterised by Lagrange as one of the principal discoveries of "that great mathematician, and to which he appears to have been led by the construction of his "Planetary Automaton;" or the new algebra, speaking of which one of my predecessors (Mr. Spottiswoode) has said, not without just reason and authority, from this chair, "that it reaches out and indissolubly connects itself each year with fresh branches of mathematics, that the theory of equations has almost become new through it, algebraic geometry transfigured in its light, that the calculus of variations, molecular physics, and mechanics" (he might, if speaking at the present moment, go on to add the theory of elasticity and the developments of the integral calculus) "have all felt its influence."

Now this gigantic outcome of modern analytical thought, itself, too, only the precursor and progenitor of a future still more heaven-reaching theory, which will comprise a complete study of the interoperation, the actions and reactions, of algebraic forms (Analytical Morphology in its absolute sense), how did this originate? In the accidental observation by Eisenstein, some twenty or more years ago, of a single invariant (the Quadrinvariant of a Binary Quartic) which he met with in the course of certain researches just as accidentally and unexpectedly as M. Du Chaillu might meet a Gorilla in the country of the Fantees, or any one of us in London a White Polar Bear escaped from the Zoological Gardens. Fortunately, he pounced down upon his prey and preserved it for the contemplation and study of future mathematicians. It occupies only part of a page in his collected posthumous works. This single result of observation (as well entitled to be so called as the discovery of Globigerinæ in chalk

* It is very common, not to say universal, with English writers, even such authorised ones as Whewell, Lewes, or Herbert Spencer, to refer to Kant's doctrine as affirming space "to be a form of thought," or "of the understanding." This is putting into Kant's mouth (as pointed out to me by Dr. C. M. Ingleby), words which he would have been the first to disclaim, and is as inaccurate a form of expression as to speak of "the plane of a sphere," meaning its surface or a superficial layer, as not long ago I heard a famous naturalist do at a meeting of the Royal Society. Whoever wishes to gain a notion of Kant's leading doctrines in a succinct form, weighty with thought, and free from all impertinent comment, should study Schwegler's Handbook of Philosophy, translated by Stirling. He will find in the same book a most lucid account of Aristotle's doctrine of matter and form, showing how matter passes unceasingly upwards into form, and form downwards into matter; which will remind many of the readers of NATURE of the chain of depolarisations and repolarisations which are supposed to explain the decomposition of water under galvanic action, eventuating in oxygen being thrown off at one pole and hydrogen at the other (it recalls also the high algebraical theories in which the same symbols play the part of operands to their antecedents and operators to their consequents): at one end of the Aristotelian chain comes out πρώτη ὕλη, at the other, πρῶτον εἶδος. We have, then, only to accept and apply the familiar mathematical principle of the two ends of infinity being one and the same point, and the otherwise immoveable stumblingblock of duality is done away with, and the universe reintegrated in the wished-for unity. For this corollary, which to many will appear fanciful, neither Aristotle nor Schwegler is responsible. We perfectly understand how in perspective the latent polarities of any point in a closed curve (taken as the object) may be developed into and displayed in the form of a duad of *quasi* points at an infinite distance from each other in the picture. In like manner we conceive how *actuality* and *potentiality* which exist indistinguishably as one in the *absolute* may be projected into seemingly separate elements or moments on the plane of the human understanding. Whatever may be the merits of the theory in itself, this view seems to me to give it a completeness which its author could not have anticipated, and to accomplish what Aristotle attempted but avowedly failed to effect, viz. the complete subversion of the "Platonic Duality," and the reintegration of matter and mind into one.

† It is well known to those who have gone into these views, that the laws of motion accepted as a fact suffice to prove in a general way that the space we live in is a flat or level space (a "homaloid"), our existence therein being assimilable to the life of the bookworm in a flat page; but what if the page should be undergoing a process of gradual bending into a curved form? Mr. W. K. Clifford has indulged in some remarkable speculations as to the possibility of our being able to infer, from certain unexplained phenomena of light and magnetism, the fact of our level space of three dimensions being in the act of undergoing in space of four dimensions (space as inconceivable to us as our space to the suppositious bookworm) a distortion analogous to the rumpling of the page. I know there are many, who, like my honoured and deeply lamented friend the late eminent Prof. Donkin, regard the alleged notion of generalised space as only a disguised form of algebraical formulisation; but the same might be said with equal truth of our notion of infinity in algebra, or of impossible lines, or lines making a zero angle in geometry, the utility of dealing with which as positive substantiated notions no one will be found to dispute. Dr. Salmon, in his extensions of Chasles' theory of characteristics to surfaces, Mr. Clifford, in a question of probability (published in the *Educational Times*), and myself in my theory of partitions, and also in my paper on Burycentric Projection in the *Philosophical Magazine*, have all felt and given evidence of the practical utility of handling space of four dimensions, as if it were conceivable space. Moreover, it should be borne in mind that every perspective representation of figured space of four dimensions is a figure in real space, and that the properties of figures admit of being studied to a great extent, if not completely, in their perspective representations. In philosophy, as in æsthetic, the highest knowledge comes by faith. I know (from personal experience of the fact) that Mr. Linnell can distinguish purple tints in clouds where my untutored eye and unpurged vision can perceive only confused grey. If an Aristotle, or Descartes, or Kant assures me that he recognises God in the conscience, I accuse my own blindness if I fail to see with him. If Gauss, Cayley, Riemann, Schalfli, Salmon, Clifford, Krönecker, have an inner assurance of the reality of transcendental space, I strive to bring my faculties of mental vision into accordance with theirs. The positive evidence in such cases is more worthy than the negative, and actuality is not cancelled or balanced by privation, as matter plus space is none the less matter. I acknowledge two separate sources of authority—the collective sense of mankind, and the illumination of privileged intellects. As a parallel case, I would ask whether it is by demonstrative processes that the doctrine of limits and of infinitely greats and smalls, has found its way to the ready acceptance of the multitude; or whether, after deducting whatever may be due to modified hereditary cerebral organisation, it is not a consequence rather of the insensible moulding of the ideas under the influence of language which has become permeated with the notions originating in the minds of a few great thinkers? I am assured that Germans even of the non-literary classes, such as ladies of fashion and novel readers, are often appalled by the habitude of their English friends in muddling up together, as if they were nearly or quite the same thing, the reason and the understanding in doing into English the words Vernunft and Verstand, thereby confounding distinctions now become familiar (such is the force of language) to the very milkmaids of Fatherland.

As a public teacher of mere striplings, I am often amazed by the facility and absence of resistance with which the principles of the infinitesimal calculus are accepted and assimilated by the present race of learners. When I was young, a boy of sixteen or seventeen who knew his infinitesimal calculus would have been almost pointed at in the streets as a prodigy, like Dante, as a man who had seen hell. Now-a-days, our Woolwich cadets at the same age talk with glee of asymptotes and points of contrary flexure, and discuss questions of double maxima and minima, or ballistic pendulums, or motion in a resisting medium, under the familiar and ignoble name of *sums*.

or of the Confoco-ellipsoidal structure of the shells of the Foraminifera), which remained infructuous in the hands of its distinguished author, has served to set in motion a train of thought and propagated an impulse which have led to a complete revolution in the whole aspect of modern analysis, and will continue to be felt until Mathematics are forgotten and British Associations meet no more.

J. J. SYLVESTER

TECHNICAL EDUCATION

MANCHESTER at all events is beginning to be alive to the present situation, and at a meeting on the 18th inst., the following document, expressing the views of the Council of the Society of Arts, was read.

1. The Council of the Society of Arts have received a communication from Owens College Extension Committee, Manchester, asking their co-operation in the extension of technical education, or, more properly, Scientific Instruction; and it affords them much pleasure to do whatever lies in their power to advance this important national object. With this view, the Council have invited the members of the Society, and especially those resident in the locality, as well as the authorities of Owens College, to meet them in conference on the subject, to discuss the best means by which scientific instruction may be promoted, and to establish an organisation which will keep an influence at work to accomplish what is so urgently needed.

2. The necessity and importance of improved scientific instruction for the people of the United Kingdom, in order that they may be placed in a favourable position in the race of industrial competition with other nations, has, for some time past, been forced upon the notice of the Society of Arts, whose chartered objects are the Promotion of Arts, Manufactures, and Commerce.

3. The great international displays of industry in 1851, 1855, 1862, and 1867, have shown unmistakeably that, if this country is to maintain her position as a commercial and manufacturing power, the people (and in this term are comprehended not only artisans, but also persons of higher position in the social scale) must have at their command the means of education improved in its general character, and embracing, if not based upon, science to a far greater extent than has hitherto been the case. The official jury reports at all the exhibitions abound in declarations of this character, and the country can no longer afford to ignore the fact, but must earnestly set to work to bring about a change. These reports, as well as those of the artisans who were sent to the Paris Exhibition of 1867 by the Society, one and all point out the great educational facilities which are available for all classes, and especially the artisan class, upon the Continent.

4. The Council are of opinion that existing schools and colleges, where science has hitherto been all but excluded, should adopt some means for its being taught; and that where such teaching already exists, measures should be taken for extending the usefulness of the institutions, and rendering them more easy of access to the great body of the people; whilst in localities where no such facilities exist, means should be taken to secure their foundation. The localities must themselves stir in this reform, and their efforts should be aided by pecuniary assistance and countenance by the State.

5. The nation must set itself earnestly to work to bring about the sought-for change in the education of the people. The evils have been so often pointed out, that it is unnecessary to enter into detail; our duty is to supply the remedy. This the Council believe to be by the localities setting themselves heartily to work, and when they have shown themselves in earnest by raising funds and organising establishments for the teaching of science, they should be entitled, as of right, to aid from the State.

6. In order, however, that such establishments, colleges, or schools should be of value to the mass of the people, so that they can take advantage of the facilities which would then be offered to them, it is absolutely necessary that elementary education, commonly known as primary education, should be extended far more widely than at present. To an ignorant population the establishment of colleges and schools for the teaching of science will be of little avail, and unless the blessings of an ordinary elementary education, *i.e.*, reading, writing, and arithmetic, at least, can be more diffused, so as to place our people on a par with those of Switzerland, Prussia, Saxony, &c., the attempt to extend the teaching of science will be in vain. Again, not only must we have improved elementary education, but these elements must themselves be taught by improved methods and organisation, so that less time may be occupied in acquiring them, thus leaving free for the learning of elementary science some of those years which are now unnecessarily taken up in mastering the mere rudiments of knowledge. Abroad it is the custom of the State only to deal with this and many other matters of public concern, but such is not the case here. The Council do not recommend State interference as of choice, but of necessity. This work of education must be done, and will have to be done, wholly by Government, if not otherwise. Experience proves that it can be done by a combination of voluntary efforts with Government aid, as in the existing system of primary education, and in the instruction aided by the Science and Art Department. The Council think that the work is to be done in part nationally, in part voluntarily, but not upon a haphazard system.

7. Adam Smith, the earliest, and, perhaps, the first English writer on political economy, as well as Mr. J. Stuart Mill, its present most able exponent, recommend scientific instruction as profitable to the nation. Her Majesty's Government must not plead economy as an excuse, for the highest and wisest economy comes out of wise expenditure.

8. The Council believe that this is the feeling of the country, which the Government will regard with respectful attention. Government must be urged to co-operate with Owens College and other bodies, either existing or to be established. Parliamentary grants are now made to the old universities of England and Scotland, and to the Queen's Colleges in Ireland, and there is no reason why the same principle should not be extended, and grants made to modern educational establishments in the great centres of industry. The Council are of opinion that a Government resulting from a wide representation of the whole people ought adequately to represent the highest intelligence and aspirations of that people for improvement, and not limit its responsibility and its labours to matters of police. There can be no more profitable investment of national capital drawn from taxes paid by the whole nation, than in promoting the best education among all classes of the people, and the widest extension of sound knowledge, on which the Arts, Manufactures, and Commerce of a kingdom rest.

At the meeting, the following resolution, proposed by Professor Jack, was carried unanimously :—

"That the best interests of the country demand the establishment of a complete system of primary education, the extension of the system of science classes under a responsible department of the Government, and under a definite plan, and especially the establishment of Science Colleges in the principal industrial centres of the United Kingdom: and such colleges ought to be established and maintained partly by local efforts, and partly by liberal assistance from the State; and existing institutions such as Owens College ought to be made available for the purpose."

For the present, we content ourselves with chronicling these facts, and calling upon other centres of industry, such as Birmingham, to help to bring the pressure of public opinion to bear upon the members of the Government, who, perhaps, more than anyone else, require to be taught the vital importance of technical education to the future national life.

WHENCE COME METEORITES?

IN examining a mass of meteoric iron found in the Cordillera of Deesa (Chili), M. Stanislas Meunier, of the Museum of Natural History in Paris, has discovered evidences of an unexpected relationship between this iron and two meteorites fallen at a great distance from Chili; viz. a mass of iron found at Caille (Alpes Maritimes), and a stone which fell at Sétif (Algeria) June 9, 1867.

The meteorite of Deesa is a mixture of these two rocks: it is composed of iron which is identical with that of Caille, injected in a state of fusion into a stone which is identical with that of Sétif. The iron of Deesa is thus evidently an eruptive rock, and it is the first hitherto

observed among meteorites. Besides this, it is asserted that the iron resembling that found at Caille, and the stone resembling that of Sétif, have been mutually connected by stratification upon an unknown globe, and it is the first time that such a connection has been materially demonstrated.

M. Meunier remarks that the meteorites which now arrive upon the earth are not of the same mineralogical nature as those which fell in past ages. Formerly iron fell; now stones fall. During the last 118 years there have been in Europe but three falls of iron, whereas there have been, annually, on an average, three falls of stones. The greater number of meteoric irons, which exist in the Paris collection, have fallen on the earth at undetermined epochs; all the meteoric stones are of comparatively recent date. Perhaps we are even justified in saying that stones of a new kind are beginning to arrive, for falls of *carbonaceous meteorites* were unknown before the year 1803, and four have been observed since then.

From this assemblage of facts, M. Stanislas Meunier concludes that meteorites are the fragments of one or more heavenly bodies which, at a period relatively recent (for these waifs are never found except in superficial strata), revolved round the earth, or perhaps round the moon. Having, in the course of ages, lost their own proper heat and become penetrated by the cold of space, they have arrived, much sooner than the moon, by reason of their inferior volume, at the last term of the molecular actions which are operating upon our satellite, and which are rendered evident to our eyes by the enormous crevices, the deep fissures with which it is furrowed. Split in all directions, they have fallen to ruin, and their fragments, remaining scattered along the orbit, so as to form a circle more or less complete, have at the same time become arranged, according to their density, in zones concentric with the focus of attraction towards which they are constantly impelled by the resistance of the ethereal medium through which they move. The masses nearest to the centre, and which were principally composed of iron, were the first to fall; afterwards came the stones, in which period we now are. Hereafter, perhaps, will arrive meteorites analogous to our crystallised formations, and perhaps even to our stratified beds.

Thus meteorites, the veritable products of demolition, represent, according to M. Meunier, the last period of the evolution of planetary bodies. The incandescent orb, the sun, figures at the present day in our system as the sole representative of the primitive state through which the earth, and all the other bodies which revolve around it, have passed; the moon representing the future which awaits the terrestrial sphere, now in all the plenitude of life; and, finally, meteorites show us what becomes of the dead stars, how they are decomposed, and how their materials return into the vortex of life.

LETTERS TO THE EDITOR

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

Dr. Livingstone's Explorations.

It certainly is to be regretted that the information received from Dr. Livingstone should be so imperfect. Still, though insufficient in itself, perhaps, to warrant our arriving at any positive conclusion respecting his claim to have discovered the chief sources of the Nile, the information furnished by him affords material aid towards the solution of that great problem of African geography, and is generally of much greater value, in my estimation, than it would appear to be in that of your learned correspondent "F.R.G.S."

Before adverting to the main subject, I desire to point out, in the first place, that Dr. Livingstone has definitively settled that the Chambeze—the New Zambesi of some of our maps—is not an affluent of the well-known river Zambesi, which flows eastward into the Indian Ocean, but is a distinct stream, of which the course is to the west and north-west. On this point it is due to Mr. Cooley to say, that, although he was mistaken respecting the upper course of the Zambesi itself, he has long contended for the separate existence of the "New Zambesi," or Chambeze.

Secondly, Dr. Livingstone has ascertained that the Chambeze, in its lower course beyond the capital of the Cazembe, is joined by another large river, the Lufira, coming from the south and south-west, which drains the western side of the country south of Tanganyika, as the Chambeze drains the east side. The Lufira was not seen by the traveller; but when he was at some place, not named by him, in 11° S. lat., that river was pointed out to him as being at some distance west of that spot, and was described as being so large there as always to require canoes; for so I read his words:—"I have not seen the Lufira, but, pointed out west of 11° S., it is there asserted always to require canoes;"—which shows that it must come from a considerable distance south of that parallel.

In the next place, Dr. Livingstone informs us that the Chambeze enters Lake Bangweolo, and then changes its name to Luapula; that this river flowing north enters Moero Lake, and "on leaving Moero at its northern end by a rent in the mountains of Rua it takes the name of Lualaba, and passing on N.N.W. forms Ulenge in the country west of Tanganyika." This, it must be remarked, is not native information, but the result of the traveller's own personal observation on the spot. His letters are dated "near Lake Bangweolo;" and in speaking of the Lualaba he says, "I have seen it only where it leaves Moero, and where it comes out of the crack in the mountains of Rua."

To make it more certain that he is speaking of the Lua*laba*, and not of the Lua*pula*, the traveller expresses his intention "to follow down the Lua*laba* and see whether, as the natives assert, it passes Tanganyika to the west, or enters it and finds an exit by the river called Locunda [or Loanda] into Lake Chowambe;" which lake, he says, "I conjecture to be that discovered by Mr. Baker;"—adding, "I shall not follow Lua*laba* by canoes," &c.

Nothing could well be more explicit than this. And yet your correspondent represents Dr. Livingstone as saying that "he saw the Lua*pula* only at this gap in the mountains," and describes the Lua*laba* as being a month's journey further west, and as falling into the Lulua and so joining the Zaire, or great river of Congo, on the west coast of Africa. There must clearly be some mistake here.

I think, too, there must be some misapprehension respecting "the great salt marshes, which chiefly supply the interior of Africa," described by "F.R.G.S." as situated on the banks of the Lualaba, a great running stream of fresh water. Is it not more likely that those salt marshes lie in some extensive depression in the interior of the continent, having no outlet, but in which the rivers that may flow into it are absorbed and lost?

Further, according to Dr. Livingstone, the Lualaba, after leaving Moero beyond the town of the Cazembe to the north, forms Ulenge, either a lake with many islands or a division into several branches, which are taken up by the Lufira. This I understand to mean, that the junction of the Lualaba and the Lufira is in Ulenge, *north* of the Cazembe's residence. "F.R.G.S." says, on the contrary, that the Lufira "flows into the Luapula from the west about 100 miles S.W., or S.S.W., from the Cazembe." How are these two statements to be reconciled?

Then "F.R.G.S." says, "When our author speaks of the Luviri (Lufira) entering Tanganyika at Uvira, he evidently casts the dimly discerned views of the natives into his own preconceived mould, and clothes them in his own language." But Dr. Livingstone could scarcely have had any "preconceived" notions on the subject, unless he took with him Mr. Cooley's map of 1852, in which the Chambeze, under the name of the New Zambesi, is laid down as joining the Luviri and then, under the name of Luapula, falling into the lake of "Zangañika" on its west side in about 8° S. lat. And this opinion Mr. Cooley would seem to regard still as the correct one; for in a letter which appeared in the *Daily Telegraph* of the 27th August last, with his initials "W.D.C.," he expressly states that "the drainage of the Cazembe's country is all into the Nyanza on the east." Though why this name should be applied to the Lake of Tanganyika is not patent. We know the "Victoria Nyanza" of Speke, the "Albert Nyanza" of Baker, the "Lake Tanganyika" of Burton, and the "Lake Nyassa" of Livingstone. We also know that in Mr. Cooley's maps of 1845 and 1852, Tanganyika and the more southerly Lake Nyassa are made to form one continuous body of water under the name of "Nyassa, or the Sea." But the present

seems to be the first time that the designation of "Nyanza" has been applied, without any qualification, to the separate Lake Tanganyika. I perceive that "F.R.G.S." associates Captain Burton with this "Nyanza;" but such a name was never given to it by its discoverer, neither is it generally known by any other designation than that of "Lake Tanganyika:" whether or not it should properly be called the "Lake *of* Tanganyika" is of no moment.

I come now to the consideration of Dr. Livingstone's claim to the discovery of the sources of the Nile, which will be best given in his own words: "I think that I may safely assert that the chief sources of the Nile rise between 10° and 12° south latitude, or nearly in the position attributed to them by Ptolemy, whose river Rhaptus is probably the Rovuma." On this "F.R.G.S." acutely remarks: "Here two different problems are attempted to be solved at once—the one touching the sources of the White Nile, and the other those of Ptolemy's Nile;" in which remark he is no doubt substantially correct. Into the question of Ptolemy's sources of the Nile, on which subject "F.R.G.S." and I differ widely, I need not now enter: what I have here to do with, is the question of the chief sources of the Nile. And in order to decide whether Dr. Livingstone has really discovered these sources, it is, in the first instance, requisite to define the limits of the basin of the Nile, so as absolutely to determine where the sources of the river can or can not be situated. As those limits were approximatively determined in a paper "On the Nile and its Tributaries," communicated to the Royal Geographical Society in 1846, and published in the seventeenth volume of the Society's Journal, I cannot do better than reproduce the portion of it relating to this particular subject.

After describing the physical character of the table-land of Eastern Africa, of which Abyssinia forms the northern extremity, and its rivers as far as they were then known,—on which subject I need not dilate, as the substantial correctness of my views is now established,—I proceeded in these terms:—

"All the streams of the plateau or western counter-slope of the Abyssinian chain are affluents of the Nile, and their eastern-most branches take their rise at the extreme eastern edge of the table-land, which is the limit of the basin of the Nile, and the watershed between its tributaries and the rivers flowing E. and S.E. towards the Indian Ocean. On the seaward side of this watershed, the declivity being much more abrupt and its extent much more limited, the rivers must necessarily be of secondary importance. Thus, proceeding from the N., we do not meet with a stream deserving of name until we come to the Hawash; and even that river is, near Aussa, lost in Lake Abhebbad before reaching the ocean. The river Haines of Lieutenant Christopher, which is the next in succession, appears, in like manner, not to have sufficient power to reach the sea, at least not at all times of the year. Further to the S. we find the river Gowin (*i.e.* Wabbi-Giweyna) or Jubb, possessing a substantive character as an ocean stream; but this river, during the dry season, has at its mouth a depth of only two feet. At a short distance to the S. of the equator is the Ozay, which river, though said to be of great extent, has very little water at the entrance. Further S. the same law appears to prevail, as is exemplified in the Lufiji or Kwavi (Quavi), the Livuma [Rovuma] and the Kwama (Quama) or Kilimane (Quilimane), which rivers rise on the eastern edge of the elevated plain in which Lake Zambre or N'yassi is situate, and flow into the Indian Ocean. *Here, however, the southern extremity of the basin of the Nile having been passed*, the larger streams of the counter-slope no longer join that river, but take their course westwards into the Atlantic, belonging in fact to a distinct hydrographical basin."

What I thus wrote three-and-twenty years ago requires now but little modification. The erroneous identification of Lake Zambre with N'yassi was simply adopted from Mr. Cooley's learned and valuable paper in the fifteenth volume of the Society's Journal, which was then our only authority on the subject. I also followed him in his alteration of the spelling of the name "Zambre," which in my paper was printed "Zambeze," with the explanatory note, "This name is usually printed Zembere, Zembre, or Zambre. It is the Lake *Maravi* of the maps." Though even this was wrong; for Nyassa is properly Lake Maravi, and Tanganyika is the Great Lake, or Zambre. The blending of the two together by Delille and D'Anville was the primary cause of the long-existing misapprehension of the subject.

In my paper from which the foregoing extract is taken, when speaking of the lakes and swamps of the Upper Nile as then known, I added in a note, "May not Lake Zambre ('Zambeze'), or Nyassi, be the continuation of this series of lakes? In this case it would be simply the upper course of the Nile."

Acting on this suggestion, Professor Berghaus, in 1850, laid down Mr. Cooley's "Nyassi, or the Sea" as the head of the Nile; but, as I pointed out to him, he had under any circumstances carried the river too far south, because the Chevalier Bunsen and I had in the previous year come to the positive conclusion, on the reports of the Church missionaries at Mombas, that Zambre (now Tanganyika) and Nyassa were two separate lakes, a conclusion which every fresh discovery only tended to confirm.

The Cuama and Quilimane mentioned by me were all that we then well knew of the Zambesi, the great western extent of which river only became revealed to us through the former explorations of Livingstone. He thus absolutely closed the basin of the Nile in that direction; though the fact of his having done so was not then demonstrable. When he wrote to Lord Clarendon in February 1867, as he says in his present letter, he "had the impression that he was then on the watershed between the Zambesi and either the Congo or the Nile." His present determination of the want of connection between the Chambeze and the Zambesi, and of the western and north-western course of the former river, has proved the soundness of his impression of February 1867.

The question is therefore now narrowed to this:—Do the united streams of the Chambeze and the Lufira, under the name first of Luapula, and then of Lualaba, flow into the Nile or into the Congo? I am of opinion that they join the former river, and that the explorations of Dr. Livingstone have established the correctness of the views I have long entertained, and especially those enunciated in the *Athenæum*, No. 1,969, of July 22, 1865, on the first announcement by Sir Samuel Baker of his (unconscious) discovery of the main stream of the Nile under the name of "Albert Nyanza," and consequently I believe we are at length enabled to strip the veil from the Nile Mystery.

CHARLES BEKE

Bekesbourne, December 1

Food of Oceanic Animals

UNDER the above head, in a note which appeared in NATURE of the 16th Dec. p. 192, Mr. Gwyn Jeffreys "calls the attention of physiologists to the fact that plant-life appears to be absent in the ocean, with the exception of a comparatively narrow fringe, known as the littoral and laminarian zones, which girds the coasts, and of the 'Sargasso' tract in the Gulf of Mexico." He then proceeds to say that, "during the recent exploration in H.M.S. *Porcupine* of part of the North Atlantic, he could not detect the *slightest trace* of any vegetable organism at a greater depth than fifteen fathoms. Animal organisms of all kinds and sizes, living and dead, were everywhere abundant, from the surface to the bottom . . . some of them being zoophagons, others sarcophagons, none phytophagons." And, lastly, after asking "whence do oceanic animals get that supply of carbon which terrestrial and littoral or shallow-water animals derive, directly or indirectly, from plants?" and "can any class of marine animals assimilate the carbon contained in the sea, as plants assimilate the carbon contained in the air?" Mr. Jeffreys sums up his conclusions on the subject in the following words:—"At all events, the usual theory, that all animals ultimately depend for their nourishment on vegetable life, seems not to be applicable to the main ocean, and consequently not to one-half (*sic*) of the earth's surface."

As Mr. Jeffreys has been constituted an authority on deep-sea exploration, and now claims the view above cited as original, I must be permitted to point out that he has either forgotten what, at one period, he professed to have read and acquiesced in, in one of my writings; or that, for some unaccountable reason, he now repudiates both my opinions and those which were once his own.

As the entire absence of plant-life, even in its primitive phases, in the deeper abysses of the ocean, and the process whereby the nutrition of the lowest animal forms is secured in the absence of even the rudimentary digestive apparatus which is observable amongst the higher Rhizopods, were fully discussed by me in my "Notes on the Presence of Animal Life at great depths in the Ocean" (p. 27), published in 1860; in my work on "The North Sea-bed" (pp. 131-2), published in 1862; in a note which appeared in the *Annals and Magazine of Natural History* for August 1863 (p. 166); and more recently in two papers contributed by me to the *Monthly Journal of Microscopical*

Science, No. 1, pp. 32-33, and No. 4, pp. 231-2-3, published in the present year,—it will, I think, be admitted that Mr. Jeffreys can hardly claim originality in his statement.

But to prove that Mr. Jeffreys was well acquainted with my previously published observations on the subject, I invite attention to two distinct statements of his which appeared in his Reports on Dredging, and were published in the *Annals and Magazine of Natural History*, on the respective dates given below:—

Annals, Nov. 1866, p. 391.

"Dr. G. C. Wallich, in his admirable and philosophic treatise, with which all marine zoologists and geologists are, or ought to be, familiar, believed," &c. &c. "As to the accuracy of his statements, *no reasonable doubt can be entertained.*"

Annals, Oct. 1868, p. 305.

"Coccospheres and Foraminifera cover the bed of the Atlantic at enormous depths. The occurrence, therefore, of such organisms on the floor of the ocean, at great depths, does not prove that they ever lived there. *I should rather be inclined to believe* that they dropped to the bottom when dead, or after having passed through the stomachs of other animals which had fed on them."

It thus becomes manifest that Mr. Jeffreys had studied my writings, but that the opinions entertained by him in 1866 became revoked in 1868; whilst those held by him in 1868 were in turn superseded by views formed and published in 1869! This circumstance is the more significant, inasmuch as Dr. Carpenter, in his "Official Report on Dredging," for 1868 (p. 181), actually singles out the opinion published by Mr. Jeffreys, as above, in the autumn of the same year, as an authoritative illustration of the want of credence which my discoveries had met with!

With regard to Mr. Jeffreys' new division of oceanic animals into *zoophagons* and *sarcophagons*, I have nothing to urge beyond my avowed inability to discern any physiological difference between creatures that are zoophagous and those that are sarcophagous. It only remains for me to express my belief that, up to the present period, I have stood alone in maintaining, against Ehrenberg and others, that plant-life, even of the lowest types, becomes extinct at depths exceeding four or five hundred fathoms; and in endeavouring, by a series of observed facts, to prove that the nutrition of the Foraminifera and certain other oceanic Rhizopods is effected by a special vital process, which enables them to eliminate and apply to the formation and sustenance of their body and shell-substance, through their surfaces only, the materials which exist in the medium in which they reside.

Kensington, Dec. 21 G. C. WALLICH

Colouring of the Cuckow's Egg

As I see Professor Newton has, in his very interesting paper on Dr. Baldamus' theory of the colour of Cuckoo's eggs, noticed my "stigmatising" the Doctor's theory as "wild," in my "Birds of Somerset," will you be kind enough to allow me space for a few lines on the subject? Although it is with great diffidence that I venture to differ from Professor Newton, I still cannot help considering Dr. Baldamus' theory as "wild," not perhaps as it appears under the manipulation of Professor Newton, for he seems to me to have pruned and pared it down so nicely that there is but little of the original left; and I think he would not much differ from me in my opinion as to the wildness of the theory, if he had to accept all the allegations in Dr. Baldamus' paper published in *Naumannia*.* For instance, compare the following passage in Professor Newton's paper in No. III. of NATURE with some passages from Dr. Baldamus' paper:—

"Having said thus much, and believing as I do the Doctor to be partly justified in the carefully-worded enunciation of what he calls 'a law of nature,' I must now declare that it is only 'approximately,' and by no means universally true, that the Cuckow's egg is coloured like those of the victims of her imposition. Increase as we may by renewed observations the number of cases which bear in favour of his theory, yet, as almost every bird's-nesting boy knows, the instances in which we cannot, even by dint of straining our fancy, see resemblances where none exist, are still so numerous as to preclude me from believing in the generality of the practice imputed to the Cuckow. In proof of this I have only to mention the many eggs of that bird which are yearly found in nests of the *Hedge-Sparrow* in this country, *without ever bearing the faintest similarity to its well-known green-blue eggs*. One may grant that an ordinary English Cuckow's egg will pass well enough, in the eyes of the dupe, for that of a Titlark, a Pied Wagtail, or a Reed Wren, which according to my experience are the most common foster-parents of the Cuckow in this country; and indeed one may say, perhaps, that such an egg is a compromise between the three, or a resultant, perhaps, of the three opposing forces; *but any likeness between the Hedge-Sparrow's egg and the Cuckow's so often found alongside of it, or in its place, is not to be traced by the most fertile imagination*. We must keep, therefore, strictly to the letter of the law laid down by Dr. Baldamus, and the practice imputed to the Cuckow is not universally, but only approximately true." This certainly is very different from Dr. Baldamus' own statement:—"If Mr. Braune, the forester of Griezland, had not cut this large Willow Wren's (*Shippolais*) egg (as it seems) out of the ovary of the Cuckoo, which was killed as she was flying out of the Willow Wren's nest; if Count Rödern, of Breslau, was not a reliable authority that this apparent Redstart's egg was taken out of the nest of the Redstart (*Ruticilla phœnicurus*); if M. Halricht had not taken this large Tree Pipit's egg out of the nest of a Tree Pipit (*Anthus arboreus*); if I myself had not taken out of the nests of the Red-backed Shrike (*Lanius collurio*) this reddish and this green-greyish peculiarly marked Cuckoo's egg, one might indeed entertain doubts whether this variously-coloured collection—these *green eggs, with and without markings;* these on white, grey, green, greenish, brownish, yellowish, reddish, and brown-reddish ground; these grey, green, olive green, ash grey, yellow brown, yellow red, wine red, brown red, dark brown and black; these spotted, streaked, speckled, grained and marbled eggs could one and all be the eggs of our Cuckoo! And yet this is indeed the fact!" How different this from the much more cautious and limited statement of Professor Newton, first quoted, which would entirely sweep away some of these varieties, especially those resembling the eggs of the Redstart or the Hedge-Sparrow, for the eggs of these two species do not differ much from each other, and what might be said of the eggs of the one would apply equally to those of the other; yet these are two of Dr. Baldamus' selected species, for, a little further on, he gives a list of the various species from the nests of which Cuckoo's eggs have been taken resembling those of the foster-parent. Of the eggs of the Redstart he says:—"These four specimens, which were found in the nests of *Ruticilla phœnicurus*, are all of a light-green ground colour; two of them have the larger and more or less brownish spots, which on one of them form a zone; the third has similar markings, but only sparingly scattered over the whole surface, whilst the fourth is without any marking at all—herein it is identical with one in the possession of Dr. Dehne, which is *uniformly light-greenish blue, without any markings whatsoever.*"

Of the single specimen of the egg resembling that of the Hedge-Sparrow, No. 15 in his list, he says:—"One of the most interesting of the Cuckoo's eggs is a beautiful blue-green one, which was taken out of the nest of *Accentor modularis, without any markings*, and which even to the shell, the grain, and the size (bis auf Shale, Korn, und Grösse) is like a very dark egg of the Hedge-Sparrow." On reading this quotation from the statement of the facts on which his theory is founded by Dr. Baldamus in the paper in *Naumannia*, and comparing it with Professor Newton's paper above quoted, we cannot help seeing that there is a decided issue of fact between them, especially as to the eggs of *Accentor modularis*.

The conclusion which Dr. Baldamus draws from the facts stated by him is that Nature, by means of such arrangements, has ensured and facilitated the preservation of a species otherwise much exposed to danger, and that she has attained this object by investing every hen Cuckoo with the faculty of laying eggs coloured exactly like the eggs of the bird of whose nest she prefers to make use, according to the locality. Now if this were really the case, and it were really true that this colouring of the eggs were essential for the preservation of the species, would it not be just one of those laws of Nature which we should expect to find universal, or so nearly so that there would be but very few exceptions? But according to Dr. Baldamus himself the exceptions are numerous, and Professor Newton would make them still more numerous, and would no doubt be quite right in doing so. How, then, do the eggs in the exceptional cases prosper? Does the Hedge-Sparrow or the Redstart throw the egg of the Cuckoo out of its nest because it does not resemble its own? or do the birds to whose tender mercies the Cuckoo, according to Dr. Baldamus himself, is occasionally obliged to entrust its eggs when it cannot find a fitting nest in which to place them, do so? This does not appear to be at all

* Where I have quoted from this paper, I have quoted from the translation by the Rev. A. C. Smith, published in the *Zoologist* for 1868, which professes to be an accurate translation, and there seems to be no possible reason to doubt its being so.

the case, but the eggs remain in the nest in which they were originally placed by the parent Cuckoo, and are duly hatched by the foster-parent. That being so, the necessity for the law of nature which the Doctor wishes to establish falls to the ground. I do not like to put forward my own opinion against such great authorities as Dr. Baldamus and Professor Newton, but I think the inquiry now set on foot in this country by the publication in English of Dr. Baldamus' paper in *Naumannia* will be to show that Cuckoo's eggs do not in fact vary from each other more than those of many others, and that the resemblances to the eggs of many other species are not greater than sometimes arises in many ordinary cases. CECIL SMITH

The Cloaca Maxima

YOUR correspondent "Ignoramus" will find some account of the drainage of Rome in Pliny ("Hist. Nat." xxxvi. 15, s. 24). He will also find further particulars in Livy (i. 38), and in Ulpian ("Dig." 43, tit. 23, s. 1).

History repeats itself. Just as the London sewers were originally natural brooks or artificial ditches by which the rainfall of the district was carried off, and into which it was penal, down to the year 1815, to turn any "sewage" proper; so the Cloaca Maxima was built originally, in very early times (by Tarquinius Priscus, according to Livy), to carry off the rain-water from the Forum. Afterwards, however, all kinds of liquid refuse were allowed to find their way into it; and this seemed such a convenient way of getting rid of troublesome matter, that the whole city was eventually undermined by a network of sewers, including small pipes of wood and earthenware connecting the houses with the main sewers. Whether "traps" were also used I am unable to say, but I think it very probable that some simple combination of trap and cess-pit, in masonry, was used to prevent an up-blast of foul gas into the *atrium*.

What became of the solid refuse I do not know, but from all that I can gather I imagine it must have been carted away periodically. I trust some of your readers may have compassion for our ignorance, and, by enlightening us on this point, completely restore to "Ignoramus" that peace of mind which he lost in early childhood.

I trust also that the days of river cloacal pollution, in this country at least, are numbered, and that the advances which other sciences have made in the last 2,000 years will at last make our engineers ashamed of their ignorant violation of what I hope I may be allowed to call one of the laws of Nature.

W. HOPE

Hydro-carbon Colours

CAN your readers inform me of any book in which I can get to know all that is known on the "Hydro-carbon colours, and their application to Art industry," or direct me to any sources where the information can be obtained?

Plymouth, December 18 T. W. FRECKELTON

NOTES

THE *Journal of Botany* will pass into new management with the commencement of the year. The leading English botanists have promised their co-operation towards making it a complete record of the progress of botany at home and abroad during the month. It will in future be edited by Mr. W. H. Trimen, M.B., of the British Museum, author of "A Flora of Middlesex."

THE persistent decrease in the yield of our sea-fisheries has assumed a serious aspect, and urgently calls for systematic investigation at the hands of the Government. The usual machinery for such investigations, namely, a Royal Commission, could, however, hardly obtain the exact kind of information necessary for a determination of the probable cause of the mischief. Nothing short of the appointment of Inspectors of Sea Fisheries, with analogous functions to those discharged (with such beneficial results) by the Inspectors of Salmon Fisheries, can afford the opportunity for a thorough examination of the subject, and prepare the way for useful legislation. This course is ably advocated in the last number of *Land and Water*, and we feel it incumbent upon us strongly to second the recommendations of our contemporary on this point.

THE Ethnographical Section of the Geographical Society of Berlin, which has existed in a more or less definite form for about three years, has just separated itself from the parent organism, and entered upon an independent career as the Society for Anthropology and Ethnology. The first ordinary meeting of the new society took place on the 10th instant, when a paper was read by Professor Virchow on the North-German Pile-works. As compared with the great majority of such remains in Switzerland and South Germany, the pile-works of the North are not of very high antiquity. There is only one colony, that of Wismar, which belongs to the Stone period; even the older forms of bronze are rarely met with. The mode of construction of the pile-works likewise indicates an advance on that employed in Switzerland. Professor Virchow is of opinion that some, at least, of the earth-works found in certain districts are contemporary with the lake habitations: evidence on this interesting point is promised at some future time. That the pile-works, although of comparatively recent date, are really pre-historic, is indicated by the discovery of the remains of beaver and elk. The latter animal is not mentioned by the old chroniclers of Brandenburg and Pomerania; neither do we find mention of any lake-dwelling people in the ancient Scandinavian or Polish historians.

WE understand that steps are being taken to found an anthropological society in Hamburg, but no particulars have as yet reached us.

WE extract the following from the last Weekly Bulletin (26th inst.) of the Scientific Association of France:—"The vine occupies in France almost 2,500,000 hectares (6,175,000 acres). This constitutes the one-and-twentieth part of the French territory, and the sixteenth part of its soil capable of cultivation. The gross produce amounts to more than 1,500,000,000 francs. This industry occupies six million men, women, and children, and nearly two million merchants, agents, traders, &c. Sixty-nine departments cultivate the vine, from the Gironde, which reckons more than 150,000 hectares (370,500 acres), to the department of Ille-et-Vilaine, which only possesses 104 hectares (256 acres)."

THE commission appointed by the Imperial Academy of Medicine in Paris to investigate the subject of vaccination has just concluded its labours by the presentation of its Report, which has been adopted.

MR. J. MIERS, so well known for his researches in the Botany of South America, is about to publish the second and third volumes of his "Contributions to Botany," which will include a complete monograph of the *Menispermaceæ*, and of the South American species of *Ephedra*, showing that this genus does not belong to the Gymnosperms or naked-seeded plants, as generally believed.

IN a letter of the 17th ultimo, addressed to the *Astronomische Nachrichten*, Dr. Oppolzer discusses the observations of a faint comet discovered by Pons in February 1808, and arrives at the conclusion that it is exceedingly probable that the comet referred to is identical with that named after Winnecke. Dr. Oppolzer is at present engaged in working out the observations of the latter comet, more especially in reference to its supposed identity with Comet II. of 1766.

WE regret to learn from the recent report of the Miners' Association for Cornwall and Devonshire, that that useful body is in danger of being dissolved in consequence of the inadequate support it receives from the mining interest. The importance of combining scientific knowledge with practical experience, if we intend to maintain our present position in mining and metallurgy as against the highly-trained miners of other countries, is acknowledged by every competent person. Surely, then, when owners of mines and shareholders in mining companies learn that the Miners' Association not only discusses and publishes important scientific papers of a practical character, but is at the present

moment educating in its classes more than a hundred young men in chemistry, mineralogy, geology, and mining, they will not suffer so important an institution to die out or languish for want of funds. Mr. Robert Hunt, F.R.S., keeper of the Mining Records, is the hon. general secretary of the association. The Report for 1869 is published at Truro (Heard and Sons), and is to be had for a shilling.

BENZOL has been applied to a somewhat novel purpose. If poured on a piece of ordinary paper, immediate transparency is produced, to such an extent as to enable one to dispense entirely with tracing-paper. On exposure to air, or, better, a gentle heat, the liquid is entirely dissipated, the paper recovers its opacity, and the original design is found to be quite uninjured.

WE are glad to learn that the acceptance, by Dr. Czermak, of an honorary professorship in the University of Leipzig is likely to lead to a departure from the rule hitherto observed in the German universities, of treating physiology as an integral part of the medical course. No doubt lectures on general physiology, with a more particular view to the special requirements of the medical student, will always be necessary; but the claims of the general student to a sound knowledge of the principles and methods of this science can no longer be ignored. Independently of the fact that physiology deals with subjects of the highest possible general interest, it must not be forgotten that in its present stage of development it can hardly be looked upon otherwise than as an extension of the physical and chemical sciences. The lectures which Prof. Czermak contemplates giving for the general benefit of the University of Leipzig are not intended to be of a so-called popular nature. They will be of the same general character as the ordinary lectures on physics, logic, or general history. The Professor insists very strongly upon the absolute necessity of direct observation for a thorough understanding of the subject; and it is solely the want of a suitable theatre and apparatus for enabling large audiences to view physiological experiments, that prevents his entering upon the promised course of lectures this winter. Dr. Czermak spoke so eloquently and so thoroughly in earnest on this subject on the occasion of his recent installation as Honorary Professor, that we make no doubt he will be able to carry out his plans successfully during the ensuing summer term.

WE have a fresh illustration of the intimate alliance between science and commerce. Mr. Winwoode Reade recently set out from Sierra Leone to explore the interior, the funds of the expedition being defrayed by the munificence of Mr. Andrew Swanzy, a London merchant. Communications have been recently received stating that Mr. Reade, travelling on a line to the south-east of the routes of Park and Caillie, has reached a point farther south than any of his predecessors. The solitary traveller, after surmounting many difficulties, was rewarded by reaching a hitherto unknown town named Farabana, situate about 10° N. lat. and 10° W. long. He had crossed several rivers, flowing we presume from the watershed of Mount Loma, and was among the head-waters of the River Niger. The town, Farabana, contains about 10,000 inhabitants, well-disposed, and eager for trade. Mr. Reade mentions his having experienced protection and help from the Sultan of Bornir; we suppose, by orders issued to his subordinate chiefs and headmen, in this outlying district of his kingdom. We may hope that Mr. Reade's discoveries will enrich our maps with accurate geography of the country to the north of the Cong Mountains, as marked on the maps, and of the Niger from its source to the point where previous travellers have struck its stream.

THE theory of the derivation of the primitive population of Western Europe from an African source is likely to receive some confirmation from recent researches in Algeria. A Mr. Faidherbe, who has examined a necropolis of 3,000 Megalithic graves at Roknia, in the province of Constantine, reports that the skulls obtained have led him to the conclusion that the Berbers were the original people of the Atlas; and that they do not resemble any African or Semitic race, but rather the earliest inhabitants of Western Europe.

THE "Transactions of the Swedish Academy of Sciences for 1868" contain a paper proposing the use of the reindeer moss and various other species of lichen as a material for the manufacture of sugar and alcohol. By means of dilute sulphuric or muriatic acid, the cellulose of the plant is turned first into dextrine, and then into grape-sugar. No experiments on a large scale have as yet been made, but the author of the paper is sanguine as to the economic success of such an undertaking. Of the other papers printed in this volume of "Transactions," we may mention the following:—"On a remarkable species of sponge living in the North Sea," by Professor Sven Lovén, and "Swedish and Norwegian Diatoms," by P. T. Cleve. These communications are illustrated by drawings. The other papers, with the exception of three by Edlund, detailing researches in reference to the electric spark, relate chiefly to the fauna and geology of various parts of the Swedish kingdom. The Memoirs of this Academy for the year 1868, containing the more important papers presented, have not yet reached us.

THE Native Guano Company, now successfully treating the sewage of the town of Leamington by the A.B.C. process, have applied to the Metropolitan Board of Works to enter into a treaty with them for the concession of the sewage on the south side of the Thames. The question has been referred to the Works Committee. Should the concession be granted, the movements of the company will be watched with great interest, as their success or failure will tend greatly to settle the question of the possibility of making the purification of the sewage of *great towns* a commercial success.

HERR KARL BRUHNS, director of the Berlin Observatory, is preparing for publication a scientific life of Humboldt, to which several illustrious German scientific men have promised to contribute. The first portion, from the pen of Dr. Ave Lallemand, will contain the life, properly so called, of Humboldt. The second part will be devoted to an account of his researches and discoveries. This latter part will occupy eight chapters, and will be confided to writers possessing special qualifications for the task. Persons having in their possession unpublished materials relative to the life or labours of Humboldt are requested to transmit them to Herr Bruhns.

OYSTERS are now so dear in London that we may reap some contentment by learning that they are sold wholesale in San Francisco, at the rate of six shillings a dozen. These oysters are said very much to resemble our "natives;" being round, fat, full-flavoured, and very good; but they do not suit the taste of those who have long enjoyed the luxury of the large, delicate molluscs of the Atlantic seaboard. There are fine beds of the long-shelled oyster in the Gulf of California, and as they will not grow in the Pacific, they are transported 1,700 miles by steamer to "Frisco;" about half the cargo dying on the passage. Notwithstanding all the oyster controversy and oyster literature of recent years, it is still very hard to understand why they should be so dear in London. At Van Laar's shop, in the Kalverstraat, at Amsterdam, the very finest oysters, thought by many to be much superior to the "natives," may be eaten at the rate of 50 cents (10*d.*) the dozen.

THE first part of a Hand-List of Genera and Species of Birds, by Mr. G. R. Gray, has just been issued from the British Museum. It includes the *Accipitres*, *Tenuirostres*, and *Dentirostres*, and forms an octavo volume of 400 pages. All the recognised genera, sub-genera, and species are enumerated, and not merely the

species represented in the national collection. The latter are, however, specially indicated. Some notion of the marvellous variety of bird-form may be gathered from the fact that this volume gives the name and habitat of no less than 6,057 species. The second and concluding volume is stated to be far advanced towards completion. We have also to chronicle, for the benefit of our entomological readers, the appearance of Part II. of the Catalogue of Specimens of *Dermoptera Saltatoria* in the British Museum, by Mr. Francis Walker.

A LARGE depôt of petroleum has just been discovered in the Caucasus. It is situated on the east of the Caspian, where there are large numbers of these springs, many of them occurring in close proximity. This new spring is said to be capable of producing 40,000 livres daily. The American method has recently been adopted with the greatest success.

DR. ROBINET, formerly president of the Paris Academy of Medicine, member of the Municipal Council, and at one time president of the Hygienic and Sanitary Commission of the City of Paris, has just died. His decease was due to an affection of the chest, contracted whilst on a scientific expedition in Germany. Dr. Robinet had completed his 72nd year.

IT appears that the surface glass which contains soda undergoes considerable change after a lengthy exposure to the air. Bluish glass undergoes no such alteration, but that which has originally a greenish tinge becomes brown after a time, whilst very pure white deteriorates rapidly, showing first a yellow, then a brown, and finally a violet film. At this season of the year we do not require this additional colouring to the appearance of our already discoloured atmosphere. It has been noticed that some modern stained glass on a foggy day has almost the richness of the ancient. We need not go far for a solution of this. The old glass has acquired in the course of ages a film which takes the place of a permanent fog, especially on those colours which, like the ruby, are formed by a thin coating of the coloured glass on a thicker plate of transparent metal.

THE Agricultural Society of France has recently addressed the following questions to each of its members, and to the presidents of all the French Agricultural Associations:—"1. Can the depreciation in the price of wool be remedied; and, if so, by what means? Does the rise in the price of meat afford a sufficient compensation to the producers of wool? 2. Do the production and sale of cereals meet with any obstacle demanding the attention of the legislator? 3. Is there any defect in the facilities for increasing the domestic consumption or the exportation of wine? 4. Have the agricultural industries, especially those which produce alcohol and sugar, any need o modification as regards the economic regulations to which they are subject? 5. Are there in your district any other branches of agricultural produce suffering from a crisis to which it would be necessary to call public and legislative attention?"

WE have been requested to state that the cable laid between Salcombe and Finisterre (Dec. 2nd) was manufactured at W. T. Henley's Telegraph Works, North Woolwich.

SCIENTIFIC SERIALS

IN the *Annales des Sciences Naturelles* (Zoologie, Tome xii. Nos. 3 and 4), M. Marcy continues his elaborate paper on the flight of Insects and Birds. Prof. E. Lartet describes and figures *Trechomys Boudnellii* and two other fossil rodents of the Eocene of Paris. New observations on the Zoological Characters and Natural Affinities of the Æpyornis of Madagascar are given by MM. Alphonse Milne-Edwards and Alf. Grandidier. Their paper is illustrated by a fine series of figures of the bones of these gigantic fossil birds: even the enormous bones of the lower limb are drawn the size of nature. The present double number of the *Annales* is concluded by a communication from M. Edward Perrier, entitled "Researches on the *pedicellaria* and *ambulacra* of star-fishes and sea-urchins."

THE November number of the *Annales de Chimie et de Physique* contains the termination of a long memoir by Lecoq de Boisbaudran, on Supersaturation; a memoir by Des Cloiseaux, on Gadolinite, a mineral whose anomalies are very lucidly connected and explained; a very interesting paper by Boussingault, on the Function of Leaves, in which the influence of light is studied as affecting the decomposition of carbonic acid; Observations on a Note of M. Velter as to the agricultural utility of salt, by Peligot; a Chemical Study of Egyptian wheat, by Aug. Houzeau; the Polarisation of the Blue Light of Water, by J. L. Soret (taken from the Geneva *Archives*); and an account of Roberts's elegant experiment, showing the increase of volume undergone by palladium in combining with hydrogen.

THE November number of Reichert and Du Bois Reymond's *Archiv fur Anatomie* contains the following papers:—"The Influence of Artificial Respiration on Reflex," by Dr. P. Urspensky, of St. Petersburg; "Musculi subcrurales et Subanconaci," by Dr. M. Kulaewsky; "The 'Ramus collateralis ulnaris nervi radialis again," by Professor W. Krause, of Göttingen; "The Inter-arytænoid Cartilage of the Human Vocal Organs," by Professor H. von Luschka, of Tübingen (plate); "On the Influence of the Curara Poison on the Electromotor Power of Muscles and Nerves," by Hermann Rocher; "The Nervi Splanchnici and the Ganglion Cœliacum," by F. Bidder, of Dorpat; "On the Musculus Broncho-œsophagus Dexter," a communication by Dr. Wenzel Gruber, Professor of Anatomy at St. Petersburg.

POGGENDORFF'S *Annalen der Physik und Chemie*, 1869. (No. 11. Vol. cxxxviii. Part 3). The physical papers in this number (the last published) are:—

(1.) "On the applicability of Ohm's Law to Electrolytes, with a numerical determination of the Electrical Resistance of dilute sulphuric acid by means of alternating currents," by F. Kohlrausch and W. A. Nippoldt (pp. 370 to 390). This paper forms the continuation and conclusion of one begun in the previous number of the "Annalen." After discussing the special difficulties that lie in the way of accurate determinations of the galvanometric properties of electrolytes, the authors show how the most important of them, the polarisation of the electrodes, may be overcome by substituting for a continuous current in one direction a rapid succession of currents of short duration in opposite directions. Such currents were obtained by the rotation of a steel magnet inside a coil of wire; and the employment of them necessitated the use of a Weber's bifilar dynamometer, instead of an ordinary galvanometer. There is a full discussion of the action of the rotating magnet, showing the mean electromotive force due to a given velocity of revolution, and the action of the resulting current on the dynamometer. In the part of the paper now published, the strength of the current traversing a column of dilute sulphuric acid is proved to be proportional to the electromotive force even when the latter does not exceed $\frac{1}{74}$ part of that of a Grove's cell. By using thermo-electric currents, the proportionality between electromotive force and strength of current, in the case of solution of sulphate of zinc between amalgamated zinc electrodes, is shown to hold good even when the electromotive force is only $\frac{1}{429000}$ of that of a Grove's cell. The paper concludes with a series of numerical determinations of the specific resistance of dilute sulphuric acid of various degrees of concentration, from which we quote the following:—At 22° C. the maximum conducting power is possessed by sulphuric acid of specific gravity 1·233 (containing 31·5 per cent. hydric sulphate); taking the conducting power of mercury at 0° as unity, the conducting power of such acid is 0·000077274.

(2.) "On a Comparable Scale for Spectroscopic Observations," by A. Weinhold (pp. 417 to 439). In order to compare the indications of various spectroscopes, the author proposes to denote the various parts of the spectrum by reference to the interference-bands seen in the spectrum of light reflected from a thin plate of biaxial mica; and to reduce the results obtained by the use of plates of various degrees of thickness to a common denomination, by taking two definite parts of the spectrum, *e.g.*, Fraunhofer's lines D and F, as fixed points, and dividing the interval between them into 100 parts. The bands of the interference-spectrum then become comparable with the divisions on an arbitrarily graduated thermometer, the value of which is determined by observing two fixed temperatures. The paper contains a full and careful description of the way of carrying out the proposed method in practice.

(3.) "Experiments on Retarded Ebullition" (third part), by

G. Krebs (pp. 439 to 448). The author describes experiments, with tiresome fulness of detail, in proof of the fact that the pressure upon water which has been long boiled may be reduced considerably below the maximum tension of aqueous vapour at the temperature of the water, without ebullition taking place; but if, under these circumstances, a further sudden diminution of pressure takes place, or if the water is heated, very rapid or even explosive ebullition is liable to occur.

(4). "Lightning without Thunder," by Prof. Th. Hoh (p. 496). In the night between the 25th and 26th July, the author observed *forked* lightning unaccompanied by thunder.

The other papers in this number are: "Investigation of Mica and allied minerals," by M. Bauer (pp. 337 to 370); "Studies of the oxygen-compounds of the Halogens," by Hermann Kämmerer (pp. 390 to 417); "Mineralogical Communications" (eighth part), by G. von Rath (pp. 449 to 496).

BOTANY

The Diffusion of Plants

PROF. DELPINO, of Florence, has published some interesting researches on the relation between the diffusion of plants and animals. The life of every plant has three principal objects: its nourishment, its reproduction, and the distribution of its seeds; for each of these three objects special biological conditions being requisite. The fertilisation of many plants can be effected only by some particular animal; as *Arum italicum*, *Aristolochia*, and *Asarum*, by gnats; the fig tribe by different species of *Cynips* (or gall-fly); *Arum dracunculus*, *Stapelia*, and *Rafflesia*, by blue-bottle flies; many others by different kinds of flies or bee-like insects (*Hymenoptera*), and some even by small birds belonging to the family of *Trochilidæ*, or humming-birds; *Rosa*, *Pæonia*, and *Magnolia grandiflora*, by beetles of the chafer tribe; others again by small slugs. If in any particular locality the animal necessary for the fertilisation of a particular plant is absent, it is certain that the plant cannot spread; and thus the conditions for the diffusion of plants are dependent on the geographical distribution of animals. A remarkable illustration is furnished by two plants belonging to the same genus, grown in the botanic gardens in Italy, *Lobelia syphilitica* and *L. fulgens;* the flowers of the former are abundantly visited by *Bombris terrestris* and *italicus*, and freely produce seeds; the latter, notwithstanding its beauty and its great store of honey, is never visited by insects in the neighbourhood of Florence, and never bears seeds spontaneously, but can be readily fertilised by artificial impregnation. Prof. Delpino conjectures that it is naturally fertilised by humming-birds. He believes that the scarlet colour of the corolla, so common in the tropics, but comparatively rare with us, is especially attractive to small birds, but offensive rather than otherwise to *Hymenoptera*. As a rule, scarlet flowers are large, bag-like in form, horizontal in position, and with the nectar completely separated, which would of itself perfectly prevent their fertilisation by insects. The largest European flowers, such as the pæony and large bird-weed (*Convolvulus sepium*) are fertilised by sphinxes and rose-chafers. [Botanische Zeitung.]

The Victoria Regia

THIS magnificent plant has thriven to an unprecedented degree during the past summer in the Botanic Garden at Ghent. Several leaves have attained a diameter of nine feet, and have supported a weight of 250 lbs., and one even the enormous weight of 500 lbs. Seven of the gigantic leaves completely covered the basin of 164 feet square, and they were obliged to be removed to make room for the young leaves which continued to develop in the centre. Every four or five days a fresh flower appeared, which lasted only two days, or rather two nights, opening in the morning of a perfectly white colour, diffusing about five or six P.M. a very powerful odour of vanilla, closing the next morning at 8 or 9 A.M., opening the same day towards evening, this time of a beautiful carmine, and finally closing the next morning. The magnificent leaves last through the summer; the plant begins to dwindle in October, and dies towards December. About this time the seeds, which have been obtained by artificial fecundation, arrive at maturity. They are sown in January, and appear above the ground in about six weeks. Their infancy is very critical; but once past this period, the young plants grow with astonishing rapidity; the plant in the Ghent Botanic Gardens, unquestionably the finest that has ever been cultivated, arrived at its full development in five months.

CHEMISTRY

Lenz on Electrolytic Iron

THE remarkable results of Graham's experiments on the occlusion of gases have induced Lenz to examine the relation of galvanically-deposited iron to this important function. With the aid of a Sprengel pump and apparatus differing but little from that employed by Graham, he has arrived at the following conclusions. Iron and copper, prepared by the reducing action of a galvanic current, contain gases, hydrogen more especially. The volume of the gas absorbed by iron varies within very wide limits, but may amount to 185 times the bulk of the iron, to the surface of which its presence is principally confined. The gas extricated from such iron, at temperatures under 100°, consists almost solely of hydrogen.

MINERALOGY

Des Cloiseaux on Gadolinite

THIS rare mineral has been studied by different crystallographers with apparently contradictory results. Haüy, Phillips, Lévy, Scheerer, and Waage have included it in the clino-rhombic system; Miller, Nordenskiöld, and Von Lang regard it as ortho-rhombic. The question could not be definitively settled by angular measurements, inasmuch as the primitive prism is a limiting form, bearing upon the corresponding elements of its anterior and posterior portions modifications whose incidences only differ by a few minutes. The author showed in 1860 that some species of gadolinite are mono-refractive, some bi-refractive, and some are mixtures of those two kinds; but it was not until the summer of last year that he was able to accumulate sufficient material for an exhaustive investigation. It now appears (1) that the Hitteröe crystals measured by Waage and the author, and analysed by Scheerer, have an energetic bi-axial refraction on two optic axes; the orientation of these axes, that of their bisectrix and their *inclined* dispersion, prove that the primitive form is an oblique rhomboidal prism, whose plane of symmetry is the same as that of the axes: this variety contains 10 to 12 per cent. of glucina. (2) The most homogeneous of the Ytterly crystals, measured by Von Lang and analysed by Berlin, are mono-refractive; they exhibit a certain number of peculiar modifications, in addition to those shown in the Hitteröe crystals, of which they are the pseudomorphs; and they do *not* contain glucina. (3) The heterogeneous specimens are forms in transition from the first to the second variety; they contain from 2 to 6 per cent. of glucina. These three kinds of gadolinite differ entirely in their symbolic chemical relations. The bi-refractive kind has the formula $\dot{R}_3\ddot{S}i$; the mono-refractive is a sort of peridote, $\dot{R}_2\ddot{S}i$; and the transition forms give an undecided result, the ratio between the oxygen of the silica and that of the bases varying from 3 : 4 to 4 : 5. These differences of constitution probably originate in local circumstances. The Hitteröe mineral seems associated with malacon and polycrase, in a granitic vein composed of quartz, orthose, and oligoclase (with a little mica), and crossing the "gabbro" of which the greater part of the island of Hitteröe is formed: but that of Ytterby is chiefly accompanied by yttrotantalite and fergusonite, and imbedded in a red lamellar orthose, divided by large plates of black mica. [Ann. Ch. et Phys. (4) xviii. 305.]

ZOOLOGY

Development of Sacculina

IN a note, published last February, on the development of the egg in those curious crustacean parasites, the *Sacculinæ*, M. Gerbe stated that the ovules of these animals are formed at first of two transparent vesicles or cells, each furnished with a nucleus and a common membrane; that one of these cells enlarges considerably, and that at the maturity of the ovum, the large cell in which the elements of the vitellus have been developed predominates to such an extent that the smaller one forms only a minute prominence at one pole of the ovum. M. Gerbe compared the large cell to the yolk in the eggs of birds, and regarded the small one as representing the germ or cicatricula. This homology was also applied by him to the ova of the *Arachnida* and *Myriopoda*.

M. E. van Beneden finds that the ovules are not at first composed of two closely applied cells, but that they form a single cell, formed of a transparent protoplasm, containing a few strongly refractive globules, and of a vesicular nucleus with a nucleolus. With these are observed others of an elongated form,

and possessing two nuclei, but showing no signs of division, and others, again, which present at one end a small bud, the size of which increases until it equals that of the mother-cell, when one of the nuclei passes into the daughter-cell, and as the division between the two cells becomes more distinct, the appearance described by M. Gerbe is produced. M. van Beneden could could not, however, detect any cell-membrane.

The development of the ovule then goes on much as described by M. Gerbe, one of the daughter-cells being enlarged much more rapidly than the other, and acquiring a vitelline character. When it has attained a diameter of 0·015—0·018 millimetre, a cell-membrane (vitelline membrane) may be detected, which, however, only covers the larger cell. With these ova others are found in which the smaller or polar cell is no longer to be distinguished, but which present at one point a depression representing the surface to which it was attached: the ova when deposited never present the least trace of the polar-cell; but after oviposition the ovaries contain numerous cells, resembling the original mother-cells, which are really the polar-cells thrown off from the mature ova. These, M. van Beneden believes, *become the mother-cells of a new set of ovules*. He supports this opinion by several instances derived from crustacea of other groups, such as *Caligus*, *Calvella*, *Lernanthropus*, *Congericola*, *Anchorella*, *Lernæopoda*, &c., in which analogous phenomena occur.

M. van Beneden remarks, that in the ova of *Sacculina* segmentation of the whole contents of the ovum takes place, and he describes the process. This, as he says, excludes the idea of a cicatricula, which occurs only where a great part of the nutritive material exists outside the protoplasm of the ovicell, as in birds. Hence there can be no comparison between the egg of the *Sacculinæ* and that of birds, nor has it any special analogy to that of the *Arachnida* and *Myriopoda*.

SOCIETIES AND ACADEMIES

LONDON

Ethnological Society, December 21.—Prof. Huxley, LL.D., F.R.S., president, in the chair. An ancient calvaria, which has been assigned to Confucius, was exhibited and described by Prof. Busk, F.R.S. This calvaria was formerly set in gold, richly ornamented, and mounted on a tripod, probably for use as a drinking vessel. It was taken from the Emperor of China's Summer Palace at Peking. The author has discovered four figures upon the skull in faint relief; that upon the frontal portion being the letter A in a Tibetan form of Sanskrit, referable to about the seventh or eighth century of our era. The skull was evidently that of a male advanced in age, but all the evidence tended to show that it ought not to be attributed to Confucius. The President suggested that those portions of the skull which now appear sculptured in relief might have been originally covered with some solid material which would have served as a protection, while the surrounding surface was worn down by constant handling. The Australians still use calvariæ, ornamented in a like manner. Mr. Fergusson alluded to the character of the workmanship displayed by the ornamentation, which had been barbarously removed. He regarded the skull as that of a distinguished personage—either a friend or a foe of some Chinese emperor; and thought that its use as a drinking-cup was supported by a passage in "Herodotus." Mr. Mummery, the present owner of the calvaria, explained the curious manner in which it came into his possession. Dr. Campbell referred to the Buddhist practice of using human thigh-bones as trumpets for calling to prayers. Mr. Donovan regarded the skull, from its small size, as belonging to an uneducated female.—At the same meeting Major Millingen, F.R.G.S., read a long paper on the "Koords and Armenians," in which he gave his reasons for identifying the modern Koords with the ancient Karduks mentioned by Xenophon. The language spoken in Koordistan is entirely different from either Persian or Turkish, and is said to be divided into several dialects. The Koords were described as a rapacious and faithless people, rejoicing in plunder and slaughter; and not the least interesting part of the paper was the description of a peculiar system of female brigandage. The Koordish race were said to be remarkably handsome, and to exhibit a great variety of complexion; a dark skin, with black hair and black eyes, is the most common, but light hair and blue eyes are also to be seen.

Statistical Society, December 21.—Mr. Newmarch, F.R.S., president, in the chair. A Report on the Seventh International Statistical Congress at the Hague was read by Mr. Brown, after which Mr. R. H. Inglis Palgrave read a paper "On the House Accommodation of England and Wales." Mr. Palgrave commenced by stating that the population of England is now probably better housed than at the commencement of the century. The average number of inhabitants to a house has slightly diminished since 1801. Mr. Palgrave continued to point out that, covered by a general average, which appeared to show ample accommodation, were great inequalities. The information obtained in the English census inquiries scarcely gives the means of tracing the subject further; but the last census in Scotland showed that one-third of the population lived each family in dwellings of only one room; another third in dwellings of two rooms; only the remaining third being lodged with comfort and decency. Mr. Palgrave showed by an analysis of Mr. Dudley Baxter's calculations, that the lowest section of the population in England was nearly twice as closely packed as the general average, in dwellings more than proportionately inferior; and by a reference to the Report on the Employment of Children and Women in Agriculture, that the condition of some rural districts apparently well provided for was scarcely superior to that of Scotland. Mr. Palgrave concluded by proposing that the census inquiry for 1871 should include more details on the house accommodation of England, Wales, and Scotland, thus to ascertain present deficiencies, and to assist those who desire to remedy the evils arising therefrom. The following gentlemen were elected Fellows, viz.:—Sir Massey Lopes, Bart., M.P., Hon. H. N. D. Beyts, Dr. Macaulay, Messrs. J. O. Chadwick, A. H. Smee, C. Inglis, M.D., Hammond Chubb, S. Ingall, and James M. Davies.

Institute of Actuaries, December 21.—Mr. S. Brown, president, in the chair. The following gentlemen were elected members, viz.:—Fellows, Messrs. Cornelius Walford and Joseph J. Dymond; and Associates, Messrs. A. C. Waters, Ainslie, Talon, E. J. Sims, jun., Henry Jeula, James D. Hobson, J. Ashton, J. H. Elder, and Joseph Burne. Mr. J. B. Sprague, M.A., read a paper "On the rate of mortality prevailing among assured lives, as influenced by the length of time for which they have been assured."

EDINBURGH

Royal Society of Edinburgh, December 20.—Professor Kelland, president, in the chair. The Keith Prize for the biennial period ending May 1869 having been awarded by the Council to Professor P. G. Tait, for his paper "On the Rotation of a Rigid Body about a Fixed Point," the medal was formally delivered to him, after which Professor Kelland, in making the presentation, said he had great pleasure in accompanying it with the sum of £57 os. 10d. He briefly referred to the manner in which Professor Tait was applying the method of quaternions, and mentioned that he was now putting on a more solid basis what they might call the mechanical sciences. On every account Professor Tait was entitled to the honour which had been conferred upon him, and he had no hesitation in saying that this was only the first of a series of successes.— Mr. Archd. Geikie read a paper "On the Geological Structure of some Alpine Lake Basins." In this paper the author reviewed the arguments which had been adduced by the geologists of Switzerland to prove that the great lakes of that country are essential parts of the architecture of the Alps. He stated that this view was untenable, for the lakes, instead of coinciding with the foldings and fractures of the rocks, ran directly across them. He entered in some detail into the geological structure of several of the Alpine lakes, particularly of the Lake of the Four Cantons, with the view of showing that between the contortions and dislocations of the rocks and the trend of the lake there is no ascertained connection. By a series of diagrams he pointed out how vast an amount of rock had been removed from the site of the lake and the adjacent mountains, and that it was physically impossible that any remnant of the original surface at the time when the rocks were folded could now remain. Particular attention was called to the fact that the greatest of the known dislocations of the Alps—the fracture which has brought down the miocene against the older tertiary and secondary rocks—has not given rise to lakes and valleys, but actually crosses them, as at the lakes of Geneva, Thun, and Lucerne, and in the valleys of the Rhine and Linth. After combating the explanation by which the lakes are referred to

general and special movements of subsidence, the author dwelt upon the intimate connection between the Alpine lakes and the innumerable rock basins of the rest of the northern hemisphere. This connection, he said, could hardly be accidental. It pointed to some general cause which had been at work during a recent geological period, and he could not doubt but that this general cause was the thick mantle of ice which, from independent evidence, can be shown to have enveloped a great part of Europe and North America. The idea of the erosion of lake basins by the grinding power of land ice had been first propounded by Professor Ramsay, and there seemed every reason to believe that this view would come eventually to be accepted even by the geologists of Switzerland. — Professor Turner read a preliminary notice of the great finner whale recently stranded at Longniddry. It was so seldom that one of these large whales found its way to our very doors, and there were still so many unsolved problems to be worked out in connection with the structure and classification of the larger cetacea, that he gladly availed himself of the arrival of the rare visitor to devote such time as he could spare to the study of the huge creature. The length of the animal, he said, measured from the tip of the lower jaw to the end of the tail, 78 feet 9 inches. The girth of the body, immediately behind the flipper, was 45 feet. Its girth, in line with the oval orifice, was 28 feet, whilst around the root of the tail it was only 7 feet 6 inches. The inner surface of the lower jaw close to its upper edge and on the border was concave, and sloped inwards so as to admit the edge of the upper jaw within it. The length from the angle of the mouth to the top of the lower jaw, along the curved border, was 21 feet 8 inches. The dorsum of the upper jaw was not arched in the antero posterior direction. It sloped gently upwards and backwards to the blow holes, from which a low but readily recognised median ridge passed forwards on the back, gradually subsiding some distance behind its tip. On each side of this ridge was a shallow concavity immediately in front of the blow holes, the ridge bifurcated and the forks passed backwards, enclosing the nostrils for several inches, and then subsided. The outer borders of the upper jaw were not straight, but extended forward from the angle of the mouth for some distance in a gentle curve, and then rapidly converging in front formed a somewhat pointed tip. Their rounded palatal edges fitted within the arch of the lower jaw. The transverse diameter of the upper jaw over its dorsum between the angles of the mouth was 13 feet 3 inches. From the blow holes the outline of the back, curved upwards and backwards, was uniformly smooth and rounded, and for a considerable distance presented no dorsal mesial ridge. From the tip of the lower jaw to the anterior border of the dorsal fin, the measurement was 59 feet 3 inches. Behind the dorsal fin the sides of the animal sloped rapidly downwards to the ventral surface, so that the dorsal and ventral mesial lines were clearly marked, and the sides tapered off to the tail. The ventral surface of the throat, and the sides and ventral surface of the chest and belly, were marked by numerous longitudinal ridges and furrows. When he first saw the animal, the furrows separating the ridges were not more than from $\frac{1}{4}$ to $\frac{3}{4}$ of an inch broad, whilst the ridges themselves were in many places 4 inches in breadth; but as the body began to swell by the formation of gas from decomposition, the furrows were opened up, became wider and shallower, and the ridges underwent a corresponding diminution in breadth. The flipper projected from the side of the body thirty-one feet four inches behind the top of the lower jaw, and fourteen feet behind the angle of the mouth. It curved outwards and inwards, terminating in a free, pointed end. The distance between the two flippers, measured over the back between the anterior borders of their roots, was eighteen feet six inches. On the dorsum of the beak and of the cranium, on the back of the body, and for some distance down its sides, the colour was dark steel, amounting in some sights almost to black. On a line with the pectoral flipper the sides were mottled with white, and on the ventral surface irregular, and in some cases large patches of silver grey or whitish colour were seen. The dorsal fin was steel grey or black, except near its posterior border, where it was a shade lighter and streaked with black lines. The anterior of the lobes of the tail, its upper surface near the root and for the anterior two-thirds, were black. The upper surface of the flipper was steel grey, mottled with white at the root, at the tip along its posterior or internal border and on the under surface white patches were seen, on the upper surface near the tip, and here they were streaked with black lines running in the long axis of the flipper. White patches also extended from the root of the flipper to the adjacent parts of the sides of the animal. The outside of the lower jaw was black, whilst the inside was streaked with grey and brown. The tongue of the whale was of enormous size. The dorsum was comparatively smooth in front, but at the posterior part it was elevated into hillocks, which were separated by deep furrows. The baleen had a deep black colour, and consisted on each side of the plates which projected from the palate into the cavity of the mouth. The plates were arranged in rows—370 were counted on each side—which lay somewhat obliquely across the palate, extending from near the base of the great mesial palatal ridge to the outer edge of the palate. The plates diminished in size so much that at the tip, where the two sets of baleen became continuous, they were merely stiff bristles. He was happy to state, however, that the skeleton had been secured by the directors of the Museum of Science and Art in this city, who had granted him permission to examine it as soon as it was in a fit state. Prof. M'Donald gave it as his opinion that the whale which stranded at Longniddry was a water-breathing animal, and not an air-breathing animal.—The other paper read was "On the Aggregation in the Dublin Lying-in Hospital."

MILAN

Royal Lombardian Institute, November 11.—Professor Schiaparelli communicated a note upon a recent pamphlet by Signor Gaetano Baratta, proposing a method for the geometrical trisection of any given angle. He showed by a table of measurements that the first angle obtained by M. Baratta's rule is always greater than one-third of the primary angle.—Professor Emilio Villari presented a memoir on the electro-motor force of palladium in gas batteries. The author was led by the consideration of the great attractive force of palladium for hydrogen, and the fact that the hydrogen thus held by palladium possesses great chemical activity, to apply it to the construction of gas batteries. He described the mode in which he constructed his batteries and the experiments performed with them, which showed very complex actions, but proved that a palladium-element has a greater electro-motor force than one of Grove's gas-elements, because hydrogen in contact with palladium is considerably more oxydisable than hydrogen in contact with platinum. This electro-motor force is still further increased if the palladium which is in contact with oxygen (*i.e.*, the positive electrode) is oxydised. —A new determination of the orbit of Clytie (asteroid 73), with ephemerides, by Signor Giovanni Celoria, was communicated by Professor Schiaparelli.

MONTREAL

Natural History Society, November 29.—Principal Dawson in the chair. Mr. Billings read a paper on the genus *Scolithus*, and some allied Fossils. The fossils known under the names of *Scolithus* and *Arenicolites* were described as consisting of cylindrical or rod-like bodies, which penetrate the layers of sandstone perpendicularly downwards, to a distance varying from a few lines to two or three feet. There are several varieties, the most common of which has the rods from one-twelfth to one-fourth of an inch in diameter; in another more rare form they have at the surface of the beds a wide trumpet-shaped expansion, two or three inches across, but taper to a point below, where they are, in general, more or less curved. Under certain circumstances, they can be entirely separated from the rock, and then present the appearance of simple cylindrical or conical rods of sandstone with no internal structure. All the varieties are more or less distinctly marked by a series of oblique annulations—a character which Mr. Billings thought to be of importance, as it seemed to show they were all members of one family of organisms. So long as these fossils were only known by specimens exhibiting no internal structure, it was impossible to decide to which division of the animal or vegetable kingdom they belonged. The Geological Survey had, however, ascertained that the Potsdam formation included a considerable deposit of limestone, in which the same fossil forms were found, with the internal structure beautifully preserved. By these it was proved that they were not the casts of worm-burrows, but sponges. Mr. Billings believed that these ancient sponges, or at least many of them, lived in the sand or soft ooze of the ocean's bottom, with their sometimes wide and trumpet-shaped mouths either even with or a little elevated above the surface. During the discussion that followed the reading of the paper, Dr. Dawson said that if Mr. Billings was right, it would appear that in the seas of the earlier ages protozoic life had the preponderance. In reply to a question by Mr. Whiteaves, Mr. Billings said that siliceous spiculæ

were found in great abundance in association with these sponges. They were generally of an elongated pyriform shape (the "acerate" form of Bowerbank). He supposed they were originally calcareous, but had become siliceous during the progress of fossilisation.—The next communication was from Dr. Carpenter upon "Different modes of Computing Sanitary Statistics, with special reference to the opinions of Mr. Andrew A. Watt." Upon this subject, which related exclusively to the statistics of population of the city of Montreal, there was an animated discussion.

NORWICH

Naturalists' Society, November 30.—The Rev. J. Crompton, the president, in the chair. Mr. Southwell read a long and interesting paper "On the Flight of Birds." The seeming impossibility of a heavy body supporting itself in mid-air, gliding along, changing its direction at will, apparently violating all the known forces of nature, is sufficiently astonishing to attract the attention and engage the researches of scientific men; and yet, till of late, the subject has been neglected, or the theories formed to account for so remarkable a phenomenon have been altogether erroneous. The great stumbling-block to the arrival at the truth seems to have been the very natural idea that buoyancy was the first essential to flight, whereas it is now shown, that so far from being an essential, it is an actual impediment. Hunter discovered the presence of air-cells in the bones and dispersed over various parts of the bird's body, and it was believed that by this means heated air was used to render them lighter, and that it was possible by thus inflating the body to increase the bulk, at the same time decreasing the weight; forgetting that additional bulk without a corresponding increase of weight would but enlarge the surface presented to atmospheric resistance, thereby rendering the too buoyant body of the bird the sport of every wind that blows. Sir Charles Bell follows up this idea of excessive lightness; but Captain Hutton, in a paper on "The Birds inhabiting the Southern Ocean," shows that in order to bring the specific gravity of the albatross to that of the atmosphere, the air-cells in its body should contain 1,820 cubic feet of air heated to 108 degs.—equal to a sphere of more than 15 feet in diameter; or, in other words, they must be 1,200 times the size of the body itself, "which," he adds, "would give it, when flying, an aldermanic appearance which I have never observed." It is obvious, therefore, that the air-cells are not intended to aid the bird in flight by rendering it lighter than the air itself. After referring to the opinions of Sir Charles Bell, Mr. Southwell gave an account of the principles enunciated in France by M. de Lucy, who has shown that three great properties are absolutely essential in all winged animals—(1) weight, or the force of gravity; (2) surface, or the area presented to atmospheric resistance; and (3) force, or the power of projection. Without weight the object might float, but it could never fly, there would be no resisting force to form a fulcrum to its movements, and it would, in fact, be part of the atmosphere and subject to it, wafted hither and thither without the power of resisting. The bird being elevated in the air, possesses, in virtue of its weight, a force always exerting itself in a downward direction, thereby producing motion, which, if it has the power to control, will prove the mainspring of its flight. In order to counteract this downward motion, surface is called into request. The expanded wing is presented to a column of air perpendicular to itself, and a new law of nature comes into operation—that of atmospheric resistance. This is not sufficient to counteract the force of gravity without some mechanical action on the part of the bird, but it would in a great measure break the force of the fall, causing it to descend in a series of zigzags, as a sheet of paper falls from a balloon. We should expect to find the surface increase in proportion to the weight of the animal; but, strange to say, it has been shown by M. de Lucy that the extent of surface is always in an inverse ratio to the weight of the winged animal. The heavier the animal, the smaller its wing surface, referred to a fixed standard. This is shown remarkably in flying insects; the body is very light, but the wing surface is enormous. The bird would soon be brought down from mid-air but for the muscular power of depressing the expanded wing forcibly and rapidly so as to cause the elastic column of the air beneath to rebound with sufficient force to destroy the remaining effects of gravity and so to equalize all the forces as to leave the bird ready to pursue its course at will. The most striking thing about the skeleton of a bird is its great lightness combined with strength. By a beautiful arrangement, the greatest power is given to the wings. The front part of the wing, that first presented to the air in forward flight, is stiff and unyielding, well adapted for cutting its way through the air; the other feathers become weaker and more pliable as they are placed nearer to the body of the bird. The feathers, which are divided into two portions by a nearly central shaft, overlap each other, the anterior web, which is the strongest and stiffest, being uppermost. When the down stroke is delivered, the wing presents to the air an impenetrable and unyielding surface, but when the corresponding up stroke is made, the yielding posterior web of each feather becomes depressed by the resistance of the air above, thus separating the feathers so as to allow of the free passage of the air; by this means giving the maximum amount of force to the down stroke, which would otherwise be neutralised by the resistance of the up stroke. But this is not all; the under surface of the wing is more or less concave, while the upper surface is convex. It is obvious, therefore, that when the up stroke is made, the air will rush off and through the wing in all directions, but when the motion of the wing is reversed, the air will be gathered up in its hollow, and the resistance immensely increased. By a wonderful contrivance, the same stroke which elevates the bird gives it a forward motion also. Mr. Southwell then gave an elaborate description of the mode in which forward motion is effected, from the Duke of Argyll's work, "The Reign of Law." Those birds with very long and pointed wings possess the greatest powers of flight; as, for instance, the sharp-winged martin for speed, and the long-winged albatross for both speed and endurance. The power of turning in flight appears to be the result of an involuntary effort, as we turn or incline to the left or right in walking. It is a matter of considerable difficulty to obtain reliable data as to the actual velocity with which birds travel through the air. The flight of a hawk, when its powers are fully exerted, has been calculated at 150 miles an hour; the usual flight of the eider duck at the rate of 90 miles an hour. Audubon estimates the flight of the American passenger pigeon at a mile a minute, and the carrier pigeon to possess, probably, an average of 50 or 60 miles in a long flight, although over short distances, as when pursued by a hawk, its speed is much greater. The flight of rooks "going home to bed with full stomachs," and taking it easy, Major Holland estimates at about 26 to 30 miles an hour; the speed of the albatross whilst coursing in company with a ship, he reckons at about 90 miles an hour. The flight of other birds, such as the swallow, the eagle, and the peregrine falcon, has been estimated as of much greater speed. The power of passing with ease and rapidity over long distances is of vast importance to birds living in communities. Rooks, for instance, would soon exhaust the supply of food in their own neighbourhood. Mr. Stevenson is satisfied that the guillemots and gulls seen feeding in Yarmouth and Lowestoft Roads in summer, come from the great nesting-places on the Yorkshire coast; and Mr. Yarrel states, on the authority of Dr. Jenner and the Rev. N. Thornbury, that the domestic pigeons about the Hague "make daily marauding excursions at certain seasons of the year to the opposite shore of Norfolk, to feed on vetches—a distance of forty leagues." Mr. Southwell quoted many instances of the extraordinary power of birds to endure protracted flights; and concluded by saying that man with all his boasted skill has not been able to construct a machine to enable him to navigate the air, and, even with the bird before his eyes, he has failed to learn its lesson. In the discussion which ensued, Mr. Southwell said he hoped his paper would attract attention to the subject of the flight of birds, as very little was known about it; and the very fact that in modern days men attributed the powers of flight in birds to the air-cells being filled with hot air, showed how little the principles of flight must have been considered.

PARIS

Academy of Sciences, December 20.—M. E. Becquerel presented a note by M. J. M. Gaugain on the electromotive forces developed by platinum in contact with various liquids, The author stated that when two platinum electrodes, *not platinised*, have remained in an acidulated liquid until they furnish no sensible current, if one of them be washed in distilled water and dried with blotting paper, it becomes negative on being again placed in the liquid. The opposite effect is produced with solution of potash. The effect in the latter case is much greater when the electrodes are platinised. The author ascribed this phenomenon to a modification of the electrodes consisting in a superficial adherence set up between the platinum and the acid or alkaline substance. He also remarked upon the difference of function in platinised and non-platinised electrodes,

and stated that with these substances as opposite electrodes an electromotive force, equal, to more than one-fourth of that of a Daniell's couple, is at first developed, but that this gradually diminished. This was ascribed by him to the slow modification of the electrodes in opposite directions. According to the author, the modification in question takes some time for its production, but it is also long persistent; and he indicated that this property of platinum electrodes may be applied to the determination of the acid or alkaline nature of liquids, even when these are so dilute as to have no action upon test-papers.—M. Peligot read a note "On the presence of potash and the absence of soda in most plants." He maintained, as on former occasions, that soda is not necessary for the nutrition of plants, and cited experiments made with potatoes cultivated close to and far from the sea, which showed no difference of constituents; soda was always absent. M. Boussingault remarked upon this communication that he had already shown, by analysis, that soda was in many cases far inferior in importance to potash, but he thought the question was especially a geological one, the composition of the ground appearing to be of much importance. M. Payne considered that spectrum analysis should be made use of in this investigation.—A discussion was raised by M. Bertrand on M. Carton's note for the demonstration of the proposition that the three angles of a triangle cannot be less than two right angles. M. Bertrand explained M. Carton's proposed demonstration.—M. Faye called attention to a passage in Genesis, in which mules are mentioned as existing in the time of Abraham, and suggested that where there were mules the horse must have been known. MM. Roulin and Milne-Edwards remarked that the passage cited by M. Faye probably related to the Hemiornis.—The following papers were also communicated:—A note by M. Bulliani on the Constitution of the Ovum in the *Sacculinæ;* a note showing that œdema does not always result from the mere ligature of vessels, but that this must be accompanied by paralysis of the vaso-motor nerves, presented by M. Claude Bernard on the part of one of his pupils; a second note by M. Perizeux on the Secular Acceleration of the Movement of the Moon; a note on the Modifications produced in Skins by the operation of Tanning, presented by M. Boussingault on the part of one of his pupils; and a note by M. Blaserga on the Graduation of Galvanometers.

PRAGUE

National Museum of Bohemia, Natural Sciences Section, Nov. 20.—Prof. T. Krejci gave a *résumé* of his researches on the Permian strata at the foot of the Riesengebirge, on the northern frontier of Bohemia. The most interesting district is that near Schwadowitz. The Permian strata and the cretaceous grit here form a crest about 2,000 feet in height, the Faltengebirge, which fills up the space between the two masses of the Riesengebirge and the Adlergebirge. Its elevation is attributable to an extensive fault situated at its southern foot; this same fault having occasioned the denudation of the coal strata of Schwadowitz which have been actively worked for some years past. The latter belong partly to the carboniferous formation, partly to the Permian, which possess a good number of species in common, just as in the basin of Schlan, near Prague, thus indicating a gradual transition from the one of these formations to the other. To the south of the Schwadowitz fault extends an abruptly-elevated ridge of Permian and cretaceous grit, the former of which is in reality the margin of an ancient fjord of the cretaceous sea running up (from the direction of Hronar) far into the Permian strata. Similar cretaceous fjords are found in the primitive strata near Czaslaw, in the centre of Bohemia, and at Kieslingswalde, in Silesia. At the northern foot of the Faltengebirge, near Radoventz, there is also a deposit of coal supposed for a long time to be carboniferous, but now acknowledged to be Permian.—M. O. Feistmantel reported on the fossil plants of Schwadowitz collected by himself and M. Krejci, in 1869. This deposit yields in point of richness to that of Radnitz: nevertheless, M. Feistmantel has discovered among nearly 2,000 specimens forty-eight species, only one of which (from this mine) was known to M. Ettingshausen. These remains are arranged in three zones. The lowest, that of the pure schist, contains Pterideæ (*Lonchopteris, Alepthopteris, Neuropteris, Sphenopteris, Adiantites, Cyatherites*), and Equisetaceæ (*Calamites, Asterophyllites, Annularia, Sphenophyllum*). The second zone, that of the black schist, contains Lycopodiaceæ (*Lepidodendron, Lepidostrobus, Lycopodites, Sagenaria*), Nöggerathiœ (*Cordaites, Noggerathia*), and Sigillariæ (*Sigillaria, Stigmaria*). The third, that of coal, contains only Sigillaria and Stigmaria. At Radganice, where fossil trunks of Araucaria in the red grit were the only remains of plants heretofore observed, M. Feistmantel obtained from the Permian coal eleven species of the genera *Annularia, Asterophyllites, Sphenophyllum, Alettsopteris, Cyatherites, Calamites,* and *Stigmaria.* A fine specimen from this locality shows that *Huttonia spicata* is the fruit of *Calamites Suckowi,* and the constant presence of Stigmaria without Sigillaria is a strong argument against the received doctrine that Stigmaria is the root of Sigillaria.

November 24.—Prof. J. Blazek demonstrated, by an elegant method, and without making use of the higher calculus, a series of theorems relating to *polyhedra maxima* inscribed in an ellipsoid of three axes. The latter being considered as a sphere distorted according to certain laws, the author demonstrates that the *corpora maxima* inscribed in the sphere are distorted according to the same laws, and that this likewise holds good for the *corpora maxima* of the derivative ellipsoid.—M. T. Palacky explained his views of the botanical geography of Asia. M. Grisebach has recently divided Asia into four botanical provinces—Western, or that of the steppes; Eastern, or Chinese; Boreal, or Siberian; and Southern, or that of India. M. Palacky only admits two provinces, the one Southern, the other Boreal, including in the latter the whole of Asia beyond the Himalayas, because the first three provinces of M. Grisebach do not appear to him to differ more from one another in regard to their flora than the sub-provinces of each do. The author lays special stress upon the tropical species inhabiting China—where they are not arrested by steppes—as far as Pekin, and even as far as the Amoor. According to him the existing flora of Central Asia is an invasion of the Mediterranean flora, which took place after the elevation of the Turcoman plateau in the place of the ancient post-tertiary sea between Europe and Asia. The principal obstacle in the way of researches connected with botanical geography is the diversity of the views adopted by various botanists; one species of Hooker, Wallich, &c., being at least equivalent to twenty-five species of Maximowicz, Ruprecht, and most of the German botanists.

DIARY

THURSDAY, DECEMBER 30.

ROYAL INSTITUTION, at 3.—On Light (Lectures adapted to a Juvenile Auditory): Prof. Tyndall, F.R.S.

SATURDAY, JANUARY 1.

ROYAL INSTITUTION, at 3.—On Light (Juvenile Lectures): Prof. Tyndall, F.R.S.

MONDAY, JANUARY 3.

ENTOMOLOGICAL SOCIETY, at 7.
MEDICAL SOCIETY, at 8.

TUESDAY, JANUARY 4.

PATHOLOGICAL SOCIETY, at 8.—Anniversary meeting.
ANTHROPOLOGICAL SOCIETY, at 8.—On the Psychical Elements of Religion: Mr. Owen Pike—On the Inhabitants of the Chatham Islands: Dr. Barnard Davis and Mr. A. Welsh.
SYRO-EGYPTIAN SOCIETY, at 7'30.—On the Suez Canal: Mr. W. H. Black, F.S.A.
ROYAL INSTITUTION, at 3.—On Light (Juvenile Lectures): Prof. Tyndall, F.R.S.

WEDNESDAY, JANUARY 5.

PHARMACEUTICAL SOCIETY, at 8.
OBSTETRICAL SOCIETY, at 8.—Anniversary meeting.
ROYAL SOCIETY OF LITERATURE, at 8.30.

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