THURSDAY, JUNE 28, 1906.

THE ORGANISATION OF AGRICULTURE.

(1) *The Transition in Agriculture.* By Edwin A. Pratt. Pp. x+354. (London: John Murray, 1906.) Price 5*s*.

(2) *An Introduction to the Study of Agricultural Economics.* By Henry C. Taylor. Pp. viii+327. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1905.) Price 5*s*.

(3) *The Development of Agriculture in Denmark.* By R. J. Thompson. A paper read before the Royal Statistical Society, May 15, 1906.

(1) THIS is the work of an author whose previous writings on subjects of agricultural economy have attracted considerable attention. The present volume has a three-fold purpose—to describe recent developments of subsidiary branches of agriculture, the progress of agricultural cooperation, and the principles on which small holdings may have the best chance of success.

Mr. Pratt states that "it is open to consideration whether the bitter cry of the distressed British agriculturist has not been persisted in with undue energy of late years." It is certain, however, that the last period of agricultural depression, which reached its culminating point about 1892, was terribly acute, and the subsequent recovery has been correspondingly slow. That there has been recovery few authorities will deny, and we believe that the general agricultural outlook is more hopeful than it has been for some time. This is certainly the impression we gain from a careful perusal of Mr. Pratt's book; yet at the same time the author scarcely touches upon the main features of British agriculture, and in this respect the title of the work is not altogether justified. Wheat-growing has declined, it is true, to a very marked extent, and a great deal of arable land has been converted into pasture during the last quarter of a century. On the other hand, the decline in the wheat acreage has been somewhat balanced by an increase in the acreage under oats. The increases in the areas of those subsidiary branches of agriculture, as Mr. Pratt calls them, with which his book mainly deals, are relatively unimportant.

The breeding of live-stock, and especially the home and export trade in pure-bred pedigree animals, the fattening of cattle, sheep and pigs, grazing and dairying, all involve operations upon such a large scale, and require individual skill of such a high order, that we cannot conceive of any "transition in agriculture" which would seriously interfere with the size of the holdings, the acreage of the crops, or the capital necessary to maintain them. But if we except agriculture on the large scale as it has been and in all probability will continue to be carried on, we admit that Mr. Pratt has done useful service in bringing under review those important developments of comparatively minor industries which are not only of benefit to agriculture, but are nationally advantageous by helping to create and maintain a sturdy, independent race of Englishmen.

An interesting account is given of the commercial aspects of milk selling. The facts related are not new, though it may well be that they have not attracted much attention outside the districts affected or on the part of persons not immediately concerned. Farmers in the dairying districts have found it pay much better to sell fresh milk than to turn it into butter and cheese. The sale of fresh milk and cream is, in fact, practically our only agricultural monopoly, and it is not likely that foreign competition will seriously threaten it. But whereas formerly the milk producer was an individual unit at the mercy of the urban wholesale dealer or middleman, judicious combination amongst dairy-farmers has enabled them to protect their interests, and especially to secure a uniform and equitable price for the milk produced. In Staffordshire, Derbyshire, Cheshire, Essex, and Somerset, associations have been formed with this object in view, and their success has been remarkable. In one case, Mr. Pratt states, the financial gain thus secured through combination amounts to from 30,000*l*. to 40,000*l*. annually, or an average annual gain per member of from 30*l*. to 40*l*.

The descriptions of fruit-farming and the production of flowers, bulbs, vegetables, poultry, and eggs will repay careful study, and they may well encourage the further extension of similar crops in districts suited to them upon the cooperative principles that have proved successful.

We come finally to the author's views on small holdings. This question is now under consideration by a Departmental Committee of the Board of Agriculture, and it is well known that the new President of the Board, Lord Carrington, is deeply interested in the subject, his own experiments in that direction in Lincolnshire and elsewhere having met with striking success. Mr. Pratt discusses the question as to whether ownership or tenancy is the more expedient form of tenure, and he pronounces unhesitatingly in favour of tenancy. We believe that his conclusions on this subject are sound, and that the example of countries where freehold occupancy has resulted in heavy mortgages with the payment of "rent" in its most odious form should be avoided.

(2) Dr. Henry C. Taylor, the author of the book on "Agricultural Economics," is assistant professor of political economy in the Wisconsin University, and an expert in the Office of Experiment Stations of the United States Department of Agriculture. His work forms part of the "Citizen's Library of Economics, Politics, and Sociology," and is in effect a studious effort to apply to practical agriculture the principles of political economy. As such it should prove useful to young agricultural students in connection with their ordinary course of "political arithmetic." Dr. Taylor himself states that one of the aims of his book is the setting forth of "fundamental economic principles, which, when carefully followed, lead the way to success in agricultural production."

In thirteen chapters the author deals with the

factors of production, the organisation of the farm, the size of farms, the prices of agricultural products, the distribution of wealth, the value of land, the methods of its acquisition, and the relations between landlord and tenant. He uses the term "capital-goods" to represent the live-stock and implements essential to agricultural production, and the word "capital" to represent the money-value of capital-goods. Land, capital-goods, and labour being the three factors of agricultural production, he discusses the economic properties of each. In regard to labour, which includes the work of the farmer himself, he advances some interesting economic propositions, especially as to the "qualitative and quantitative efficiency of farmers"—qualitative efficiency relating to the return a man can obtain from a given piece of land with a given supply of capital-goods, and quantitative efficiency to the quantity of land and capital-goods which a man can operate. He shows that the farmer with the highest degree of qualitative efficiency can make not only more than a living upon land of any grade, but that he can make the largest net profit on the most productive land after outbidding all competitors for its use. Thus, "owing to the higher rents which the more efficient are willing to pay for the better grades of land, the farmer can secure the largest net profit by employing that grade of land which corresponds to his degree of qualitative efficiency."

In discussing the principles which determine different methods of farming, the author points out that whereas formerly agricultural conditions demanded that farms should produce all that was required by the cultivators, modern conditions of increased population and improved facilities of transport have given rise to what is described as commercial agriculture, the system under which agricultural produce is grown in bulk, and marketed in return for other commodities required but no longer produced by the seller.

In this country we pride ourselves upon the superior yield of our agricultural crops. This is, however, due to a system of intensive cultivation, and Dr. Taylor shows that the extensive system of cultivation as pursued in the United States is that which is at present best suited to the economic conditions of the country. Pressure of population in the older States of the American Union is already causing a more intensive cultivation than that previously followed. "In new countries," Dr. Taylor writes, "where land is relatively abundant, extensive culture is generally most profitable, and the average size of farms is usually greater than in older countries where land is scarce, land values very high, and intensive culture most profitable."

Incidentally, the book contains many statistical details relating to the United States that are not readily accessible to the general reader. For instance, the land area of the United States is given as 1,900,947,200 acres. The area of the United Kingdom is 77,671,319 acres. The percentage of improved land, or, as we describe it, "land under crops and grass," is in the United States about 22, in England about 76, and in Germany about 60. Again, with regard to the size of farms, in the United States the average is given as 146·6 acres. In England it is about 65 acres (or 85 acres if holdings above one acre and not above five acres be not included); in Germany it is 19·2 acres, and in France 21·4 acres. This variation in the average size of holdings is, of course, significant of the different systems of land tenure, tenant-farming prevailing in England and peasant-proprietorship in France and Germany. In the United States most of the land is either cultivated by its owners or on the sharing principle. According to the census of 1900, the different classes of farmers in the United States are represented in the following proportions:—

Owners	54·9 per cent.
Part Owners	7·9 ,,
Owners and Tenants	0·9 ,,
Managers	1·0 ,,
Cash Tenants	13·1 ,,
Share Tenants	22·2 ,,
	100·0

An interesting description is given of the American system of "share-tenancy," which is scarcely, if at all, practised in this country. The principle of it is something akin to *métayage*, as adopted in France, Italy, and Spain. A share-tenant in America pays for the use of the farm a proportion (such as one-third or one-half) of the crops cultivated. The share is delivered to the owner in kind. The owner participates in the management of the farm, and, in fact, directs all the more important operations. Under this system the landlords are usually the older and more experienced men, who own more land than they can well cultivate, whilst the tenants are younger men who prefer share tenancy to fixed rent, because their risk of loss is less.

(3) Denmark is a concrete example of the successful development of "commercial agriculture." Mr. Thompson has made an elaborate statistical study of the agricultural conditions prevailing in Denmark, and his facts and figures are well worthy of careful study on the part of economists. Most authorities agree that the prosperity of Denmark is attributable to three causes—the system of land tenure, education, and cooperation. Thrift, the art of wisely saving and wisely spending, is a national characteristic of the Danes, and this, combined with the admirable organisation of their export trade in dairy produce, has enabled them to attain to a greater relative degree of agricultural prosperity than perhaps any other country. Whilst there may be much to admire and copy in the methods of agricultural organisation pursued in Denmark, it should be remembered that this little country is almost entirely dependent upon its exports to the free and immense markets of Great Britain, and that its system of wholesale grading for despatch to one country could not be applied, without modifications, to Great Britain, which has little or no export trade in dairy produce, and whose local home markets are scattered and unlinked with any central administration. E. H. G.

THE MANUFACTURE OF CYANIDES.

The Cyanide Industry Theoretically and Practically Considered. By R. Robine and M. Lenglen. Translated by J. Arthur Leclerc, Ph.D., with an appendix by C. E. Munroe, Ph.D. Pp. xi×408; illustrated. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1906.) Price 17*s.* net.

THE stimulating effect on industrial research caused by the prospect of immediate material gain is strikingly illustrated by the progress of the cyanide industry. Until cyanide of potassium was applied to the treatment of gold ores, comparatively little interest was taken in its manufacture. The consumption amounted to about fifty tons a year only, and the old expensive and wasteful methods of obtaining it from ferrocyanide which had been made by the use of nitrogenous organic substances were deemed sufficient for the purpose. When the demand was rapidly growing in the 'nineties there was a rush of investigators to discover new and cheaper methods of manufacture. A fair amount of success was attained, and some thousands of tons of cyanide are now produced annually in Great Britain and Germany and sold at one-third the former price. The older processes have been abandoned and new ones introduced, and, although some doubt still remains as to the future of the industry, the field for useful research has been narrowed, and once again offers little attraction to the chemical "pot-hunter." Comparatively little cyanide is produced in France, however, and apparently it was the apathy of their fellow-countrymen on the subject which induced MM. Robine and Lenglen to write the book which has just been translated.

The authors divide their book into four parts, of which part iii., on the methods of manufacturing cyanide compounds, is alone of any real importance.

Part i., occupying sixty-five pages, deals with the chemistry of cyanogen and its derivatives. It contains no correct statement that does not appear in ordinary text-books of chemistry, and is distinguished by an extraordinary number of misprints or misstatements, such as "cyanogen does not unite directly with hydrogen," "it [cyanogen] becomes a liquid at 20°.7 under ordinary pressure," and "If the cyanide contains chlorides, the method [of estimation of cyanide by means of silver nitrate] is not accurate." There are no references to the sources of information, and the whole section seems to have been drawn up in a perfunctory way.

Of even less value is part ii., which occupies twelve pages, and is on "The Present Condition of the Cyanide Industry." None of the information given in this part appears to be of later date than 1901, and some of the tables of figures end in 1896. The tables refer mainly to France, but there is a list of works producing cyanide compounds which applies to the whole world.

Part iii. occupies 213 pages, and gives a clear account of a very large number of methods of manufacture, most of which, as the authors are careful to point out, have never been successful on an industrial scale. All the chief cyanide compounds are dealt with, and separate chapters are devoted to the manufacture of cyanides, ferrocyanides, ferricyanides, and sulphocyanides. Sulphocyanides and, to a less extent, ferrocyanides owe their importance to their use in the preparation of cyanides, but the authors devote most attention to the interesting direct synthetic processes of making cyanides from carbon and nitrogen or ammonia.

The fixation of atmospheric nitrogen is a fascinating problem which is likely to continue to exercise the minds of chemists, and the translator, as an agricultural chemist, expresses the daring hope that the publication of this volume will result in the solution of the problem on an industrial scale. It is, of course, well known that cyanides are formed in blast furnaces, and many attempts have been made to apply this knowledge, beginning with Bunsen's special furnace, which was built in 1845. In most of the later processes, atmospheric nitrogen, freed from oxygen by passing it over heated metals or by distilling liquid air, has been passed over carbides of metals heated in electric or other furnaces, but although some progress has been made, the cyanide industry still continues to depend on more roundabout chemical actions. One of these is the synthesis of sulphocyanide by the action of ammonia on carbon bisulphide in the presence of a base such as lime, followed by the reduction of the sulphocyanide by means of carbon, metals, or hydrocarbons.

Illuminating gas and its residues constitute a source of cyanide which has not been fully exploited. The authors anticipate that in the future a large proportion of the required cyanides will be obtained from gas works, and estimate that in France alone 4,000,000 tons of coal used annually in the manufacture of illuminating gas could be made to yield cyanide compounds worth from eight to twelve million francs, all of which is now lost. In other countries, however, the matter has not been overlooked, and it is certain that the illuminating gas used in the world could be made to yield far more cyanide than could possibly be disposed of, unless new uses for cyanide should be discovered. The progress of the cyanide industry is checked rather by well-founded fears of overstocking the market than by the neglect by manufacturers of their opportunities or by the need of fresh sources of supply.

In part iv., which occupies twenty-seven pages, there is an adequate account of the use of cyanogen compounds, and this is followed by an appendix of seventy-one pages. Here a digest is given of the United States patents relating to cyanide processes for the recovery of the precious metals. No doubt the list is fairly complete, but it has nothing to do with the main subject of the book, and does not contain any reference to patents relating to the manufacture of cyanides. However, as it shows the activity of the consumers of cyanide, it may be taken as a tonic by disheartened manufacturers, who, after all, are probably more interested in markets than in chemical formulas.

T. K. ROSE.

A YEAR ON THE "SIBOGA."

Ein Jahr an Bord I.M.S. Siboga. Von Frau A. Weber van Bosse. Beschriebung der Holländischen Tiefsee-Expedition im Niederländisch-Indischen Archipel 1899–1900. Nach der II Auflage aus dem Holländischen übertragen von Frau E. Ruge-Baenziger. Pp. xiii+370. (Leipzig: W. Engelmann, 1905.) Price 6*s.* net.

IN this book Mrs. Weber gives a popular account of the expedition the scientific results of which have been described in the "Siboga-Expeditie" edited by Dr. Max Weber.

The *Siboga*, a twin-screw vessel of the Royal Dutch Navy, built for the East Indian service, deprived of her armament, and specially fitted for her scientific voyage, left Surabaya, on the north coast of Java, on March 7, 1899, and returned thither on February 26, 1900, having spent the interval—practically a year—in exploring the marine, and especially the deep-water, fauna of the East Indies. The expedition consisted of Prof. Max Weber and Mrs. Weber, two scientific assistants, a doctor, and a draughtsman, and received from the naval staff of the vessel those ungrudging and invaluable services which the officers of our own Navy so invariably put at the disposal of the scientific members of an expedition. The investigation of the marine flora was in the hands of Mrs. Weber.

The course of the *Siboga* lay at first along the coasts of the Lesser Sunda group from Java to Timor, then across the Flores Sea to Saleyer Island, and to Macassar, in Celebes, where the expedition was landed for a time while the ship made a trip to Surabaya. On her return the voyage was continued through the Macassar Straits to the Sulu Islands, then southwards across the Celebes Sea to Kwandang, in Celebes, northwards again to the Sangir and Talaur groups, southwards through the Molucca Straits to Obi, and eastwards across the Halmahera Sea to the coast of New Guinea. From Atjatuning, in New Guinea, the ship sailed by Ceram, Amboyna, Buru, and Buton to Saleyer again. Here the expedition was left during a second trip of the *Siboga* to Surabaya. When a fresh start was made the course lay eastward across the Banda Sea by Amboyna to Aru and back to Amboyna. From this place the *Siboga* returned to Surabaya along the Sunda Islands by a different route from that which she had taken at starting.

The story of this voyage is pleasantly told by Mrs. Weber. Scattered through her account of the everyday life of the ship and the happenings at various stopping-places and dredging-grounds are allusions to the scientific discoveries of the expedition. Some of the soundings are particularly interesting. It appears that the Lombok Straits, instead of being a deep cleft between Bali and Lombok, are in reality quite shallow (170 fathoms). Since Weber has already shown that the fauna of the East Indies changes only gradually from an Asiatic to an Australian character in an easterly direction, we have now probably heard the last of that old friend of our student days, "Wallace's Line"—a picturesque and fruitful hypothesis, for all the contempt with which it is apt to be treated nowadays. On the other hand, interesting soundings of considerable depth were obtained among the islands—some 2700 fathoms in the Banda Sea and in the Celebes Sea, 2200 fathoms in the Ceram Sea, 1500 fathoms between the Banda Sea and the Flores Sea, and 2000 fathoms close to land off Saleyer. Near the latter island great banks of calcareous algæ were found, which recalls Stanley Gardiner's observations on the importance of these organisms in Funafuti and elsewhere. The plankton also seems to have been unusually rich and plentiful. The sea bottom is in many places rough, entirely unlike the oozy bed of the great oceans, and was the cause of much loss and damage to gear.

The book is well got up and illustrated by some good photographs, and should prove interesting to the large class of readers who are attracted by books of travel.

YORKSHIRE FUNGI.

The Fungus Flora of Yorkshire. By G. Massee and C. Crossland. Yorkshire Naturalists' Union Botanical Transactions, vol. iv. Pp. 396. (London: A. Brown and Sons, Ltd., 1905.)

THE Yorkshire Naturalists' Union has held and maintained a high place in the history of British cryptogams, and its published Transactions abound in records of fungi in which the county seems to be peculiarly rich. It is hardly surprising, therefore, that a scientific society of such well-proved eminence should every now and then issue the results of its labours, originally published in its serial journal, in the form of a separate book.

To do this in the case of the fungi required more initiative and enterprise than with most other cryptogams, and the committee is to be congratulated, not only on having carried the work through, since 1902, but on having done it so thoroughly and efficiently.

When we extend our congratulations also to the two authors responsible for the work, we may take the opportunity of pointing out that while one is an amateur field naturalist of that peculiarly enthusiastic and accurate type for which Yorkshire has long been famous, the other is a professional mycologist of high reputation; and the combined labours of the two give us all the advantages of the accurate and industrious notes of a collector who knows his county thoroughly, together with the critical supervision of one who knows his herbarium equally well, and who has had shed on to his shoulders the cloak of Berkeley, and has been a fellow-worker with Cooke.

The book consists of 365 pages with appendices and an index, a too meagre bibliography, and more than 2600 entries. There is a short introduction and classification, with notes on the distribution within the county. The work is by no means a mere catalogue, though in many cases little more than the record of the name is given, together with the localities in which the fungus has been found growing. Interesting notes

as to the habit of the fungus abound, and while it is, of course, impossible in such a work to define species or even genera, there are excellent explanatory notes here and there for the use of the critical systematist.

The volume, which is neatly printed, is, in spite of rather too many misprints, indispensable to every professional mycologist, and will, of course, be the basis for all other fungus floras of Yorkshire and other counties.

The work affords a very good example of the excellent services to science which may be contributed by the collaboration of individual workers who are experts in different departments and will join their forces loyally for the benefit of the rest.

Of course, it is not claimed that all the fungi of the large area covered are recorded, and much remains for other workers, especially in the domain of the smaller and lower fungi; but, as has already been pointed out, we have a firm basis for the benefit of further workers, and shall hope to see the records gradually rendered more and more complete.

OUR BOOK SHELF.

The Principles and Practice of Iron and Steel Manufacture. By Walter Macfarlane. Pp. xi+266; 96 figures. (London: Longmans, Green and Co.) Price 3*s.* 6*d.* net.

THIS is a difficult book to review so as adequately to represent the nature of its contents to the "technical students, metallurgists, engineers," and others for whom it is intended. The somewhat florid style of the introduction, "Machinery ponderous and powerful or nimbly delicate and deft . . ." would lead one to expect a kind of poetic phantasy woven to give joy to the general reader, and the expectation is supported by the last sentence, about iron being the Master Metal because it has so many good qualities in well-balanced proportion. Really it is quite human, however, in that it has many wicked ways also, well known to the aforesaid engineers.

Later in the work there is a compound of the general and the technical, as is evidenced by the type of illustrations, numbering about a hundred, of which a considerable proportion are reproductions from photographs; thus, "Fig. 6, Charging a puddling furnace"; "Fig. 44, Siemens casting pit with ladle in the distance," evidently taken with a short-focus lens, for the ladle seems about half a mile away; "Fig. 54, Shovelling lime into a steel melting furnace"; while "Fig. 52, Empty steel ladle," may be introduced to finish with a little humorous touch. Taking at random the working of an acid open-hearth charge, the author says that after melting (p. 117) "Oxidation steadily proceeds. In the first two stages the oxidation is effected by the excess air which enters the furnace along with the producer gas. The oxidised products SiO_2, MnO, and some FeO and Fe_2O_3 go into the slag. In the third stage oxidation is largely due to the oxygen in the ore which is fed in." On p. 122 the author distinctly says, "During the third or boiling stage . . . when this stage is reached ore is cautiously fed into the furnace. . . ." How long it would take an ordinary charge to come on the boil without ore one could hardly guess, but to bring it on in a reasonable time requires very considerable additions of ore to get the slag into proper condition. This is a grave error for an author who has been fourteen years in iron and steel works, and is also very misleading to a student of the subject. The matter has been dealt with in recent and ancient literature.

To sum up, the work may be of considerable interest to the general reader, but can hardly be recommended as a guide to the technical man engaged in such work as the manufacture of steel.

On Models of Cubic Surfaces. By W. H. Blythe. Pp. xii+106. (Cambridge: University Press, 1905.) Price 4*s.* net.

MR. BLYTHE has attempted a difficult task, to give an account of methods of constructing models of a cubic surface without either assuming all the theory of the surface as known or recapitulating it; the result, so far as the introductory portions of the book are concerned, is an unsatisfying mixture of rudiments and quotations and references to difficult theorems. As regards the latter portion Mr. Blythe may best speak for himself. "About ten years ago my attention was drawn to arranging the twenty-seven straight lines. . . . After constructing several models, I did not continue the series, for I subsequently found that a complete set had been made in Germany. . . . Copies of these models can be purchased. Still the models described in this book are sufficient to give an idea of the shape of a cubic surface."

We think Mr. Blythe is too modest, and that this little book of a hundred pages will be of interest to those who are studying the surface and desire actually to make models; but it must be confessed that in our opinion the writer would have been better advised either to make the theoretical portions more systematic or to have omitted them, and given a fuller account of the models with many more figures. Perhaps it is fair to say that Mr. Blythe's book is a good example of what may in cases be the bad effects of a too rigid and uniform examination system; it happens that cubic surfaces are outside what is regarded as the normal course of geometry for a student for the mathematical tripos; under a free and stimulating system, when Mr. Blythe first began to take an interest in models of cubic surfaces he would have been encouraged by his environment to go on and make a complete set, and other students would have helped him, and there would have been formed a fresh rootlet for the mathematical school to grow from; as it is, the environment requires either that he should invent a completely novel theory of the surfaces or models, or pay the penalty of being regarded as off the track, except by those few who value mathematics as they find it interests them.

A Synonymic Catalogue of Homoptera. Part i. Cicadidæ. By W. L. Distant. Pp. 207. (London: Printed by Order of the Trustees of the British Museum, 1906.)

MR. W. L. DISTANT has for many years made a study of the Rhynchota, and has paid particular attention to the Cicadidæ. The catalogue of this family, together with a synopsis of the subfamilies and genera now published, was, we learn from Prof. E. Ray Lankester's preface, generously placed at the disposal of the Trustees of the British Museum by Mr. Distant. This work should be of great assistance to students of this group of insects.

Iona. By Elizabeth A. McHardy (Mrs. Raymond Smith). Pp. 48. (Glasgow: R. Gibson and Sons, Ltd., n.d.) Price 1*s.* net.

THIS attractive booklet provides brightly written and well illustrated accounts of Iona—"the Blessed Isle"—and of Staffa with its wonderful Fingal's Cave, together with an appreciation of St. Columba. It should not be long before the little publication secures a wide popularity among visitors to the west of Scotland.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Kew Publications.

As I was responsible before I left Kew for the publications noticed in NATURE of June 21 (p. 180), perhaps I may be permitted a few words of explanation.

The Kew Bulletin was not intended at the outset to rank with scientific journals. It was started at the desire of Parliament for the purpose of issuing, for public use, information for which there happened to be a demand, and of a commercial, or at any rate economic, kind. It was subsequently decided by the Government that it should be the vehicle for other matter, scientific or otherwise, for which prompt publication seemed desirable.

It is sent out to all the botanic and agricultural departments in correspondence with Kew in India and the colonies, and much of its contents is usually reprinted in the local journals.

It also serves the purpose of expeditiously answering inquiries at home. A stock of the numbers is kept at Kew for communication to correspondents. So useful has it proved in this way that it has been necessary to reprint more than once a large number of the articles. The output in any one year may have been exiguous; but if there was no urgent demand for information on some new subjects, there was usually more pressing work on hand than the mere manufacture of padding. As, however, the Bulletin is filed in many libraries, I was glad to have the leisure to put the successive annual volumes into a shipshape form. When the next general index is issued the whole series of volumes will form a sort of rough, though necessarily incomplete, encyclopædia of practical information on Indian and colonial agriculture and products.

The announcement of appointments may have been belated, but that again is of little consequence, as they are only intended to be items in a continuous record.

The catalogue of portraits was not supposed to be exhaustive, and does not compare, therefore, with the "Catalogus Stockholmiensis." It is simply a hand-list for the use of visitors of the portraits exhibited in Museum No. 1. The Kew collection has always been popular, and, as I know of no other, *is* "probably unique," but it has latterly grown out of all bounds. As the available space was restricted, I made a selection, and, so far as prints were concerned, had them uniformly framed. I was guided by considerations which I have stated in the preface, and I confess I was largely influenced for the purpose of public exhibition by artistic merit. Mere trivial photographs and cuttings from illustrated papers, though valuable so far as they go, seem to me most conveniently preserved in portfolios.

The personality of those who have made a mark in scientific history has, I think, a peculiar, because intimate, interest. The world is certainly the poorer for having no portrait of Gilbert White. Only recently I have seen the posthumous portraits of two distinguished men of whom no memorial now remains which bears the impress of vitality.

In the seventeenth and eighteenth centuries few men of any note disdained to transmit their portraiture to posterity by the aid of the engraver. It was not, indeed, until the middle of the last century that the practice expired in the more feeble art of the lithographer. Some examples of its decadence I felt obliged to withdraw as painful caricatures. Nowadays, modesty or indifference seems to leave neglected all but the most eminent. I am not without hopes that more space may be found at Kew for portraits. I hope the collection may continue, as in the past, to be the recipient of gifts from private liberality, and that in this way many obvious gaps may be filled up.

W. T. THISELTON-DYER.

Witcombe, Gloucester, June 25.

A Remarkable Lightning Discharge.

THE afternoon of Saturday last, June 23, was sultry, and it was therefore without surprise that about 8.30 p.m. we observed the reflection in the clouds of lightning to the west and south-west, and heard from time to time the low sounds of distant thunder; there was no indication of the storm coming near to us until 9.30 p.m., when we were startled by a tremendous explosion and a brilliant flash of light, which, according to some observers, was continued after the explosion took place. This explosion was, I think, the loudest that I ever heard, and the impression on all of us was that it was quite close, and I am told that it was heard nearly two miles off as if it was close at hand. The thunderstorm continued for some hours after this explosion, but never came near to us.

It was not until the next morning that we discovered the scene of the explosion of the fire-ball, if such was the nature of the agent.

In one part of the garden here there is a mound—the remains of an old greenhouse—of irregular form and height—on the northern side grown over with ferns, ivy, and weeds, from which, towards its western end, grows an ash tree of moderate size, which gives out its first branches between 16 feet and 17 feet from the ground. The leaves of the tree seem intact, but the ivy of the trunk, from immediately below the branches down to the mound, has been more or less stripped of its leaves; a space half round the tree has been disturbed, and the weeds and plants thrown down, very much as if they had been trampled down by human feet; and this disturbance is continued in a line down the mound on the northern side, the plants being depressed from above downwards, and the gravel path at the foot of the mound broken up more than halfway across. Many of the leaves of the ivy have been scattered about, and many of the leaves lying on the mound have been torn to pieces. Several pieces of dead wood on the mound have been broken asunder. A branch of ivy close to the root of the ash tree has been stripped of its bark; an old brick lying on the mound under the vegetation was broken into four pieces, two small pieces and two large of nearly equal size; one of these larger pieces was found on the mound, one was found about 7 feet 6 inches from the point at the foot of the mound where the disturbance was seen, one smaller piece was about 7 feet beyond this, and another yet 2 feet further beyond the last. A piece of highly-crystallised Old Red Sandstone lying on the mound was found with a new and unweathered exposure several inches in length, and fragments of the same stone with new faces were lying near.

The conclusion from these facts seems to me to be that the electric agent, whether a fire-ball or not, must have approached the ash tree in a nearly horizontal line and struck it just below the lowest branches, have passed down the tree to the mound, have disturbed the vegetation to the south of the trunk of the tree, have passed then towards the north down the mound, and then to have nearly crossed the garden path, when it disappeared. When exactly the explosion took place I feel at a loss to ascertain, but perhaps some of your readers may be able to assist in determining this point. EDW. FRY.

Failand, near Bristol, June 25.

The Magnetic Inertia of a Charged Sphere in a Field of Electric Force.

DR. O. HEAVISIDE has investigated (NATURE, April 19) the slow motion of a charged conducting sphere through a uniform electric field, in a direction *parallel* to the electric force of the field, and has calculated the increase in the magnetic energy and inertia of the sphere resulting from the re-distribution of the charge under the influence of the field. His paper has suggested the following investigation, in which the slow motion of the sphere is *at right angles to* the direction of the electric field. But, as Dr. Heaviside has pointed out to me, this problem has no single definite solution. For, if the sphere, initially at rest in the field, be set in motion, the motion of the unequally distributed charges on the surface of the sphere will tend to give rise to magnetic force in the interior; but the magnetic force will only gradually pene-

trate into the interior, and electric curents circulating in the sphere in parallel planes will cause a magnetic force opposed to that due to the moving charges. If the conductivity be perfect, these currents will persist, and the interior of the sphere will be permanently free from either electric or magnetic force; but, with finite conductivity, the currents will die away, and the magnetic force will finally attain a definite value inside the sphere, although the electric force vanishes. In each of these cases a solution is easily found; but while the currents are dying away the magnetic energy gradually changes, and the calculation of the energy at any given time might be difficult. I therefore confine myself to the two limiting cases. The case of the final stage when there is finite conductivity I had solved when Dr. Heaviside suggested to me that I should include the case of infinite conductivity in my investigation. The present communication is the outcome of that suggestion.

The sphere is of radius a, and carries a charge Q at a speed u, which is very small compared with v, the velocity of light; the strength of the field is F, and the specific inductive capacity is c. I employ Dr. Heaviside's units in order that my results may be comparable with his. The origin is at the centre of the sphere, and the axes of x and y are respectively parallel to the direction of motion and to the direction of the uniform electric field.

When u/v is very small, the electric force E, *due to the moving sphere*, is the same as if the sphere were at rest, and is therefore derivable from a potential function. Since there is no electric force inside the sphere, the induced distribution on the sphere produces the potential Fy at internal points, and hence produces the potential Fa^3y/r^3 at external points. Thus at internal points the components of E are

$$E_1=0, \quad E_2=-F, \quad E_3=0,$$

while at external points they are

$$E_1=\frac{Qx}{4\pi cr^3},$$

$$E_2=\frac{Qy}{4\pi cr^3}+Fa^3\left(\frac{3y^2}{r^5}-\frac{1}{r^3}\right),$$

$$E_3=\frac{Qz}{4\pi cr^3}+Fa^3.\frac{3yz}{r^5}.$$

Finite Conductivity, Final Stage.—In this case the magnetic force is entirely due to the motion of the charge on the sphere, and we have

$$H_1=0, \quad H_2=-ucE_3, \quad H_3=ucE_2,$$

and thus $H^2=u^2c^2(E_2^2+E_3^2)$.

If, now, we write

$$x=r\cos\theta, \quad y=r\cos\phi\sin\theta, \quad z=r\sin\phi\sin\theta,$$

we find that for internal points $H^2=u^2c^2F^2$, and that for external points

$$H^2=u^2c^2\left[\frac{Q^2\sin^2\theta}{16\pi^2c^2r^4}+\frac{QFa^3}{2\pi cr^5}\cos\phi\sin\theta(3\sin^2\theta-1)+\frac{F^2a^6}{r^6}\left(1-6\cos^2\phi\sin^2\theta+9\cos^2\phi\sin^4\theta\right)\right]$$

The magnetic energy is $\frac{1}{2}\mu H^2$ per unit volume, and thus the total magnetic energy is

$$T=\tfrac{1}{2}\mu u^2c^2F^2.\tfrac{4}{3}\pi a^3+\tfrac{1}{2}\mu\int\int\int H^2r^2\sin\theta\,dr\,d\theta\,d\phi,$$

where r ranges from a to infinity, ϕ from 0 to 2π, and θ from 0 to π. On effecting the integration, we find

$$T=\tfrac{1}{2}u^2[\mu Q^2/6\pi a+16\pi\mu c^2F^2a^3/5]=\tfrac{1}{2}mu^2,$$

where m is the magnetic inertia.

For motion parallel to F instead of right angles to it, Dr. Heaviside finds (NATURE, April 19)

$$T=\tfrac{1}{2}u^2[\mu Q^2/6\pi a+8\pi\mu c^2F^2a^3/5].$$

When the quantities are measured in ordinary units the results become

$$T=\tfrac{1}{2}u^2[2\mu Q^2/3a+4\mu c^2F^2a^3/5] \qquad \text{(Searle)}$$

and

$$T=\tfrac{1}{2}u^2[2\mu Q^2/3a+2\mu c^2F^2a^3/5], \qquad \text{(Heaviside)}$$

where, if we use C.G.S. electromagnetic units, we have $\mu=1$ and $c=(3\times10^{10})^{-2}$.

Infinite Conductivity.—In this case a system of currents flows round the sphere, on its surface, in planes normal to the axis of z, the distribution being such as to give rise to a magnetic potential $-ucFz$ at internal points. The magnetic force due to these conduction currents then neutralises, at internal points, the magnetic force $-ucF$ due to the moving charges. The external magnetic force *due to the conduction currents* will satisfy Laplace's equation for very slow speeds, and must, therefore, be expressible in zonal harmonics, while, for all speeds, the magnetic force normal to the sphere must be continuous. If $z/r=\cos\psi$, the normal force at points just inside the sphere is $ucF\cos\psi$. The conditions are satisfied by the external potential

$$\Omega=ucFa^3\cos\psi/2r^2=ucFa^3z/2r^3,$$

for this is a zonal harmonic, and gives rise to the normal force $ucF\cos\psi$ at the surface.

Thus, at external points,

$$H_1=-d\Omega/dx, \quad H_2=-d\Omega/dy-ucE_3, \quad H_3=-d\Omega/dz+ucE_2,$$

where E_1, E_2, E_3 have the values already given. We thus find

$$H_1=\frac{3ucFa^3xz}{2r^5},$$

$$H_2=-\frac{ucQz}{4\pi cr^3}-\frac{3ucFa^3yz}{2r^5},$$

$$H_3=\frac{ucQy}{4\pi cr^3}+ucFa^3\left[\frac{6y^2+3z^2}{2r^5}-\frac{3}{2r^3}\right].$$

It will be found that $xH_1+yH_2+zH_3=0$ for all values of r, and thus the magnetic force is tangential to the sphere, a condition pointed out to me by Dr. Heaviside.

Hence we find

$$H^2=u^2c^2\left[\frac{Q^2\sin^2\theta}{16\pi^2c^2r^4}+\frac{3QFa^3}{4\pi cr^5}\cos\phi\sin\theta(2\sin^2\theta-1)+\frac{F^2a^6}{4r^6}\left\{36\sin^4\theta\cos^2\phi-9\sin^2\theta(4\cos^2\phi+\sin^2\phi)+9\right\}\right].$$

Remembering that $H=0$ at points inside the sphere, we find, on integration through the external space, that the magnetic energy is

$$T=\tfrac{1}{2}u^2[\mu Q^2/6\pi a+6\pi\mu c^2F^2a^3/5].$$

When the quantities are expressed in ordinary units the result becomes

$$T=\tfrac{1}{2}u^2[2\mu Q^2/3a+3\mu c^2F^2a^3/10].$$

If an electron be a conducting sphere of radius 10^{-13} cm. with a charge of 10^{-20} electromagnetic units, an electric force of a billion volts, or 10^{20} C.G.S. units, per centimetre, would not change its magnetic inertia by so much as one part in ten billions, and the results are of no consequence in experiments on the electrostatic deflection of kathode rays; but it is possible that there are other cases where it would be necessary to take the change of magnetic inertia into account.

When u becomes comparable with v, the analysis becomes more complicated, but does not present any difficulty, at least in the final stage, with finite conductivity, provided a Heaviside ellipsoid be substituted for a sphere.

In conclusion, I desire to acknowledge the help I have received from Dr. Heaviside's suggestions, and to thank Mr. Norman R. Campbell for verifying the formulæ.

G. F. C. SEARLE.

The Date of Easter.

THAT the formula of Gauss for finding the date of Easter fails in certain cases, of which the year 1954 is one, was pointed out by Gauss in his original paper in the *Monatliche Correspondenz* (vol. ii., p. 129), where he shows that there are the following two exceptions to the formula in the Gregorian calendar:—

(1) When the formula gives April 26, Easter falls on April 19.

(2) When the formula gives $d=28$, $e=6$, while $11M+11$ divided by 30 gives a remainder smaller than 19, then

Easter does not fall on April 25, as given by the formula, but on April 18.

These exceptions are caused by an inconsistency in the Gregorian rule, caused by the adherence to the old custom, that Easter should never fall later than April 25.

Armagh Observatory, June 22. J. L. E. DREYER.

THE discrepancy between the date of Easter, 1954, April 18 as given by the tables in the Book of Common Prayer, and April 25 as given by the formula of Gauss, arises from a purely artificial contrivance of Clavius, who arranged the reformed calendar, which is thus described on p. 55 of "The Prayer Book Interleaved," 1873, in an account of the calendar founded on a paper by Prof. De Morgan:—"It will never happen as to mean lunations, and rarely as to real ones, that in the same cycle there should be the lunation of a given month beginning on the same day in two different years of the cycle; and such a thing never happened in the unreformed Calendar. Clavius thought it desirable to imitate this in the new Calendar; and he observed that by taking the preceding day whenever the Epact was xxv., and the year of the cycle after the 11th, he could avoid the reiteration, and thus make the desired resemblance." "Whenever the Epact should be xxv., the year of the cycle being upwards of 11, say that the Epact is 26. This is not an astronomical correction, but a mere conventional mode of reconciling the choice which Clavius made of the mode of writing the Epacts with an essential peculiarity of the old cycle of 19 years which that mode of writing would have otherwise destroyed." "In 1954 the Golden Number is 17, the Sunday letter C, and the Epact according to the ordinary rule, xxv. *Call it therefore* xxvi. Thence April 17 will be the 14th day of the Paschal Moon, April 18, Easter Day. If the Epact xxv. were used April 25 would be Easter Day." The paper by Prof. De Morgan will be found in the "Companion to the British Almanac" for 1845.

My copy of NATURE for April 5 has long since gone to Bolivia, but probably your correspondents will find that Gauss did not take into account this artifice of Clavius. If in this century golden number 6 and Sunday letter C had coincided, Easter would have been set on April 25, because 6 comes in the cycle before 11 instead of after it as 17 does. An inspection of Table III. for finding Easter will show in the two half-lines for April 17 and 18 the arrangement made by Clavius. C. S. TAYLOR.

Banwell Vicarage, June 22.

Musical Thunder.

EARLY this morning a storm broke in this neighbourhood accompanied by heavy thunder. During the storm I noticed that two of the peals began with a musical note of distinct and definite pitch. The "musical" portion of the peal lasted for about two seconds in each case, and the frequency of the note was both times about 400 per second.

This sound closely resembled a foot-fall in a narrow alley between high walls, and was only heard in two consecutive peals, separated by an interval of about a minute, the first being much more definitely musical than the second. In each case the interval between the flash and the first sound of thunder was about five seconds.

As is well known, a peal of thunder from lightning near at hand frequently sounds like a quick succession of raps or a volley of guns. Can the successive raps have followed one another so rapidly in this case that they combined to form a note?

If so, and if this note was due to a special configuration of reflecting surfaces in the clouds, possibly to others in slightly different positions, considerably different frequencies may have been observed.

The fact that two peals only sounded in this manner separated by the short interval of about one minute, and that the second was not so decidedly musical as the first, seems to indicate that they were due to some rapidly changing source such as one might expect the reflecting surfaces of a cloud to be. I listened carefully to determine that the note had its origin outside and was not due to resonance within the room, and in the second peal it was certainly outside, and probably had the first had its origin within the room I should have observed it.

I should be very glad to hear if anyone has observed a similar phenomenon. G. H. MARTYN.

1 Marden Road, S. Tottenham, N., June 24.

How do Inquiline Bees find the Nest of their Host?

THE following observation may serve to throw light on the above question, which has doubtless occurred to many entomologists. Yesterday I saw a specimen of the inquiline *Coelioxys quadridentata* enter the burrow of a leaf-cutter bee, *Megachile circumcincta*. I dug the nest out of the burrow, and in so doing scattered the sand over an area of several square inches, completely destroying all appearance of a burrow. I sat down to await the return of the Megachile, in order to identify the species, and was much astonished to see (and capture) in the course of the next ten minutes two more specimens of Cœlioxys, which came hovering over the spot and alighted on the disturbed soil. I can think of no other explanation than that these "cuckoos" were attracted to the spot by the scent of the excavated nest. I may add that during several hours spent on the heath where this occurred I saw no other specimens of Cœlioxys, and, further, that there was a fresh south-east breeze blowing at the time, and that the bees came up against the wind.

OSWALD H. LATTER.

Charterhouse, Godalming, June 24.

THE DISTURBANCE OF GREENWICH OBSERVATIONS.

IN the House of Lords on Thursday last, June 21, attention was directed to the threatened danger to the continued efficiency of the Royal Observatory, Greenwich, caused by the great electrical generating station erected by the London County Council about half a mile due north of the observatory. The danger was referred to by the Astronomer Royal in his report to the Board of Visitors on May 30, a summary of which appeared in NATURE of June 7 (p. 135). The generating station is situated exactly in the Greenwich meridian, as will be seen from the accompanying photograph of a view looking north over the top of the transit room; and the tall chimneys shown in the picture, as well as the heated air from them, will obviously interfere with some observations of northern stars, which are essential for latitude and refraction. Moreover, from tests already made it appears that the powerful engines which are being installed at the generating station will cause vibrations that will seriously affect the value of observations by reflection from a mercury horizon, required for the fundamental work of the observatory.

This is not the first time that the effects of generating stations and electric tramway systems in the neighbourhood of the observatory have been pointed out. About six years ago the question of the possible effect of disturbances from electric railways on the magnetic work carried on at the observatory was given careful consideration; and the hope was then expressed that in the event of future electric tramways regulations would be laid down by the Board of Trade to secure adequate protection for the magnetic work. The records in this department of the observatory have been obtained continuously on a general system for sixty-five years, but the astronomical work extends over more than two centuries and a quarter, and it would be unfortunate if circumstances should arise to break this chain of continuity.

The generating station established at Deptford—nearly a mile from the observatory—to supply the London County Council Tramways with electric

power, has not caused such serious tremors as are produced by the small portion of the engineering plant now available for work at the new station, which is much nearer and larger. It appears, therefore, that if the new station is completed and equipped to supply electric power over London, though it was authorised only for the requirements of tramways, the work of the observatory will be impaired to no slight extent. When the scheme was first put forward, it was not supposed that the works or the engines would assume the gigantic and overpowering proportions now contemplated, and the Astronomer Royal, in referring to this point in his report, remarks :—

The question arises why the immediate neighbourhood of the observatory should be selected for the planting of generating stations on an unprecedented scale to supply electric power to distant districts. The very powerful engines required for such a large output are liable to cause

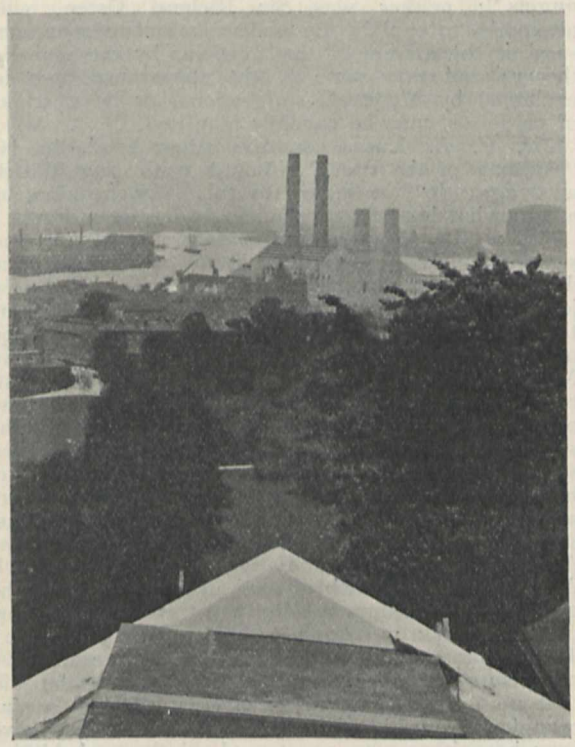

FIG. 1.—View of chimneys of the electrical works of the London County Council, looking north over the transit room of the Royal Observatory, Greenwich. The roof of the transit room is shown at the bottom of the picture.

vibrations the extent of which could hardly be anticipated from previous experience of ordinary engineering plant or of railway trains, which have hitherto not affected the work of the observatory.

The question as to the action the Government proposes to take to prevent the Royal Observatory from being injuriously affected by electric stations or other works, either at present or in the future, was asked in the House of Lords by Lord Ellenborough, who remarked that the difficulty which has arisen might have been obviated to some extent by the installation of turbines or triple-expansion horizontal engines instead of vertical engines. The Earl of Crawford pointed out that the interference with observations would arise from the heated air of the chimneys and the tremors due to machinery in motion. He said in the course of his remarks :—

The essentials for observation of an astronomical kind are stability and quietude. Nothing is so dangerous in astronomical observation as the unknown errors which have to be guarded against at the present time. If an error is known no great harm is done. In connection with the meridian, careful observations of the moon require to be made. For very many years the moon has been given over by the scientific world to Greenwich Observatory. The Royal Observatory has specialised on the moon mainly owing to the grand labours of Sir George Airy, the late Astronomer Royal, so that the position of the moon at a given time hence may be fairly accurately predicted. The observations at Greenwich, and the manner in which they have been carried out by the late Astronomer Royal, have led the whole scientific world to say, "Gentlemen, you know your moon so well, pray continue to be responsible for her." If now Greenwich is reduced to the position of saying that its lunar observations have not the weight and value which so far have attached to them, it will be a terrible blow to the reputation of the Royal Observatory and also to our existence as a scientific country. Another difficulty is that disputes as to boundaries between countries are mainly settled by astronomical observation as to the position of the moon, and as the moon is being constantly watched at Greenwich Observatory, applications are frequently received from foreign countries as to the error of the moon at such an hour on such a day. This also shows how extremely important it is that the observations at Greenwich should be trustworthy.

The suggestion that the observatory should be moved from Greenwich was considered by Lord Kelvin to be a most undesirable solution of the difficulty. He added :—

Even at present we may look forward to possible changes in the arrangement of the works by which the electricity will not seriously disturb or practically cripple the astronomical observations at Greenwich. The disturbance caused at the observatory by the vibration from the electric works may be to some extent avoided by the substitution of steam turbines for reciprocating engines and the use of different electric dynamos. It is no exaggeration to say that the whole world outside, as well as the British Empire, would deplore anything that would injure the great and good work done in the Royal Observatory at Greenwich, and both Houses of Parliament should unite in preserving it.

As further development of the machinery equipment must increase the effects shown by the tests already made, Earl Cawdor considered that powers should be obtained, or set in action, to prevent the County Council from carrying out works that injure the observatory, and that the half a million pounds expended by the Council is a small sum compared with the matter at stake.

Replying on behalf of the Government, Lord Tweedmouth, First Lord of the Admiralty, made the following statement of the case; and his remarks, with those contained in the recent report of the Astronomer Royal to the Board of Visitors, are the only official comments available upon the subject :—

Since the subject was raised it has been closely considered at the Admiralty. As to the origin of this generating station, in 1901 the London County Council resolved on it, and in 1902 a Bill was passed through Parliament. In this Bill was inserted a clause, known as the Observatory clause, which gave to the Board of Trade the power, if any use of electrical power was likely to affect injuriously the instruments used in the observatory, to require reasonable and proper precautions to be taken. This proposal was made public and approved by Parliament. It is a pity that the County Council did not more closely apprehend the possibility of danger in choosing this particular site, but some responsibility must also be attached to the various departments and to Parliament. At present, at any rate, no absolute damage has been done, but there is an apprehension of it when the station

is developed to its fullest power. It will be almost the biggest generating station in the world when completed. Eight engines will work up to 52,000 horse-power, and the electricity generated will be sufficient to work the whole of the London tramway system. At the present time the Astronomer Royal said that no serious effect has as yet arisen in the working of the principal meridian instrument. The Astronomer Royal, however, says that the instrument which has been affected is the portable transit instrument used for determining longitude. From the large generating station at Deptford no damage has resulted, and there is no indication of any disturbance. What the authorities have to do is to take very careful observation as to what is exactly going on at Greenwich. At present the station is never worked up to more than 3000 horse-power. A trial has been made of two engines, but the experiments are neither complete nor satisfactory. It is proposed to ask Prof. Ewing to represent the Admiralty in the observations to be taken, which must extend over a considerable time. The disturbances vary very much, and there is a great deal to be said as to the possibility of meeting the difficulties by reducing the high chimneys, though the Astronomer Royal does not think that the vapour of the chimneys seriously interferes with the observations. It is proposed also to ask the County Council to appoint a representative of its own for observation in order to have an independent report as to the exact amount of disturbance that might arise. The London County Council will not go on with the two chimneys, which are now only partly erected. Before doing anything it is necessary to discover whether by any re-arrangement of the machinery the threatened damage can be averted. Every effort will be made to make the inquiry a thorough one, and one which should command everyone's respect.

The position then, as stated by Viscount Goschen, is that a mistake has been made—a mistake by the Admiralty, by the Astronomer Royal, by the County Council, and by Parliament. The matter affects, not only the Royal Observatory, but the whole world; and the best scientific knowledge available should be utilised to avert any danger which imperils the useful existence of the observatory or interferes with its work.

THE SEA-SERPENT.

THE narrative of an encounter with the "sea-serpent" on December last off the coast of Para, given by Messrs. Nicoll and Meade-Waldo at the meeting of the Zoological Society held on June 19, has once more awakened interest in the question as to the possibility of the existence of a large unknown marine vertebrate animal. The appearance of the so-called "sea-serpent" has been recorded from time to time by quite a number of witnesses. Many of these alleged appearances were evidently based on objects other than vertebrate animals unknown to science, but others, as being witnessed by trustworthy and educated observers, are evidently worthy of more serious consideration. The importance of the recent case—of which more anon—is that it was witnessed by two gentlemen who have undergone a long training in the observation of animals, and are therefore far less likely to be mistaken than persons who have not specially devoted themselves to the study of natural history.

To attempt to record on the present occasion all the trustworthy cases of the alleged appearance of the sea-serpent (for the sake of convenience we may discard the inverted commas) would much exceed our limits of space, and we may therefore refer our readers to the volume by Mr. A. C. Oudemans entitled the "Great Sea Serpent," published in 1892, where all the more important ones up to that date will be found mentioned. It may be profitable to refer, however, to a few of the published opinions of naturalists on the sea-serpent question. In his *Challenger* book, the late Prof. H. N. Moseley wrote as follows:—

"The sea-serpent, however, is always open to criticism. This wonderful animal has hardly ever been seen alike by any two observers. It is nearly always easy to a naturalist to understand the stories told. Sometimes it is a pair of whales that is seen; sometimes a long mass of floating seaweed deceives the distant observer; sometimes the serpent has large eyes and a crest behind the head; then it is a ribbon-fish. I myself am one of the few professed naturalists who have seen the serpent. It was on a voyage to Rotterdam from the Thames. . . . It was a flock of cormorants, which were flying in line behind the waves, and which were viewed in the intervals between them with a sort of thaumoscopic effect."

Clearly Mr. Moseley was not "on the side of the angels"; neither was Sir Richard Owen, who attempted to explain the undermentioned appearance seen by the officers of the *Daedalus* by the seaweed theory; and that some of the appearances can be explained by Moseley's suggestions, or by a school of porpoises, may be candidly admitted.

Mr. F. A. Lucas, on the other hand, in his "Animals of the Past," although confessing himself an "agnostic" in regard to this subject, takes up a somewhat less uncompromisingly hostile attitude.

"Like the 'fossil man,'" he writes, "the sea-serpent flourishes perennially in the newspapers, and despite the fact that he is now mainly regarded as a joke, there have been many attempts to rehabilitate this mythical monster and place him on a foundation of firm fact. The most earnest of these was that of M. Oudemans, who expressed his belief in the existence of some rare and huge seal-like creature whose occasional appearance gave rise to the reports of the sea-serpent. Among other possibilities it has been suggested that some animal believed to be extinct had really lived to the present day. Now there are a few waifs, spared from the wrecks of ancient faunas, stranded on the shores of the present, such as the Australian ceratodus and the gar-pikes of North America. . . . If a fish of such ancient lineage as the gar-pike is so common, why may there not be a few plesiosaurs or a mosasaur in the depths of the ocean? The argument was a good one, the more that we may 'suppose' almost anything; but it must be said that no trace of any of these creatures has so far been found outside of the strata in which they have long been known to occur, and all the probabilities are opposed to this theory."

The event recorded by Messrs. Nicoll and Meade-Waldo took place in the forenoon of December 7, 1905, when they were on board the yacht *Valhalla* off the coast of Para. At a distance of about 100 yards from the vessel the two observers saw what appeared to be the vertical dorsal fin of some large animal, and a short time afterwards the head and neck of an animal was raised above the water some distance in advance of the fin. The head was compared to that of a turtle, while the neck appeared to be about 6 feet in length. The description, so far as we can judge, suggests a creature of not more than about 20 feet or 25 feet in length. Although the vessel was subsequently put about, no further signs of the sea-serpent were seen during daylight. It is, however, noteworthy that during the night two of the ship's officers became aware of the presence of some large animal swimming alongside the yacht at a rapid pace; the two officers, it is stated, had no cognisance of the events of the morning.

A most significant feature in this circumstantial account is that it tallies to some extent with the narrative given by the officers of H.M.S. *Daedalus* of the appearance of the sea-serpent seen by them in the year 1848 in the Atlantic.

In the figures given by Oudemans the (double) back-fin is very low, and the neck seems relatively short and ill-defined. Revised restorations, however, give a longer neck and no back-fin. It is possible, if a fin was present, that its apparent difference in height in the two instances was due to the animal swimming faster in one case than the other. *Megophias megophias*, it appears, is a name which has been suggested for the creature. In 1903 Prof. Racovitza (Bull. Soc. Zool. Paris, xxviii., p. 11) gave an account of a sea-serpent seen by Lieut. Lagresille in 1898 in Along Bay, Tonkin, and in 1904 M. Vaillant (Bull. Mus. Paris, x., p. 217) mentioned another apparition of an apparently similar creature in the same locality. In this second account the animal is described as being probably scaled, with a head like that of a turtle or a seal, and as "spouting" from terminally placed nostrils. It was also stated to move in undulations—at one time vertical, at another horizontal. Two occurrences in the same locality are very noteworthy.

In each of these four instances it can scarcely be doubted that the object seen was a living creature (or creatures) of some kind, and that it (or they) was of the same general type. If the object were formed by more than one animal, *cadit quaestio*. If, on the other hand, it consisted of a single individual, furnished with a dorsal fin, a long, snake-like neck, and a head like a turtle, it could scarcely be any known living animal. Neither, it may be suggested, could it be even an unknown type of seal, especially since all the known members of that group come ashore to breed. The next question is, Could it have been a survivor of some Mesozoic reptilian? Two arguments, so far as they go, are against this. Firstly, the one referred to by Mr. True as to the absence of the remains of any such creature in Tertiary deposits, and secondly (on the hypothesis that it is an air-breathing vertebrate, and if not, why should it come to the surface at all?), the rarity of the sea-serpent's appearance, the latter argument being applicable whether the creature is considered to belong to a supposed extinct group or not.

With regard to the fossil theory, it might be urged that the creature is an inhabitant of the deep sea, and consequently that its remains should not be expected to occur in Tertiary deposits, which belong for the most part, at any rate, to more or less shallow water. For what it is worth, it may be mentioned in reply that no traces of the creature have been found on the ocean bottom, where sharks' teeth and cetacean ear-bones are common. A more forcible objection is that, if the creature is in the habit of coming to the surface (as on the hypothesis of its existence it must), it cannot be a denizen of the abysses, no animal (despite the old belief in regard to whales) being able to live under such diversities of pressure. *Ergo*, its remains ought to occur in Tertiary deposits. Its stranded carcase ought also to have been found. If the creature be a "living fossil," the plesiosaurian group has the strongest claim to its ownership, as, although the zeuglodont cetaceans are the latest in time of possible extinct representatives, the smallness of its head prevents the reference of the sea-serpent (as described) to that group. As to the rarity of its appearance, it can scarcely be urged that only two or three (or even half a dozen) examples of the creature are in existence.

Without offering any suggestion as to what the nature of the object seen by Messrs. Nicoll and Meade-Waldo really was, it may be pointed out that the testimony of two such trained observers (supplemented by that of the officers of the *Daedalus* and by the two "apparitions" off Tonkin) cannot possibly be brushed aside in the light-hearted manner with which Prof. Moseley treated the evidence available in his time.

R. L.

THE ROYAL SOCIETY CONVERSAZIONE.

MANY of the exhibits of scientific apparatus and objects at the second, or ladies', conversazione held at the Royal Society on June 20 were the same as those shown at the gentlemen's conversazione on May 9. As these have already been described (May 17, p. 59), it is only necessary to refer now to the new exhibits. During the evening demonstrations, with lantern illustrations, were given by Dr. Tempest Anderson, Sir William Crookes, and Mr. Fred. Enock. Dr. Tempest Anderson described the recent eruption of Vesuvius, his photographs showing the phenomena during the later stages of the eruption, as well as some of the results. In several cases the views afforded a comparison with the conditions of the same places as previously observed. Sir William Crookes gave a short address with experiments in illustration of some properties of the diamond; and Mr. Fred. Enock described slides showing by means of colour photography (Sanger Shepherd process) the adaptability of lepidopterous insects to their environment.

In the subjoined summary of the official catalogue, the exhibits are arranged roughly in groups of related subjects.

Dr. H. Forster Morley on behalf of the International Catalogue Committee: A map of the world was shown upon which thirty-one countries or regions were coloured. Each of these has established a Regional Bureau for indexing its scientific literature. The literature indexed is that published since January 1, 1901. Each annual issue of the catalogue contains seventeen volumes, dealing with seventeen sciences. A copy of the second annual issue was shown. The Regional Bureaus for France, Germany, and that for Polish literature employ the material prepared for the International Catalogue for the compilation of bibliographies of their own scientific literature. Specimens of these bibliographies were shown.—*Prof. H. McLeod on behalf of the Committee of the Royal Society's Catalogue of Scientific Papers:* An exhibit illustrating the course of operations in the preparation of the catalogue, which was fully described in an appendix to the descriptive programme of the conversazione.

Sir James Dewar, F.R.S.: (1) New charcoal calorimeter and thermoscope. Charcoal at the temperature of liquid hydrogen that has absorbed at atmospheric pressure considerable quantities of helium or hydrogen—or alternatively of nitrogen, oxygen, or air at their respective boiling points—is utilised in this instrument as a material that, by reason of changes in the volume of the occluded gas, exhibits great sensibility to heat and light radiation, and can be used in calorimetry at the temperature of solid hydrogen. (2) Charcoal vacua. Electric discharge tubes showing gradual gas absorption by charcoal cooled in liquid air until, after the Röntgen radiation stage, the electric resistance becomes so great that a discharge will not pass. (3) Spectrum tubes. (*a*) The less condensable gases of the atmosphere—helium and neon. (*b*) The more condensable gases of the atmosphere—krypton and xenon, each set of gases being separated by the charcoal method. (4) Some scientific uses of liquid air. (*a*) Electric ice crystals. (*b*) Rough measures of relative thermal conductivities in metals and alloys, by observing the height of the deposited ice cap when similar wires are placed alongside each other

and the ends immersed in liquid air. The relative conductivities are as the squares of the height of the ice columns. (*c*) Spheroidal state of liquid air on the surface of different fluids and solutions, showing changes of volatility from the varying amount of vapour condensation; at the same time exhibiting interesting rotatory and translatory movements.—*Department of Applied Mathematics, University College, London:* (1) Investigation into the stresses in masonry dams, Prof. Karl Pearson, F.R.S., and Mr. A. F. C. Pollard. The investigation suggested that the shear distribution should in each case be found from a model dam, before the stresses are determined by graphical methods. The existence of stretch in the tail of dams of ordinary type is confirmed by the experiments illustrated. (2) Solution of the problem of the random walk, Prof. Karl Pearson, F.R.S., and Mr. J. Blakeman. The diagrams shown give the sections of the frequency surface for two, three, four, five, six, and seven stretches or flights, and show the passage of the discontinuous function into Lord Rayleigh's continuous surface. The problem is of considerable importance from the standpoint of the migration of species, and was suggested by Major Ross's investigations into the infiltration of mosquitoes into a cleared district. The solution has been obtained by successive mechanical integration from the first case by using the functional relation between successive flights.—*Mr. A. A. C. Swinton:* Visibly luminous electrical discharges *in vacuo* obtained with comparatively low electrical pressures. Edison, Fleming, and others have shown that the passage of the electric discharge *in vacuo* is much facilitated by heating the kathode. Owen and Wehnelt have proved that this effect is enormously increased if the heated kathode be coated with oxides of the alkaline metals. The present experiments show that similar results can be obtained by coating the kathode with radium, and that the effect will be greater when the kathode is heated than obtains without heating.—*Mrs. Watts-Hughes and Mr. Richard Kerr:* Floral, geometric, and other forms produced by the human voice in singing. Moistened water-colour is spread on paper attached to an india-rubber disc stretched over a cup-shaped vessel. The sound vibrations are communicated to the under side of the india-rubber through a tube in the side of the cup.—*Mr. Oliver S. Dawson:* Photographic prints in natural colours (Smith-Merckens process).—*Messrs. Carl Zeiss, Jena:* Photomicrographic apparatus for ultra-violet light (designed by Dr. A. Köhler).

Mr. R. G. Durrant: Evidence to show that ionic separation occurs when solutions of acids or of salts are allowed to diffuse into sensitised jellies or solutions.—*Dr. O. Silberrad and Dr. R. C. Farmer:* Stability test for cordite. This exhibit illustrated a method recently devised at the Chemical Research Department, Royal Arsenal, Woolwich, for the determination of the stability of cordite and other propellant explosives. It is well known that these explosives decompose gradually on storage, and may eventually ignite spontaneously, if their stability be not tested from time to time. The principle of the new test is based upon the results of several thousand experiments, and is the only method known which gives trustworthy results with cordites. The test has been adopted by the Service, and will shortly be made use of as a safeguard against spontaneous explosions in powder magazines, particularly in the tropics, where the deterioration takes place most rapidly. In examining cordites the procedure is briefly as follows:—50 grams of the explosive are maintained at 70° C. in a glass vessel fitted with a mercury manometer; the alteration in pressure is measured at intervals. A contraction takes place at first owing to the absorption of oxygen from the air; subsequently a gradual expansion occurs; the former of these phenomena has never previously been observed.—*Dr. F. D. Chattaway:* Copper mirrors obtained by the deposition of metallic copper upon glass. The method of silvering glass by depositing the metal in a thin film by reduction of some soluble silver compound has long been employed in the production of mirrors, but hitherto no method of similarly depositing copper in a brilliant film has been discovered. The exhibit showed a number of glass vessels on which copper had been thus deposited by a slow reduction of the black oxide. The metal being protected from the air, such mirrors retain their lustre permanently.

Mr. G. F. Herbert Smith: Precious stones and simple methods for their identification. This exhibit illustrated the variety of precious stones which are available for ornamental purposes. A gem stone must be hard enough to resist the abrasive action of ordinary dust, and at the same time be either transparent or, if opaque, of pleasing colour. The number of mineral species suitable for the purpose is not so restricted as popularly supposed. The names employed by jewellers frequently differ considerably from the scientific nomenclature, being often associated with certain colours rather than particular species, *e.g.* topaz (yellow), sapphire (blue), ruby (red), emerald (green), and amethyst (violet). The colour, though the most obvious character of a stone, is the least trustworthy; and the hardness, while of immense importance as regards its durability, is of little discriminative value. On the other hand, the optical characters (refractivity, double refraction, and dichroism) and the specific gravity may be easily and accurately determined, and lead to the precise identification of the stone. In the case of practically all faceted transparent stones the refractivity and double refraction are sufficient for the purpose, and the stone need not be removed from its setting.—*Sir William Crookes, F.R.S.:* (1) Occurrence of the diamond. (*a*) Example of "blue ground" in which diamonds are found, from the 1320-feet level, De Beers Mine; (*b*) diamantiferous gravel from the Pulsator, De Beers Mine; (*c*) selected stones from the Pulsator, De Beers Mine. (2) Models of crystals of diamond. (3) Cut and polished section of a piece of silicified wood found about twelve years ago in the untouched "blue ground" of the Du Toits Pan Diamond Mine, Kimberley. (4) Polished section of the Cañon Diablo meteorite in which diamonds have been found.—*Prof. W. Gowland:* (1) Portion of a meteorite containing diamonds found near Cañon Diablo, Arizona, and specimens of diamonds extracted from it. (2) Alloys of copper and calcium. A series of alloys ranging from 0·8 per cent. to 61·5 per cent. of calcium. All are brittle, and those containing 6 per cent. to 7 per cent. calcium extremely hard. The higher alloys decompose water, and are readily oxidised in the air. Specimens were also exhibited showing the effects of calcium on lead, tin, bismuth, aluminium, and coinage bronze.—*Miss Rhodes:* Stereoscopic views of the Victoria Falls and the Batoka Gorge of the Zambezi, and of the Batoka country east of the Falls. Photographed by the late Colonel F. W. Rhodes.

The Director, Royal Gardens, Kew: Sturt's desert pea (*Clianthus Dampieri*). A prostrate herbaceous plant, native of West Australia, first collected by Captain William Dampier. Under cultivation it is very delicate, but when grafted on the bladder senna (*Colutea arborescens*) it grows with vigour and flowers freely.—*Dr. F. E. Fritsch:* Method of colonisation of free surfaces by subaërial Algæ (Cyanophyceæ) in the tropics.—*Mr. E. A. Newell Arber, Miss M. Benson, Miss W. Brenchley, Prof. F. W. Oliver, F.R.S., Dr. D. H. Scott, F.R.S., and Prof. F. E. Weiss:* Fossil plants from the English Coal-measures.—*Mr. W. Saville-Kent:* Stereoscopic and other natural-colour photographic transparencies illustrating the fauna of the Polynesian coral reefs. This series of natural-colour photographs was more particularly illustrative of the coral-frequenting fishes of Polynesia. A notable genus of mostly minute percoid fishes, Tetradachnum, represented in the series, habitually make isolated bushy coral stocks their headquarters. They cruise around these coral growths in sport and in search of food, retreating within the coral's ramifications to rest or to escape from any enemy.

The Solar Physics Observatory, South Kensington: Recent photographs of some British stone circles.—*Dr. W. M. Flinders Petrie, F.R.S.:* (1) Hyksos fortress model, and pottery, 2000 B.C., Egypt. (2) Model of the temple and city of Onias, Egypt. (3) Photographs, enlarged, from Sinai. The Egyptian turquoise mines were worked from 5000 B.C. The oldest rock sculptures are those of the middle of the first dynasty of kings. Both centres of mining, Wady Maghara and Serabit el Khadem, were shown.

NATIONAL PHYSICAL LABORATORY.

OPENING OF NEW BUILDINGS FOR ELECTROTECHNICS AND PHOTOMETRY.

THE new buildings of the National Physical Laboratory for electrotechnics and photometry were opened on Monday, June 25, by Mr. Haldane, Secretary of State for War. A large company assembled at the invitation of Lord Rayleigh and the general board, and among those on the platform were Lord Rosse, Lord Kelvin, Sir John Wolfe Barry, Sir J. Lawrence, M.P., Sir John Brunner, M.P., Sir William White, Mr. Gavey, M. Hospitalier, Herr W. von Siemens, Prof. Semenza, M. Gerard, Sir Thos. Wrightson, and Sir Chas. Tupper.

Among the audience, numbering nearly six hundred, were representatives to the International Electrical Congress, now being held in London, from the American, German, French, Swiss, Italian, and other electrotechnical societies.

Lord Rayleigh presided, and in opening the proceedings said that the gathering marked another stage in the evolution of the institution, and they all hoped the new buildings would play a considerable part in the science of electrotechnics in this country.

The director, Dr. Glazebrook, then made a statement concerning the new extensions, and detailed the gifts which had been made towards equipment by numerous firms and individuals. The Chancellor of the Exchequer had asked Parliament for a grant of 5000*l.* last session for new buildings, and this year's grant towards the cost of the further extensions in the engineering, chemical, and metrological departments was 10,000*l.* The building in which they were assembled had cost only about 7000*l.*, largely owing to the liberal treatment accorded to the laboratory by the contractors, Messrs. Mowlem, and by Messrs. Mott and Hay, who gave their services as architects. The director expressed his indebtedness to the members of the staff, who had helped in designing and fitting up the building, especially to Mr. Paterson, Mr. Rayner, and Mr. Melsom, who had all given much time and careful thought to the plans.

Mr. Haldane then addressed the meeting and declared the laboratory open. The meeting terminated with votes of thanks to Mr. Haldane, proposed by Sir John Wolfe Barry and seconded by Sir John Brunner, M.P., and to the chairman, proposed by Mr. Gavey.

The objects of the new building are the provision of suitable accommodation for the rapidly extending work of the laboratory in electrotechnics and photometry. In the old building will remain all the fundamental-standard work relating to measurements of current, electromotive force, resistance, capacity, and inductance. The main portion of the new extension consists of a top-lighted shed, 120 feet by 50 feet, divided into two bays, each 25 feet wide. The southern bay is divided transversely, forming two rooms, each 60 feet by 25 feet. The inner of these has a glass ceiling, and the lights above are glazed with double glass, and face north. The space between the ceiling and the roof can be heated, and by means of a large fan artificial ventilation is provided. It is hoped by this means to maintain the temperature fairly uniform. This internal room is intended for resistance measurements. The other half of the same bay is designed for heavy-test work. Two bed-plates are provided for machine testing, and arrangements have also been made for addition of a travelling crane.

The large bay to the north side, in which the ceremony was held, is for general electrotechnical testing. At the west end of this is the main switchboard, receiving power from the dynamo room, and also from the mains of the supply company, and distributing it to the machines in the building and to the batteries.

Near by is provided space for the special electrotechnical machine equipment. This includes a 5 kilo-watt motor-generator set for single or three-phase current, the frequency of which can be widely varied, another motor-generator of specially high efficiency for life-tests on lamps, and a third for transformer and high-tension experiments. The rest of the bay is assigned to experimental work, the western portion being reserved for alternating-current experiments, and the eastern portion for direct-current. The batteries are on the top floor of an annexe to the east of the main block, above the rooms reserved for photometry; thus the direct-current work requiring heavy currents will go on in the extreme eastern portion of the main bay.

Four new accumulator batteries are provided, and to charge these and furnish the additional power necessary for general work a 50 kilo-watt motor-generator has been provided in the power-house, driven from the supply mains of the local company. For ammeter-testing, currents up to 6000 amperes for an hour can be obtained by paralleling of one of these batteries, and 10,000 amperes for short periods. A special 300-volt battery is reserved for photometric experiments.

The remainder of the new building is intended for photometry. On the ground floor is a large room for life-tests of electric and gas lamps, and, above, a room for standard photometry and a specially arranged gallery for arc-lamp testing. A length of 90 feet is available for photometry of specially high candle-powers, and in the arc-lamp room a height of nearly 35 feet.

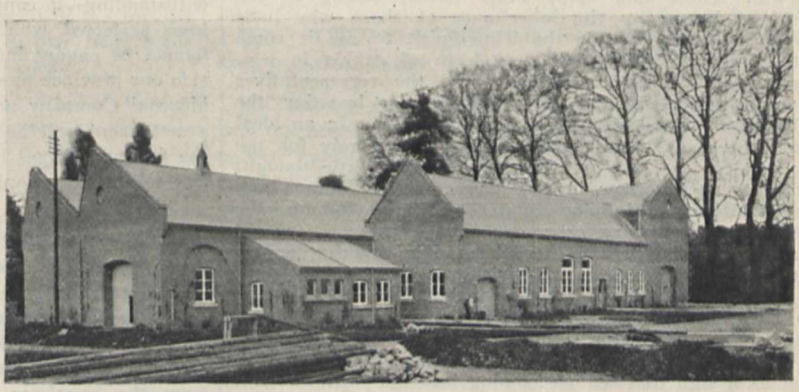

FIG. 1.—New Buildings of the National Physical Laboratory.

No money has been spent on unnecessary adornment of the buildings, marble and granite being conspicuous by their absence, but already the grounds have been planted with flowers and creepers, and the exterior, though plain, is by no means an eyesore.

After the opening ceremony the visitors proceeded to the old buildings and the garden, and inspected the various laboratories, where the assistants in charge explained the work of their own departments. The objects which appeared to attract most attention were the new ampere balance in the main electrical room, the various electric furnaces, the radiation pyrometers in the thermometric department, and the new measuring machines in the department of weights and measures.

A summary of the *Times* report of Mr. Haldane's address is subjoined.

The Government is keenly interested in the development of science, and a donation by the Chancellor of the Exchequer on a scale of double what was anticipated last year is an earnest of what it means. A contrast

may be made between the German and the British attitude towards science. Prussia began her emancipation by founding a university as an answer to the conqueror. Germany became the victor by the sheer might of thought and by the wonderful organisation which that might of thought enabled her to make the foundation of her future power. We, on the contrary, have always made the effort after material prosperity first, and when prosperity has been attained have strained after science. This is rather an outcome of the Anglo-Saxon temperament. There is an aversion in this land from anything that is abstract, a desire to do as much as possible by individual effort, and finally to turn to science and to the aid of thought and organisation for the completion rather than the foundation of the edifice. It is a good sign that brotherhood of science brings men of different races and different temperaments together. The possession of common conceptions and intellectual instruments, the passion for, and fascination of, common problems, the fact that the minds of men of the most varying temperaments and the most differing races are making toward a common point, has brought about a great intellectual common ground, and united men for the effort to accomplish a common task. The functions of the State are becoming more and more recognised, and more and more people in different parts of the world are beginning to feel that it is not merely the State, but the great individualities of which we are proud—individualities which form a common heritage. It is not merely Frenchmen who are proud of Laplace and Lavoisier, nor merely Germans who rejoice in the names of Weber, Helmholtz, Gauss, and Riemann, nor merely Englishmen who speak with pride of Newton and of Darwin. These and many other names belong to the world at large, are the inheritance of those who have drawn in the breath of the Time-Spirit to see it come forth again in the concentrated form of genius in conspicuous individuals too great to be the representatives of any one race, satisfied with being nothing less than the embodiment of the finest genius of humanity. In an ideal State, the ruler would take thought, not merely for the day, but for the morrow; but there is very little thought taken for the morrow in the government of almost any nation. What an infinite amount of friction would have been avoided, what an enormous quantity of waste would have been obviated, had there been only thinking organisation, plain principles not hurriedly to be departed from, at the root of policy! In the National Physical Laboratory we have a sign, a portent of the times, the evidence that we are advancing. But a few years ago and such an institution would have been impossible. We may look at it as a sign that we are coming into line with the rest of the world, and recognising that it is to science, and science in the main, that we must look for the means of maintaining ourselves in the vast competition of the world.

NOTES.

THE programme of events in connection with the international celebration of the coal-tar colour jubilee has now been definitely arranged. The steps leading up to the celebration have been described in these columns already (vol. lxxiii., p. 419). The celebration will be held on July 26 and 27. On the first day a meeting will take place at 11 a.m. at the Royal Institution for the presentation to Dr. W. H. Perkin of his portrait and bust, and in the evening a banquet has been arranged at the Whitehall Rooms, Hotel Metropole, when many distinguished guests are expected to be present. On July 27 a visit will be paid to the original works at Greenford Green, where mauve was first manufactured, and a garden-party will be held at Dr. Perkin's house. In the evening a soirée will take place at the Leathersellers' Hall, at the invitation of Dr. and Mrs. Perkin. The international committee arranging the ceremony includes distinguished representatives of science, especially chemical science, in France, Germany, and Switzerland, as well as in this country. Applications for tickets and invitations should be made to Dr. J. C. Cain, 28 Pembury Road, Clapton, N.E., who is acting as assistant honorary secretary to the executive committee.

WE learn from the *Chemist and Druggist* that the Chemists' Club of New York has also decided to honour Dr. Perkin. At a meeting held on May 28 the committee (of which Prof. Chandler is chairman) reported in favour of the establishment of a library, probably to be known as the Perkin Library, and to cost 10,000*l.*; the appropriation of 1000*l.* for a Perkin medal and a token to Dr. Perkin; and a dinner on October 6, at which Dr. Perkin is expected to be present. The proposals were adopted. The Perkin medal is to be awarded annually to an American chemist for distinguished work in technical chemistry.

MUCH correspondence has appeared in the *Times* and other journals during the past week with reference to the Wireless Telegraphy Bill which has just passed its third reading in the House of Lords. The Bill is merely to extend the Act of 1904, a summary of which appeared in our columns at the time (vol. lxx., p. 349). The original Act expires in July of this year, but will now be extended to 1909. The extreme importance of wireless telegraphy for the purpose of national defence has been recognised from the very first, and in consequence exercise of control had to be placed in the hands of the Government, especially in view of the fact that—all claims to the contrary notwithstanding—it cannot be said that any system has yet been perfected which is completely immune from interference or cannot interfere with other systems. It is outside our province to enter into the legal dispute between the Marconi Company and Lloyd's, but it is to be hoped that a settlement will be arrived at which will give the public the full advantages in connection with shipping that wireless telegraphy affords.

PARAGRAPHS have appeared in the daily papers alluding to a "new disease" which was said to have appeared in Essex about ten days ago. Some children at Highwood, near Chelmsford, were found to be suffering from a rash on the hands, face, and neck, accompanied with great irritation of the eyes and skin. On inquiry it was found that the children had been playing with some caterpillars taken from the hawthorn hedges. Much amusing "newspaper science" has appeared, and the name *Plusia gama* (sic) has been applied to the insect. The caterpillars were undoubtedly those of the Gold-tail Moth (*Liparis auriflua*), which is now common on the hedges. It is a pretty creature, but the hairs which cover its body are very easily detached, and, being exceedingly fine, readily enter the soft skin of children, and thus set up inflammation. It is doubtful whether any poisonous secretion accompanies the hairs, or whether the painful injury is purely mechanical. The malady is well known to practical entomologists, most of whom have learnt by experience to banish Liparis from their breeding-cages. An allied species, *Liparis chrysorrhoea* (the Brown-tail Moth) is in some seasons abundant on bushes on the Essex coast, and is even a greater irritant than its congener, but it is one of our immigrant moths, and is not seen every year.

A VIOLENT shock of earthquake was felt yesterday, June 27, at 9.45 a.m. over the whole of South Wales. At Swansea a chimney was thrown down, while at Cardiff the Exchange and other big buildings were shaken. The shock lasted about three seconds. The earthquake was felt at Knighton at 9.46 a.m., and tremors were also experienced at Llandrindod Wells and in South Shropshire. A slight shock was felt at Abergavenny and Carmarthen,

and at Bridgend people walking in the street were nearly thrown down. At Newport (Mon.) also the disturbance was felt distinctly.

A BANQUET was given by the Institution of Electrical Engineers on Monday night in honour of the delegates from kindred institutions in Canada, France, Germany, Italy, Switzerland, and the United States who are visiting this country. Mr. John Gavey, C.B., president of the institution, presided, and there were about 450 guests and delegates present. The toast of the visiting delegates, proposed by the president, was responded to by Prof. J. L. Farny, representing the Association Suisse des Électriciens; Mr. P. J. B. E. Auzépy, Consul-General of France; Prof. E. Budde, president, Verband Deutscher Elektrotechniker; Dr. Emil Naglo, representing the president of the Elektrotechnischer Verein; Mr. S. S. Wheeler, president of the American Institute of Electrical Engineers; and Mr. Guido Semenza, hon. general secretary of the Associazione Elettrotecnica Italiana, who during his response presented to the institution, in the name of the Associazione Elettrotecnica, a bust of Alessandro Volta. A conversazione in honour of the visitors was held at the Natural History Museum on Tuesday evening.

DR. T. P. ANDERSON STUART has been elected president of the Royal Society of New South Wales for the current year.

THE Guy medal in silver of the Royal Statistical Society has been awarded to Dr. W. N. Shaw, F.R.S., for his paper entitled "The Seasons in the British Isles since 1878," read before the society in March, 1905.

THE presidency of the Yorkshire Naturalists' Union for 1907 has been offered to, and accepted by, Mr. C. Crossland, of Halifax, joint author of the recently-published "Fungus Flora of East Yorkshire."

A SPECIAL meeting of the Faraday Society, to which the public is invited, will be held at the Society of Arts on Monday, July 2, when Prof. Kr. Birkeland, of Christiania, who is at present on a visit to England, will read a paper on the oxidation of atmospheric nitrogen in electric arcs. At the same meeting Mr. F. W. Harbord will communicate a paper, by Dr. Eugen Haanel, of Ottawa, describing the recent experiments on electric iron and steel smelting that were made at Sault Ste. Marie on behalf of the Canadian Government.

SIR DANIEL MORRIS, K.C.M.G., the Imperial Commissioner of Agriculture for the West Indies, has arrived in this country on a short visit, and will attend the forthcoming International Conference on Hybridisation and Plant Breeding to be held in London under the auspices of the Royal Horticultural Society at the end of July. Sir Daniel will read a paper on the hybridisation of the sugar cane, a subject with which he has been actively associated for many years.

BY the regretted death of Lieut. Forbes Tulloch, R.A.M.C., last week, another name is added to the honoured roll of the martyrs of science. Lieut. Tulloch, in association with Lieut. Grey, had been for the past year investigating sleeping sickness at Entebbe, Uganda. In March, while making a *post-mortem* on an inoculated rat, he accidentally scratched his finger. In a short time fever developed, and an examination of his blood showed the presence of the dreaded trypanosome. Although at once invalided home, the disease ran a very acute course and ended fatally as stated. Lieut. Tulloch had, in co-operation with Lieut. Grey, made the important observation that trypanosomes multiply in the tsetse fly, and was regarded as a worker of great promise. His untimely death is much to be deplored.

ON Thursday last, June 21, a paper was read before the Royal Society of Antiquaries by Dr. Jonathan Hutchinson, F.R.S., and Mr. E. W. Swanton, on prehistoric remains found during recent years in the neighbourhood of Haslemere. The authors commented on the large number of Neolithic implements which had been found, chiefly by Mr. Allen Chandler. Many were obtained from the site of a Neolithic flint factory on Blackdown, 912 feet above sea-level, and ten miles away from the nearest chalk-with-flints bed. Among the objects from this spot were rubbing stones and perforated circular hammer stones of quartzite, also a very fine series of the so-called "pigmy flints." The second part of the paper detailed the discovery of a Celtic urn-field adjacent to Haslemere town. Crude flint chips, and in one case a fragment of a bronze fibula, occurred among the fragments of calcined bone in the cineraries. No iron was found, and but one piece of bronze. A hole in the base of one of the cineraries had been repaired by inserting a plug of lead. Many accessory vessels had been placed around some of the urns; several in almost perfect condition were exhibited, they were of various shapes and sizes, and the paste was of several qualities. In the discussion which followed it was agreed that the pottery belonged to the later Celtic period or early Iron age, B.C. 50 approximately. The vessels and flints from this urn-field have been presented to the Haslemere Museum.

MR. GEORGE JAMES SNELUS, F.R.S., who died on June 18, was the first to eliminate phosphorus during the Bessemer process by the use of a basic lining to the converter. He took out a patent for the idea in 1872, and subsequently made five tons of steel by this method. The process was, however, not brought into commercial operation until after the work of Thomas and Gilchrist. Mr. Snelus's share in the invention was recognised by the Iron and Steel Institute, which in 1883 awarded him, jointly with Sidney Thomas, the Bessemer gold medal. Mr. Snelus, who was born on June 25, 1837, in London, was educated at St. John's College, Battersea, and at Owens College, and subsequently obtained a scholarship at the Royal School of Mines, where he took the associateship in metallurgy and in mining, and received the De la Beche medal for mining. His first appointment was as chemist to the Dowlais Ironworks. In 1871 he went as expert for the Iron and Steel Institute to the United States to report on the Danks rotatory puddling furnace. He was elected a Fellow of the Royal Society in 1887. He wrote a large number of papers on the metallurgy of iron, which were contributed to the Proceedings of the Iron and Steel Institute, of which society he was an original member, and at the time of his death occupied the position of vice-president. He possessed unusual talents for experimental research.

IN place of the usual autumn meeting, the Iron and Steel Institute will this year hold a joint meeting with the American Institute of Mining Engineers in London on July 23–26. Under the chairmanship of the Lord Mayor, an influential reception committee has arranged an attractive programme of entertainments, visits, and excursions. The King will receive a deputation of the institute's American guests. There will be a banquet in the Guildhall of the City of London, evening receptions by the president and by the Lord Mayor, and entertainments at

the Earl's Court Exhibition and at the Crystal Palace. Technical interests have not been neglected, the programme including visits to the National Physical Laboratory, to the power stations at Greenwich and Chelsea, to the Wellingborough blast-furnaces, to the Dover Harbour works, and to various engineering, shipbuilding, and cement-manufacturing works. The Iron and Steel Institute has down on the programme for reading a list of twelve papers, and the American society eleven more. These have all to be dealt with in three morning sessions. The papers likely to prove of chief interest are communications on blast-furnace gas engines, by Prof. H. Hubert (Liége), Mr. K. Reinhardt (Dortmund), and Mr. T. Westgarth (Middlesbrough); on the crystallography of iron, by Mr. F. Osmond (Paris); on high-speed tool steels, by Dr. H. C. H. Carpenter (National Physical Laboratory); and on segregation in steel ingots, by Mr. H. M. Howe (New York). For the week following the London meeting a tour to York, Middlesbrough, Durham, Newcastle-upon-Tyne, Glasgow, and Edinburgh has been arranged for the institute's American guests by a committee of which Mr. R. A. Hadfield, president of the institute, is chairman, and Mr. Bennett H. Brough secretary.

THE latest issue to hand (March) of the Proceedings of the Philadelphia Academy contains the completion of Dr. B. Smith's communication on the phylogeny of *Volutilithes petrosus* (already noticed in our columns), and an article by Mr. H. W. Fowler on the fishes and reptiles of the Florida keys.

Two papers bearing on the Mendelian doctrine, more especially as regards the theory of pure gametes, have been recently published by the Carnegie Institution, one, by Messrs. Castle and Forbes, on the heredity of hair-length in guinea-pigs, and the other, by Mr. W. E. Castle, on the origin of a polydactylous race of these rodents. Considerations of space alone prevent fuller notice.

LIMITATIONS of space must likewise be our excuse for not noticing in detail an important paper on the germ-cells of Aphides, by Mr. N. M. Stevens, also published by the Carnegie Institution. The present classification of aphides is considered imperfect, and reference to the cytology of the germ-cells will probably be necessary before an improvement can be made. Special attention is directed to the fact that while in some species parthenogenetic and sexual modes of reproduction alternate irregularly, in others parthenogenesis continues throughout the summer.

THE contents of the fourth part of vol. lxxxi. of the *Zeitschrift für wissenschaftliche Zoologie* are entirely devoted to invertebrates. In the first article Mr. W. Mayer discusses the dermal sense-organs of leeches; spermatogenesis in earthworms forms the subject of the second article, by Mr. Depdolla; in the third Dr. M. Nowikoff has remarks on the median eye and frontal organ of the crustacean Artemia; while in the fourth Mr. E. Martini describes certain superficial structures in nematode worms.

THE report for 1905 of the Marine Biological Association of the West of Scotland has just been received. "At no time has the station been so efficient as an instrument of research, of organised education, or of general instruction as it now is. At no time, either, have its prospects of growth in usefulness and efficiency on all these lines been so promising." At the same time, if the work is to be properly carried on, a large increase in the endowment fund is essential, and for this a special appeal is made in the report. Provision must likewise be made for the upkeep and working of the *Mermaid*, the five years' fund generously provided by Mr. J. Coates having now come to an end. An increase of the staff by the addition of a trained assistant is also a matter of urgency, but for this no funds are at present available.

IN the Oregon University Bulletin (vol. iii., Supp., No. 3, May) Mr. T. Condon describes, under the new generic and specific title of *Desmatophoca oregonensis*, the skull of a seal, referable to the family Otariidæ, from the Miocene of the Oregon coast. The author claims this as the first Miocene seal yet described. Evidently he is unacquainted with the seal-skull, referable to the same family and from the same formation (at Empire City), described by Mr. True in the quarterly issue of the Smithsonian Miscellaneous Collections for May, 1905, under the name of *Pantoleon magnus*. Although Mr. True's specimen is considerably the larger of the two, there is no apparent reason why it should not be the male of the skull described by Mr. Condon. The latter author urges that the Miocene age of the Oregon seal is a bar to the view that the Pinnipedia are descended from the bears.

VERTEBRATE osteology constitutes the main item in the contents of the first three parts (issued in one fasciculus) of vol. xix. of the Bulletin of the Imperial Society of Naturalists of Moscow. In the first article, for instance, Mr. L. P. Kravetz discusses the development of the mammalian sternum and presternum, more especially in relation to the conflicting views which have been expressed in regard to the origin of these structures. The skeleton of the cat-fishes (Siluridæ), as exemplified by the skull of the Old-World genus Clarias, forms the subject of a long communication by Mr. G. Schelaputin, in which the author revives the view that the fully ossified and sculptured cranial roof indicates some kind of affinity with the Palæozoic Coccosteus. The skeleton of the cat-fishes (inclusive of the American Loricariidæ) forms the subject of another article, by Mr. D. N. Koschkaroff, constituting a portion of a dissertation on teleostean osteology in general. A phylogenetic tree of the silurids and loricarids is included in this paper.

THE results of experiments in Barbados for the seasons 1903–5 with new seedling canes and manurial experiments on sugar-cane plots have been published in the pamphlet series, No. 40, issued by the Imperial Department of Agriculture for the West Indies. One or two of the varieties have now been under trial for six years, while others are newer and have only been tried for two or three seasons; one of the latter is B 1529, that with the highest quotient of purity takes the first place among plant canes. The manurial experiments confirm the results obtained in previous years, pointing to the value of nitrogen and potash and to the detrimental effects of phosphatic fertilisers.

MR. H. H. COUSINS contributes a third article on cassava trials at the Hope Experiment Station to the Bulletin (April) of the Department of Agriculture, Jamaica. The object has been to compare the yields of different varieties when grown for different periods. It was found in one instance that the yield of starch per acre was increased from 3½ tons at the end of a year to 7¼ tons after cultivation for twenty-one months, so that as far as cultivation alone is concerned a biennial crop would be the most profitable. On the subject of oranges, Mr. Fawcett offers some

practical advice on the treatment of trees to produce early ripening of the fruit, recommending root pruning and timely clearance of all fruit at the end of the season.

THE regulations governing the training of probationers at Oxford for the Imperial staff of the Indian Forest Service naturally arouse keen interest in India, and an editorial article in the *Indian Forester* (April) compares the course of studies prescribed at Oxford with the course given to recruits for the subordinate executive service at the Imperial Forest School, Dehra Dun. The opinion is expressed that the course at Oxford requires stiffening, and the immense advantage of obtaining practical experience at Dehra Dun under Indian forestry conditions as contrasted with those in European forests is emphasised. An article on felling timber in Bashahr, contributed by Mr. G. S. Hart, in which the felling of trees uphill is advocated, is accompanied by some interesting photographs.

IN the *Naturwissenschaftliche Wochenschrift* (June 17) there is an excellent summary of what is known respecting the structure of the reproductive cells, illustrated with a number of particularly good figures. The author is Dr. C. Thesing.

THE Bulletin of the Johns Hopkins Hospital for June (xvii., No. 183) contains articles on the use of quinine during the Civil War, by Dr. J. W. Churchman; on an experimental study on the regeneration of lymphatic vessels, by Dr. A. W. Meyer; and various medical papers.

THE Livingstone College "Year-book" for the current year contains the annual report, extracts from letters of former students, &c. The college is doing a useful work in giving to those about to become missionaries elementary training in medicine, surgery, and hygiene.

THE New Jersey State Legislature has recently passed an Act for the extermination of mosquitoes. The title of the Act is as follows:—"An Act to provide for locating and abolishing mosquito-breeding salt-marsh areas within the State, for assistance in dealing with certain inland breeding places, and appropriating money to carry its provisions into effect." The full text is given in *Science* (June 1).

THE preservation of brains for anatomical and anthropological investigations is the subject of an elaborate paper by Mr. Ales Hrdlicka (Proc. U.S. National Museum, xxx., p. 245). It is found that the best preservative is a mixture of formalin, water, and 95 per cent. alcohol in varying proportions according to size: formalin 3 parts, distilled water 45–25 parts, alcohol 52–75 parts; less water and more alcohol being used for the larger sized brains.

THE Local Government Board has published a further report on the destruction of rats and disinfection on shipboard with sulphur dioxide, by Dr. John Wade (No. 232). It is found that rats and insects are destroyed in less than two hours by air containing 0·5 per cent. of sulphur dioxide, a condition easily realised in cabins, empty holds, spaces round cargo, &c., but for adequate penetration of closely packed cargo, air containing 3 per cent. of the gas must be circulated around the cargo for eight to twelve hours. Non-sporing pathogenic bacteria are also killed by this treatment. Textile fibres and fabrics, metal and furniture, are not affected by sulphur dioxide, but are liable to injury by the accompanying sulphuric acid when the gas is generated by burning sulphur, unless they are protected. Meat, fruit, vegetables, and wheat in bags are deleteriously affected. Liquid sulphur dioxide may be employed as a source of the gas, but burning sulphur, as in the Clayton process, is on the whole preferable on the ground both of convenience and of economy.

IN the *Engineering Magazine* (vol. xxxi., No. 3) Mr. J. A. Macdonald gives an interesting account of twelve months' prospecting and surveying in northern Ontario, and also a detailed account of the occurrence of cobalt ore and of the development of the deposits. These deposits, which contain silver, cobalt, nickel, and arsenic, are among the most remarkable now engaging the attention of the mining world.

WE have received from the director, Prof. G. Gerland, a circular summarising the work of the Central Bureau at Strassburg of the International Seismological Association. The bureau was founded in 1903 by the second International Conference of Seismology. The observatory or central station in connection with the bureau is furnished with a triple horizontal pendulum with photographic registration, a Rebeur pendulum for recording photographically two components, a Milne pendulum, a Wiechert pendulum, a Vicentini microseismograph, Omori and Bosch horizontal pendulums, and a trifilar gravimeter. The apparatus and records are always at the service of foreign observers. The bureau and the station have distinct organisations, but work together. The director hopes that seismologists in other countries will transmit regularly to the central bureau accurate observations of any seismological disturbances in their respective districts. The most practical way, Prof. Gerland suggests, would be for observers at the various stations to send copies of important earthquake records to the bureau at Strassburg, where they would be available for inspection by students of seismology.

WITH the advance of refractometry in chemistry, Messrs. Carl Zeiss, of Jena, have introduced several forms of refractometers suitable for special purposes, and have issued pamphlets descriptive of these. Their "dipping refractometer" is specially applicable in analysis, particularly in ascertaining the proportion of alcohol and extract in beer. For scientific purposes it gives very accurate values between the ranges of $\mu_D = 1{\cdot}325$ and 1·366, and is especially adapted for the examination of aqueous solutions. The firm has issued in pamphlet form a bibliography of papers dealing with their well-known Abbe refractometer, and the refractometers used in examining milk and butter respectively.

IN continuing their studies in luminescence, Messrs. E. L. Nichols and Ernest Merritt in No. 5 of the *Physical Review* investigate the law of decay of the phosphorescence of Sidot blende. In previous experiments in this connection the decay of the total light has been measured, the assumption being made that all portions of the light decay at the same rate. In the present investigation the decay of light of a definite wave-length in the phosphorescence spectrum has been observed, and it is shown that in such a case the intensity of the light diminishes according to the law originally proposed by H. Becquerel, $I^{-\frac{1}{2}} = a + bt$, where a and b are constants. This law can be deduced from different theoretical conceptions from those originally suggested by Becquerel. It is only necessary to apply Wiedemann's hypothesis of the cause of photoluminescence and to assume a law of recombination of the dissociated parts of the substance similar to that which has been applied to the case of ionisation of gases. With such an assumption it is deduced that the quotient a/b should be the same for different wave-lengths when the excitation and other

physical conditions are the same. The measurements given in the paper show that between the limits $\lambda=483\,\mu$ and $\lambda=547\,\mu$ this is very approximately true.

We have received from Messrs. W. and A. K. Johnston, Ltd., a convenient pad of sectional paper ruled in inches and tenths. The size of the sheets is 8 inches by 10 inches, and the price of the pad 1*s.* 6*d.* net.

Mr. John Murray has published a fourth edition of Mr. W. C. Clinton's "Electric Wiring." The first issue of the primer was reviewed in Nature for October 23, 1902 (vol. lxvi., p. 629). Of the present edition it will suffice to say that in its revision an effort has been made to bring it up to date without increasing its size unduly.

The current issue of *The Central*—the magazine of the Old Students' Association of the Central Technical College—commences the third year of publication of what has become an enterprising periodical. Some impressions of South Africa, by Prof. O. Henrici, F.R.S.; with the British Association in South Africa, by Dr. E. F. Armstrong; Mr. Freeman's account of the Witwatersrand, and Mr. Ashcroft's description of a lecture-table testing machine are all interesting contributions; and there are numerous first-rate illustrations.

A second edition of Dr. W. D'Este Emery's "Handbook of Bacteriological Diagnosis for Practitioners" has been published by Mr. H. K. Lewis under the new title "Clinical Bacteriology and Hæmatology for Practitioners." Though the general scope of the book remains unaltered, several additions have been made. The additions to the bacteriological portion are mostly concerned with the examination of materials from special parts of the body. The hæmatological portion is almost all new, and provides a practical guide to blood examinations, especially their application to the diagnosis of disease. The price of the new edition is 7*s.* 6*d.* net.

OUR ASTRONOMICAL COLUMN.

Astronomical Occurrences in July:—

July 2. 7h. 55m. to 8h. 52m. Moon occults γ Libræ (mag. 4·1).
,, 12h. Neptune in conjunction with the Sun.
5. 15h. 15m. to 16h. 15m. Moon occults ξ^2 Sagittarii (mag. 3·5).
6. 12h. 2m. Minimum of Algol (β Persei).
15. 3h. Mercury at greatest elongation (26° 39′ E.).
,, 8h. Mars in conjunction with the Sun.
,, 13h. 34m. to 14h. 31m. Moon occults Tauri (mag. 4·3).
,, Venus. Illuminated portion of disc = 0·760; of Mars = 1·000.
16. 7h. Ceres in conjunction with Moon. Ceres 0° 38′ S.
,, 14h. 10m. to 15h. 2m. Moon occults γ Tauri (mag. 3·9).
17. 0h. 40m. Moon approaches near to α Tauri (mag. 1·1).
18. 14h. 0m. Jupiter in conjunction with Moon. Jupiter 3° 21′ N.
19. 14h. 0m. to 16h. 40m. Transit of Jupiter's Satellite III. (Ganymede).
21. 1h. 14m. Partial eclipse of the Sun invisible at Greenwich.
24. 7h. Venus in conjunction with Moon. Venus 1° 23′ S.
29. 10h. 33m. Minimum of Algol (β Persei).

The Figure of the Sun.—In his discussion concerning the variable figure of the sun, which was referred to in these columns on January 18, Dr. Poor included the heliometer measures of the polar and equatorial diameters made by Messrs. Ambronn and Schur at Göttingen during the period 1890 to 1902, and found from them a confirmation of his previous conclusions.

The validity of the conclusions thus obtained is now questioned by Dr. Ambronn in No. 4, vol. xxiii., of the *Astrophysical Journal*. He points out that the variation, if it exists, cannot, according to the heliometer measures, exceed 0″·1 by any appreciable amount, and suggests that the measurement of the earlier photographic plates could not produce results accurate to this figure. Further, the measurements for 1894 furnish, for the more recent photographs, a proof that the oscillations adduced by Dr. Poor are not present.

After several other explanations Dr. Ambronn states that the most thorough investigation of the large amount of data collected at Göttingen has convinced him that this furnishes no justification for the suggested periodicity.

Discovery of Algol Variables.—Circular No. 117 from the Harvard College Observatory announces the discovery that the star H1236 (−30°.16169 C.DM.) is an Algol variable having a range of about one magnitude and a period slightly exceeding two days.

This variable was discovered by Mrs. Fleming on a plate taken in accordance with the multiple-image method described in a previous Circular, and by which it is hoped to discover all the short-period variables of magnitude 10·0 and brighter. In this method a dozen or more exposures, each of thirty minutes' duration, are made on the same plate moved by a small amount between each exposure.

Plates covering nearly the whole of the sky have now been obtained under these conditions, but only a few have so far been examined; nevertheless, this is the second Algol variable thus discovered by Mrs. Fleming.

An Interesting Minor Planet.—A recently-discovered minor planet (T.G.) proves to be of exceptional interest owing to its great mean distance.

Elliptical elements recently deduced by Dr. Berberich indicate that the mean distance of this asteroid is slightly greater than that of Jupiter, whilst its aphelion distance is nearly one unit beyond Jupiter's orbit. This discovery extends the limits of the asteroids so that they now include a distance of 1·1, the perihelion distance of Eros, and one of 6·0 units, the aphelion distance of the newly-discovered T.G. (the *Observatory*, No. 371).

Observations of Jupiter in 1903 and 1905–6.—In continuation of his record of the observations of Jupiter made during the years 1898–1902 inclusive, which was published in vol. lxiii. of the Monthly Notices, Mr. Denning now publishes (in vol. lxvi., No. 7) his results for the oppositions of 1903 and 1905–6.

During 1903, 1388 transits were observed, and of these 1188 were utilised in determining the rotation periods of the different zones as given in the present paper. The periods determined vary from 9h. 55m. 54·3s. for the N. temperate markings to 9h. 50m. 27·9s. for the equatorial; only the latter, however, gives a value less than 9h. 55m. 6·0s. In the 1905–6 apparition the mean period of rotation of the equatorial spots had increased to 9h. 50m. 32·7s., a value which is a few seconds in excess of that exhibited during the previous eight years. Mr. Denning also gives a number of notes on the apparition of 1905–6, dealing with the appearance and the variations of the different markings in detail. He also states that the best time for examining details on Jupiter is near the time of sunset.

The results of a number of micrometer measures of Jupiter's diameter and of the various belts, made at the Copenhagen Observatory during the recent opposition, are published in No. 4098 of the *Astronomische Nachrichten* by Dr. H. E. Lau.

Photometric Observations of Saturn's Satellites.—In No. 4098 of the *Astronomische Nachrichten* Dr. P. Guthnick publishes the results of a series of photometric observations of Saturn's six brightest satellites. The observations were made during the summer and autumn of 1905 at the Bothkamp Observatory, and the results for Tethys, Dione, Rhea, Titan, and Japetus are set out in tabular form so as to show the anomaly of the satellite

and the corresponding apparent magnitude at the time of observation.

NEW DOUBLE STARS.—Forty-two newly-discovered double stars are described by the Rev. T. E. Espin in a catalogue which appears in No. 7, vol. lxvi., of the Monthly Notices (R.A.S.).

The stars are all situated between 30° and 40° N. declination, and the author gives in the catalogue the position (for 1900), the separation, the position-angle, and the magnitudes for each pair.

THE INTERNATIONAL CONGRESS OF ANTHROPOLOGY AND PREHISTORIC ARCHÆOLOGY.

THE International Congress of Anthropology and Prehistoric Archæology held its thirteenth session at Monaco, on the generous invitation of H.S.H. Prince Albert, "Protecteur" of the congress, on April 16–21. The place of meeting was the Grande Salle of the beautiful and now nearly completed Museum of Oceanography in course of erection by this Royal savant. More than 400 members, of whom upwards of thirty were British, assembled under the distinguished presidency of Prof. Hamy, of the Institute of France. To the sincere regret of all the members, the Prince was prevented by illness from opening the proceedings as he had intended, and, indeed, from being present at any of its meetings. He was, however, represented by his son, the Crown Prince, who, accompanied by the high officers of the Principality, attended at the opening seance and read the address which his father was unable to deliver, and from which we quote the following sentences:—"Je me félicite de ce que mes efforts pour le développement de l'anthropologie m'aient permis de réunir, sur ce point de l'Europe où les vestiges de l'Humanité remplissent la terre, une assemblée comme la votre choisie entre les savants de plusieurs pays avancés. Je suis certain, d'ailleurs, que votre Congrès laissera au domaine scientifique, des notions importantes sur l'histoire de notre espèce, car les travaux tout récents de MM. Boule, Verneau, de Cartailhac, de Villeneuve suffisent à lui constituer un monument. . . . C'est dans le Palais de la mer que l'Anthropologie trouve accueil aujourd'hui; et l'union de toutes les sciences alliées contre l'ignorance . . . que l'Océanographie peut déjà relier certaines conquêtes de la Science. Car l'étude des lois physiques et chimiques de la mer conduit a l'explication des remaniements géologiques de notre planète et des luttes successives entre les continents et les mers. Les progrès de la Biologie et de la Zoologie marines permettent d'utiliser les révélations de la Paléontologie pour constituer l'échelle des transformations infiniment nombreuses par lesquelles une force que nous appellons la vie a fait passer la matière organique. Et la Météorologie, si intimement liée avec l'Océanographie par des rapports incessants, nous aide à comprendre les fluctuations, les migrations, et la distribution géographique des êtres, y compris celle de l'homme. Parmi les Congrès précédemment réunis ici même, il en est un, celui de la Paix, dont j'évoquerai le souvenir aujourd'hui, parce que la Science et la Paix sont inséparables et que l'Anthropologie, comme tous les Sciences, doit contribuer au bien-être des hommes. . . ." The congress was formally welcomed also by H.E. M. Ritt, the Governor-General of the Principality, in a most courteous speech, which was acknowledged by representatives of the foreign delegates, Sir John Evans replying on behalf of Great Britain. The inaugural address of the president on the objects of the congress, the importance of its work, and the present position of prehistoric archæology concluded the first day's proceedings.

By an ordinance of the congress, French is the only language permitted in verbal or written communications, a restrictive regulation, we believe, enforced at no other international convention. A proposition was, however, early submitted to the council at Monaco that other languages should be admissible, but it met with favour only so far as regards written communications, which, it was resolved, may now be presented also in English, Italian, or German. All verbal communications, however, must still be in French. This change concedes practically little; for while it may be easy to prepare and read a paper in a foreign language, it is extremely difficult to express on the spur of the moment, in a language with which one is not very familiar, exactly what one wishes to convey. The chief privilege of members is the right to express their views on questions before the congress, but this rule practically disfranchises all those unable to speak French. Considerable dissatisfaction was felt at the severity with which the regulation was enforced. Indeed, many foreigners thus compelled to speak in French were less intelligible even to those acquainted with that language than if they had been permitted to use their own tongue! It is sincerely to be hoped that at the next session, which has been fixed to meet in Dublin in 1909, this harsh bye-law will be entirely abrogated, and that members of all countries may be allowed, equally with their French colleagues, to address the congress in their own language.

The dominant subject of the second seance was the genuineness of the implements known as "eoliths." A series of mill-modelled flint nodules was exhibited, among which there was certainly a number closely resembling many Prestwichian types, but conspicuous by their absence were the decidedly purposeful and rationally usable Kentian forms. A small collection exhibited by Prof. Girod, obtained near Aurilliac, affirmed to be out of a bed of Tortonian (Miocene) gravels containing Hipparion, underlying a massive stratum of basalt, contained at least one "eolith" unquestionably of human manufacture. The occurrence was vouched for, by M. Rutot, of implements of a particular silex identical in form with those from Kent in pre-Glacial beds in Belgium in which no other silex pebbles of the same character and composition were present, and the manufacture and introduction of which could be due only to man. Prof. Ray Lankester submitted that he had recently placed on exhibition in the British Museum a considerable series of specimens selected from Prestwich's collection, all borer-like in form, too identical in shape and so obviously of rational utility for any possibility of their being the result of fortuitous natural collisions. The congress was, however, divided in opinion on the subject. At a later meeting a telegram from Prof. Schweinfurth, in Egypt, was read announcing full confirmatory evidence of the occurrence of eoliths in the Nile Valley. The most important part of the day's programme was the visit paid to the Grimaldi caves at the Red Rocks, between Mentone and Ventimiglia, the inspection commencing with the most easterly—the Grotte du Prince. This cave has been most systematically and scientifically explored by a trio of distinguished archæologists, Prof. Marcellin Boule, the Abbé de Villeneuve (director of the Archæological Museum of Monaco), and Prof. Verneau. With much trouble and no little risk to limb, the grotto-walls had been marked by labels and lines of paint to indicate the limits of the various horizons in correspondence with those on a diagram of a longitudinal section of the cave distributed to members. From an elevated crag the Abbé de Villeneuve gave an account of the method of excavation and of the discoveries made at the various levels, while Prof. Boule detailed the sequence of events from the geological and palæontological point of view. So lucid were both these demonstrations that no one could fail to carry away a perfectly clear comprehension of the original contents of the cave, and form their own opinion on the evidence for man's antiquity in this region afforded by its exploration. No human osseous remains were met with in this grotto, but worked implements occurred in abundance from the lowest to the highest layers. Those from the lowest beds, which were roughly worked and chiefly Mousterian in type, occurred in association with bones of *Rhinoceros merckii*, *Elephas antiquus* and hippopotamus, and with specimens of *Cassis rufa*, an Indian Ocean mollusc which may perhaps have been acquired by barter. The contents of this cave have been transported to the Archæological Museum in Monaco, and arranged with such care by the Abbé de Villeneuve in the order of succession of the various strata, and so accurately labelled, that it is impossible to overestimate the importance to anthropological science of this comparatively small collection.

The Barma (=Grotte) Grande next claimed attention

under the special guidance of Prof. Verneau, by whom the greater part of its exploration had been carried out. As is well known, this cave yielded several human skeletons, all of the Cro-Magnon type, the most deeply interred lying in association with bones of the reindeer. Several of these have been left *in situ* preserved under glass; while in a small museum erected, close by the mouth of the grotto, at the expense of Sir Thomas Hanbury, are arranged the bones and other objects discovered in it. After a hasty visit to the Grotte du Cavillon the congressionists proceeded to inspect the famous Grotte des Enfants under the same excellent guidance. The two celebrated skeletons from the lowest *foyer* of this cave, the types of Verneau's negroid *Race Grimaldi*, are safely preserved in the Monaco Museum. These discourses *sub divo* were necessarily succinct, but they were supplemented by fuller addresses of extreme interest during the following forenoon by the Abbé de Villeneuve, Profs. Boule and Verneau, and M. Cartailhac, under whose joint authorship a beautifully illustrated volume on the results of their exploration of these caves will shortly be published by the generous provision of the Prince of Monaco.

The next day's programme was reserved specially for papers on the engravings and frescoes on the walls of prehistoric caverns. The Abbé Breuil presented a communication on the process of the evolution of art during the Reindeer age, a *résumé* of a large work on which he is engaged, resulting from his laborious copying of the wall pictures of many caverns in collaboration with his colleagues Cartailhac, Capitan, Peyrony, and Bourrinet. The most important as well as most attractive item, however, was the exhibition by Dr. Capitan of a long series of lantern-slides of mural, engraved, and polychrome pictures—the latter in colour—most carefully copied by himself, the Abbé Breuil, and their associates named above, under the most trying and difficult conditions in the grottoes—more frequently than not far in their dark, damp, and cramped recesses—of Mas-d'Azil, Combarelles, Marsoulas, Bernifal, Les Eyzes, de Freye (Dordogne), la Mouthe, Altamira, Font de Gaume, de Teyjat, La Greze, and others. The number and variety of subjects depicted indicates powers of accurate observation and a mastery of hand in the arts of sculpture and drawing at that early age which are really astonishing, and it is evident that this wonderful capacity for art was the common heritage of Palæolithic man in all parts of Europe. *Rhinoceros merckii* and some dozen other extinct quadrupeds appear to have been his favourite studies. *Bison priscus*, however, was the species most frequently and most characteristically represented, being perhaps the commonest or the most dreaded member of his fauna. The human figure was less frequently, and always rudely, portrayed, and usually with monstrous or grotesque faces, suggesting that actors in some ceremonial were intended to be depicted in masks, recalling the dance-masks of the Chiriqui and Arizona Indians. Further papers on the same theme occupied also a great part of the following morning's sitting, at which the most interesting exhibition was a series of burins and scrapers of flint from the Grotto of Eyzes, exquisitely manufactured of every degree of fineness—some of them worked at both ends—to serve the manifold purposes of the artist. They were unquestionably the very tools by which the wall pictures beside them had been executed. With the exception of a short note by Dr. Arthur Evans (who on rising was very warmly greeted by the congress), on the Ægean, Minoan, and Mycenæan epochs, the remainder of the communications on the day's programme dealt with the Bronze and Iron age in Europe.

The sitting of the forenoon of Saturday, April 21, was given up chiefly to the archæology of northern Africa. The most important communication was M. Flammaud's, on his discovery in the Sahara of megalithic monuments of new shapes and of peculiar sculpture, and on the numerous evidences he had obtained of contact between the interior of Lybia and Egypt in the Neolithic age. The afternoon was spent on an excursion through beautiful scenery *viâ* the well-known *Tropaea Augusti* at La Turbie to the mysterious prehistoric entrenchments occupying the summit of Mont Bastide, as that of many of the other foot-hills of the Maritime Alps. The congress assembled on Sunday afternoon for the formal closing ceremonies usual on such occasions, the Prince of Monaco being again represented by his son, who, at the palace previous to the meeting, had, on his father's behalf, conferred the decoration of St. Charles on the presidents, the secretaries, and several of its more distinguished members, of whom Sir John Evans received the cross and ribbon of the Order.

Several social entertainments were given during the week "en l'honneur des congressistes," including, besides a reception at the palace, an evening performance of *Méphistofèles* and a *matinée* concert, both in the beautiful Casino Theatre.

For those—and they proved a goodly company—who could spare the time, a whole-day excursion, under the able leadership of M. Paul Goby, to the prehistoric monuments—dolmens, tumuli, and entrenchments—in the neighbourhood of Grasse was arranged by the excellent committee of organisation as a pleasant termination to a very successful and profitable session of the congress.

SUMMER TEMPERATURES OF THE NORTH SEA.

THE "Bulletin Trimestriel" of the International Council for the Exploration of the Sea, for the period July to September, 1905, has just been issued. As the observations are for the summer months, they are naturally more numerous than in other seasons of the year, and an immense amount of material is dealt with. The increase in the number of surface observations, and the extension of the area from which they have been obtained, are specially noteworthy; a plate of nine charts showing the variations of mean temperature in the North Sea for ten-day periods, from July 1 to September 30, 1905, is added to the usual quarterly maps. These charts have been prepared by dividing the area into squares of 1°, and ½° close to the coast, and the results checked by mean values from Dutch observations, worked up by a different method.

The sections drawn from the observations of the special steamers sent out by the different countries are very numerous in the narrower seas, forming a close network in the Baltic and the North Sea. A line north-eastward from Scotland defines the conditions across the northern entrance to the North Sea, but it is unfortunate that, except for some very useful lines running seaward from the coast of Ireland, and one section from Iceland to Færöe, information from the western section of the area is somewhat deficient, notably in the Færöe-Shetland Channel. It would be a great matter if observations in the depth could be carried further seaward to the south-west of the British Isles with the view of ascertaining the precise limit to which waters of Mediterranean origin penetrate northward, and in this connection an increase in the number of gas samples analysed would be of value.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The following is the text of the speech delivered by Prof. Love in presenting Prof. J. Milne for the degree of D.Sc. *honoris causa* at the Encaenia on June 20:—

In terrae motibus cognoscendis nemini profecto cedit Ioannes Milne. Hic ille est qui nova eademque plurima quaerendi instrumenta commentatus, quibus vim terrae motuum longinquis in locis redundantem emetiretur, ostendit tribus quibusdam momentis rem agi: duobus enim tremoribus medium terrae globum concutientibus succedere tertium latius patentem et in summo volitantem, sicut undam mare supereminentem. His repertis illud etiam consecutus est ut interioris terrae naturam et compagem certius cognosceret. Nullas profecto regiones non peragravit vir acerrimus, dum telluris superficiei studet, praecipuam vero laudem adeptus est quod rei publicae Iaponicae viginti annos inservit, Geologiae doctor insignis, fodinarum publicarum curator peritissimus. Ibi etiam sexcentas stationes disposuit omnia quae ad terrae motus pertinent et observantium et litteris mandantium. His etiam diebus patriae redditus in insula Vecti tale labor-

atorium constituit vir strenuus, eorum antesignanus qui hanc sectam secuti id agunt ut omnibus in terris eandem ipsi diligentiam praestent. Tantis tot strenuorum virorum laboribus nonne id aliquando fieri potest ut de caecis horum motuum causis paullo certiores fiamus?

CAMBRIDGE.—The Quick professorship of biology is vacant. The professor is to devote himself to the study of the Protozoa, especially such as cause disease. The stipend is 1000*l.* a year. The election will take place on July 26. Candidates are to send their names and references to the Vice-Chancellor by July 19.

Mr. R. A. Herman and Mr. H. W. Richmond have been appointed university lecturers in mathematics.

The Raymond Horton-Smith prize, for an M.D. thesis "On Changes in Sensation Associated with Gross Lesions of the Spinal Cord," has been awarded to Mr. H. Theodore Thompson, of Christ's.

The Gordon-Wigan prize of 50*l.* for a research in chemistry has been awarded to F. E. E. Lamplough, Trinity.

EARL CARRINGTON, President of the Board of Agriculture, will open the new buildings at the South-Eastern Agricultural College, Wye, and distribute the diplomas and prizes, on Wednesday, July 18, at 3.15.

THE Court of the University of Manchester has decided to confer the following honorary degrees:—D.Sc. on Prof. Emil Fischer, professor of organic chemistry in the University of Berlin, and on Prof. Adolf von Baeyer, professor of organic chemistry in the University of Munich; M.Sc.Tech. on Mr. Ivan Levinstein, and M.Sc. on Mr. James Grier, lecturer in pharmacognosis.

PROF. A. MELVILLE SCOTT, late 1851 Exhibition scholar from the University of Toronto, has resigned his position as professor of physics and electrical engineering at the University of New Brunswick to accept the office of superintendent of schools for the city of Calgary, Alberta. His successor will be Prof. W. H. Salmon, a graduate of Cambridge, now of King's College, Windsor, N.S.

NEW science buildings, built and equipped at a cost of 7000*l.*, were opened at Repton School on the occasion of the speech day, June 21, by Sir Oliver Lodge, F.R.S. The buildings are largely the result of the munificence of Lord Burton, until recently the chairman of the governing body. In the course of his address, Sir Oliver Lodge spoke of the importance of the study of science, and particularly of astronomy, in order that a better conception of the universe, of its magnitude, and man's place in it might be obtained.

IT is announced in *Science* that the Woman's College of Baltimore has now received gifts amounting to 116,000*l.* Of this amount 100,000*l.* was needed to clear the college of debt, and 16,000*l.* will be added to the endowment fund. Mr. Andrew Carnegie gave 10,000*l.*, the Massey estate 10,000*l.*; other gifts range from small amounts to 6000*l.* We learn from the same source that Governor Higgins has approved a Bill appropriating 16,000*l.* for a school of agriculture at St. Lawrence University, with an additional 2400*l.* for maintenance. This school, it is understood, will be managed in cooperation with the authorities of the State College of Agriculture at Cornell University. By the will of Catherine L. R. Catlin, of New York, 2000*l.* is left to New York University.

IN the House of Lords on Monday Lord Barnard asked the President of the Board of Agriculture whether he has been able to consider the representations made to the secretary of the Board, on December 5, 1905, by a deputation from universities, colleges, and agricultural institutions, and whether there is any prospect of an increased grant to such institutions. In the course of his reply, Earl Carrington said no money could be better spent than that which is applied to helping farmers to meet the fierce and growing competition which they have to encounter from all sides. Some time ago 4500*l.* was voted towards this object, and in 1906 the vote has risen to 11,500*l.* The sum is small, it is true, when compared with the amounts voted in other countries, but the country has received the full value of the grant owing to the cordial cooperation and good work of the different county councils. He suggested that some inquiry should be held into the system of agricultural education. There has been no inquiry since 1888—nearly twenty years ago. If it should appear that there is good ground for an increase of grant, those who advocated such an increase would find their hands strengthened very considerably.

A MEETING of university extension students and others is to be held at Cambridge on August 2–28. The principal subject of study will be the eighteenth century, especially the period 1714–1789. Among the lectures arranged, the following, dealing with subjects of science, may be mentioned:—Cloud problems in astronomy, by Mr. A. W. Clayden; a total eclipse of the sun, by the Rev. T. E. R. Phillips; great astronomers of the eighteenth century, by Mr. Arthur Berry; the Milky Way and the clouds of Magellan, by Mr. A. R. Hinks; the dawn and progress of modern geology, by Dr. R. D. Roberts; great botanists of the eighteenth century, by Prof. W. B. Bottomley; great zoologists of the eighteenth century, by Mr. L. A. Borradaile; and the beginnings of the steam engine, by Mr. E. K. Hanson. Besides these purely scientific lectures, others of interest to students of the methods of science occur in the programme, such as those by Mr. H. Yule Oldham on the teaching of geography, and by Mr. E. A. Parkin on hygiene in schools. Practical courses in chemistry and botany, primarily for teachers, will also be held. Forms of entry and further information will be supplied by the Rev. D. H. S. Cranage, Syndicate Buildings, Cambridge.

IN the May issue of the Transactions of the Oxford University Junior Scientific Club is a thoughtful paper by Mr. M. H. Godby on the place of natural science in education. The spirit of the paper provides an encouraging sign of appreciation of the value of scientific studies, and serves to show that a generous recognition of the importance of a training in the methods of science is producing a beneficial effect upon the present generation of Oxford students. Mr. Godby first indicates the influence on British education exerted by Bacon in directing the attention of speculative thinkers to the importance of founding theories on knowledge gained from the senses, and subsequently refers approvingly to Herbert Spencer's insistence upon the necessity of training the body and the value of a scientific education. As indicative of modern tendencies at Oxford one or two of the writer's remarks may be cited:—"The man of science perhaps alone of all men understands and appreciates the value of working hypotheses, even when they are wrong." "A great charm, too, of science is that one can always appeal against the decisions of tutors and authorities to Nature herself, and so there is produced a freedom from the awe of authority which must tend to develop self-respect and to encourage independence and originality." "Science is more capable of arousing the interest of its students than other subjects. There is a sort of spirit of antagonism, a feeling that you are pitting yourself against Nature and trying to unravel her secrets, and this feeling is just what will always appeal to the sporting instincts of English boys." It is satisfactory to find that young Oxford is alive to the responsibility of the University for the growth of scientific knowledge.

REPLYING to a question in the House of Commons on Tuesday as to the action which the President of the Board of Education proposes to take on the report of the Departmental Committee on the Royal College of Science, &c.; and as to whether any reorganisation of the University of London is contemplated, with a view to the association with it of the proposed Technological College, Mr. Lough said:—The Board is at present engaged in the preparation of a scheme for the establishment of a new institution on lines corresponding as closely as possible to those recommended by the departmental committee. The Board agrees with that committee in regarding it as of first importance that there should be no delay in the organisation of the institution, and with the recommendation of the committee that its relation to the University of London should, in the first instance, be that of a "school of the University"—a recommendation in which the senate of the University

has informed the Board that it concurs. In considering the constitution of the new institution the Board has had under consideration the suggestion of the departmental committee (No. 94, p. 27) that, without delaying the commencement of the new institution's work, a Royal Commission should be appointed to consider whether changes could advisedly be made in the character and constitution of the University which may make it desirable and possible to amalgamate the two institutions. It has also had before it the resolution of the senate of the University deprecating the appointment of such a Royal Commission within so short a period after the reorganisation of the University, and expressing the desire that opportunity should be afforded for conference between the Board and the Senate as to any changes of the kind suggested. In the course of the conference, which took place on March 9, between the Board of Education and a deputation from the University senate upon these matters, the suggestions thrown out by the University deputation seemed to be contingent, practically, upon the incorporation of the new institution within the University. As this would necessitate a prolonged delay in the starting of the institution, which the committee specially recommended should be avoided, the Board has found it impracticable to proceed on those lines, but is hastening as much as possible the preparation of a draft charter on the lines of the report of the departmental committee.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 5.—"On a Method of Obtaining Continuous Currents from a Magnetic Detector of the Self-restoring Type." By L. H. **Walter.** Communicated by Prof. Ewing, F.R.S.

Magnetic detectors for wireless telegraph purposes have proved satisfactory for telephonic reception, but have not hitherto been capable of furnishing continuous currents suitable for use with recording instruments. The author has devised a new form of magnetic detector which is capable of furnishing both continuous and alternating currents, the former for recording purposes and the latter for telephonic reception. The apparatus consists of a form of differential dynamo, having two similar armatures on the same shaft. The armature cores are of iron or steel wires. The electromotive forces generated by the two armatures are opposed to each other and normally balance, so that no potential difference is detectable at the commutator brushes. Oscillations set up in the receiver aërial as a result of signals are led through the magnetic wire forming one armature core, causing it to take up a higher induction, and thus disturbing the balance, a continuous current being obtainable from the brushes so long as the oscillations persist. This current is utilised for actuating the recording instrument or relay. For simultaneous reception of the signals on the telephone, the alternating current generated as a result of the action of oscillations is taken off, by means of slip-rings and brushes, before it is commuted into unidirectional current.

May 17.—"Some Stars with Peculiar Spectra." By Sir Norman **Lockyer,** K.C.B., F.R.S., and F. E. **Baxandall.**

This paper relates to a few stars the spectra of which show certain peculiarities that make them not altogether conformable to any common type. The most notable of these stars are α Andromedæ, θ Aurigæ, α Canum Venaticorum, and ε Ursæ Majoris. They are all on the descending side of the Kensington curve of stellar temperature, the first three being of the Markabian type and the last of the Sirian type. A short account is given of the spectrum of each of these stars.

α Andromedæ has recently been found by Slipher, of the Lowell Observatory, to be a spectroscopic binary with a period of about 100 days. Prior to this, an investigation of the various Kensington spectra of α Andromedæ, taken in the years 1900–4, appeared to indicate slight changes in the relative intensity, position, and definition of some of the lines in the various photographs. There does not, however, seem to be any regularity in these changes, either in the lines themselves or in the manner in which they are affected, so that it has not been possible to come to any conclusion as to their real significance. Additional photographs will be necessary to test whether the changes in the spectrum bear any relation to the period established by Slipher. The spectrum of α Andromedæ also shows a set of well-marked strange lines which do not occur in any other celestial spectrum, and for which records of terrestrial spectra afford no satisfactory clue as to origin.

θ Aurigæ and α Canum Venaticorum show several strange lines nearly identical in the two spectra, but entirely different from the strange lines of α Andromedæ. No terrestrial equivalents have been found for these stellar lines.

In ε Ursæ Majoris, the chief deviations from the Sirian type are the weakening of the silicium (group ii.) lines and the strengthening of the enhanced lines of chromium.

Entomological Society, June 6.—Mr. F. Merrifield, president, in the chair.—*Exhibits.*—Specimens of *Lomechusa strumosa*, F., taken with *Formica sanguinea* at Woking on May 26 and 29: H. St. J. **Donisthorpe.** Only two other British examples are known, one taken by Sir Hans Sloane on Hampstead Heath in 1710, the other found by Dr. Leach, in the early part of the last century, while travelling in the mail-coach between Gloucester and Cheltenham.—A case to illustrate a large number of the life-histories of Coleophorids, notes on which have appeared in the society's Proceedings or in the Entomological Record: H. J. **Turner.**—A few butterflies from Majorca, captured between April 8 and April 20: H. **Lupton.**—A specimen of *Crambus ericellus*, Hb., taken at Loughton, Essex, August 8, 1899, not previously recorded from further south than Cumberland; two specimens of *Nola confusalis*, H.S. ab. *columbina*, Image, taken in Epping Forest, May 5: S. **Image.** The first examples of this aberration were taken by the exhibitor at the same locality, May 22, 1905, and a specimen of *Peronea cristana*, F., the ground colour of upper-wings abnormally black, even more intensely black than in the ab. *nigrana*, Clark, also taken in Epping Forest, August 19, 1905.—The type of *Spathorrhamphus corsicus*, Marshall, from Vizzavona, Corsica: J. H. **Keys.** This fine Anthribid was supposed by some coleopterists to have been an accidental importation into the mountainous regions of the island, but was no doubt endemic. Mr. G. C. Champion remarked that he had taken *Platyrrhinus latirostris*, in numbers, at the same locality, in the beech and pine forests (*Pinus laricio*) along the line of railway, above the tunnel.—Specimens of African Pierinæ found by Mr. C. A. Wiggins on February 2 settled on damp soil near the Ripon Falls, Victoria Nyanza, and caught, to the number of 153, at a single sweep of the net: Dr. F. A. **Dixey.** Eight species were represented; the examples were all males, and, with one exception, belonged to the dry-season form of their respective species.—Notes on Natal butterflies, received from Mr. G. H. Burn, of Weenen, and the four individuals of *Euralia wahlberghi*, Wallgr., and *E. mima*, Trim., captured by Mr. G. A. K. Marshall, near Malvern, Natal: Prof. E. B. **Poulton.** Prof. Poulton then exhibited Mr. Marshall's latest demonstration of seasonal phases in South African species of the genus Precis, the proof by actual breeding that *P. tukuoa*, Wallgr., is the dry-season phase of *P. ceryne*, Boisd. Prof. Poulton further showed 325 butterflies captured in one day by Mr. C. B. Roberts, between the eighth and tenth mile from the Potaro River, British Guiana, and directed attention to the preponderance of males.—*Papers.*—Some bionomic notes on butterflies from the Victoria Nyanza region, with exhibits from the Oxford University Museum: S. A. **Neave.**—The habits of a species of Ptyelus in British East Africa: S. L. **Hinde,** illustrated by drawings by Mrs. Hinde.—(1) Mimetic forms of *Papilio dardanus* (*merope*) and *Acraea johnstoni*; (2) Predaceous insects and their prey: Prof. E. B. **Poulton.**—Studies on the Orthoptera in the Hope Department, Oxford University Museum, i., Blattidæ; and a note on a feeding experiment on the spider *Nephila maculata*: R. **Shelford.**

Physical Society, June 8.—Prof. J. Perry, F.R.S., president, in the chair.—The solution of problems in diffraction by the aid of contour integration: H. **Davies.** The method adopted is to obtain a solution for unbounded space as a contour integral. The special boundary conditions are then accounted for by adding terms to the previous expression. When the complete expression has been obtained it is then evaluated in the form of a series by the aid of Cauchy's residue theorem.—J. Goold's experiments with a vibrating steel plate: **Newton** and Co. The phenomena peculiar to this plate may be classified under two heads:—(1) beats, simultaneously audible and visible; (2) dispersion figures. In addition to these, vortex-vibration, resonance-effects, and many other experiments may be exhibited by using suitable clamps, &c. The dispersion figures are due chiefly to the interaction of two systems of vibrations of the same pitch working at right angles to each other.—Fluid resistance: Colonel R. **de Villamil.** Prof. Hele-Shaw, in a paper on the motion of a perfect fluid, remarks that one of the most perplexing things in engineering science is the absence of all apparent connection between the higher treatises on hydrodynamics and the vast array of works on practical hydraulics. The reason for this appears to be the immense difference between the flow of an actual liquid and that of a perfect one, owing to the property of viscosity. According to the author, this is not the only reason. There appear to be two fundamental difficulties to be got rid of before they can be reconciled. Engineers assume that a liquid can be "pushed" in any rectilinear direction. This, though a very popular notion, is not correct. The other difficulty is the assumption that in a perfect fluid there can be no resistance of any kind to any body moving in it at any velocity. It is only in an infinite ocean of perfect fluid that there would be no resistance.

Society of Chemical Industry (London Section), June 11.—Mr. A. G. Salamon in the chair.—Purifying and stabilising guncotton: Dr. R. **Robertson.** This communication—published by permission of the War Office—deals with large-scale experiments having for their object the best means of obtaining a pure and stable guncotton by a boiling process. For the elimination of impurities from the guncotton and the rapid attainment of a stable product, boiling in dilute acid at the beginning of the process is superior to an alkaline treatment, which has the additional disadvantage of tending towards an undue hydrolysis of the ester itself. The acid hydrolysis must not be unduly curtailed, or elimination of the impurities will be rendered difficult.—The determination of indigotin in commercial indigo and in indigo-yielding plants: C. **Bergtheil** and R. V. **Briggs.** The authors have investigated the standard methods of estimating indigotin in commercial [illegible]. It is shown that all the methods dealt with are trustworthy when applied to pure indigotin, but that in application to commercial indigo the impurities present lead to errors; only those methods depending on the oxidation or reduction of solutions of sulphonated indigo are found to be applicable in this case.—Recent progress in the cement industry: B. **Blount.** The author compares the condition of the cement industry in 1886 and at the present time, pointing out that at the former date somewhat crude methods of manufacture were in use, whereas now improved processes are in operation under scientific control. The world's production of Portland cement has increased from 2,500,000 tons to some 11,000,000 tons in the last twenty years, and the centre of the industry has shifted from Europe to the United States. The second part of the paper deals with improvements in controlling the quality of cement in the works and by the user which have been made during the last twenty years.

Royal Meteorological Society, June 20.—Mr. Richard Bentley, president, in the chair.—The mean prevalence of thunderstorms in various parts of the British Islands during the twenty-five years 1881–1905: F. J. **Brodie.** The author gives the mean number of days on which thunderstorms, or thunder only, occurred in each month, each season, and in each year at fifty-three stations situated in various parts of the United Kingdom. July is the month with the largest number of thunderstorms over Great Britain as a whole, and August at some places in the north of Scotland and north-west of England, while June is the stormiest month at nearly all the Irish stations. For the whole year the largest number of thunderstorms is over the northern and eastern parts of England, where more than fifteen occur, while there are less than five in the west and south of Ireland and at most places in the north of Scotland. The summer distribution of thunderstorms is very similar to the annual distribution, while the winter distribution is quite different, when the largest numbers occur along the west coasts of Ireland and Scotland and extreme south-west of England.—Typical squall at Oxshott, May 25, 1906: W. H. **Dines.** During the morning there was a steady wind from the south-west of more than ten miles per hour until 11 a.m., when there was some falling off for fifteen minutes, then a rise to more than twenty miles per hour, accompanied by a sudden increase of barometric pressure and a fall of a few hundredths of an inch of rain. After the squall the wind dropped suddenly, and there was almost a dead calm for about twenty minutes. The author, who was flying a kite at the time, gave some account of the changes in the wind at a considerable altitude above the earth. At 11.26 a.m. the squall struck the kite, which was then at a height of 2400 feet. Two minutes later the velocity at the kite had risen to fifty-eight miles per hour, and the wire broke under a strain of 180 lb. Three minutes later the kite fell at a spot 2¼ miles distant from Oxshott.

EDINBURGH.

Royal Society, June 4.—Dr. R. H. Traquair, F.R.S., vice-president, in the chair.—Recherches sur la Glauconie: Drs. Léon W. **Collet** and Gabriel W. **Lee.** The paper contained a careful examination of the chemical composition of the mineral glauconite, which was found in what Sir John Murray called, in the *Challenger* expedition reports, the blue and green muds of the ocean beds. It was shown that glauconite was ferric silicate, and not ferrous silicate, as had been stated by Calderon and Chaves, of Madrid.—A rare dolphin, *Delphinus acutus*, recently stranded on the coast of Sutherland: Sir William **Turner,** K.C.B. There were very few previous records of this species having been found in the vicinity of the Scottish shores.—Contributions to the craniology of the people of the Empire of India, part iii., natives of the Madras Presidency, Thugs, Veddahs, Tibetans, and Seistanis: Sir William **Turner,** K.C.B. Among the skulls exhibited were those of some of the famous Thugs who practised highway murder with such skill and secrecy as to elude for long the authorities in India. Their crimes were regarded by themselves as a religious duty. The skulls were all well formed, with no resemblance to what some have called a criminal type. Of the two Tibetan skulls, one was of Mongolian type, but the other was that of a Kham warrior from eastern Tibet, and its dolichocephalic form supported Grierson's theory of the Tibeto-Burman stock. The three skulls from Seistan, in south-west Afghanistan, belonged to two types, one approximating to the Afghan and the other to the Beluchistan type.—Interpolation for a table of fractions, with a notice of synthetic division and its use: Dr. James **Burgess,** C.I.E. All fractions with denominators under 100 and numerators less than 50 were tabulated in order of magnitude. The formulæ $q=n/d=(n+q)/(d+1)$ suggested a simple and rapid way of dividing by any number differing by unity from a simple multiple of 10, 100, 1000, &c.—The length of the normal chord of a conic: Prof. **Anglin.**—The hydroids of the Scottish National Antarctic Expedition: James **Ritchie.** The collection brought home by the *Scotia* was very large. There were forty-five specimens giving one new genus, nine new species, and several new varieties. The new genus had been named Brucella, in honour of Mr. W. S. Bruce. The *Scotia* collection also extended our knowledge of the geographical range of hydroids, especially towards the Antarctic regions.—Prof. D. J. **Cunningham** exhibited a photograph taken from a bridge of a large number of salmon resting in the Corrib River, Galway.

PARIS.

Academy of Sciences, June 11.—M. H. Poincaré in the chair.—Some points relating to the study of the specific heats and the application to these of the law of corresponding states: E. H. **Amagat.** It has been shown in a previous note that the specific heat at constant volume, following an isotherm, undergoes a discontinuity at each intersection of this isotherm with the saturation curve. In the present paper the question is discussed as to whether this discontinuity persists in the neighbourhood of the critical point.—The products of the reaction, at a high temperature, of sodium isobutylate and propylate of camphor: A. **Haller** and J. **Minguin.** Camphor, heated at about 230° C. with sodium isobutylate, gives sodium isobutyrate and isobutylcamphol, various derivatives of which have been prepared. The general action of sodium propylate on camphor at a high temperature is similar to that of sodium isobutylate, but the yields are not so good.—Some attempts made in the German Navy to utilise photography in voyages of exploration: A. **Laussedat.**—The orthography of the word *caesium*: M. **de Forcrand.**—Vaccination against tuberculosis by the digestive tracts: A. **Calmette** and C. **Guérin.** The authors summarise the views put forward by them in previous papers as to the exact mechanism of tuberculous infection, laying stress upon the fact that the tubercle bacilli are probably absorbed by the digestive tube, and find their way to the lungs indirectly, and not directly as usually assumed. It has been found that it is possible to vaccinate young calves by the simple intestinal absorption of tubercle bacilli modified by heat, and that this method of vaccination is quite free from danger.—Remarks by M. Emile **Roux** on the preceding paper. The results of experiments carried on by M. Roux since November, 1905, are in general agreement with those described in the preceding paper; it is possible to give immunity to cattle against tuberculosis by means of the digestive tracts.—The problem of the elliptical cylinder: Mathias **Lerch.**—Specific inductive power and conductivity. Electrical viscosity: André **Broca.**—The aurora borealis: P. **Villard.** A complete theory of the aurora is given, and, using this as a guide, it is shown that the characteristic features of the aurora can be reproduced by means of a large spherical bulb placed between the conical poles of an electromagnet.—The liquefaction of air by expansion with external work: Georges **Claude.** Details are given of the arrangements for "compound" liquefaction, this constituting an advance on the previous results. Whereas spontaneous liquefaction under atmospheric pressure gave the author only 0·2 litre of liquid air per horse-power hour, the second step, liquefaction under pressure, gave 0·66 litre per horse-power hour, whilst the compound liquefaction raises the yield to 0·85 litre per horse-power hour.—The magnetic properties of the compounds of boron and manganese: Binet **du Jassonneix.** Of the two manganese borides MnB and MnB_2, the former alone possesses magnetic properties, and the permeability of ingots of manganese boride obtained from the electric furnace is proportional to the amount of MnB present.—The iodomercurates of magnesium and manganese: A. **Duboin.** These salts give rise to solutions of densities approaching 3·0, and various crystalline double iodides were separated and isolated.—The reduction of antimony selenide: P. **Chrétien.** The determination of the fusing points of mixtures of antimony and selenium in various proportions indicated the existence of three new compounds of selenium and antimony, SbSe, Sb_4Se_5, and Sb_2Se_3.—The attack of platinum by sulphuric acid: L. **Quennessen.** In the case of the sulphuric acid of the usual strength sold, it is the oxygen of the air which intervenes as the oxidising agent. In the absence of free oxygen with acids of high concentration, the necessary oxygen for the solution of the metal is furnished by the sulphur trioxide in solution in the acid.—The chlorination of wool: Leo **Vignon** and J. **Mollard.**—The estimation of albuminoid and gelatin materials by means of acetone: F. **Bordas** and M. **Touplain.** The authors have shown that egg-albumin, casein, and fibrin are completely insoluble in pure acetone. Diastases and peptones are also precipitated by acetone. In all cases the aqueous solutions separated by centrifugal action from the precipitate gave on analysis no trace of nitrogen, showing the separation to be complete. Details are given for the processes recommended for the analysis of butter, cheese, and milk.—Researches on the development of *Botrytis cinerea*, the cause of grey rot in grapes: J. M. **Guillon.**—Note on the bathypelagic Nemerteans collected by the Prince of Monaco: L. **Joubin.**—Impregnation and fertilisation: E. **Bataillon.**—The motility of the echinococcic scolex: J. **Sabrazès,** L. **Muratet,** and P. **Husnot.**—The graphitic schists of Morbihan: M. **Pussenot.**—The local winds in the neighbourhood of the Canaries: H. **Hergesell.**

DIARY OF SOCIETIES.

THURSDAY, JUNE 28.

ROYAL SOCIETY, at 4.30.—Sex-determination in Hydatina, with some Remarks on Parthenogenesis: R. C. Punnett.—On the Julianiaceæ, a New Natural Order of Plants: W. B. Hemsley, F.R.S.—On Regeneration of Nerves: Dr. F. W. Mott, F.R.S., Prof. W. D. Halliburton, F.R.S., and A. Edmunds.—The Pharmacology of Ethyl Chloride: Dr. E. H. Embley.—The Alcoholic Ferment of Yeast Juice, part ii., The Co-ferment of Yeast Juice: Dr. A. Harden and W. J. Young.—Total Eclipse of the Sun, August 30, 1905, Account of the Observations made by the Solar Physics Observatory Eclipse Expedition and the Officers and Men of H.M.S. *Venus* at Palma, Majorca: Sir Norman Lockyer, K.C.B., F.R.S., and others.—Researches on Explosives, part iv.: Sir Andrew Noble, Bart., K.C.B., F.R.S.—Tidal Regime of the River Mersey as affected by the Recent Dredgings at the Bar, in Liverpool Bay: J. N. Shoolbred.—The Refractive Indices of Water and Sea-water: J. W. Gifford.—The Ionisation produced by Hot Platinum in Different Gases: O. W. Richardson.—The Action of Plants on a Photographic Plate in the Dark: Dr. W. J. Russell, F.R.S.—On the Ultra-Violet Spectrum of Ytterbium: Sir William Crookes, F.R.S.—On the "Kew" Scale of Temperature and its Relation to the International Hydrogen Scale: Dr. J. A. Harker.—Note on the Production of Secondary Rays by "a" Rays from Polonium: W. H. Logeman.—The Hygroscopic Action of Cotton: Prof. Orme Masson, F.R.S., and E. S. Richards.

THURSDAY, JULY 5.

CHEMICAL SOCIETY, at 8.30.—Saponarin, a New Glucoside, Coloured Blue with Iodine: G. Barger.—The Constitution of Umbellulone: F. Tutin.—Electrolytic Oxidation: H. D. Law.—The Action of Ethyl Iodide and of Propyl Iodide on the Disodium Derivative of Diacetylacetone: A. W. Bain.

CONTENTS.