THURSDAY, DECEMBER 5, 1889.

THE MANCHESTER CONFERENCE.

THE Manchester Conference on the working of the Technical Instruction Act was as important a representative gathering as has taken place for some years to consider an educational question. The Conference was called by the Technical Association, and the Executive Committee and the branch Associations throughout the country were strongly represented. Invitations were also addressed to the chief local authorities and School Boards in large centres, and the principal technical schools and institutions. It says much for the change which has come over public opinion in the last two years on educational matters, that a circular, unadorned by promises of party speeches by prominent M.P.'s, but merely inviting discussion on the details of the operation of an Education Act, should have sufficed to cram the Mayor's parlour with a body of nearly 300 delegates, representing more than sixty local authorities and institutions.

"Conferences," Mr. Acland said at the outset, "are usually disappointing," and it would be absurd to expect that so large and miscellaneous a gathering would dispose satisfactorily, within little more than a couple of hours, of the four difficult questions raised on the agenda sheet. But such progress as was possible was made, and the remorseless bell sounded with impartiality when a speaker's limit of five minutes had been reached. In this way a good many expressions of opinion from many different points of view were compressed into the afternoon, and few could have gone away without any new ideas suggested by the Conference. That is, if they had previously taken the trouble to acquaint themselves with the provisions of the Act, for no time was wasted in the room in explaining its general scope, though literature in abundance on the subject could be had from the bookstall at the door.

The subjects discussed were: the relation of the Act to elementary schools; the mode of its adoption and the preliminary proceedings connected therewith; the mode in which, and the conditions under which, grants may best be made by local authorities to institutions giving technical instruction, and the principle on which such grants should be apportioned among institutions of different grades; and the mode of re-organization by which the Science and Art Department may meet the new duties imposed upon it by the Act. The four speakers who introduced these subjects happily represented the four chief "interests" involved—education, politics, manufactures, and science.

Without following in detail the order of the discussion, we may briefly sum up the impression which it left.

The chief interest centred in the question of the relation of the Act to public elementary schools. It is no secret that a certain amount of misunderstanding and difficulty has arisen over the interpretation of the sections of the Act which bear on this knotty point. The Act forbids the application of rates raised under it to the instruction of scholars working in the "obligatory or standard subjects" of the Code. The meaning so far is clear. No scholar of an elementary school at the time working in any of the standards can take advantage of the Act. But how about ex-seventh standard scholars, or indeed of any children in elementary schools, above the exemption standard, to whom the managers may wish to give technical instruction? It is well known that, in many Board and some voluntary schools, a large number of children are retained who have passed all the standards, but are receiving science and art instruction, and earning grants from South Kensington. What are the powers of Boards and managers with respect to these children? One thing is certain—whatever Boards could do before the Act, that at least they can do still. There is no restrictive clause in the Act, which purposely enacts that "nothing in this Act shall be so construed as to interfere with any existing powers of School Boards with respect to the provision of technical and manual instruction." But there has always been some little doubt as to the exact status of School Boards with respect to higher elementary schools, and this the Act does nothing to remove. Sir Henry Roscoe's Bill, if carried, would have placed the whole position of higher elementary instruction on a sound and satisfactory basis. It is a great flaw in the present Act that it leaves matters where they were. It is, however, an ill wind that blows nobody any good, and it may be that certain advantages will, after all, result from this anomalous state of things. Opinions of experts not being unanimous about the meaning of the Act, it is clearly a time for experiments to be made. Liverpool is already moving in the matter, after obtaining Sir Horace Davey's opinion that it is within the power of the School Board to provide technical and manual instruction out of the rates under their general powers, and other School Boards need have little fear in taking a comprehensive view of the Act and applying to the City Councils for their share of the proceeds of the special rate.

The Conference also discussed the question whether a local authority is bound to distribute any grant which it may make among the different qualified schools which apply for aid, or whether it may take the initiative and adopt the course (in many cases the wisest) of concentrating its efforts on making one central school efficient. This question, on which some doubt was previously felt owing to the obscurity of the wording of the Act, was satisfactorily cleared up at Manchester. The town clerk of Blackburn threw down the challenge, by declaring that he intended to advise his Council that they had the power to build a technical school and give it all, or the greater part, of the proceeds of the rate. To this General Donnelly replied that there was nothing in this to which he could take exception, so that local authorities have—so far as the Science and Art Department is concerned—greater liberty of action than some had supposed; and who can object except the Science and Art Department?

But, perhaps, a question of more real importance even than this, is the nature of the qualification entitling a technical school to rate-aid. Here, again, the wording of the Act is not very clear, and it must be confessed that the discussion at the Conference still left it in doubt. In Section I., Sub-section (*a*), we read: "A Local Authority may, on the request of a School Board for its district or any part of its district, or of any other managers of a school or institution within its district *for the time being in receipt of aid from the Department of Science and Art*," make provision for technical education in its district. The narrowest interpretation of this clause would confine the whole benefit of the Act to schools already receiving grants from South Kensington, and this view was understood by some members of the Conference—we hope wrongly—to be endorsed by General Donnelly.

We need hardly point out that such an interpretation would seriously restrict and cripple the operation of the Act. If there is one conclusion clearer than another from the Manchester Conference, it is that there is a general wish to use the rate for what we may venture to term its legitimate purpose—the assistance of those technical subjects which are not at present included in the Science and Art Directory. The worst thing that could be done would be to fritter it away in the form of doles to existing science and art classes; and yet, if only grant-earning schools can profit by the Act, this is what will inevitably tend to take place. Such an institution as the Leicester Technical School, which has classes in bootmaking, lace-making, &c., but no science and art classes, could get no help. The same would be true of such a school as the Finsbury Technical College.

We are glad to believe that so narrowing a meaning cannot fairly be given to the wording of the section. It is true that the words we have italicised make it necessary that the first institution to make a request to the local authority to put the Act in force must be already in connection with South Kensington, if it is not a School Board. But this condition only applies to the initial proceedings. When the request is made and granted, the local authority may make, "to such an extent as may be reasonably sufficient having regard to the requirements of the district, but subject to the conditions and restrictions contained in this section, provision in aid of the technical and manual instruction for the time being supplied" (not only in the school which makes the request, but) "*in schools or institutions within its district*."

That is, it may aid all higher schools already giving instruction which falls within the four corners of the Act, and this instruction includes very much more than the list of subjects on which grants can at present be earned.

And this leads us to the further question, What is meant by technical instruction in the Act? Some people, even at the Conference, understood it to mean merely the subjects in the Science and Art Directory, and any others which may be sanctioned by the Department on the representation of a local authority. This interpretation, again, would severely cripple the usefulness of the Act. At a time when the public is beginning to realize the mechanical nature of much of the teaching subsidized by South Kensington, and the want of elasticity and local adaptability which inevitably results from over-centralization, it would be nothing less than a disaster to tie down all science and art, and perhaps even technological teaching, to the rigid syllabus of a Government Department. Chemistry *quâ* chemistry would not be a "technical" subject, unless, forsooth, it were taught according to a certain syllabus, and followed by a certain examination. No really "technical" subject (except the four or five which are included in the Directory) would be "technical" under the Act until the local authorities in each district (not, be it noted, the managers of schools) had made a representation on the subject to the Science and Art Department, and a minute had been laid before Parliament.

But here, again, we are strongly of opinion that no such meaning can fairly be attached to the definition. "Technical instruction," so runs Clause 8, "shall mean instruction in *the principles of science and art applicable to industries, and in the application of special branches of science and art to specific industries and employments. It shall not include teaching the practice of any trade or industry or employment*." There is the definition. What follows is not a restriction, but an amplification, intended to provide a mode of clearing up doubtful cases. Some one might hereafter declare that some subject, as, for example, mathematics or landscape-painting, though included in the Directory, was not contemplated by the Act, as not being "instruction in the principles of science and art applicable to industries." The section therefore expressly declares that the definition *shall* include all such subjects; and if there be any other subject outside the Directory about which doubt is entertained, that doubt may be set at rest by a representation from a local authority. The Science and Art Department is umpire in doubtful cases, but no appeal to the Department is necessary with reference to subjects—say the principles of weaving, dyeing, plumbing, &c.,—which fall unmistakably within the definition. That, at least, is our view, and we believe the only rational one. It seems to us as clearly the meaning of the letter of the Act, as it was certainly the intention of its promoters.

The Science and Art Department, however, will have the power to define the mode of teaching of technical subjects for the purpose of earning Imperial, though not local, grants. The Department might, as was suggested at Manchester by Principal Garnett, take over the whole system of grants and examinations now controlled by the City and Guilds Institute. But we venture to hope—and Principal Garnett himself would, we believe, agree in this—that the authorities at South Kensington will think very carefully before embarking on a new system of payments on results, in the case of subjects which admit far less of such a test than most of those included in the Science and Art Directory.

They would do well to rely far more on efficient inspection than on individual examinations, and if the inspection were made a reality, instead of being, as now, too often a farce, they might, perhaps, ultimately base their grants for technical instruction on the amount of local contributions, in some such way as that provided for in the Welsh Intermediate Education Act. The Manchester Conference was strongly opposed to any increase of centralization, and the greatest possible freedom ought to be allowed to localities from the outset to develop their own system to suit their own needs.

If the Conference was decided on this point, it was, we think, equally decided that, under a broad interpretation of the Act, the powers conferred on local authorities are really very extensive. It is little short of a scandal that an Act for the improvement of English industry should itself offer such an exhibition of bad workmanship. But it is clear that the right way to solve the problem is for local authorities and School Boards to push ahead, as we believe they can do without fear. The list read by Sir Henry Roscoe at the opening of the proceedings shows what progress in this direction has already been made towards adopting the Act, and the Conference can hardly fail to result in a still more vigorous attempt to make a wise and extensive use of its provisions.

AMERICAN ETHNOLOGICAL REPORTS.

Sixth Annual Report of the Bureau of Ethnology to the Secretary of the Smithsonian Institution, 1884-85. By J. W. Powell, Director. (Washington: Government Printing Office, 1888.)

FROM the introductory remarks of the Director of the Bureau, we learn that the results of the research prosecuted among the North American Indians, as directed by Act of Congress, were of special interest during the continuance of the work in the fiscal year 1884-85.

As in forme years, the labourers in the mound explorations were remarkably successful, more especially in the territories east of the Rocky Mountains, where Prof. Cyrus Thomas, in 1885, and his coadjutors, Messrs. Middleton and Thing, subsequently, made important finds in Indian pottery, which were unique of their kind. Even more valuable are the results of the explorations carried on in New Mexico by Mr. and Mrs. Stevenson, the latter of whom succeeded in obtaining the largest and most important collection extant of objects relating to the sociology of the Zuni tribes. This rare treasury of Indian relics includes specimens of woven fabrics, pottery, stone implements, both ancient and modern, pictured urns, shrines, altars, sacred masks, fetishes, plume sticks, and other objects connected with the ancient mythology and religious practices of these people. Owing to the great variety of the objects, their true character cannot be determined without prolonged investigation, and in the meanwhile they have been deposited in the U.S. Museum, where they await their final classification. According, however, to Mr. Curtis, these, as well as the still more numerous collections of pottery, stone implements, and other objects, amounting to 4000 specimens, which have been obtained in New Mexico, all belong to the indigenous arts and industries of the ancient tribes who occupied the almost unknown tracts of Central America in which the Pueblo Indians are now located.

In the department of linguistic research, prosecuted by the various *employés* of the Bureau, none have perhaps been more successful than Mrs. Ermine Smith, who was fortunate enough to discover two Onondaga MSS., and one MS. in the Mohawk dialect, all of which she has annotated and translated with the assistance of a half-caste of Tuscaroran descent. The origin and history of these MSS. are not distinctly known, but it is conjectured that they are copies of originals which have been lost or destroyed. In their present form, they are, however, alike interesting from a sociological and a linguistic point of view, for while the Mohawk MS. gives an account of the religious rites and chants of the Iroquoian League which represented the elder members of the entire nation, one of the Onondaga MSS. records the ritual in use among the younger members of the same council, and the other the form of address used by the chief Shaman on the initiation of a newly elected chief.

These curious records have been turned to good account by Mrs Smith in the completion of her Tuscarora dictionary, and in filling up her vocabulary for the "Introduction to the Study of the Indian Languages" now preparing for publication.

In the Far West, and especially in California, the results of linguistic field-work are not equally satisfactory; and in the latter province, it would appear from the report of Mr. Henshaw, who was charged with the inquiry, that a number of the native dialects are extinct. Only a month before his arrival, an old woman had died who was the last person to speak the language of the Indians of Santa Cruz. The search for still surviving members of the several families of Indian languages current on the arrival of the Spaniards has not, therefore, begun too soon. The general results of these linguistic researches are embodied in a work entitled "Proof-Sheets of a Bibliography of the Languages of the North American Indians." This volume, a quarto of more than 1100 pages, was compiled by Mr. Pilling, and issued in 1884 by the Institute, which, with its usual liberality, has distributed the hundred copies printed to other public institutions, and to the various collaborators in the work.

In turning from the highly interesting explanatory remarks of the Director to the various monographs contained in the volume before us (a folio of more than 800 pages), we have first to notice the comprehensive and profusely illustrated treatise of Mr. Holmes, "On the Ancient Art of Chiriqui on the Isthmus of Panama."

Here the author supplies the technologist with an exhaustive history of the rise and development of plastic and textile art in this part of the continent, while he also treats fully of the literature and geography of this hitherto little-known province, whose position between North and South America imparted to the people some of the characteristics of the civilization of both sections of the western hemisphere.

Almost the whole of the enormous mass of clay and metal objects found in Chiriqui was extracted from tombs in the various *huacals*, or cemeteries, which are scattered over the Pacific slope of the province. These were first made known to science by Mr. Merritt, the director of a gold mine in Veragua, who, on hearing of the accidental discovery of a gold figure in Chiriqui, visited the district, and published a report of his explorations in 1859. From him we learn that in 1858, after it became known that a golden image had been discovered at Bugava, more than 1000 persons flocked to the spot, who it was estimated had in that year collected 50,000 dollars' worth of gold from one cemetery alone, which had an area of only 12 acres. A curious fact connected with the plastic decorations of the Chiriqui vases and other objects is that no vegetable forms have served the artificers as models, animals alone having been used for the purpose, as crocodiles, armadillos, monkeys, lizards, alligators, owing probably to their zoo-mythic conceptions of their divinities. Among the various groups of vases, the one comprising the so-called "alligator ware" is the most interesting; this animal being not only represented as a surface ornament, but serving as a model for the form of such dissimilar objects as whistles, rattles, tables, stools, jars, vases and other utensils. Occasionally the human figure appears under some grotesque form, and less frequently it is used to represent a divinity. According to Mr. Holmes, the entire system of the scrolls, frets, and other devices used in Chiriqui art have been derived from various parts of the body of an animal, probably the alligator, and he regards this system of ornamentation as indigenous to the district. In a separate article, the author treats of textile art in its relations to the development of form and ornament, and more especially with respect to the industries of the early American people.

The article on the Central Eskimo, by Dr. Franz Boas, although complete and admirable of its kind, has comparatively little interest for the English reader conversant with the results of Arctic research, since a very large and important part of the information given has been derived from the narratives of Franklin, Ross, Parry, and other more recent British explorers. Yet some additions have been made to our older knowledge of the Eskimo by Dr. Boas, who gives much interesting information regarding their tribal laws and customs, the musical art of the people, and their capacity for drawing; while he relates several curious tales and traditions, which present so remarkable a similarity to those of the Greenlanders and the Behring Straits' tribes as to make it probable that all these people are of one race.

The Rev. O. N. Dorsey, to whom the Bureau is indebted for the compilation of seventeen vocabularies of the different dialects used by the Oregon Indians, adds an interesting contribution to this volume, in which he describes the results of his visit, in 1883, to the Osages in the Indian Territory. During his short stay he obtained information regarding the existence of a secret society of seven degrees, in which a knowledge is preserved of the grades and general history of the various gentes and subgentes, with their taboo and names which are regarded with reverence and not spoken of. Owing to the strict secrecy usually maintained by members of this society, it was with extreme difficulty that he induced two of the initiated to recite to him the traditions referring to the mythic history of their tribe, which had been imparted to them on their initiation. These traditions, which the author gives with an interlinear translation, record the passage of the primæval Osages from higher worlds before they bore the semblance of birds, or had acquired from a beneficent red eagle the bodies and souls with which they alighted on the earth. The sacred chart on which their descent was symbolized by a river flowing beside a cedar, the tree of life, surrounded by sun, moon, and stars, was observed by Mr. Dorsey to be tattooed on the throats and chests of some of the elder men; but the younger Osages knew nothing of such symbols, and he was asked not to speak to them on the subject. From all he saw and heard among these and various tribes of Iowa and Kansas, he believes that in this traditional record of the descent of their gentes from different birds and animals, we have a clue not only to the names by which they are distinguished, but to the meaning of the chants and war-songs which only members of the seven degrees of their sacred societies have the right to sing. It would appear that an arrangement by sevens is common to various kindred tribes, and there is reason for assuming that wherever mythic names or taboos are in use there are, or have been, secret societies or mysteries, which have been derived from early traditional history.

In an elaborate article by Prof. Cyrus Thomas, entitled "Aids to the Study of the Maya Codices," we have an interesting account of the far-famed Maya Codex, which was acquired by the Royal Library of Dresden in 1739, and a large portion of which was collated for Lord Kingsborough's great work on "Mexican Antiquities," of which it forms the larger part of the third volume. According to Dr. Thomas, this unique document consists not merely of one, but of several original MSS., while it presents no evidence, as often asserted, that its symbols, figures, and signs are to be accepted as alphabetical, or phonetic, characters, its series of dots and lines seeming to indicate a close relationship with the pictographic system in use amongst the North American Indians. He is of opinion that these series have a chronological significance, based on the method of counting time common to the Mexicans and Mayas, in which a religious, or hierarchical, cycle of 260 days was recognized, as well as the solar year calendar of 360 days in use among the people. This interpretation must, however, for the present rank as merely conjectural, although his elaborate analyses of the Maya symbols cannot fail to be of use to the few interested in the solution of the curious philological problem involved in the elucidation of this unique codex, to which special notice was first drawn by Alexander von Humboldt. His acquaintance with ancient South American MSS. enabled him to show that, while its symbolic characters presented a close affinity with those used by the Mexicans, the material of which the MS. was composed was the Mexican plant metl, *Agave mexicana*.

EXACT THERMOMETRY.

Traité pratique de la Thermométrie de précision. Par Ch. Ed. Guillaume. Pp. xv. and 336. (Paris: Gauthier-Villars, 1889.)

THE thermometer, practically as we now have it, is an instrument several centuries old, and by far the most popular of all scientific apparatus. Yet probably much less is generally known about it than about its companion implements the barometer and the telescope. The reason for this want of knowledge lies doubtless in the fact that the common use of the thermometer is chiefly for rough observations on the temperature of the air, and for this the ordinary instruments are sufficiently accurate as they leave the maker.

Meteorologists and physicians, however, occasionally have the zeros of their thermometers tested; and, for factory work, other points have sometimes to be examined. But in chemical and physical laboratories, investigations not unfrequently require that thermometers should be corrected with all possible delicacy, if the resulting measurement is to be exact and valuable. For such operations there has hitherto been no exhaustive guide; and M. Guillaume, whose ample experience in the Bureau international des Poids et Mesures is a guarantee for the practical value of what he writes, has done good service by issuing the present work at an opportune moment.

It is natural for a "Traité pratique" to refer mainly to the mercurial thermometer; for the great majority of practical thermometric measurements lie within its scope. Having a range from $-40°$ to at least $360°$ C., and a possible sensitiveness of about $0°.001$, it rarely has to be exchanged for more delicate or larger-scaled appliances. Even the air thermometer—a sort of general appeal court in measurements of heat—is always accompanied by a number of ancillary mercurial thermometers.

To begin at the beginning (which, by the way, the author has not done), a thermometer has to be made; and the method of making it has a serious influence on the result. One maker will overheat his glass, and thus make the bulb harder than the stem; another will leave irregularities in the bulb which will cause the zero to rise irregularly; a third can never perfectly "deprive," as it is termed, the stem of air; the breath of a fourth is constantly leaving fatty matter in the capillary tube. In short, there are endless variations in technique, to which, for delicate instruments, attention should be drawn.

The division of the thermometer is, as might have been expected, well described; and minute details of calibration (chiefly by the method of broken threads) are duly set forth. Then follows a notice of a less familiar correction—that, namely, which depends on internal pressure when the thermometer is in a vertical position, and that which is produced by the (external) pressure of the air. Two methods of ascertaining the thickness of the bulb are given, but they are both inferior to Stokes's, which turns upon measuring angularly the distance between a spot on the outside of the glass and its reflection from the inner surface. Then ensues a description of the usual apparatus for determining the zero (which M. Guillaume seems to read somewhat too soon after immersing the bulb in the bath); and the method of ascertaining the boiling-point of water accompanies this. In the comparison of thermometers, which is next treated, the present writer prefers an air current to the metal plunger figured on p. 125.

If we observe the zero of a thermometer soon after manufacture, and subsequently at frequent intervals, we shall find that it is continually rising. The late Dr. Joule observed this ascent in one of his thermometers for more than seven-and-twenty years. There can be no doubt that it is due to a kind of setting of harder silicates in presence of softer or more viscous silicates in the mixture of which the bulb is composed. The softer glasses show it more than the harder ones; but in all exact work, it has to be determined and allowed for. This variation takes place at the ordinary temperature. If now we heat the thermometer moderately (say to 100°) and cool it, we shall notice a temporary depression due to a temporary set. If, again, as is often the case in factory work, we heat the thermometer for a long time to a high temperature (say 180°) the glass of the bulb (especially if soft) will become sensibly more plastic; and will sometimes yield sufficiently to external pressure to cause an ascent of 6°. At higher temperatures the ascent is still greater. Measurements of zero are therefore exceedingly important, even for moderately accurate work, and the author does not fail to draw minute attention to them. We should have been glad if at this point he had said something about the form of thermometer bulbs. Bulbs, for instance, which have their sides concave vary readily in capacity with barometric changes.

The exposure correction has exercised the minds of physicists for a great many years. When the bulb but not the stem of a thermometer is in a bath, the stem may clearly have a different temperature from the bulb, and the reading as a whole will be too low. In most chemical and physical laboratories, it is usual to follow Regnault, and to add, to the otherwise corrected reading T., the quantity

$$\alpha(T - t)N.$$

(N is the length in degrees of the exposed column, t is its mean temperature, and α is the difference between the expansion coefficients of glass and mercury.) There can be no doubt that this correction gives too low a result at high temperatures. It has been shown that if instead of α we simply write $(\alpha + \beta N)$—calculating α and β from the results—the demands of experiment are fulfilled with all desirable accuracy. The author, however, is disposed to leave the reader pretty much to his own devices for this correction.

The remainder of M. Guillaume's work is chiefly devoted to the comparison of the mercurial with the gas thermometer, and the measurement of dilatation of solid bodies: there are some valuable tables at the end.

A perusal of this "Traité pratique" will perhaps cause some regret that in most of our measurements of temperature we should be obliged to employ a material that is constantly undergoing physical change, and that necessitates in instruments constructed of it so many corrections. It is, on the other hand, a fortunate circumstance that we have in the mercurial thermometer an admirable means of establishing and measuring the corrections necessary to be imposed wherever glass is accurately worked with. For it cannot be too emphatically pointed out that every lens, cylinder, flask, or other glass instrument we employ is more or less amenable to these corrections. M. Guillaume's work, therefore, should command, as it deserves to command, a very wide interest. EDMUND J. MILLS.

THE FAUNA OF BRITISH INDIA.

The Fauna of British India, including Ceylon and Burma. Edited by W. T. Blanford. Vol. I. Fishes. By Francis Day. Pp. 548; 164 Figs. (London: Taylor and Francis, 1889.)

THE first volume of this, the last work of the well-known Indian ichthyologist, Francis Day, was issued under particularly painful circumstances, viz. almost on the very day of the author's death. The state of Mr. Day's health during the last few months had prevented him from attending to the correction of the proofs beyond the middle of this volume, which deals with the Chondropterygians, the Physostomes, and the Acanthopterygian family *Percidæ;* and the task of carrying the remainder through the press has fallen on the editor. This work is but a condensation of the author's quarto "Fishes of India," completed in 1878, so valuable for the copious and beautifully-executed lithographic plates which accompany it. And, fortunately, a number of these excellent illustrations (one for every genus) have been reproduced, intercalated in the text, in a manner which is highly creditable to the Lithographic Etching Company.

Considering how much remains to be done in the investigation of the fish-fauna of India and its British dependencies, it is a matter of regret that so little attention has been paid to the subject since Mr. Day's departure from India. The supplement to the "Fishes of India," published in 1888, records no more than sixty additions to the number of species, a figure which might easily have been doubled in the same lapse of ten years but for the unaccountable want of interest shown in this most important branch of study. As an example of the results which may be attained by an enthusiastic collector in those regions, we may allude to the collections of fishes brought together during the last three or four years by Mr. Jayakar, a surgeon stationed at Muscat, at the entrance of the Persian Gulf, and presented by him to the British Museum, by which no less than twenty-five species, many of large size and of commercial importance, have been added to the record of the fishes of the Indian Ocean. It is to be hoped, therefore, that this new and well got up issue of the "Fishes of India" in a more portable form will give a fresh stimulus to the study of that fauna. A little more, however, might have been done to facilitate the identification of species, a particularly arduous task, the difficulties of which would have been greatly lessened by the preparation of satisfactory "keys." Such as they appear in this work, viz. mere abbreviated tabulations of characters, without or with scarcely any groupings under special headings, the synopses fail in their object, and it is really a matter of regret that the editor did not bring his influence to bear for a thorough recasting of this portion of the work, especially in the case of such extensive genera as *Barbus*, *Nemachilus*, *Lutjanus*, or *Serranus*, where the work of identifying species by means of the synopsis given is perfectly discouraging. With the enormous multitude of species which our present knowledge requires us to grasp, it is of primary importance that every possible facility should be given to the naturalist who uses a manual of this kind, which after all is intended chiefly for those who have but an elementary knowledge of the special subject.

The above notice was in type when we received a copy of the second and concluding volume (509 pp., 177 figs.). We are glad to see that the editor has, in many cases, recast the synopsis of genera and species. The total number of fishes known from Indian waters is given as 1418.

In concluding, we congratulate Mr. Blanford on having, under difficult circumstances, so successfully brought out this portion of the "Fauna of India"; and we join in his tribute to the memory of the late author, who, as he justly says, has rendered signal service to Indian zoology.

OUR BOOK SHELF.

La France Préhistorique. Par Émile Cartailhac. (Paris: Félix Alcan, 1889.)

THIS volume forms one of the well-known series, "Bibliothèque Scientifique Internationale," published under the direction of M. Ém. Alglave. The subject, we need scarcely say, is one with which M. Cartailhac is eminently competent to deal, and all who are interested in the study of prehistoric times will be glad to have so compact and lucid an account of the facts to which the work relates. He begins with a good sketch of the rise and progress of modern ideas with regard to primitive civilizations and the antiquity of the human race; and this is followed by a discussion of the questions connected with man's place in Nature, his origin, and the supposed traces of his existence during the Tertiary period. An admirable chapter is devoted to the striking manifestations of artistic impulse by men of the Palæolithic age. The monuments of the Neolithic era in France are grouped with perfect clearness, and M. Cartailhac has not failed to do justice to any one of the various questions which these monuments have forced upon the attention of students. The scientific value of the book is enhanced by the fact that he avoids as much as possible the use of purely hypothetical reasoning. When he comes to sets of phenomena which cannot be simply and naturally accounted for, he thinks it better to offer no theory at all than to suggest purely conjectural explanations. The illustrations, although in no way remarkable, will be of considerable service to readers who have not made themselves familiar with the aims and methods of archæological science.

Experimental Science (Elementary, Practical, and Experimental Physics). By George M. Hopkins. (New York: Munn and Co. London: E. and F. N. Spon, 1890.)

THE subject of experimental physics is here set forth in a manner calculated to afford to the student, the artisan, and the mechanic, a ready and enjoyable method of acquiring a knowledge of this fascinating subject. Although the popular style adopted by the author perhaps makes the book better suited to the general reader than to the student, it may safely be said that all classes of readers will find much to interest them. All the subjects usually included in the comprehensive term "physics" are discussed; and, in addition, photography, microscopy, and lantern manipulation. By carefully performing each experiment at the time of writing the description, the author guarantees certain success if his instructions are followed. There is an excellent chapter on "mechanical operations," containing many valuable hints on glass working, simple apparatus for laboratory use, soldering, and moulding. Mathematical expressions are almost entirely excluded.

The book is chiefly remarkable for its hundreds of excellent illustrations, very few of which are diagrammatic. Many of them, like a considerable portion of the text, have already appeared in the *Scientific American*, which is alone sufficient guarantee of their quality. Some of the latest inventions, including Edison's new phonograph, are described and illustrated.

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.*]

"Modern Views of Electricity."

THE only point really at issue between Prof. Lodge and myself seems to be whether the difference of potential between two metals in contact can be measured by the Peltier effect or not. He asserts that he regards the statement that it can as an axiom, while I maintain that the only reason for calling it an axiom is that it cannot be proved. Let us take a simple case. Suppose we have a condenser, the plates of which are made of two different metals metallically connected, and that this condenser is placed in a vacuum, then, so far as I can see, Prof. Lodge's principle must lead to the conclusion that the difference of potential between the plates of the condenser is proportional to the Peltier effect; but if this is so, it is quite easy to show by the second law of thermodynamics that if the system is regarded as a heat-engine, the Peltier effect cannot vanish except at the zero of absolute temperature.

On the other points mentioned by Prof. Lodge in his letter, there does not seem sufficient difference of opinion between us to make it worth while discussing them.

In conclusion, let me assure Prof. Lodge that I am thoroughly in sympathy with the view that the consideration of the behaviour of the medium in the electric field is absolutely essential. I do not think there is anything inconsistent with this in the paragraph he quotes, which was intended to express what is well known to have been the opinion of Maxwell himself—that the key to the secret of electricity would be found in the "vacuum" tube. THE REVIEWER.

The Physics of the Sub-oceanic Crust.

IN your article on the above subject in NATURE of November 21 (p. 54), the important proposition that the earth's crust rests on a liquid layer is once more brought to the front. The question reaches to the very basis of geology, but, like most of those of real importance, is not now recognized by the Society which occupies apartments in Burlington House, rent free, for the purpose of forwarding the study of geology.

Nothing is more obvious to the geological student than that enormous thicknesses of strata have been formed at practically one level. We do not find that, when a thousand feet of sediment has been deposited under water, the deposition began in water which was 1000 feet deep, and went on gradually lessening the depth until the sea or lake was filled up; but we do find, as in the coal-measures, that the entire 1000 feet was deposited in most uniformly shallow water; that therefore the crust of the earth must have sagged foot by foot as additional feet of burdens were laid upon it. Deltas that have not yet been bottomed show hundreds of feet of silt, every yard of which was deposited at only a few feet from the surface level of the water; estuaries and river valleys slowly sink where there is sedimentation; ice-caps tell of accumulation accompanied by depression and submergence, and re-elevation when the burden is melted and dissipated; coral formations and submergence are regarded as well-nigh inseparable, and even lava-flows flowing on to a plain have sunk its level in a degree corresponding with their mass. Where there is fifty or a thousand feet of piled-up lava-sheets you may look for a fault of like amount on its flanks, like that which, still unsuspected by geologists, cuts the Isle of Mull in half. Whether we look at the past or the present, we seem to see evidence of a crust resting in equilibrium on a liquid layer, and sensitive to even apparently insignificant readjustments of its weight. And if the crust did not respond to, and make room for, the burdens laid upon it by the removal of disintegrated land and its redeposition as silt under water, would not the seas be choked for miles round every coast? The abrading action of the waves cuts down the land, be it high or low, to a dead uniform level, and sooner or later it must become first beach, and then sea-bottom. There it is covered with silt or sea-weed, and is no longer abraded, and would, therefore, form great level tracts, instead of almost uniformly shelving coasts, unless it yielded *pari passu* to the increasing weight of sediment and water. The immediate effect of cutting down cliffs, say of 100 feet in height, and removing them in solution or by wave action, is to relieve the pressure at their base; and I claim that, wherever I have excavated for the purposes of collecting under such conditions, I have found a decided slope inwards away from the sea, if the strata were at all horizontal, no matter what direction their general inclination might be at a distance from the sea margin. But on the beach, a little way from the base of the cliffs, the slope is, on the contrary, towards the sea, and whatever the general inclination may be, we see the harder ledges, even if but a few inches thick, sloping away into deeper and deeper water until lost to view; and if you choose to follow them and dredge, you trace them tending downwards into yet deeper water. This appears to me to be simply because the relief from pressure has made the beach-line the crown of a slight arch, and an arch that continues to grow and travel, else how could we collect day after day and year after year, on the same spots, such as Eastware or Bracklesham Bays, fresh crops of fossils after every tide? I have hundreds of times picked up every vestige of a fossil on perhaps an acre of Eocene or Gault, yet a couple of tides have removed so appreciable a layer that the area has appeared studded with fresh specimens that were twenty-four hours previously wholly covered and concealed under matrix. Yet this ceaseless waste does not lower the level of the beach as it ought to.

And if such slight displacements as result from coast denudation have so appreciable an effect, what must take place in ocean, if subsidence is going on, and the weight of water on the increase? Darwin saw that the vast rise of land, which he so graphically describes in South America, must have been accompanied by a corresponding depression in the bordering oceans; and in turning his pages you almost expect to come on the view that depression in the Pacific must be the cause of the upheaval of the coast-line. It only wanted the liquid layer theory to make the dependence of one on the other obvious. No general rise of land has, or ever can, take place, under the overwhelming pressure of the great ocean depths, and oceans are thus permanent; the struggle is confined to whether the liquid layer shall overcome lateral resistance and find relief along the coast-lines, which are the nearest lines of least resistance, and already weakened by abrasion, forming coast ranges, or rending the crust, and pouring over thousands of square miles from fissure eruptions; or whether it shall overcome vertical resistance, and raise the beds of shallower ocean eventually, perhaps, into land.

Thus the tendency, as noticed by the writer of your article, is for deep oceans to become deeper, under pressure which may increase but never relaxes, and for mountain-chains to grow into higher peaks, the more weight is lessened by valleys being cut up and denuded.

This theory accounts for innumerable facts in the physics of the earth which space would not permit me to enter on, and is, so far as I know, opposed to none.

J. STARKIE GARDNER.

Area of the Land and Depths of the Oceans in Former Periods.

IN a letter to NATURE (p. 54), entitled "Physics of the Sub-oceanic Crust," by my friend, Mr. Jukes-Browne, the following passage occurs:—

"We are at liberty to imagine a time when there was much more land than there is at present, and when all the oceans were comparatively shallow."

I wish to point out that such a condition of things could not obtain if the bulk of the ocean water was the same as now. To get more land, the ocean would have to be *deeper* than now, not shallower. An easy way of conceiving the effect of shallowing the oceans is to mentally lift up the present ocean-floors, the result being an overflow of water and decrease of land area. The only possible way of shallowing the oceans and increasing the area of the land would be to make the ocean-floors perfectly flat, and to surround the continents with vertical walls of rock —in fact, to make the oceans into docks, which nevertheless would exceed two miles in depth.

I pointed out this geometrical fact in "Oceans and Continents"[1]—an article which has provided some of the stock arguments against their fixity. If, therefore, theorists feel it necessary that the land areas should be greater, and the oceans shallower, in former ages, they are bound at the same time to provide some means of decreasing the bulk of the ocean waters. This seems difficult, as other theorists tell us that the amount of water on the globe goes on decreasing, being used up in the hydration of the crust of the earth, and point to the condition of things on the moon as the final stage of our planetary existence.

T. MELLARD READE.

Park Corner, Blundellsands, near Liverpool,
November 23.

Distribution of Animals and Plants by Ocean Currents.

SOUS ce titre, vous donniez naguère (vol. xxxviii. p. 245) une correspondance de M. A. W. Buckland concernant divers phénomènes observés à Port-Elisabeth, dans l'Afrique du Sud. Entre autres choses il y était relaté que, vers la fin de l'année 1886, un fruit analogue à celui du cocotier avait été porté par la mer sur le rivage de Port-Élisabeth en même temps que des quantités considérables de pumites ou pierres-ponces.

[1] *Geological Magazine*, 1880, p. 389; also, see letter in same magazine, 1881, p. 335, headed "Subsidence and Elevation."

Le fruit ramassé par un *boy*, "*Il* y porte la dent, fait la grimace. . . . Le moindre ducaton serait bien mieux *son* affaire." Notre *boy* se décide dès lors à porter le fruit au jardinier de "North End Park." Le végétal confié à la terre poussa et donna un arbre, *Barringtonia speciosa*, qui avait atteint 4 pieds de hauteur vers le milieu de l'année 1888.

M. A. W. Buckland émettait l'hypothèse que fruit et pumites, comme aussi quelques poissons et serpents appartenant à des espèces jusque-là inconnues dans le pays, et arrivés en même temps, provenaient des parages de la Sonde, et, à la suite de la grande éruption de Krakatoa en 1883, avaient été portés par les flots jusque sur les rivages de la côte Sud-Africaine.

Il n'y a plus à douter, je crois, de la provenance des pumites. Je n'ai rien à dire au sujet des poissons et serpents. Mais pour ce qui est du fruit de *Barringtonia speciosa*, il me semble qu'on pourrait lui donner une autre origine ou point de départ, et diminuer ainsi de beaucoup la durée de sa traversée sur l'océan.

L'arbre *Barringtonia speciosa* croît, en effet, à Madagascar, où je l'ai vu à Tamatave, sur les bords de la mer. Il ne serait donc ,point du tout improbable que le fruit porté par les flots à Port-Elisabeth provint de la grande île Africaine. En même temps que je signalais l'arrivée sur nos plages Malgaches des pumites de Krakatoa, en Septembre 1884 et en Février 1885 (*Cosmos*, nouvelle série, No. 12, p. 320), j'envoyais en Europe divers spécimens de ces pumites ramassés sur la plage de Tamatave. Parmi les spécimens adressés à la Société Nationale d'Acclimatation de France s'en trouvait un dans lequel s'était logé une partie de végétal,—une fleur, si je ne me trompe, d'une espèce de *Terminalia*, qui croît aussi à Tamatave sur les bords de la mer (*Bulletin de la Société Nationale d'Acclimatation de France*, Décembre 1884, p. 983).

Un fruit de *Barringtonia speciosa* arbre qui, comme je l'ai fait remarquer, croît au bord de la mer sur la côte orientale de Madagascar, a très bien pu, de même, prendre "passage" sur une pumite ou un banc de pumites atterrées sur la plage Malgache ; puis, à la première haute marée, avoir cinglé sur ce "transport" d'un nouveau genre vers la côte Sud-Africaine, poussé par le Courant Indien, jusqu'à son arrivée à Port-Elisabeth, où il a enrichi le "North End Park" d'un nouvel arbre exotique.

Mais, ,même dans cette hypothèse, le phénomène observé à Port-Elisabeth n'aurait pas un moindre intérêt. L'île de Madagascar y gagnerait de pouvoir être considérée comme une grande "escale," établie par le Dieu Créateur et Ordonnateur des Mondes, pour le service des "Messageries maritimes" de la Nature entre les Archipels de la Malaisie et la côte Sud-Africaine.

Veuillez agréer, Monsieur le Rédacteur, les respectueuses salutations de votre humble serviteur,

PAUL CAMBOUÉ, S.J.,
Missionnaire apostolique à Tananarive.

Tananarive, Madagascar, 15 Octobre.

A Marine Millipede.

BRITISH naturalists, especially such as work on the south coast, will hear with interest that Mr. J. Sinel has lately found in Jersey the very curious *marine* Millipede, *Geophilus submaritima*, Grube (*Verh. d. schles. Gesellsch.*, 1872). Dr. Latzel, of Vienna, tells me that the specimens differ somewhat from the type, and probably constitute a well-marked variety. Some examples were found close to the low-water mark of very low spring tides, where they could not be exposed more than two days in a fortnight.

The Geophilus occurs associated with two or three beetles, of which at least one appears to be new, and with a remarkable Chelifer which is probably identical with *Obisium littorale*, a new species described by Moniez from Boulogne, in this month's *Revue Biologique*, or with the doubtful species *O. maritimum* of Leach (*Zool. Miscellany*, iii. 1817).

Mr. Sinel's crowbar, a tool the naturalist makes too little use of, is doing wonderful service. D. W. T.

December 2.

A Case of Chemical Equilibrium.

DURING some experiments made in connection with a research recently laid before the Royal Society, we came upon an interesting case of chemical equilibrium.

The object of the research was to determine the rate of evolution of oxidizing material liberated, under varied conditions, in a solution containing dilute hydrogen chloride and potassium chlorate. There was also introduced a little starch solution and a small quantity of potassium iodide to serve as an indicator of the completion of a certain amount of work, which was the conversion of a known small weight of sodium thiosulphate into tetrathionate. The completion of this change was marked by the appearance of a blue colour in the liquid. The operation was then repeated.

In these experiments the amount of substances undergoing change, when compared with the total amount present, was so large that the masses of the substances remained practically constant during each experiment.

In such a mixture the condition of equilibrium may be considered to be represented by the following equation :

$$n\mathrm{HCl} + m\mathrm{KClO_3} = m\mathrm{HClO_3} + m\mathrm{KCl} + (n - m)\mathrm{HCl},$$

where n is greater than m.

We may then regard the oxidizing material as being liberated by the reaction of the $(n - m)$ molecules of hydrogen chloride with the m molecules of hydrogen chlorate so liberated. The presence of the m molecules of potassium chloride will produce its specific effect (in this case acceleration) on the rate of reaction. So that out of the n molecules of hydrogen chloride employed only $n - m$ are actively engaged in liberating oxidizing material, the rest having been employed in saline decomposition. If such be the case, it ought to be possible to obtain a similar rate of oxidation by taking m molecules of hydrogen chlorate instead of potassium chlorate, and then reducing the hydrogen chloride used from n to $(n - m)$ molecules. If we then add the m molecules of potassium chloride we should then be able to build up a system similar to what is obtained in the former case as regards saline equilibrium. The following results were obtained by this method of procedure.

The numbers signify millionth gram molecules per c.c., and the rates, R, denote the number of millionth gram molecules of $\mathrm{ClO_3}$ decomposed per minute in each cc.

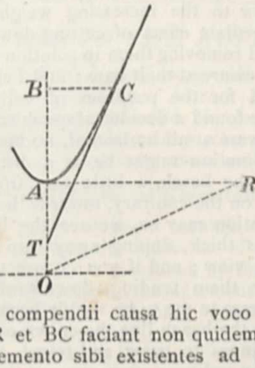
I.	$n = 18 \times 65{\cdot}11$ $m = 6 \times 51{\cdot}5$	A. $n\mathrm{HCl} + m\mathrm{KClO_3}$ gives $R = 0{\cdot}0104$ B. $(n - m)\mathrm{HCl} + m\mathrm{HClO_3} + m\mathrm{KCl}$ gives $R = 0{\cdot}0105$
II.	$n = 15 \times 65{\cdot}11$ $m = 6 \times 51{\cdot}5$	A. $n\mathrm{HCl} + m\mathrm{KClO_3}$ gives $R = 0{\cdot}00554$ B. $(n - m)\mathrm{HCl} + m\mathrm{HClO_3} + m\mathrm{KCl}$ gives $R = 0{\cdot}00555$
III.	$n = 15 \times 65{\cdot}11$ $m = 2 \times 51{\cdot}5$	A. $n\mathrm{HCl} + m\mathrm{KClO_3}$ gives $R = 0{\cdot}00195$ B. $(n - m)\mathrm{HCl} + m\mathrm{HClO_3} + m\mathrm{KCl}$ gives $R = 0{\cdot}00191$

Dover College. W. H. PENDLEBURY.

On the Use of the Word Antiparallel.

AFTER reading Mr. James's note, I looked out the reference quoted by him from Stone's Dictionary in the "Acta Eruditorum." Stone's reference is quite correct, and, as the passage is an interesting one, it may be well to quote it in full. It occurs in an article by Leibnitz treating of the catenary.

"Tangentem ducere ad punctum lineæ datum C ; in AR horizontali per verticem A sumatur R ut fiat OR æqualis OB datæ et ipsi OR ducta *antiparallela* CT, occurrens axi AO in T, erit tangens quæsita.



"*Antiparallelas* compendii causa hic voco ipsas OR et TC si ad parallelas AR et BC faciant non quidem eosdem angulos sed tamen, complemento sibi existentes ad rectum, ARO et BCT."

The following quotation is given in Murray's "New English

Dictionary," and is assigned to the year 1660:—"To take the opposite course and to provide our remedy *antiparallel* to their disease." Here it seems intended to convey the idea of "parallel and in the opposite sense."

In Barlow's "Mathematical Dictionary" (1814), the modern meaning is given, and the old error as to the ratios of the segments of the sides of the triangle is pointed out.

In Rees's "Cyclopædia" (1819) the modern meaning is given, but a remark is added that Leibnitz used the word in the sense explained above; as no reference is given, we cannot tell whether the writer meant that he habitually used it or only in the article on the catenary. E. M. LANGLEY.

Bedford.

A Surviving Tasmanian Aborigine.

IN your issue of November 14 (p. 43), you refer to the paper read by Mr. James Barnard before the Royal Society of Tasmania on a Mrs. Fanny Cochrane Smith, who lays claim to be the last surviving aboriginal Tasmanian. Since your note appeared, I have read a report of the paper published in the *Hobart Mercury* of September 10 last, and think my view on the claim may be of some interest to your readers.

Mr. Barnard states that he knew Mrs. Smith forty years ago when she was seventeen years of age, and that during the period which elapsed since then until she called upon him shortly before he wrote his paper, he had not known of her whereabouts. In favour of the claim I can only find that she has, with apparently one exception, always been referred to officially as a pure-bred aborigine, and that Parliament appears to have voted her grants on two occasions (in 1882 and in 1884) on account of her unique position.

The objections to the claim may be briefly summarized as follows:—

(1) From the meagre account given, it appears her hair and complexion are both that of half-castes, and we are not supplied with any other description of her features or stature or peculiarities so as to be able to judge on the question.

(2) Beyond the mere statement as to mutual recognition no evidence is given that the claimant is the same girl Mr. Barnard knew forty years ago at Oyster Cove, nor, indeed, is there anything to show that this woman is the child, or one of the children, referred to by Lieut. Friend in controverting Count Strzelecki's well-known views, which *quasi* fact forms the foundation for the claim.

(3) The woman herself is reported to have no recollection of witnessing, at the age of thirteen, a document sufficiently important to have impressed itself on her memory, and it is somewhat strange that this very document is said to describe her as a half-caste.

It would, no doubt, be interesting were it to be eventually proved that this woman Fanny is a pure-bred aborigine, but for the present Truganina must be considered the last survivor of her race. HY. LING ROTH.

Lightcliffe, November 23.

Brilliant Meteors.

THE brilliant meteor seen at Warwick School and in Cumberland I saw at Folkestone on November 4 a little before 8. It was travelling slowly from north-west to north, about 30° above, and parallel with, the horizon. After travelling some distance it appeared to partly explode, and then went a little farther and burst. At first it was a beautiful green colour, but after it had partly burst it was nearly white. I imagined its colour was through the haze there was in the sky. From what I saw I am certain it would have been a splendid sight had the atmosphere been clear. P. A. HARRIS.

Inchulva, Maidstone, November 27.

LAST night, in clouded moonlight, whilst walking here from Newton by the road over Little Dunnow, my attention was arrested by the glare of what must have been a very bright meteor, seen through clouds which formed a general covering. The quarter in which the light appeared was east by north, at an elevation of about 25°, and it lasted a second and a half. There appeared to be three centres of illumination, but these may have been only thinner portions of the clouds. The time, as nearly as I could get it by comparing my watch by telegraph at the village post office this morning, was 22h. 48m. 45s.

Slaidburn, Clitheroe, December 2. R. H. TIDDEMAN.

REPORT ON THE MAGNETICAL RESULTS OF THE VOYAGE OF H.M.S. "CHALLENGER."

IT will be remembered by readers of the "Narrative of the Voyage of H.M.S. *Challenger*," that Vol. II., published in 1882, contained a report of the magnetic observations made in that vessel in considerable detail. It has, however, been reserved to the present year for a full discussion of the *Challenger* observations and their bearing on our existing knowledge of terrestrial magnetism to be made, and the following is an abstract of the final Report about to be published in Vol. II., "Physics and Chemistry of the Voyage of H.M.S. *Challenger*."

The method of representing the values of the magnetic elements by curves of equal value has, since 1700, when Halley published his map of the declination, found general favour; for in succeeding years we find Mountain and Dodson, Churchman, Yeates, and Barlow, also published maps of the same magnetic element.

In 1819, Hansteen added maps of inclination to the declination for certain epochs, and in 1826 produced a chart of isodynamic lines, revised in 1832.

Following Hansteen, there appeared, in 1840, Gauss and Weber's atlas, the result of calculations from about eighty-four observations distributed over the world, presenting a remarkable approach to the truth, even when viewed in the light of our comparatively extended knowledge of the earth's magnetism in the present day. It may be observed that, if only a fresh magnetic survey of the regions south of 40° S. latitude were now made, a re-calculation of the Gaussian constants might be undertaken promising important results.

Between 1868 and 1876 Sir E. Sabine's "Contributions to Magnetism" were read before the Royal Society, forming a series of papers on the magnetic survey of the globe for the epoch 1842·5. Although the maps accompanying these contributions serve as a point of departure for comparison with subsequent maps, an examination of them shows that in Africa and the North and South Pacific Oceans there were large blanks from want of observations

There remained, therefore, a large field for observation, and it will now be shown how largely the *Challenger* Expedition contributed to the filling up of these blanks, and added to our knowledge of the changes going on in the magnetic elements in places visited by previous observers.

The whole of the magnetical results have been embodied with others from every available source in four charts[1] of the magnetic elements, for the epoch 1880, which may prove acceptable to magneticians desirous of noting the changes in the magnetic elements since 1842·5.

The *Challenger* was not an ideal ship in which to conduct magnetic observations at sea, for she was seldom at rest from pitching and rolling, and although the errors in the observations caused by the horizontal component of the ship's magnetism were moderate, and could be eliminated by "swinging" the ship, those proceeding from the vertical component were large, and necessitated a frequent comparison with normal values on land. But by discussing fully a series of observations made in numerous places in both hemispheres where no trace of local magnetic disturbance could be found, the magnetic condition of the ship was readily determined for any period of the voyage. As a consequence of this, normal values of the magnetic elements could be obtained in the neighbourhood of places known or suspected of being affected by local magnetic disturbance, and the amount of such disturbance measured with considerable accuracy.

This method of detecting local magnetic disturbance,

[1] Note published with the "Report of the Scientific Results of the Voyage of H.M.S. *Challenger*," Physics and Chemistry, Vol. II., Part VI.

was applied to the solitary islands of the ocean visited by the *Challenger*, and the following are some of the principal results.

At Madeira there was a difference of 7½° in the observed inclination between observations made at 1 foot and 3½ above the ground; and at Santa Cruz, Tenerife, the inclination was 2½° in excess of the normal observed in the ship.

It was at Bermuda, however, that the most remarkable results were obtained. For some years previously, observers in different parts of the group had obtained very different values of the declination, and our men-of-war when swinging for deviations of the compass had found constant errors for every direction of the ship's head which were peculiar to Bermuda. It could only, therefore, be by a properly equipped expedition like that of the *Challenger*, and systematic observation, that the immediate cause of all this local magnetic disturbance could be traced.

For this purpose the declination was observed at seventeen stations, the inclination at ten, and the intensity at seven. Combining these observations with others made by previous observers, it was found that between the Governor's house at Mount Langton and the lighthouse on Gibb's Hill, there is a disturbing magnetic focus attracting the north-seeking end of the needle with a force considerably in excess of that due to the position of Bermuda on the earth considered as a magnet. The normal values of the magnetic elements were obtained by swinging the ship at sea 15′ south of the green outside the dockyard. The difference between the observed declination at Clarence Cove and Barge Island was 5° 44′. The greatest difference in the inclination was 1° 47′, and in the vertical force + 0·314 (Brit. units).

Local magnetic disturbances were also noted at St. Vincent, Cape de Verde Islands, Tristan d'Acunha, Kerguelen Island, Sandwich Islands, Juan Fernandez, and Ascension, but not at St. Paul Rocks.

By applying the same method of obtaining normal values at sea, and observing on other adjacent solitary islands such as St. Helena, similar effects result, and the following general conclusions seem to be supported by fact with regard to local magnetic disturbance:—

(1) That in islands north of the magnetic equator, the north-seeking end of the needle is generally attracted vertically downwards, and horizontally towards the higher parts of the land; (2) south of the magnetic equator the opposite effects are observed, the north-seeking end of the needle being repelled: in both cases by an amount above that due to the position of the island on the earth considered as a magnet.

Interesting as these conclusions may possibly be from a scientific point of view, they are of real importance in practical navigation. Navigators have asserted that their compasses were disturbed when passing the land in certain parts of the world. We learn from the *Challenger* observations that within 5 feet from the soil the greatest magnetic disturbance did not exceed 3° in the declination and 2½° in the inclination. Remembering the law of magnetic attraction and repulsion, it is impossible that a compass in such case could be disturbed in a vessel passing the land at the ordinary distance. In point of fact, it has been shown that it is to submerged magnetic land comparatively near the ship's bottom that the disturbance of the compass is due. The remarkable instance at Cossack in North-West Australia may be cited in support of this conclusion. Thus in H.M.S. *Meda*, sailing on a line of transit of two objects on land for a quarter of an hour in 8 fathoms of water, it was found that the compass was steadily deflected 30°, no visible land being nearer than 3 miles.

Great as the gain must be to the navigator to be thus warned of a formidable danger in certain places, it also lays upon him the important duty of being on his guard against similar disturbances elsewhere, reporting any new discoveries as he would a rock or shoal.

Large as was the *Challenger's* contribution to the magnetic charts for 1880, it will be readily understood that it required considerable reinforcement from other sources, as their construction was dependent on observation alone. Every available observation between the years 1865–87 was utilized. Beyond the published sources of information on this subject may be mentioned the observations made on the east coast of Africa by the officers of H.M.S. *Nassau* in 1874–76, and on the west coast of Australia in 1885–86 by H.M.S. *Meda*. Also the sea observations between Australia and Cape Horn of the declination in H.M.SS. *Esk*, *Pearl*, and *Thalia*, between 1867–87, not forgetting those of the New Zealand Shipping Company's vessels in 1885–86.

To combine this twenty years' observation usefully, a somewhat extended knowledge of the distribution and amount of secular change became a necessity. Generally speaking, it is only at fixed observatories that this element of terrestrial magnetism is known with precision, for, as already shown, observations a few feet apart often give very different results. In the more frequented parts of the earth this secular change is approximately known, especially in the United States, where valuable work has been accomplished.

One great object of the voyage of the *Challenger* was to visit certain unfrequented positions where previous observers had been, rather than the beaten tracks. Thus Ross's position of 1840 on St. Paul Rocks was visited, and the secular change during thirty-three years obtained. Then Tristan d'Acunha, an important station situated in mid-ocean, rarely visited for magnetic purposes. At Kerguelen Island, another of Ross's positions, observations of all three principal magnetic elements were made, and the secular change found approximately.

In the Indian Ocean generally, north of 30° S., the secular change of the declination rarely exceeds 1′ annually, but at Kerguelen Island the westerly declination is increasing at least 5′ annually.

It was, however, from two positions on the homeward voyage that the most novel and remarkable values of the secular change were obtained—Sandy Point, Magellan Straits, and the Island of Ascension, with its adjacent waters.

At Sandy Point, with the horizontal force nearly stationary, and the declination decreasing 3′ annually, it was hardly suspected until 1876, when the *Challenger* visited the place, that the inclination was apparently changing 11′ annually. Comparing the *Challenger's* results by swinging near the Island of Ascension with Sabine of 1842·5, the following values of the secular change are obtained: declination increasing 8′ annually; south inclination increasing 14′.

From these results the notable fact is made evident, that the north-seeking end of the needle is found to be moving in opposite directions, downwards at Sandy Point, and more strongly upwards at Ascension. Extending the inquiry into the surrounding seas and countries, it was found that these opposite movements of the needle were not confined to the spots where they were discovered.

The author of this Report, after having discussed his collection of a large number of observations of the magnetic elements for all parts of the world—in many cases extending over several years—obtained approximate values of their secular change for the epoch 1840–80.

These several values were weighted according to their relative accuracy, and entered on maps against the places of observation. Lines of equal value were then drawn for each element, and the following general results obtained with regard to the movements of the north-seeking end of the needle.

1. *Declination*.—The principal lines of little or no change were found to take the course from St. John's,

Newfoundland, to the West Coast of Africa, near Cape de Verde, emerging near Cape Palmas, and then to Cape Town; thence curving upwards near Mauritius, downwards south of Cape Leeuwin, again upwards through Adelaide and Cape York to the vicinity of Hong Kong. A second line passed from Sitka through the western portion of the continent of North America, striking South America near Callao, then following the trend of the coast to a point near the western entrance to Magellan Strait.

The foci of maximum value of change were found: (1) between Scotland and Norway, change about 9′ annually, needle moving eastward; (2) on the east coast of Brazil, needle moving westward about 8′. Minor foci were also found: one near Kerguelen Island, the other in the South Pacific. Another focus apparently exists in Alaska. The general tendency was for the values of the change to decrease gradually from the foci to lines of no change.

2. *Inclination.*—Similarly to that of the declination, there are lines of no change, two principal foci of maximum secular change, but only one minor focus. The lines of no change are not so clearly defined as those for the declination, data being still wanting. The principal foci of maximum change in the inclination were found: (1) near the Gulf of Guinea, between Ascension and St. Thomé, which may be called the Guinea focus. Here the north-seeking end of the needle was moving *upwards* about 15′ annually. (2) in the latitude of Cape Horn, and about 80° W. long. This may be called the Cape Horn focus, and the annual change was 11′, needle being drawn *downwards*. It must be distinctly understood that both the positions and values of the change are only approximate, and only the general features in the angular movement of the freely suspended needle are to be accepted, as clearly shown by this investigation.

3. *Magnetic Intensity.*—In the horizontal force, the annual change (B.U.) was about −0·002 near Cape Horn, whilst between Valparaiso and Monte Video the focus of greatest change was about −0·017. Again, on the west coast of Portugal a focus of +0·009 (B.U.) occurred.

Turning to the vertical component of the earth's intensity, some remarkable results were observed. At the Cape Horn focus an annual change of 0·055 (B.U.) was found in the vertical force, the north-seeking end of the needle being drawn *downwards*, the change diminishing in value until the zero line extending from Callao across the American continent to the west coast between Bahia and Rio de Janeiro, and then taking a south-easterly course north of Tristan d'Acunha, was reached. Northward and eastward of this zero line there were found increasing values in the annual change in the *upward* vertical force acting on the north-seeking end of the needle until the Guinea focus was reached, where its full value was increasing 0·025 annually. From the Guinea focus to Northern Europe, Asia, and the Atlantic seaboard the change gradually decreased in amount. There were signs of minor movements in the north-seeking end of the needle in China, Mexico, and the United States.

One of the chief factors in the compilation of the previously mentioned maps of the three elements for the epoch 1880 were the observations taken in the *Challenger*, and these were reduced to the common epoch by means of the investigation of annual change to which reference has just been made.

It may be truly said that the *Challenger's* track was studded with magnetic observations. After successfully traversing the Atlantic Oceans in varying directions, the three magnetic elements were obtained by swinging, in probably the most southerly position since the days of Ross in the *Erebus* and *Terror*, in lat. 63° 30′ S., and long. 90° 47′ E. But the most valuable part of the contributions to terrestrial magnetism obtained in the *Challenger* were the observations made in the North and South Pacific. The route lay from Wellington, N.Z., to Tongatabu, and Fiji, from the Admiralty Islands to Japan, and thence in mid-ocean from nearly 40° N., through the Sandwich Islands and Tahiti to 40° S., nearly at right angles to the curves of equal magnetic inclination.

During the voyage much experience was gained as to the usefulness of the Fox circle as an instrument for use on board ship at sea, the general result being that valuable work may be done with it if frequently compared with the absolute instruments on land, and the instrument mounted on a gimbal stand prepared to withstand the vibrations caused by the engines of the vessel.

Although on the general question of the secular change of the magnetic elements much has been already written in this Report, there yet remain some important points which demand further discussion.

As to the causes of the secular change various hypotheses have been advanced. Thus in the early part of the last century, Halley considered the change was chiefly caused by a terella with two poles or foci of intensity rotating within and independently of the outer shell of the earth, which also possessed two foci of intensity, the axes of the two globes being inclined one to the other but having a common centre.

Again, Hansteen at the beginning of the present century concluded that there are four poles of attraction, and computed both the geographical positions and the probable period of the revolution of this dual system of poles or points of attraction round the terrestrial pole.

In later years Sabine considered the secular change to be caused by the progressive translation of the point of attraction at present in Northern Siberia, this point of attraction resulting from cosmical action. Walker also agreed with Sabine as to the cosmical origin of the change.

Later still, Balfour Stewart gave reasons for attributing the secular variation to the result of solar influence of a cumulative nature.

Keeping in view these hypotheses, and recalling the chief results of observation during recent years, how do they accord?

Observation generally points to the fixity of the magnetic poles—or two limited areas where the needle is vertical—in respect to the geographical poles. Again, in Siberia there is little or no apparent translation of the greatest point of attraction in that region, and the North American focus of intensity is probably at rest.

Thus the results of observation in recent years are not favourable to hypotheses founded on the translation of the poles or foci of magnetic intensity.

Let the terms blue and red magnetism be adopted, and the movements of the red, or north-seeking, end of the needle alone be considered.

The question arises, What have recent observations offered us instead? They tell us that near a line drawn from the North Cape of Norway across the Atlantic to Cape Horn lie some of the foci of greatest known secular change. It was also found that at the Cape Horn focus of vertical force the needle was moving downwards, or there was the equivalent to a blue pole of increasing power of attraction, the freely suspended needle being attracted towards it over an extended region around. At the Guinea focus there was the equivalent to a red pole of increasing power of repulsion, the freely suspended needle being repelled over an extended region of undefined limits. The action of these two poles apparently combine to produce a focus of considerable angular movement in the horizontal needle near Brazil.

In China there is a minor blue pole of increasing power attracting the needle over a large area.

With apparently small secular changes in Siberia, and the horizontal needle moving somewhat rapidly to the eastward at the focus of change in the declination in the German Ocean, and similarly to the westward in Alaska, analogy points to the probability of there being a decrease in the vertical force in the high latitudes of North America, or the equivalent to a red pole of increasing power repelling the needle for a large area around it.

The variations in the vertical force at and about these poles or foci of attraction and repulsion at different epochs are not yet sufficiently determined, but if the hypothesis of translation be given up, it is not unreasonable to suppose that the secular changes in the declination and inclination are chiefly dependent upon changes in the relative power of these poles.

No satisfactory explanation has yet been given of the remarkable changes in the earth's magnetic force as measured on its surface, and suggestions are only possible in the present instance.

The voyage of the *Challenger* has shown that local magnetic disturbance is found in the solitary islands of the sea, although surrounded by apparently normal conditions, similar to that on the great continents. It has also been suggested that the magnetic portions of these islands causing the disturbance may possibly "have been raised to the earth's surface from the magnetized portion of the earth forming the source of magnetism," and tending to prove Airy's conclusion "that the source of magnetism lies deep."

In view, therefore, of past geological changes and those now in progress, it may fairly be conceived, not only that large changes have likewise occurred in the distribution of the magnetic portions of the earth appearing here and there on the surface and producing local magnetic disturbance, but that there are others of a more progressive character below the earth's surface which are only made manifest by the secular change observed in the magnetic elements. This conception with regard to secular change is not intended to exclude the view that solar influences may have a small share in producing the observed phenomena.

In conclusion, it may be remarked that they who would fully see the substantial gains to terrestrial magnetism which have been obtained by the voyage of the *Challenger* must refer to the original of this abstract Report, with its plates and charts of the magnetic elements. Subsequent research may add to, qualify, or reverse the conclusions drawn from the observations, but the observations will probably retain a long-abiding value to magneticians. E. W. CREAK.

ON THE SUPPOSED ENORMOUS SHOWERS OF METEORITES IN THE DESERT OF ATACAMA.

IT is now universally acknowledged both that meteorites come from outer space and that shooting-stars, whatever they are, have an extra-terrestrial origin. It is further asserted that a meteoritic fireball and a shooting-star are only varieties of one phenomenon. Indeed, after it is once granted that a meteoritic fireball is produced by the passage through the terrestrial atmosphere of a dense body entering it with planetary velocity from without, and that shooting-stars have an extra-terrestrial origin, it is a very fair assumption that a shooting-star is likewise a dense body rendered luminous during its atmospheric flight.

One great objection to this assertion is that, again and again, showers of hundreds of thousands of shooting-stars have taken place, during which no heavy body has been observed to reach the earth's surface. The only known case of the arrival of a meteorite during a shooting-star shower has been that of Mazapil, on November 27, 1885, and that single coincidence may possibly be the result of accident. A sufficient explanation of this difficulty, however, is to be found in the small size of the individuals which produce the appearance of a shooting-star shower. That the individuals are really minute is proved by the fact that, while the total mass of a large swarm, like that producing the November meteors, is so small that there is no perceptible influence on the motion of the planets, the number of separate individuals is almost infinite. It is established that the Leonid swarm must be hundreds of millions of miles in length, and some hundreds of thousands of miles in thickness; and in the densest part of the Bielid swarm, passed through in 1885, the average distance of the individuals from each other was about twenty miles.

Further, it is now acknowledged that comets are themselves meteoritic swarms, and Mr. Lockyer has lately brought forward spectroscopic evidence that the fixed stars and the nebulæ are similar to comets in their constitution.

The question therefore immediately presents itself, Is the size of a meteoritic shower, on reaching the earth's surface, ever comparable with that of a meteoritic swarm, as manifested by a shower of shooting-stars?

During the present century nearly 300 meteoritic falls on the earth's surface have been observed, and on only a single date, namely August 25, 1865, has there been observed a fall on two distant parts of the earth on the same day. On that date stones fell at Aumale in Algeria, and at Sherghotty in India; but as the times of fall differed by about eight hours, and the stones arrived from different directions, it is more than probable that the coincidence of date was accidental. Hence we must infer that a swarm of meteorites, as far as actual observation of tangible objects goes, far from being hundreds of millions of miles long, with individuals a few miles apart, is a comparatively small group, separated from its neighbours, if it has any, by a distance comparable with the earth's diameter.

The extent of surface over which meteoric stones have been picked up after some of the best known and most widely spread falls is given in the following list:—

Limerick, 3 miles long.
Mocs, 3 miles by 0·6 mile.
Butsura, 3 miles by 2 miles.
Pultusk, 5 miles by 1 mile.
L'Aigle, 6 miles by 2·5 miles.
Barbotan, 6 miles long.
West Liberty, 7 miles by 4 miles.
Stannern, 8 miles by 3 miles.
Knyahinya, 9 miles by 3 miles.
Weston, 10 miles long.
Hessle, 10 miles by 3 miles.
New Concord, 10 miles by 3 miles.
Castalia, 10 miles by 3 miles.
Khairpur, 16 miles by 3 miles.

As far as I have yet been able to ascertain, the greatest observed separation has been sixteen miles. In the case of Macao, Cold Bokkeveldt, and Pillistfer, wider spreads have been chronicled, but later information has shown the inaccuracy of the earlier statements.

As regards the meteoric irons, there have only been nine observed falls since the year 1751: in seven of them only a single mass was found; in the remaining two there was in each case a couple of masses, not more than a mile apart. There is thus no recorded instance of an observed shower of meteoric iron. The most convincing proof of the actuality of such showers is furnished by the masses which have been found in the Valley of Toluca, in Mexico; their existence had been chronicled as early as the year 1784, yet in 1856 it was still possible to collect as many as sixty-nine. When etched, they show the Widmanstätten figures in the most excellent way, and in their characters they are typical meteorites. Belonging, as they do, to a single type, they lead to the conviction that they are the result of a single shower. But the region over which the fall took place is not large; the length of it is said to have been only about fourteen miles.

It is very probable, though not conclusively proved, that large meteoritic showers of stones, like those of Pultusk and L'Aigle, reach the terrestrial atmosphere as swarms of isolated bodies; still, we must have regard to the fact that a mass is much fractured during its passage through the air by reason of the enormous pressure and the violent change of temperature. In the case of the Butsura fall, for example, it was conclusively established that stones picked up some miles apart must originally have formed part of a stone disrupted during the atmospheric flight.

It is a question of a certain amount of interest as to whether there is any evidence of the actual fall of a shower of meteorites over a large extent of the earth's surface.

Such evidence has long been supposed to be furnished by the plentiful occurrence of meteorites in the Desert of Atacama, a term applied to that part of Western South America which lies between the towns of Copiapo and Cobija, about 330 miles distant from each other, and which extends inland as far as the Indian hamlet of Antofagasta, about 180 miles from the coast.

The generally received impression as to the occurrence of meteorites in this desert is well illustrated by the following statement of M. Darlu, of Valparaiso, read to the French Academy of Sciences in 1845:—

"For the last two years I have made observations of shooting-stars during the nights of November 11–November 15, without remarking a greater number than at other times. I was led to make these observations by the fact that in the Desert of Atacama, which begins at Copiapo, meteorites are met with at every step. I have heard, also, from one who is worthy of trust, that in the Argentine Republic, near Santiago del Estero, there is—so to say—a forest of enormous meteorites, the iron of which is employed by the inhabitants."

A study of the literature indicates that "the forest of enormous meteorites" near Santiago del Estero, understood by Darlu as significative of infinity of number, is really a free translation of a native statement "that there were several masses having the shape of huge trunks with deep roots," and that not more than four, or perhaps five, masses had really been seen in the Santiago locality at the time of Darlu's statement. There is a similar misunderstanding relative to the Atacama masses: it is clearly proved that, at a date long subsequent to 1845, the Desert was virtually untrodden and unexplored. In Darlu's time it was only crossed along definite tracks by Indians travelling between San Pedro de Atacama and Copiapo, and between the inland Antofagasta and the coast. In fact, it is established that the only Atacama meteorites then in circulation were all got from a single small area, three or four leagues in length, in the neighbourhood of Imilac, one of the few watering-places on the track between San Pedro and Copiapo.

Since that time the discovery of rich silver-mines in the centre of the Desert, and the working of the nitrate deposits, have led to vast changes; the Desert has been more or less closely examined, and other meteoritic masses have been found. Still, the number of meteorites yet discovered, distinct either in mineralogical characters or locality, is shown to be, at most, thirteen.

One of them, Lutschaunig, is distinct from all the rest as being a chondritic stone; a second, Vaca Muerta, likewise differs from all the others in that it consists of nickel-iron and stony matter, both in large proportion; a third, Imilac, is a nickel-iron with cavities, like those of a sponge, filled with olivine; a fourth, Copiapo, is a nickel-iron with irregularly disposed angular inclosures of troilite and stony matter; the remaining nine consist of nickel-iron, virtually free from silicates, some of them showing no Widmanstätten figures when etched, others showing excellent figures more or less differing in character.

Now, in every meteoritic shower yet observed, the individuals which have fallen simultaneously have been found to belong to a common type. Hence, it is reasonably certain that several distinct meteors are represented in the Desert, and that the above masses are the result of several falls; and this being accepted, the assertion of simultaneity of fall of two or more masses on the purely geographical ground that they have been found in the same Desert, can be allowed no great weight.

But have masses belonging to any one of the above types been found scattered over a part of the Desert so extensive as to indicate a meteoritic fall more widely spread than any of those actually observed? A critical examination of the cases in which such an enormous spread has been asserted proves that the evidence is quite unsatisfactory. The results may thus be summarized:—

(1) *Lutschaunig.*—This was a single stone.

(2) *Vaca Muerta.*—The masses were in great abundance distributed over a small area. But fragments undoubtedly belonging to this type have been brought from two other places far distant from the main locality. Very cogent evidence is brought forward to prove that the said fragments must have been *carried* to those places—the Jarquera Valley and Mejillones—from Vaca Muerta itself.

(3) *Imilac.*—An examination of all the known literature indicates that the whole of the fragments belonging to this type have been got from the immediate neighbourhood of Imilac. Caracoles, Potosi, and Campo de Pucará, from which specimens, belonging to this type, have been brought, are shown to be on regular lines of traffic starting from the Atacama coast. It is further shown that Imilac specimens were in great request, and were certainly carried to very distant places along such lines of traffic.

(4) *Copiapo.*—It is conclusively proved that the two localities, upwards of 400 miles apart, for meteoritic masses belonging to this type, result from a mere interchange of labels, and that all the masses probably came from a single place.

(5–13) There is no satisfactory evidence furnished by similarity of type for any of the meteoric irons being part of a widespread shower.

It is thus clear that the meteorites of the Desert of Atacama afford absolutely no proof that enormous meteoritic showers have ever reached the earth's surface.

The general dryness of the air of the Desert, and the rarity of rain, have been sufficient to ensure the preservation of masses which have fallen in the course of many centuries unto a time when an exploration of a large extent of the Desert has taken place.

That the meteoritic masses are far from being so plentiful as has been imagined is conclusively proved by the experience of Mr. George Hicks, one of the earliest explorers of the 23rd and 24th parallels; although much interested in their occurrence, he never found a mass himself, and he only obtained his first specimen after years of persevering inquiry from the Indians.

Detailed information relative to the Atacama meteorites, with a description and map of the Desert, will be found in the recently published number of the *Mineralogical Magazine*. L. F.

EARLY EGYPTIAN CIVILIZATION.

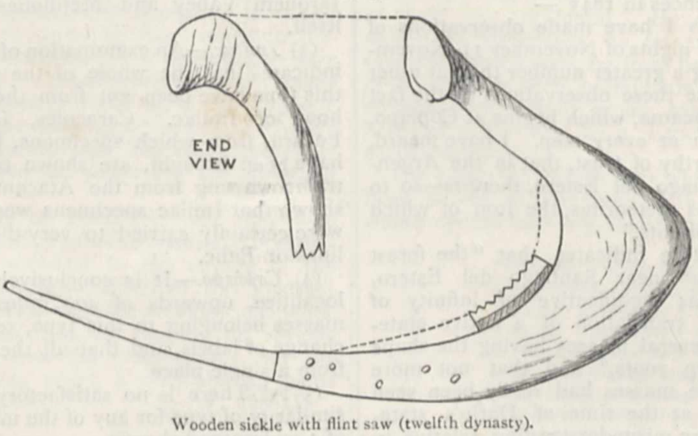
ALTHOUGH the paintings in the tombs of Memphis, of Beni Hasan, and of Thebes, have preserved to us the knowledge of much of the civilization of Egypt, yet hitherto we have handled but few examples of the implements used, and those are mostly undated. Broadly speaking, the three sites just named represent respectively the Old Kingdom before 3400 B.C., the Middle Kingdom about 2600 B.C., and the New Kingdom from 1600 B.C.; and though debarred from scientific work in these richest districts of Egypt—owing to national jealousies—I have been fortunate enough to discover two small towns, each only occupied for a couple of centuries, which have thus revealed the works of the Middle and New Kingdoms with chronological exactness. Beside the Egyptian interest of these places, they are of prime importance for Mediterranean history, having been colonies of foreign workmen.

These towns are one on each side of the entrance to the Fayum province, fifty miles south of Cairo. The northern town, now called Kahun, was built for the workmen employed by Usertesen II., for his pyramid and temple, about 2600 B.C. The southern town, now called Gurob, was founded by Tahutmes III., and destroyed by Merenptah, thus lasting from about 1450 to 1190 B.C. Obtaining thus two sites of different ages, close together, we can be certain that all differences are due entirely to time and not to locality. The change in an interval of 1200 years is most marked. Of the pottery, scarcely a single type of form or material is alike in the two periods; of the many varieties of beads of stone and glazed ware, hardly one was continued; the metal tools are every one changed in form; and the use of flints had practically died out. For the first time we are able to trace the definite and decided changes in all the products of two ages so remote. The idea that Egypt was changeless is only due to our lack of knowledge; not only fashions changed—every few years in minor details—but radical rearrangements were made from age to age in the manufactures.

The twelfth dynasty town—Kahun—is the more important, and we will briefly note some of its products. Flint working was carried to a high pitch, the thin flat knives being flaked with much skill: but alloys of copper were also in use, and show ability in their casting and hammering, a thin bowl being wrought out of one piece. We find, then, flint and metal side by side, the flint being the commoner material, but yet influenced in its forms by the types of metal tools. Moreover, we now see the use of the numerous flint saws, formed of serrated flakes; many of them have black cement upon them, and one was found remaining in its socket in a wooden sickle (Fig. 1).

Beside hatchets, adzes, and chisels of bronze, we find needles, barbed and unbarbed fish-hooks, netting-needles, and knives of the straight-backed type. Among wooden tools are hoes, rakes, grain-scoops, a brick-mould, plasterers' floats, bow-drills, plummets, &c. Perhaps the most important of all is a fire-stick, on which five burnt holes

Fig. 1.



Wooden sickle with flint saw (twelfth dynasty).

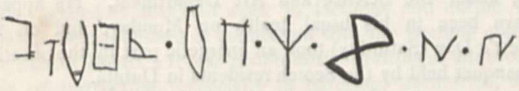
remain where fire has been drilled by a rotating rod: the drilling was begun by hacking a groove in the side of the stick, down which the heated wood powder might run, until it caught alight. This shows, for the first time, how the Egyptians obtained fire: and familiar as they were with the bow-drill, they doubtless used it for the fire-stick. A very interesting point is the origin of the shoe from the sandal. Two sandal-shoes have been found; both with toe and heel straps, but with an upper of leather across the foot. Tops, tip-cats, clay toys, dolls with jointed limbs, and game boards, were all in use. Among a large number of papyri that I found are two wills, one of which is a recital of a will and a settlement, duly witnessed. The provisions show that the later law of Greek times was much the same in matters of descent as it was two thousand years earlier. On receiving family property the man settles it on his wife; she has a life interest in the dwellings, and may divide all the property among their children at her discretion. The man's official position he left to his son. A guardian was also appointed, excluding the eldest son from that duty. Some numerical notes concerning fractions are also found; and all these papyri are in course of study by Mr. F. L. Griffith.

On turning to the later town—Gurob—of about 1300 B.C., we find that the art of flint working was lost; only a few rude leaf-shaped flakes (totally different from the earlier forms) and some little saw-flakes remain, and these are scarce. Thus we may date the fall of fine flint manufacture in Egypt to about 2000 B.C.; though rude flakes continued to be used till late Roman times, and more abundantly in poorer ages. Bronze tools were much modified; hatchets and chisels less finely formed, knives always double edged, fish-hooks not barbed, and punched metal rasps were brought in. Bronze working reached a high level in the making of two large pans, 14 and 9 inches across, exquisitely wrought with difficult curves, and so thin that they can be still bent in and out by the fingers. Glass ornaments were commonly used, though not found in the earlier town. The plain beads of fine blue, violet, &c., belong to about 1300 B.C.; while the coarser beads of black, yellow, green, brown, and white, with eye-patterns, are about a century later.

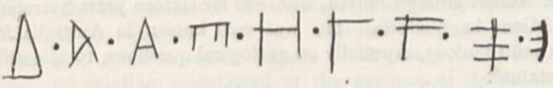
The presence of foreigners in both of these towns is shown by the weights discovered, which are—with scarcely an exception—of foreign standards, foreign forms, or foreign materials. A commercial intercourse must therefore have been kept up between these foreign colonies and the Mediterranean. Beside this evidence we find at Gurob the burials of one of the Tursha or Turseni (from Asia Minor), and a Hittite; foreign art is seen in a mirror handle with the Phœnician Venus, and a wooden figure of a Hittite; and foreign complexions are shown by the light hair found on some of the bodies. A very strong Mediterranean influence appears in the quantity of pottery identical with the earliest styles found at Mykenæ, at Thera, and at Mytilene; and we are now able to date those stages of early culture in the Greek lands to 1300 B.C., a fixed point of the greatest value.

The most novel discovery of all is the presence of apparently alphabetic signs in use in both towns (Fig. 2), and by all the circumstances amply guaranteed to be of about 2500 B.C. and 1300 B.C. Our existing theories of alphabetic development require us to suppose that the Phœnician letters were established before 2000 B.C.; as the Egyptian writing from which De Rougé derived them, was extinct after that date; and the Cypriote syllabic signs must be older. Thus, though no known inscriptions can be placed before about 900 B.C., yet the forms must have started about the same period as that of the first of these towns, Kahun. The conditions that we find, therefore, of a great variety of signs in use, many of which have not survived, while others have drifted apart into many different alphabets, are just what might be expected at

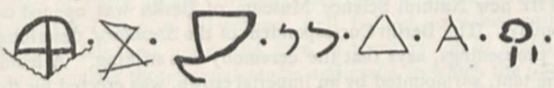
Fig. 2.



Continuous inscription on wood. Signs incised in pottery (the dots separating different examples).



Signs incised on pottery of the twelfth dynasty (Kahun).



Signs on pottery of the eighteenth to nineteenth dynasty (Gurob).

these early times. The apparent connection of these signs with some of the mason's marks of Egypt suggests that they may have been adopted by the foreign workmen from their Egyptian fellow-labourers; and the very lack of literary education among such men would lead to their forming alphabets of their own from such materials. We have at least now obtained two well-defined stages, between the finished and segregated alphabets of the period of known inscriptions, of 900 B.C. downward, and the original elements of Egyptian hieroglyphs, hieratic, mason's marks, and perhaps Hittite and cuneiform characters, from which the alphabets were evolved. To discuss the historical descent of the signs, and to form a continuous theory of them, will need much discussion, and more materials. Meanwhile, my work will lie in the complete gathering in of what may still remain in these towns. A full account and drawings of every sign and every object of importance found this year will appear in a few months. W. M. Flinders Petrie.

MR. STANLEY'S GEOGRAPHICAL DISCOVERIES.

THIS week an interesting letter from Mr. Stanley to Colonel Grant has been published. It is dated, "Villages of Batundu, Ituri River, Central Africa, September 8, 1888." Speaking of Lake Albert, Mr. Stanley says:—

"When on December 13, 1887, we sighted the lake, the southern part lay at our feet almost, like an immense map. We glanced rapidly over the grosser details—the lofty plateau walls of Unyoro to the east, and that of Baregga to the west, rising nearly 3000 feet above the silver water, and between the walls stretched a plain—seemingly very flat—grassy, with here and there a dark clump of brushwood—which as the plain trended south-westerly became a thin forest. The south-west edge of the lake seemed to be not more than six miles away from where we stood—by observation the second journey I fixed it at nine miles direct south-easterly from the place. This will make the terminus of the south-west corner at 1° 17′ N. lat. By prismatic compass the magnetic bearing of the south-east corner just south of Numba Falls was 137°, this will make it about 1° 11′ 30″ N. lat. A magnetic bearing of 148° taken from N. lat. 1° 25′ 30″ about exactly describes the line of shore running from the south-west corner of the lake to the south-east corner of the Albert. Baker fixed his position at N. lat. 1° 15′, if I recollect rightly. The centre of Mbakovia Terrace bears 121° 30′ magnetic from my first point of observation, this will make his Vacovia about 1° 15′ 45″, allowing 10° west variation.

"In trying to solve the problem of the infinity of Lake Albert as sketched by Baker, and finding that the lake terminus is only four miles south of where he stood to view it 'from a little hill,' and on 'a beautifully clear day,' one would almost feel justified in saying that he had never seen the lake. But his position of Vacovia proves that he actually was there, and the general correctness of his outline of the east coast from Vacovia to Magungo also proves that he navigated the lake. When we turn our faces north-east, we say that Baker has done exceedingly well, but, when we turn them southward, our senses in vain try to penetrate the mystery, because our eyes see not what Baker saw. When Gessi Pasha first sketched the lake after Baker, and reduced the immense lake to one about ninety miles long, my faith was in Baker, because Gessi could not resolve by astronomical observations the south end of the lake. When Mason Bey—an accomplished surveyor—in 1877 circumnavigated the lake, and corroborated Gessi, then I thought that perhaps Mason had met a grassy barrier or sandbank overgrown with sedge and ambatch, and had not reached the true beyond, because he admitted that he could not see very far from the deck of his steamer, my faith still rested in Baker; but now, with Lieutenant Stairs, of the Royal Engineers, Mr. Mounteney Jephson, Surgeon Parke, Emin Pasha, Captain Casati, I have looked with my own eyes upon the scene, and find that Baker has made an error. . . .

"I am somewhat surprised also at Baker's altitudes of Lake Albert, and the 'Blue Mountains,' and at the breadth attributed by him to the lake. The shore opposite Vacovia is ten and a quarter miles distant, not forty or fifty miles; the 'Blue Mountains' are nothing else but the west upland—the highest cone or hill being not above 6000 feet above the level of the sea, not 7000 or 8000 feet high. The altitude of Lake Albert by aneroid and boiling-point will not exceed 2350, not 2720, feet.

"And last of all, away to the south-west where he has sketched his 'infinite' stretch of lake, there rises, about forty miles from Vacovia, an immense snowy mountain—a solid square-browed mass with an almost level summit between two lofty ridges. If it were 'a beautifully clear day' he should have seen this, being nearer to it by thirteen geographical miles than I was."

Of the snowy Mountain, Mr. Stanley writes as follows:—

"My interest is greatly excited, as you may imagine, by the discovery of Ruwenzori—the Snowy Mountain—a possible rival of Kilimanjaro. Remember that we are in north latitude, and that this mountain must be near on the equator itself, that it is summer now, that we saw it in the latter part of May, and that the snow-line was about (estimate only) 1000 feet below the summit. Hence I conclude that it is not Mount Gordon Bennett, seen in December 1876 (though it may be so), which, the natives said, had only snow occasionally. At the time I saw the latter, there was no snow visible. It is a little further east, according to the position I gave it, than Ruwenzori.

"All the questions which this mountain naturally gives rise to will be settled, I hope, by this Expedition before it returns to the sea. If at all near my line of march, its length, height, and local history will be ascertained. My young officers will like to climb to the summit, and I shall be glad to furnish them with every assistance."

At the time when this letter was written, Mr. Stanley was uncertain as to the destination of the streams flowing between "the two Muta Nzigés":—

"Many rivers will be found to issue from this curious land between the two Muta Nzigés. What rivers are they? Do they belong to the Nile or the Congo? There is no river going east or south-east from this section, except the Katonga and Kafur, and both must receive, if any, but a very small supply from Gordon Bennett and Ruwenzori. The new mountain must therefore be drained principally south and west. If south, the streams have connection with the Lake South; if west, the Semliki tributary of Lake Albert, and some river flowing to the Congo must receive the rest of its waters. Then, if the Lake South receives any considerable supply, the interest deepens. Does the lake discharge its surplus to the Nile or to the Congo? If to the former, then it will be of great interest to you, and you will have to admit that Lake Victoria is not the main source of the Nile; if to the Congo, then the lake will be the source of the River Lowwa or Coa, since it is the largest tributary to the Congo from the east between the Aruwimi and the Luama. For your comfort I will dare venture the opinion even now that the lake is the source of the Lowwa, though I know nothing positive of the matter. But I infer it, from the bold manner in which the Aruwimi trenches upon a domain that anyone would have imagined belonged to the Nile. It was only ten minutes' march between the head of one of its streams to the crest of the plateau whence we looked down upon the Albert Nyanza.

"From the mouth of the Aruwimi to the head of this stream is 390 geographical miles in a straight line. Well, next to the Aruwimi in size is the Lowwa River, and from the mouth of the Lowwa to the longitude of Ugampaka post in a direct line is only 240 geographical miles."

NOTES.

THE Gilbert Club, to which we referred last week, was formally founded on Thursday, November 28. The following officers were appointed at the first general meeting:—President, Sir William Thomson. Vice-Presidents: Lord Rayleigh, Prof. D. E. Hughes, Prof. Reinold, Mr. Jonathan Hutchinson (President of the Royal College of Surgeons), Dr. B. W. Richardson, and Mr. H. Laver, of Colchester. Mr. Latimer Clark was elected Treasurer, and Mr. Conrad Cooke, Prof. R. Meldola, and Prof. S. P. Thompson, Hon. Secretaries. The resolution finally adopted by the meeting was:—"That the objects of the Gilbert Club be as follows:—(1) To produce and issue an English translation of 'De Magnete' in the manner of the folio edition of 1600. (2) To arrange hereafter for the tercentenary celebration of the publication of 'De Magnete' in the year 1900. (3) To promote inquiries into the personal history, life, works, and writings of Dr. Gilbert. (4) To have power, after the completion of the English edition of 'De Magnete,' to undertake the reproduction of other early works on electricity and magnetism, provided at such date a majority of the members of the Club so desire." At the time of the inaugural meeting eighty-seven members had joined the Club.

PROF. J. BRYCE's speech (read by Prof. Holland) at the presentation of Mr. A. R. Wallace for the degree of D.C.L., *honoris causâ*, at Oxford, on November 26, was one of unusual interest. We may note especially the very masterly way in which the doctrine of the survival of the fittest was expressed. After describing Mr. Wallace's travels in Brazilian forests, and among the islands, "quæ ultra Chersonesum aureum soli nimium propinque subjacent," the speech referred to his discovery of the theory according to which new species are evolved, which was shortly stated as, "ea corpora vigere magis prolemque ex iis lætiorem surgere quæ ipsa nescio quo pacto natura vitæ periculis subeundis aptissima creaverit: sic stirpem a cæteris stirpibus dissimilem et in dies longius discrepantem propagari." The contemporaneous discovery of natural selection by Charles Darwin, and his cordial recognition of Mr. Wallace's merits, were mentioned: "tanta et in hoc et in illo inerat animi nobilitas veritatis quam gloriæ propriæ studiosior." Reference was made to Mr. Wallace's various writings.

WE regret to announce the sudden death of Dr. W. R. McNab. He died at his residence in Dublin on Tuesday morning, the 3rd inst. Dr. McNab was Professor of Botany in the Royal College of Science, Dublin, having succeeded Prof. Thiselton Dyer, F.R.S. He was also Scientific Superintendent and Referee to the Royal Botanic Gardens, Glasnevin, under the Science and Art Department. He appears to have been in his usual health on Monday, and on St. Andrew's Day (Saturday) took an energetic part in the meeting and banquet held by the Scotch residents in Dublin.

THE *Colonies and India* reports the death, in Melbourne, of Mr. Robert Brough Smyth, who was for sixteen years Secretary of Mines in Victoria. He was well known in Australia for his contributions, especially on geological questions, to scientific literature.

THE new Natural Science Museum of Berlin was opened on Monday. The Berlin Correspondent of the *Standard*, describing the proceedings, says that the ceremony was striking. A handsome tent, surmounted by an imperial crown, was erected for the Emperor and Empress, who were present with the Princess Frederick Charles, Prince Alexander, the Hereditary Prince and Princess of Meiningen, and a brilliant suite. Nearly all the Ministers, including Count Bismarck, who has just returned from Friedrichsruh, and the Minister of War, were in attendance. Count Waldersee, representatives of the Academy of Art, and the Professors of the University, were also present. Dr. von Gossler, Minister of Education, delivered an eloquent address, in which he mentioned that the collections were founded a hundred years ago, and expressed the hope that both science and the State would derive equal benefit from the new institution. Prof. Beyrich, the first Curator of the Museum, pledged himself to keep abreast with the progress of science. Their Majesties were conducted through the building by the keepers of the various collections.

THE Paris Museum of Natural History is about to elect a successor to M. Chevreul in the Chair of Chemistry.

AT the general monthly meeting of the Royal Institution, on December 2, the managers reported that they had reappointed Prof. James Dewar, F.R.S., as Fullerian Professor of Chemistry.

THE Academy of Sciences of Vienna has appointed Prof. G. Niemann, of Vienna, and Major Steffan, of Cassel, to be present as impartial witnesses at the excavations at Hissarlik, begun, on November 25, under the direction of Dr. H. Schliemann and Dr. W. Dörpfeld. Captain Ernst Bötticher, who has often called in question the utility of Dr. Schliemann's archæological investigations, has been requested to take part in the excavations.

MR. HUGH G. BARCLAY, in his Report as to the fund for the preservation of birds in the Farne Islands, says he has every reason to believe that the birds were very well protected this season. He visited the islands twice, and each time he satisfied himself, by his own personal investigations, that the birds had not been unduly disturbed. Last year, at the request of the authorities, he allowed some young birds to be taken from the islands for the purpose of being placed on the lake at St. James's Park, London. The following is an extract from a letter he lately received from Mr. Rilly, the bird-keeper there:—"The only birds alive now of those brought from the Farne Islands are the cormorants, which are thriving. The puffins all died during the first three months. The guillemots lived somewhat longer, the death of the last one being the result of an accident. The one kittiwake also died by an accident. The terns died during the severe frost, being apparently unable to get about on the ice, their tail and wings collected the ice; I suppose on account of their being pinioned and not being able to use their wings freely."

THE Council of the Dundee and District Association for the Promotion of Technical and Commercial Education has issued its first Annual Report, and is able to give a very good account of the results it has achieved. With regard to the future work of the Association, the Council suggests that workshop instruction for lads engaged at unskilled work in factories and during the day should be established in connection with the evening classes of the School Board. It also proposes the drafting of additional courses of instruction, especially in painting, decoration, and pattern designing, and the encouraging of higher classes in these subjects. In this connection the Council appropriately refers to the fact that in 1884 the Technical Instruction Commissioners reported that "the crowded schools of drawing, modelling, carving, and painting, maintained at the expense of the municipalities of Paris, Lyons, Brussels, and other cities—absolutely gratuitous and open to all comers, well lighted, furnished with the best models, and under the care of teachers full of enthusiasm—stimulate those manufactures and crafts in which the fine arts play an important part to a degree which is without parallel in this country."

A SERIES of questions on the effects of London fogs on cultivated plants has been issued by the scientific committee of the Royal Horticultural Society. The experience of the current season only is to be utilized.

A SPECIMEN of the *Rorqual musculus* has just come ashore on the coast of the Médoc district. Dr. Beauregard, *aide-naturaliste* at the Paris Museum, went to the spot to examine this interesting cetacean. Unfortunately, the brain was already in a state of decomposition, but the breasts and ears were dissected off for complete examination. The animal was 14 metres long, and 6 metres in circumference at the thickest part of the body.

PROF. CHAUVEAU has lately published in the *Archives de Pathologie Expérimentale* a contribution to the study of "transformism" in microbiology. His researches relate to *Bacillus anthracis*, and show that by experimental means various important biological alterations may be obtained.

PROF. MARSHALL WARD is about to deliver, at th eCity and Guilds of London Institute, a course of six lectures on timber, its nature, varieties, uses, and diseases. The lectures will be given on Monday and Thursday evenings, at 7.30 (December 12, 16, and 19, and January 23, 27, and 30). The object of the course is to explain as simply and clearly as possible, with the aid of numerous lantern illustrations, the nature, properties, varieties, and uses of the ordinary timbers used in construction, and to give an intelligible account of dry-rot, and allied diseases of timber.

THE second series of lectures given by the Sunday Lecture Society will begin on Sunday afternoon, December 8, in St. George's Hall, Langham Place, at 4 p.m., when Mr. W. Lant Carpenter, B.Sc., will lecture on "The Wonders of the Yellowstone Park—a Personal Narrative," with oxy-hydrogen lantern illustrations from the lecturer's own camera. Lectures will also be given by Commander V. L. Cameron, R.N., Mr. J. F. Blake, Mr. Henry Blackburn, Mr. Wilmott Dixon, Mr. Stanton Coit, and Mr. Eric S. Bruce.

THE annual general meeting of the Institution of Electrical Engineers will be held at the Institution of Civil Engineers, 25 Great George Street, Westminster, on Thursday, December 12, at 8 o'clock in the evening, for the reception of the annual report of the Council, and for the election of Council and Officers for the year 1890. The following paper will be further discussed: "Electric Engineering in America," by Mr. G. L. Addenbrooke.

IT is stated that a scheme is on foot for establishing a Natural History Society in the Punjaub. It is to be hoped that it will be successful, and that the Society will flourish as other Indian scientific societies are doing.

IN the introductory lecture to the agricultural class at the University of Edinburgh, delivered at the opening of the present session, Prof. Wallace chose as his subject some aspects of Australasian agriculture. In this lecture, which has now been printed, Prof. Wallace urges that sheep farmers in this country will shortly feel the effects of rivalry with the flock masters of Australia. There are 100,000,000 sheep in Australia, mostly merinos, which are not, by the way, a flesh-yielding but a wool-giving race. Prof. Wallace hazards the opinion, by a very easy process of arithmetic, that, before many years have passed, Australia will be possessed of over 200,000,000. He makes, also, the astonishing statement that merino mutton is equal in flavour and texture to our best Highland, Welsh, or South Down mutton. Upon these two assumptions, for they are nothing more, he foretells calamities to the meat producers of this country, which he, it is to be hoped, will not live to see.

A STALACTITE cave has been discovered in Ascheloh, near Halle, in Westphalia; it is reported to be more than 100 metres long.

A SHARP shock of earthquake was felt at Oran, Algeria, on November 27, at 3 p.m. It lasted ten seconds, the oscillations being from east to west.

ACCORDING to a telegram sent through Reuter's agency from Belgrade on December 2, violent shocks of earthquake, accompanied by loud subterranean rumblings, were felt on Sunday afternoon at Kregugewatz, Jagodina, and Kupsia. The disturbance generally travelled from east to west, but some of the shocks moved from north to south.

MR. H. C. RUSSELL, Government Astronomer of New South Wales, has published the results of meteorological observations made in that colony during 1887. The number of reporting stations is now 862, being 94 more than in 1886, the increase being almost wholly in rain stations. The arrangement of the tables, which give the most important data for each station separately, is the same as in previous years; but there are also two new tables giving the mean maximum and minimum temperature at Sydney for each month from 1856 to 1887. The mean temperature of the whole colony for the last seventeen years is 61°·2. At Sydney the mean for thirty years is 62°·7. The diagrams appended to the volume give a good idea of the weather conditions at Sydney, and clearly exhibit the peculiarities of certain periods, such as the very short winter of 1873, and the long one of 1874, also the long summer of 1877–78, with four months of hot weather, and the short summer of 1886-87, when there was only one month of hot weather. In 1878 the lowest winter temperature occurred in June, and in 1872 in August. A comparison is made of the rainfall at the principal places in the various colonies. The contrast between the amount at Brisbane and Sydney and that at Melbourne is very striking. At the former places as much rain sometimes falls in one month as would make a year's rainfall at Melbourne. At Sydney the least annual rainfall on record is 21·48 inches, and the greatest 82·81 inches. The question of evaporation continues to receive considerable attention; the tabular results are published, with the rain and river results, in a separate volume.

THE Meteorological Report of the Straits Settlements has been published for the year 1888, being the fifth year in which meteorological observations in the colony have been made the subject of a general systematic report. The temperature of the air ranged between 67°·2 and 96°, and solar radiation varied from 81° to 179°; the lowest temperature on the grass was 61°. Rainfall observations were received from forty-one stations. The annual amount differs considerably in the various provinces, the mean of the stations ranging from 65·6 inches in Singapore, to 111·7 inches in Penang, and 123·2 inches in Province Wellesley. The greatest fall in twenty-four hours, was 12 inches at Bertam, Province Wellesley, on October 21. The Report also contains a tabular statement of annual and monthly rainfall at Singapore since 1869, and diagrams of annual rainfall and other elements since 1870, at the same place.

THE International Commission for the scientific investigation of the Lake of Constance have nearly finished their task, which consisted of drawing a new and comprehensive map on a scale of 1 : 25,000; investigating the currents, density, temperatures, and chemical composition of the water; and minutely describing the flora and fauna of the lake. A full account will be issued when the researches are complete.

WE have received the latest instalment (pp. 321–84) of vol. xvi. of the Proceedings of the Royal Society of Edinburgh, session 1888–89. It contains:—The solubility of carbonate of lime in fresh and sea water, by W. S. Anderson, chemist at Marine Station, Granton (continued); secretion of carbonate of lime by animals, part ii., by Robert Irvine and Dr. G. Sims Woodhead; theoretical description of a new "azimuth diagram," by Captain Patrick Weir, communicated by Sir William Thomson; note on Captain Weir's paper, by Prof. Tait; on the coagulation of egg and serum albumen, vitellin, and serum globulin, by heat, by Dr. John Berry Haycraft and Dr. C. W. Duggan.

THE fourteenth part of Cassell's "New Popular Educator" has been published. It includes a clearly printed map of the world.

AT a recent meeting of the Bombay Anthropological Society, Mr. W. E. Sinclair, of the Civil Service, read a paper on flint remains in the Kolaba district. Referring to a collection belonging to the Society made in the Ghar Hills, near Sukker, on the Indus, Mr. Sinclair said that these hills were evidently a sort of "Black Country" to the flint-using races. Cones and flakes can be got there literally by the hundredweight. There is no historical evidence of the use of such things in India proper. On the contrary, all historical evidence points to the conclusion that India was one of the first countries to use iron, if not the very first. Amongst the wildest forest tribes to-day the use of stone does not go beyond weighting a fishing-line or bird arrow with a pebble; and although stone spindle-weights are still used on the coast, these are no more barbarous than the stones in an English mill. These cones of flint are covered with long grooves of a curved section; and the flakes show each one face corresponding to such a groove, which shows that they have been struck off such cones. The cones themselves have a peculiar typical form, and the art of producing flake or cone is one lost in the India of to-day. Where a flint shows that peculiar groove, there is good reason to assume that it was made before iron was known in India. On all the agates and chalcedonies in the Kolaba collection there are the same strange grooves, the same long blade-like flakes matching them, as in Sind or in England or France; and we are, in fact, in presence of a lost art, for which there has been no occasion from the time that iron came into common use. That was a long time ago in India. Steel—and very good steel, too—must have been for many generations in the hands of the ancient inhabitants of the Konkan when the first cave temples were hewn—at least 2000 years ago. On the other hand, the position of the flakes, both in Sind and in Kolaba, shows that they belong to a very recent geological period. The Kolaba specimens, except one or two, come from the surface of the lacustrine gravels abundant in the valleys of the Konkan. All search for them in places where sections of these gravels are exposed has hitherto been fruitless, and the few water-worn specimens found came out of a river bed. They most commonly occur at places where fresh water is to be had near an estuary.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus* ♀) from India, presented by Colonel J. D. C. Ferrell; two Common Marmosets (*Hapale jacchus*) from South-East Brazil, presented by Mr. Charles Petrzywaski; an Arctic Fox (*Canis lagopus* ♀) from Siberia, presented by Mr. Stuart N. Corlett; a Corn Crake (*Crex pratensis*) from Essex, presented by Mr. Bibby; four Common Snakes (*Tropidonotus natrix*), British, presented by the London, Chatham, and Dover Railway; a European Bison (*Bison bonasus* ♂) from Central Europe, deposited; a Stanleyan Chevrotain (*Tragulus stanleyanus*) from Ceylon, a Prevost's Squirrel (*Sciurus prevosti* ♂) from Malacca, a Common Roe (*Capreolus capræa* ♂), European, a White-faced Tree Duck (*Dendrocygna viduata*) from Brazil, four Black-necked Swans (*Cygnus nigricollis*) from Antarctic America, a Curlew (*Numenius arquata*), British, two Indian Cobras (*Naia tripudians*) from India, an Annulated Snake (*Leptodira annulata*) from Panama, a Hawk's-billed Turtle (*Chelone imbricata*) from the East Indies, purchased; two Crested Pigeons (*Ocyphaps lophotes*) bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m., December 5 = 2h. 59m. 33s.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G. C. 648	—	—	3 12 31	+40 7
(2) D M. + 3° 410 ...	7	Yellowish-red.	2 51 19	+ 4 3
(3) γ Persei	3	White.	2 56 48	+53 4
(4) ι Cassiopeiæ	4	Bluish-white.	2 20 0	+66 54
(5) D.M. + 57° 702 ...	8	Red.	3 2 57	+57 29
(6) R Persei	Var.	Reddish.	3 23 3	+35 18
(7) T Geminorum ...	Var.	—	42 42	+24 0

Remarks.

(1) The General Catalogue description of this nebula is as follows:—Pretty bright, pretty small, round, brighter in the middle. The spectrum has not yet been recorded.

(2) This is a star of Group II., in which Dunér records the bands 2–8, and states that the bands 2 and 3 are especially well developed. This latter fact indicates that the star is well advanced, and it accordingly falls in a late species (13) of the group. As I have before pointed out with reference to similar stars, absorption *lines* of metallic substances, and possibly of hydrogen, may be expected at this stage, and it is important to note the presence or absence of these, as they will probably form a connecting link between the stars of this group and the slightly hotter stars of Group III. The intensity of the bright carbon fluting near *b*, as compared with its appearance in other stars of the group, will be an additional check in placing it in position on the "temperature curve."

(3) This is classed with stars of the solar type by Gothard, but there is not sufficient detail in his description of the spectrum to enable us to say whether it be Group III. or V. Further observations with special reference to this point are therefore required (for criteria, see p. 20). Gothard's statement as to the colour of the star should be checked, as most of the stars of Groups III. and V. are yellowish. The stars which are not far removed from Group IV., on either side, are the whitest.

(4) This is a star of Group IV., and the usual observations are suggested.

(5) This is a very fine example of the stars of Group VI., showing the subsidiary bands 4 and 5. The band 6 (λ 564) appears to be most subject to variation in the different stars of the group as described by Dunér, in some cases being wide and pale, and in others wide and dark. As this may subsequently form the basis of a temperature classification, the character of the band in the star under consideration should be carefully noted. The presence or absence of lines in the spectrum should also be recorded. [Dunér's notation for the bands in the spectrum of stars of Group VI. is as follows:—(1) 656, (2) 621, (3) 604·8, (4) 589·8, (5) 576·0, (6) 563·3, (7) 551, (8) 528·3, (9) 516·3, (10) 472·7. (6), (9), and (10) are the dark flutings of carbon.]

(6) The period of this variable is given by Gore as 210 days, and the magnitudes at maximum and minimum as 7·7–9·2 and 12·5 respectively. The spectrum has not yet been recorded. The maximum will occur on December 15.

(7) This variable has a period of 288·1 days, the next maximum occurring on December 14. The magnitude at maximum is given by Gore as 8·1–8·7, and that at minimum as < 13. It is still doubtful whether the star belongs to Group II. or to Group VI., and the approaching maximum may afford an opportunity of settling the question. A. FOWLER.

SUN-SPOT OF JUNE, JULY, AND AUGUST, 1889.—The Memoir of the Società degli Spettroscopisti Italiani for October contains a series of observations by Prof. Riccò of this spot. The latitude of the spot from its appearance on June 16 and during the first semi-rotation, varied between the limits $-5°·9$ and $-7°·5$. At the second appearance, the variation was between $-7°·5$ and $-10°·8$, whilst at the third appearance, in August, the limiting latitudes were $-8°·5$ and $-10°$.

The group of spots that appeared on June 30 was found to have a latitude as high as $-41°$. The following day, however, the latitude was found to be $-40\frac{1}{2}°$, and on July 2 the group disappeared.

Prof. Spörer, in a communication to Prof. Riccò, notes that the following bright lines were measured at Potsdam on June 28 in a prominence that appeared as the above large spot was disappearing over the sun's edge.

Wave-length.	Origin.	Wave-length.	Origin.
672·6	... Calcium	558·8	... Calcium
671·6	... Calcium	531·6	... Coronal line
C	... Hydrogen	526·9	... Calcium
649·2	... Calcium	518·8	... Calcium
646·2	... Calcium	b_1	... Magnesium
D_1	... Sodium	b_2	... Magnesium
D_2	... Sodium	b_3	... Magnesium
D_3	... ?		

PHOTOGRAPHIC STAR SPECTRA.—As a portion of the Henry Draper memorial, the spectra of stars are being photographed at Chosica in Peru. Of the photographs that have been received at Harvard College, Prof. Pickering notes (*Astr. Nachr.*, No. 2934) several have similar spectra to the "bright line" stars in Cygnus. The hydrogen line F is bright in θ Muscæ, the same as in γ Cassiopeiæ, and the presence of bright hydrogen lines in η Argûs and R Hydræ is also confirmed by the photographs.

Numerous photographs have been taken at Harvard College of the spectra of the stars in the Pleiades, and an examination of them shows that the hydrogen line F in the spectrum of Pleione D.M. + 23° 558, consists of a narrow bright line superposed on a broader dark line. The other hydrogen lines, especially that near G, show some indications of a similar effect.

With respect to this, Prof. Pickering observes that an interesting analogy between the Pleiades and θ Orionis appears in the fact that in both cases extensive nebulosities surround stars with bright lines in their spectra.

COMET BROOKS (*d* 1889, JULY 6).—The following elements and ephemeris have been computed by Dr. Knopf from observations made at Mount Hamilton, July 8; Dresden, August 25; and Vienna, October 24:—

T = September 29·7436 Berlin Mean Time.

$$\left.\begin{aligned} \omega &= 343°\ 18'\ 56''·5 \\ \Omega &= 17\ 58\ 29·6 \\ \iota &= 6\ \ 3\ 59·6 \end{aligned}\right\} \text{Mean Eq. } 1889·0.$$

$$\phi = 28\ \ 4\ 13·3$$
$$\mu = 501''·8156$$
$$U = 7·071 \text{ years.}$$

Ephemeris for Berlin Midnight.

1889.	R.A. h. m. s.	Decl. ° ′	1889.	R.A. h. m. s.	Decl. ° ′
Dec. 7 ...	0 7 58 ...	+ 2 48·1	Dec. 19 ...	0 22 54 ...	+ 4 55·2
8 ...	9 7 ...	2 58·4	20 ...	24 15 ...	5 6·1
9 ...	10 17 ...	3 8·8	21 ...	25 36 ...	5 17·0
10 ...	11 28 ...	3 19·2	22 ...	26 58 ...	5 27·9
11 ...	12 41 ...	3 29·7	23 ...	28 21 ...	5 38·9
12 ...	13 55 ...	3 40·2	24 ...	29 45 ...	5 49·9
13 ...	15 9 ...	3 50·8	25 ...	31 9 ...	9 0·9
14 ...	16 24 ...	4 1·4	26 ...	32 34 ...	6 12·0
15 ...	17 40 ...	4 12·1	27 ...	34 1 ...	6 23·1
16 ...	18 57 ...	4 22·8	28 ...	35 28 ...	6 34·2
17 ...	20 15 ...	4 33·6	29 ...	36 55 ...	6 45·4
18 ...	21 34 ...	4 44·4	30 ...	38 23 ...	6 56·5
19 ...	21 54 ...	4 55·2	31 ...	39 52 ...	7 7·7

Mr. Chandler notes (*Astr. Jour.* No. 204) that the result of an inquiry into the corrected elements of this comet is extremely interesting. The descending node of the comet's orbit upon that of Jupiter lies at 185°·5 long., Jupiter's aphelion at 191°, and the comet's aphelion at 183°. The aphelion distances are 5·4541 and 5·3992 respectively, the mutual inclination of the orbits is 3°, and the orbital velocities nearly the same; so that when both bodies happen to be near this region they will remain together many months.

COMET SWIFT (*f* 1889, NOVEMBER 17).—The following elements and ephemeris are given by Dr. Zelbr in Circular No. 69, issued by the Vienna Academy of Sciences, November 25, 1889, and have been computed from observations made at Rochester, November 17; Vienna and Palermo, November 20; and at Vienna, November 22:—

T = 1889 December 10·5665 Berlin Mean Time.

$$\left.\begin{aligned} \Omega &= 309°\ 51'\ 12'' \\ \omega &= 109\ 24\ 70 \\ \iota &= 7\ 14\ \ 1 \end{aligned}\right\} \text{Mean Eq. } 1889·0.$$

$$\log q = 0·07554.$$

$$\Delta\lambda \cos \beta = +132'' \ \ldots\ \Delta\beta = -14''.$$

Ephemeris for Berlin midnight.

1889.	R.A. h. m. s.	Decl. ° ′	Log Δ.	Log *r*.	Brightness.
Dec. 7 ...	23 41 56 ...	+ 18 32·4 ...	9·6509 ...	0·0759 ...	1·29
11 ...	23 58 44 ...	20 2·7 ...	9·6457 ...	0·0756 ...	1·32

The brightness at discovery has been taken as unity.

S CASSIOPEIÆ.—The Rev. T. E. Espin, examining the spectrum of this star on November 27, found that it resembled in appearance that of R Andromedæ, the bright F line blazing out upon the background of the continuous spectrum, and being plainly visible even with the least dispersion used. The star is not included by Dunér in his classical work, "Les Étoiles à Spectres de la Troisième Classe," but its general spectrum is apparently of that type—Group II. of Mr. Lockyer's classification. Mr. Espin adds that "the yellow is brilliant, suggesting (bright) lines, but the star is at present too faint to be sure."

The star is a variable of very long period, 607·5 days; the next expected maximum falls on December 26, so that it may show some further and interesting developments during the next three weeks. Chandler, however, records his suspicion that the period is shortening, so that the actual maximum may be very close at hand. The maximum brightness varies from 6 7 mag. to 8·6. Mr. Espin estimated it as 7 8 on the night of observation. Place for 1890: R.A. 1h. 11m. 34s.; Decl. 72° 1′·9 N.

THE ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

ON Saturday last, St. Andrew's Day, the Royal Society held its anniversary meeting. The President read the anniversary address, a copy of which has not yet reached us. The medals were then presented as follows: the Copley Medal to the Rev. Dr. Salmon (received by Sir R. S. Ball); the Davy Medal to Dr. Perkin; a Royal Medal to Dr. Gaskell; and a Royal Medal to Prof. Thorpe. The Society next proceeded to elect the Officers and Council for the ensuing year. The selected names we have already published.

In the evening the Fellows and their friends dined together at the Whitehall Rooms, Hôtel Métropole, the President in the chair. Over two hundred Fellows and guests were present.

The toast of "The Royal Society" was proposed by the Speaker of the House of Commons. He said:—Sir George Stokes and Gentlemen,—If I thought the audience whom I have the honour to address, took the same view as I do of my own want of qualifications for proposing this toast, I think I should at once sit down; but it is because I trust to your generous forbearance for a few moments that I ask you to allow me to propose a toast which needs no advocacy of mine, the toast of the Royal Society. I suppose the reason why your President has selected me to propose this toast is owing to the fact of the official position that I hold in the House of Commons, and also partly owing to the fact that the holder of one chair has been willing to pay a compliment to the holder of another. There are very few members of the House of Commons, I believe, who are entitled to put three letters to their name to indicate membership of your Society. I omit those Privy Councillors who, I believe, by virtue of their office, have a claim to be looked upon as members of this Society. I am speaking now of the strictly scientific men, and I believe I could number the strictly scientific members of the House of Commons who are members of the Royal Society on the fingers of one hand. But I may say that those members of the House of Commons make up for their numerical weakness by the qualities they display, the high place they have filled, by their pre-eminence in debate, and by the records they have left upon the Statute-book of the country. It may be said that five members is a small infusion to leaven the whole lump of the House of Commons, and I am very conscious that scientific gentlemen may regard at times with a feeling of displeasure, if not with a more contemptuous feeling, some of our modes of procedure and some of our habits of thought in the House of Commons. You may think that we do not display that calmness of judgment, that patient investigation of detail, which characterize the scientific mind. You may think that we import into our discussions too much of a very unscientific heat, and that we are diverted from our objects by a great many cross-currents of prejudice and of party. However that may be, Sir, I believe that the object that you and we have in view is the same. The great historian Hume, speaking of the inception of this Society, said that it was the part of scientific men to lift the veil from the mysteries of Nature. It is a humbler function which the House of Commons has to discharge—to solve the great social and political questions of the day. But the object of both is the same, the attainment of truth, and, by whatever means we can attain that object, that object ought to be the main purpose of our lives. I believe I am right in saying this Society owes its inception and its origin to the University of Oxford. In these later days it owes a debt to the great sister University, in the fact that that University has sent to the chair of your Society a gentleman who combines in his own person, not for the first time, the functions of a Professor, of a member of the University of Cambridge, and of President of this great scientific body. Sir, I am very loth, indeed, to trespass any longer upon your time. I have no claim whatever to do so. I will only very humbly express my views. My own individual opinion is worthless and insignificant; but possibly invested for a few moments with a representative character, and speaking for the House of Commons, and that great public who are behind it, I would say that the public of the present day regard not only with that vague astonishment, which they might well do, the great achievements of science, but they look with admiration upon the great men who have illustrated the history of your Society, and they see in that very lengthened list one of the greatest tributes to the greatness of their country. I do, Sir, very much feel the imperfection with which I have addressed to you these few words. But if I have said that the scientific mind is needed in the House of Commons, I will also say this, that the House of Commons has in these days to face not only great political problems, but some of those questions which are surging up and coming ever more to the front, I mean the great social problems—problems connected with the aggregation of vast multitudes in towns, problems connected with the question how to make the lot of the poor happier, how to make it easier for men to support a life of continuous labour, how, in short, to sweeten life, and to make that toil which falls upon us all lighter to the poor with some ray of hope, and easier with some degree of comfort and convenience. But it is to science that the public must look for aid in solving these questions. You have done much already, but you will add a still nobler title to the admiration of the world if you deal with these subjects, as I am sure you will, in such a manner as to make it impossible for the practical politician to separate himself from the nobler follower of science. It is with a very deep sense of the value of this Society and of the feeling which is abroad with regard to it, that I beg to propose to you —and I thank you most cordially for the toleration with which you have listened to my few remarks—the toast of "The Royal Society."

In response, the President said:—My Lords and Gentlemen, —On behalf of the Society which I have the honour to represent on this occasion, I beg to return our thanks for the honour you have done us in drinking the toast. This Society is by far the oldest scientific Society in the Kingdom, but it cannot for a moment compare in antiquity with that other institution over which the Speaker presides. Our aims are of course naturally very different, and our modes of procedure are different too. We have, as the other House has, discussions in our body, but our discussions are usually carried on with calmness, and we endeavour—those of us who pursue different branches of science —to assist one another. I do not think that that is always the case in the other Society. Perhaps there is nowadays at times something akin to obstruction rather than assistance. However, in order that truth may be elicited, it is necessary that there should be contact between mind and mind, and contact sometimes produces severance. It is better that that contact should take place in order that we should understand one another. Our Society does not exactly deal with social problems such as the Speaker has alluded to, still there are many cases in which questions of great interest to the bulk of the population are capable of being illuminated by scientific researches. To take one remarkable example which has been brought prominently before us. Let us consider the investigations, so important in their results, so purely scientific in inception, which have been carried on by M. Pasteur in France. As the result of a long series of scientific experiments, he has now succeeded in protecting in a great majority of instances those persons who have been so unfortunate as to have been bitten by rabid animals from that terrible disease which ordinarily follows in the wake. His merits in that respect have been duly acknowledged in this country. We know that recently, within the course of the present year, the Lord Mayor called a meeting at the Mansion House to make some recognition on the part of this country of the great debt which we owe to M. Pasteur for those researches. I mention that as one, but it is only one, of many instances in which great social advantages have accrued from purely scientific investigation. I trust that harmony will long continue to exist between the Society which I have the honour to represent, and that which the Speaker represents. I can say this much—that, whatever Government may have been in power, there have frequently been applications made to the Royal Society for advice on some purely scientific questions on which the Cabinet of the day did not feel that they had the requisite knowledge to pronounce an opinion; and this I must say, that the Royal Society has freely given the best of their knowledge on these subjects to the Government of the day, without any consideration of what the politics of that Government might be. I trust that this will ever continue to be the case, and that the Royal Society may go on in a peaceful way doing the duties which belong to it, and that the country may reap the benefits resulting therefrom.

Responding for the toast of "The Medallists," proposed by the President, Prof. Thorpe said:—Mr. President, my Lords, and Gentlemen,—We must all regret, I am sure, that Dr. Salmon's duties as Provost of Trinity College, Dublin, should have prevented him from being present amongst us to-day to receive the Copley Medal in person and to respond to the toas which has just been so cordially drunk by you. For reasons which my brother medallists at least can fully appreciate, no one feels that regret more keenly than I do. I may confess that it was with a feeling akin to astonishment that I received through a good-natured friend the intimation that the Council of the Society had seen fit to honour such chemical work as I had been able to do by the signal recommendation of the award of a Royal Medal; but that feeling culminated into something like consternation when you, Sir, informed me of your wish that I should reply, in the absence of the Copley Medallist, to the toast with which you have connected my name; and I began to realize the full force of the truth that there are occasions when it is more blessed to give than to receive. Dr. Salmon's absence, however, enables me to attempt to give expression to the feeling of satisfaction and pleasure with which, I am informed, the mathematical world regards this year's award of the Copley Medal. The worker in the field of pure mathematics appeals for recognition to a very select few; his work is, indeed, *caviare* to the general; his are not the triumphs which appeal to the popular fancy or which strike the popular imagination. If he labours for fame, he must be content to wait with the certain knowledge that, if his work be good and true, it will at length meet with the recognition it merits from a tribunal which is unmoved by prejudice and is insensible to the forces of fashion or faction. For nearly half a century Dr. Salmon has so worked, and to-day he receives his reward at the hands of the highest scientific tribunal in the world by the award to him of the most precious gift which it is in the power of that tribunal to bestow. The other medallists, Dr. Gaskell and Dr. Perkin, are happily with us to-night to receive the congratulations of their fellow-workers in science, and to be witnesses of the cordiality with which their health has been drunk by you. But I cannot forego the opportunity of saying also, in their case, how entirely your awards have been appreciated by the great body of scientific opinion, both within and without the Royal Society. To be praised by men who are themselves praised is, we all know, the very highest form of approbation that a man can enjoy, and such, to my knowledge, is the happy lot of the gentlemen whom you have been pleased to honour to-night. It is, however, one of the penalties to a man who is in the position in which I now find myself, and who does not pretend to be an Admirable Crichton, that he is unable from his own knowledge, or rather from the imperfection of it, to do adequate justice to the claims which such men have upon your regard. Dr. Gaskell's work is so entirely outside my own province that it would be in the highest degree presumptuous on my part to offer you any expression of my own opinion as to its merits. Of my colleague and fellow-worker, Dr. Perkin, to whom your Council has awarded the Davy Medal, I trust I may be allowed to speak with greater freedom, because in his case I am more or less upon my own ground, and am talking about matters which are within my own knowledge. It is exactly ten years since that Dr. Perkin was placed by your Council in the position in which I find myself to-day. In awarding him a Royal Medal on that occasion, our former President, the late Mr. Spottiswoode, took the opportunity to say that Dr. Perkin had then been, during more than twenty years, one of the most industrious and successful workers in organic chemistry, and he added that it was seldom that an investigator had extended his researches over so wide a range as was the case with Dr. Perkin, whose work had always commanded the admiration of chemists for its accuracy and completeness, and for the originality of its conception. There is not a chemist here present who will not cordially re-echo these words. Dr. Perkin is, no doubt, known to you all as the originator of one of the most important branches of modern chemical industry—that of the manufacture of colouring matters from coal-tar derivatives—an industry which has acquired almost colossal proportions, and which has effected a complete revolution in the tinctorial arts. I say it with bated breath to you, Sir, as the member for the University of Cambridge, but we all remember the famous saying of Swift as to the value to mankind of the whole race of politicians put together when compared with that man who has made two blades of grass to grow where only one blade grew before. I do not know that Dr. Perkin has achieved that feat, but I claim for him that he has done even more than this, for he has succeeded in demolishing an entire agricultural industry. By his researches he has shown us that we have practically at our own doors, or at least in our own coal-pits, all the richness and beauty of colour which were formerly only to be obtained from the madder fields of Avignon and the Levant. A beneficent fortune, we are glad to know, has not been unmindful of Dr. Perkin's success in thus enriching the world, and she has endowed him with a share of that material benefit which his skill and genius as an investigator has conferred upon us all. That competency, and the well-earned leisure which has sprung from it, Dr. Perkin has dedicated, with a directness and singleness of purpose which merits our warmest appreciation, to the service of science. Nothing, I think, more clearly indicates the truly scientific character of his mind, and his love of science for its own sake, than that he should, whilst comparatively a young man, have turned aside from the pursuit of the great wealth which all his friends thought would ultimately be within his grasp in order that he might follow, undisturbed, his innate desire for pure scientific research. The ten years which have elapsed since our late President alluded in such characteristically graceful terms to Dr. Perkin's labours in the domains of pure and applied chemistry have been rich in scientific achievement, and they have now culminated in that laborious series of researches on one of the most abstruse points of physical chemistry which has been so fittingly rewarded by you by the gift of the Davy medal. I have already alluded to the feeling with which I received the intimation from my good-natured friend that the Council of the Royal Society had been pleased to confer upon me a distinction which is my sole excuse for trespassing upon your indulgence to-night. I will only again refer to that feeling to say that in deference to the express wish of my distinguished friend I am doing my best to get over it. I am bound to add that my friend has himself supplied a reason which in some measure serves to explain the circumstance. Among the pieces of work which the Council have thought worthy of notice was a redetermination of the atomic weight of gold made in conjunction with Mr. Arthur Laurie. I shall not trouble you with the reasons which made that redetermination seem specially desirable, but that it was desirable will be evident from the fact that no fewer than three independent investigations were in progress at the same time in Germany, England, and America. All the results have now been published, and they are, I think, in very fair accord. But my distinguished friend, whose good-nature is only equalled by his candour, has reminded me that there is a discrepancy of a remote decimal place or so in our several values for the atomic weight, and, in default of any other probable hypothesis, it had occurred to him that the real motive of the Council in making the award was to give me both the hint and the opportunity to clear up the disparity. The Gold Medal, he pointed out, would afford an ample supply of the material on which to base a new determination, and the Silver Medal would come in handy for the preparation of the necessary standard solutions. This seemed to me to put the whole matter in a new light, but, on turning to the official intimation of the award forwarded to me by Dr. Foster, and then to a friendly letter which the President has been so good as to send me, I have not gathered that this intention was ever in the mind of the Council, and until I receive a further official intimation that such was the case, I mean to do my best to preserve intact the counterfeit presentment of the gracious lady which adorns the medals. There is just one other matter connected with my work to which, with your permission, I would allude. Reference was made in the terms of the award to a series of researches on fluorine compounds on which I have been engaged for some years past. I wish to mention, and I do so with a very special pleasure, that much of this work has been carried out in co-operation with some of my senior students at the Normal School of Science. This work has been at all times difficult, often disagreeable, and occasionally dangerous, and I am glad to seize this opportunity of testifying to the zeal, assiduity, and, I may add, courage, which my *collaborateurs* have shown in the progress of the investigations. It is a further satisfaction to me to add that the qualities thus evoked and the training thus acquired have been of material benefit to them in their professional advancement, and I can wish them no greater good fortune than that it may be their lot in time to come to occupy my place here, and to be received by you with that indulgence which you have extended to me to-night.

A NEW METHOD OF PREPARING FLUORINE

A NEW method of preparing fluorine has been discovered by M. Moissan. This discovery is the outcome of the success which has attended M. Moissan's efforts to prepare anhydrous fluoride of platinum. During the process of his memorable work upon the isolation of fluorine by the electrolysis of hydrofluoric acid containing hydrogen potassium fluoride, one of the most remarkable phenomena noticed was the rapidity with which the platinum rod forming the positive electrode was corroded by the action of the liberated gaseous fluorine. It was surmised that a fluoride of platinum was the product of this action, but hitherto all efforts to isolate such a body have proved unsuccessful. In fact, for a reason which will be discussed subsequently, it is impossible to prepare platinum fluoride in the wet way. M. Moissan has, however, been enabled to prepare anhydrous platinum fluoride by the action of pure dry fluorine itself upon the metal. It was found at the outset that, when fluorine is free from admixed vapour of hydrofluoric acid, it exerts no action whatever upon platinum, even when the latter is in a finely-divided state, and heated to 100° C. But when the temperature of the metal is raised to between 500° and 600° C., combination readily occurs with formation of tetrafluoride of platinum and a small quantity of protofluoride. The moment the gas is mixed with a little vapour of hydrofluoric acid, the action is immensely accelerated, and then occurs readily at ordinary temperatures. The same rapid action occurs when platinum is placed in hydrofluoric acid saturated with free fluorine, which accounts for the disappearance of the positive terminal during the electrolysis. In order to prepare the fluoride of platinum, a bundle of wires of the metal is introduced into a thick platinum or fluor-spar tube, through which a current of fluorine gas from the electrolysis apparatus is passed. On heating the tube to low redness, the wires become rapidly converted to fluoride, when they are quickly transferred to a dry stoppered bottle. If the operation is performed in a platinum tube, a large quantity of fused fluoride remains in the tube. The tetrafluoride of platinum, PtF_4, formed upon the wires, consists either of fused masses of a deep red colour, or of small buff-coloured crystals resembling anhydrous platinum chloride. It is exceedingly hygroscopic. With water it behaves in a most curious manner. With a small quantity of water it produces a fawn-coloured solution, which almost immediately becomes warm, and decomposes with precipitation of hydrated platinic oxide and free hydrofluoric acid. If the quantity of water is greater and the temperature low, the fawn-coloured solution may be preserved for a few minutes, at the expiration of which, or immediately on boiling the solution, the fluoride decomposes in the manner above indicated. This peculiar behaviour with water explains the impossibility of preparing the fluoride in the wet way. When the anhydrous fluoride is heated to bright redness in a platinum tube closed at one end, fluorine at once begins to be evolved as gas, and if a crystal of silicon be held at the mouth of the tube it takes fire and burns brilliantly in the gas. The residual platinum is found on examining the contents of the tube to consist of distinct crystals of the metal. Hence by far the most convenient method of preparing fluorine for lecture purposes is to form a considerable quantity of the fluoride first by passing the product of the electrolysis over bundles of platinum wire heated to low redness, and afterwards to heat the fluoride thus obtained to full redness in a platinum tube closed at one end. It only remains now to discover another method of preparing fluoride of platinum in the dry way, to be able to dispense with the expensive electrolysis apparatus altogether. M. Moissan has also prepared a fluoride of gold in the same manner. It is likewise very hygroscopic, decomposable by water, and yields gaseous fluorine on heating to redness.

SOCIETIES AND ACADEMIES.

London.

Royal Society, November 21.—"On the Local Paralysis of Peripheral Ganglia, and on the Connection of Different Classes of Nerve-Fibres with them." By J. N. Langley, F.R.S., Fellow of Trinity College, and W. Lee Dickinson, Caius College, Cambridge.

We found that in the rabbit, 30 to 40 milligrams of nicotin injected into a vein stopped the effect of stimulating the sympathetic in the neck, not only on the pupil, but also on the vessels of the ear. It occurred to us that this action of nicotin might be due to a paralysis of the nerve-cells of the superior cervical ganglion, and not to a paralysis of the peripheral endings of the sympathetic nerve. On testing this view, we found that, after a certain dose of nicotin, stimulation of the sympathetic fibres below the ganglion does not produce dilation of the pupil or constriction of the vessels of the ear, whilst stimulation of the sympathetic nerve-fibres above the ganglion produces these changes in the normal manner.

The method of action of nicotin can be tested in a more direct manner by local application to the isolated nerve and ganglion. When the sympathetic in the neck has been brushed over with a 1 per cent. solution of nicotin, stimulation of it produces the usual dilation of the pupil and constriction of the vessels of the ear; but when the superior cervical ganglion and the filaments proceeding from it have been brushed over with the 1 per cent. nicotin, stimulation of the sympathetic in the neck is found to be completely without effect, while stimulation of the filaments running from the ganglion to the carotid arteries produces the normal action.

Hence nicotin paralyzes the cells of the superior cervical ganglion.

On the fibres of the cervical sympathetic, which are vaso-motor for the head generally and secretory for the salivary glands, we have made a few experiments only; but so far we have been unable to detect any effect from stimulating the sympathetic in the neck after nicotin has been applied to the ganglion.

We conclude that *the dilator fibres for the pupil, the vaso-constrictor fibres for the ear* (*probably also those for the head generally*), *and the secretory fibres for the glands, end in the cells of the superior cervical ganglion.*

Ganglion of the Solar Plexus.—In the dog, cat, and rabbit, the splanchnic nerve on the left side runs to two chief ganglionic masses, which we may call respectively the cœliac and superior mesenteric ganglia. The renal ganglia are scattered, but in the dog the chief one often lies underneath the supra-renal body, and in the cat the chief one is placed between the artery and vein about ½ inch from the superior mesenteric ganglion.

To determine whether the inhibitory fibres of the splanchnic end in the nerve-cells of the solar plexus we proceeded as in the case of the superior cervical ganglion. Having ascertained that the application of 1 per cent nicotin to the splanchnic leaves its inhibitory power unaffected, we found that nicotin applied to the whole plexus at once abolishes the inhibitory power of the splanchnic; but inhibition can still be produced by stimulating the fibres proceeding from the ganglia. Hence, *the inhibitory fibres of the splanchnic end in the cells of the solar plexus.*

Our experiments are not sufficiently numerous, especially with regard to the connection of the cœliac ganglion with the stomach, to make it certain that the one ganglion is entirely connected with fibres to the intestine, and the other with the fibres to the stomach; but we think they show *that in the main, and possibly altogether, the stomachic inhibitory fibres of the splanchnic nerve end in the cells of the cœliac ganglion, and the intestinal inhibitory fibres of the splanchnic end in the cells of the superior mesenteric ganglion.*

We find, however, that *the motor fibres of the vagus for the stomach and intestines do not end in the nerve-cells of the solar plexus.*

The connection of the vaso-motor fibres of the splanchnic with the nerve-cells of the solar plexus can be determined by taking a tracing of the arterial blood-pressure and stimulating the splanchnic before and after the application of nicotin to the ganglia. By applying nicotin to both ganglia, the rise of blood-pressure caused by stimulating the splanchnic is reduced to very small limits, and by applying it to the renal plexus as well, the effect of splanchnic stimulation on the blood-pressure is abolished. Since in this case there is no fall of blood-pressure, we conclude *that the vaso-dilator as well as the vaso-constrictor fibres of the splanchnic end in the cells of the solar and renal plexuses.*

Combining oncometer observations on the dog with blood-pressure observations on the rabbit and cat, we think there is fair evidence *that the splanchnic vaso-motor fibres for the kidney end in the cells of the renal plexus.*

We have experimented upon various peripheral ganglia other than those mentioned above, and, though our results are as yet incomplete, with essentially similar results; that is, we have obtained an abolition of the effect of some one or more of the classes of nerve-fibres running to them. We think, then, there is fair ground to conclude that *by stimulating the nerve-fibres running to and those from any peripheral ganglion, before and after the application of dilute nicotin to it, the class of nerve-fibres which end in the nerve-cells of the ganglion can be distinguished from those which run through the ganglion without being connected with nerve-cells.*

Linnean Society, November 7.—Mr. W. Carruthers, F.R.S., President, in the chair.—Mr. H. Veitch and Rev. Prof. Henslow exhibited a beautiful series of East Indian hybrid rhododendrons, on which Prof. Henslow made some valuable remarks on the effects of cross-fertilization in regard to colour and alteration of structure, upon which some critical observations were made by Mr. Veitch, Prof. Bower, and Captain Elwes.—Mr. E. M. Holmes exhibited and made remarks upon some new British marine Algæ, describing their origin and affinities.—Dr. St. George Mivart, F.R.S., exhibited a drawing by a surgeon, who had been consulted as to amputation of a tail-like process in the human subject, being a prolongation of the coccyx to the extent of 4½ centimetres. Dr. Mivart also exhibited a photograph, showing a remarkable resemblance between two arm stumps; one the result of an amputation, the other a congenital defect in the child of a nurse who had attended the patient whose arm was amputated. Both cases were commented on and explained by Dr. W. O. Priestley, and further remarks were offered by Dr. Murie, and Mr. W. Thiselton-Dyer.—Mr. W. B. Hemsley then read a paper by General Collett, C.B., and himself, on a collection of plants made in the Shan States, Upper Burmah. An interesting discussion followed, in which Messrs. J. G. Baker, C. B. Clarke, and Captain Elwes took part.

Anthropological Institute, November 12.—Dr. J. Beddoe, F.R.S., President, in the chair.—Dr. Beddoe read a paper on the natural colour of the skin in certain Oriental races. Dr. Beddoe's observations showed that the parts of the skin covered by clothing were very much lighter than those exposed to the sun and air; and that those people whose skin was the darkest in the covered parts, were not those who tanned to the blackest hue.—A paper by the Rev. James Macdonald was read on the manners, customs, superstitions, and religions of South African tribes.

PARIS.

Academy of Sciences, November 25.—M. Hermite in the chair.—On the November number of the *American Meteorological Journal*, by M. H. Faye. With this number begins the publication of a complete exposition of the author's theory of cyclonic movements, translated into English by Mrs. W. Harrington. The first part deals with storms, the second with tornadoes, while the third is occupied with the relations of tornadoes and storm phenomena to cyclones properly so called.—On animal heat, by M. Berthelot. In continuation of his previous paper on this subject, the author here discusses the question of the heat liberated by the action of oxygen on the blood. The quantity thus set free, referred to the molecular weight of oxygen (O_2 = 32 gr.), is found, by the extremely delicate experiments here described, to average 14 77 calories.—On the exhaustion of soils cultivated without manure, and on the value of the organic matter in the soil, by M. P. P. Dehérain. A series of experiments carried out at the Agricultural School of Grignon clearly shows that the substance chiefly lost by continuous cultivation without manure is carbon, the proportion of phosphoric acid, potash, and nitrogen eliminated being comparatively slight. It also appears that the organic matter itself is as important a fertilizing element for beetroot as are the nitrates, phosphates, or potash.—On the freno-secretory fibres, by M. Arloing. Experiments are described which demonstrate the existence of these fibres in the cervical chord of the large sympathetic nerve.—Observations on Swift's new comet (November 17) made at the Paris Observatory with the equatorial of the west tower, by M. G. Bigourdan. On November 21 the comet had the appearance of a very faint nebulosity (about 13·4), nearly round, diameter about 50″, without marked condensation. Observations made by Mdlle. D. Klumpke with the equatorial of the east tower on November 23 yielded similar results.—Generalization of Makeham's law of probabilities, by M. A. Quiquet. The chief property of Gompertz's formula as generalized by Makeham has been demonstrated in a very simple way by M. J. Bertrand. M. Quiquet in his turn now inquires whether this property may not itself be a particular case of a still more general principle, and whether the function discovered by the two eminent English actuaries may not therefore be capable of further generalization.—On the employment of electric conducting mediums in studying the displacements and distribution of acids with complex nature, by M. Daniel Berthelot. Of the numerous substances acting both as acid and as alkali one of the simplest is aspartic acid. The author here studies the equilibria that are produced in the presence of this acid in diluted saline solutions. The measurements have been made with the Lippmann capillary electrometer, by M. Bouty's electrometric method.—Variations of the electric resistance of nitric peroxide at different temperatures, by M. J. J. Boguski. Measurements obtained by several methods lead to the conclusion that an increase of temperature of nitric peroxide produces an increase of its electric resistance, the most abrupt variations occurring between 0° and 17° C. Above 70° this acid forms an almost perfect insulator. During the process of heating two consecutive phenomena were observed which call for special attention. To a rise of temperature up to a given limit generally corresponds a *static* and definite increase of resistance; but this increase itself *is preceded by a dynamic* (passing) *decrease* of resistance, whose momentary value is at times no more than $\frac{1}{100}$ or $\frac{1}{2000}$ of the static and normal resistance.—Preparation and properties of the anhydrous platinous fluoride, by M. H. Moissan. In continuation of his previous researches, the author here shows that platinous fluoride, $PtFl_2$, decomposes water at the ordinary temperature, which accounts for the impossibility of preparing it by the wet process. At red heat it is decomposed into crystallized platinum and fluorine.—Contribution to the study of double decompositions between the halogen salts of mercury and zinc, by M. Raoul Varet. The author has studied (1) the action of cyanide of mercury on bromide of zinc; (2) the action of cyanide of zinc on bromide of mercury.—On a new sugar of the aromatic group, by M. Maquenne. To inosite and quercite, the only saccharine substances hitherto obtained from benzene, the author adds a third, provisionally named β-inosite, which he obtains from a pinite derived from the resin of *Pinus lambertiana*, of Nebraska.—Synthesis of metaphenylene-diamine, by M. Alphonse Seyewitz. The author has succeeded in effecting this synthesis by heating, to 280° or 300° C., a mixture of resorcine and calcium chloride under conditions here described.—Papers were submitted by MM. A. Béhal and Choay, on the action of heat on chloral-ammonia; by M. Raphael Dubois, on the mechanism of awakening in hibernating animals; by M. E. Couvreur, on the pulmonary circulation of the frog, as affected by the excitation of the pneumogastric nerve; by M. R. Moniez, on the larva of the new species *Tænia Grimaldii*, a parasite of the dolphin; by MM. Appert and Henrivaux, on the devitrification of the ordinary glass of commerce; by MM. E. A. Martel and G. Gaupillat, on the formation of springs in the interior of the limestone plateaux of the *causses* of Languedoc; and by M. J. Thoulet, on the quantitative analysis of the fine sediment held in suspension in natural waters.

BERLIN.

Physiological Society, November 15.—Prof. du Bois-Reymond, President, in the chair.—After the appointment of officers for the year 1889–90, Dr. Virchow spoke on the spiracle gill of Selachians. With the assistance of drawings and a series of diagrams he discussed the varying arrangements and divisions of the blood-vessels which go to form the gills of Selachians; he also described the frequent occurrence, confined to certain regions of the head, of blood-vessels which are elaborately convoluted; the physiological significance of these vessels is quite unknown, but their morphological interest is so great that an extended investigation of them in other groups of animals is a matter of great importance. In all probability they are rudimentary structures, whose significance would be understood if the above extended investigations were carried out.—Dr. I. Munk spoke on the absorption of fats and fatty acids in the absence of bile in the intestine. The older classical experiments on animals with a biliary fistula had taught that, in the absence of bile, proteids and starch are digested as completely as in a normal animal, whereas, on the other hand, the absorption of fat is largely interfered with. In correspondence with this view, the later observers were of opinion that all fat which is not absorbed does not leave the body as neutral fat, but as fatty acids, and from this the conclusion was drawn that the fats of food are decomposed into fatty acids (and glycerin) before they are normally absorbed. The speaker had carried out a series of experiments on dogs with biliary fistulæ, during the past summer, with a view to clearing up several obscure points in the whole question of the absorption of fats. After he had confirmed the older views as to the normal digestion of proteids and starch, and the appearance of unabsorbed fat in the form of free fatty acids in the fæces, he proceeded to determine quantitatively the absorption of fat from the intestine in the absence of bile. He found, first, that in such animals there is a relatively large absorption of fat from the alimentary canal as long as they receive the fat in company with proteids and starch, but that the absorption is much less when the fat is administered—as it was in the experiments of the older observers—mixed only with proteids. It was found that the animals absorbed more than 70 per cent. of such a fat as pig's lard, whose melting-point is low, without the assistance of bile; they also absorbed an almost proportionately large quantity of the free fatty acids of the lard, thus corresponding exactly to the behaviour of normal animals, which can absorb about 94–98 per cent. of any fat whose melting-point is low, whether it be administered in the form of neutral fat or of the fatty acids which it contains. When a fat was administered whose melting-point is high—especially such a fat as only begins to soften at the temperature of the body (*e.g.* mutton fat)—the amount absorbed was considerably less, and it was still less when the free fatty acids of this fat were given with the food. The speaker pointed out, with regard to the fæces of animals with a biliary fistula, that they may be dark-coloured, or even black, on a proteid diet, and only appear light-gray in colour when carbohydrates are given with the food. This dark colour is not, however, due to any derivative of the bile-pigments, but to hæmatin. The speaker had not been able to detect, with certainty, any further advanced decomposition of the contents of the intestine in animals with a biliary fistula, neither did he observe any increase of putrefactive products, such as indol, skatol, &c., in their urine.

IN our report, last week (p. 95), of the meeting of the Berlin Physical Society on October 25 (first column, fifth line from foot), *for* "waves in air 21 metres long" *read* "waves in air 2 kilometres long."

DIARY OF SOCIETIES.

LONDON.

THURSDAY, DECEMBER 5.

ROYAL SOCIETY, at 4.30.—Remarks on Mr. A. W. Ward's Paper on the Magnetic Rotation of the Plane of Polarization of Light in Doubly-Refracting Bodies: O. Wiener and W. Wedding.—Researches on the Chemistry of the Camphoric Acids: J. E. Marsh.—The Internal Friction of Iron, Nickel, and Cobalt, studied by means of Magnetic Cycles of very Minute Range: H. Tomlinson, F.R.S.—A Compound Wedge Photometer: Dr. Spitta.

LINNEAN SOCIETY, at 8.—Life History of a Stipitate Fresh-water Alga: G. Massee.—On the Anatomy of the Sand Grouse: G. Sim.

FRIDAY, DECEMBER 6.

PHYSICAL SOCIETY, at 5.—The Electrification of a Steam Jet: Shelford Bidwell, F.R.S.—Notes on Geometrical Optics, Part II.: Prof. S. P. Thompson.—On the Behaviour of Steel under Mechanical Stress: C. H. Carus-Wilson.—On a Carbon Point in a Blake Telephone Transmitter: F. B. Hawes.

GEOLOGISTS' ASSOCIATION, at 8.—*Conversazione.*

SUNDAY, DECEMBER 8.

SUNDAY LECTURE SOCIETY, at 4.—The Wonders of the Yellowstone Park, the Recreation Ground of America; a Personal Narrative (with Oxyhydrogen Lantern Illustrations from the Lecturer's own Camera): Wm. Lant Carpenter.

MONDAY, DECEMBER 9.

SOCIETY OF ARTS, at 8.—Modern Developments of Bread-making: William Jago.

TUESDAY, DECEMBER 10.

ANTHROPOLOGICAL INSTITUTE, at 8.30.—The Natives of Mowab, Daudai, New Guinea: Edward Beardmore. Communicated by Prof. A. C. Haddon.—Fire-making in North Borneo: S. B. J. Skertchley.—On the Origin of the Eskimo: Dr. H. Rink.

INSTITUTION OF CIVIL ENGINEERS, at 8.—On the Triple-Expansion Engines and Engine Trials at the Owens College, Manchester: Prof. Osborne Reynolds, F.R.S. (Discussion.)

WEDNESDAY, DECEMBER 11.

SOCIETY OF ARTS, at 8.—The Paris Exhibition: H. Trueman Wood.

ROYAL MICROSCOPICAL SOCIETY, at 8.—On the Freshwater Algæ and Schizophyceæ of Hampshire and Devon: A. W. Bennett.

THURSDAY, DECEMBER 12.

ROYAL SOCIETY, at 4.30.

MATHEMATICAL SOCIETY, at 8.—On the Radial Vibrations of a Cylindrical Shell: A. B. Basset, F.R.S.—Note on 51840-Group: G. G. Morrice.—On the Flexure of an Elastic Plate: Prof. H. Lamb, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Annual General Meeting.—Election of Council and Officers for 1890.—Electrical Engineering in America: G. L. Addenbrooke. (Discussion.)

FRIDAY, DECEMBER 13.

ROYAL ASTRONOMICAL SOCIETY, at 8.

INSTITUTION OF CIVIL ENGINEERS, at 7.30.—Hydraulic Station and Machinery of the North London Railway, Poplar: John Hale.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Giornale di Scienze Naturali ed Economiche, 1887 and 1888 (Palermo).—*Challenger* Report—Zoology, vol. xxxii (Eyre and Spottiswoode).—Collotype and Photo-lithography: Dr. J. Schnauss; translated by E. C. Middleton (Iliffe).—A Text book of Human Anatomy: Dr. A. MacAlister (Griffin).—A Naturalist in North Celebes: Dr. S. J. Hickson (Murray).—Algebra, Part 2: G. Chrystal (Edinburgh, Black).—A Hand-book of Modern Explosives: M. Eissler (Lockwood).—Contributions to Canadian Palæontology, vol. i., Part 2: J. F. Whiteaves (Montreal, Brown).—Modern Thought and Modern Thinkers: J. F. Charles (Relfe).—The Land of an African Sultan: W. B. Harris (Low).—Index of British Plants: R. Turnbull (Bell).—Manual for Beginners and for the London University Matriculation Examination.—The Anatomy of the Frog: Dr. A. Ecker; translated by Dr. G. Haslam (Oxford, Clarendon Press).—A Narrative of Travels on the Amazon and Rio Negro: A. R. Wallace (Ward, Lock).—Pawnee Hero Stories and Folk Tales: G. B. Grinnell (New York).—Palestine: Major Conder (Philip).—Tractatus de Globis: R. Hues; edited by C. R. Markham (Hakluyt Society).—Among Cannibals: C. Lumholtz (Murray).—Im Hochgebirge: Dr. E. Zsigmondy (Leipzig, Duncker and Humblot).—Niels Klein's Wallfahrt in die Unterwelt: L. Holberg; edited by E. H. Babbitt (Boston, Heath).—Practical Observations on Agricultural Papers, &c., 2nd edition: H. Wilson, Jun. (Simpkin).—Du Transformisme et de la Génération Spontanée: C. A. Rohant and Dr. M. Peter (Paris, Baillière).—Einiges über die Entstehung der Korallenriffe in der Javasee und Branntwunsbai, und über Neue Korallenbildung bei Krakatau: Dr. C. Ph. Sluiter (Batavia, Ernst).—Journal of the Royal Microscopical Society, October (Williams and Norgate).—The Asclepiad, No. 24, vol. vi.: Dr. Richardson (Longmans).—Proceedings of the Boston Society of Natural History, vol. xxiv., Parts 1 and 2 (Boston).—Journal of Morphology, vol. iii. No. 2 (Boston, Ginn).

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