

THURSDAY, JUNE 12, 1902.

THE HISTORY OF THE MYTH-MAKING AGE.

The Ruling Races of Prehistoric Times in India, South-western Asia, and Southern Europe. By J. F. Hewitt. Vol. i. Pp. lxxv + 627 (1894), 18s. Vol. ii. Pp. xxxv + 382 (1895), 12s. (Westminster: Constable and Co., Ltd.)

History and Chronology of the Myth-making Age. By J. F. Hewitt. Pp. xlviii + 682. (London: Parker and Co., 1901.) 15s. net.

THE object of the present short article is not so much to call the attention of the readers of NATURE to two works by Mr. J. F. Hewitt, late Commissioner of Chota Nagpore, who has devoted many years of hard work to the elucidation of the history of the ruling races of prehistoric times in India, south-western Asia, and southern Europe, as to mention some of the difficulties connected with the history and chronology of the myth-making age. To discuss at length and in detail the contents of the three volumes the titles of which appear at the head of this review would require several numbers of NATURE, or a whole volume, and while an attempt is here made to indicate the general line of his arguments and the trend of his opinions, the reader, if he wishes to become master of the subjects as treated by Mr. Hewitt, must read the works themselves. Mr. Hewitt brings to bear upon his studies a knowledge of several Indian dialects, and a general knowledge of what other investigators have written about subjects which are germane to his own; his observations and opinions have not been formed hastily, and every fair-minded reader will, after a perusal of his works, arrive at the conclusion that he is an honest, even if sometimes mistaken, seeker after facts, and that, so far as his knowledge will allow him to do so, he sets the truth before those who will take the trouble to read what he has written. The chief importance of his books, in the writer's opinion, is the proof which they afford of the little value of philology in arriving at any decision as to the religious views and practices of early nations; moreover, we cannot help wishing that when Mr. Hewitt was making his quotations he had taken the trouble to give the words and passages on which he bases his arguments in the languages in which they were originally written. We have no intention of finding fault or of making carping criticisms, but Orientalists other than experts in Indian languages would have felt much more comfortable if they could have seen before them the Babylonian, or Assyrian, or Egyptian forms of the words which he quotes. The answer to this objection is, of course, that the use of mixed Oriental types is a costly luxury to an author, and to many it will seem a sufficient one; meanwhile, let us thank Mr. Hewitt for what we have, and then proceed to consider generally the aim and scope of his work.

The older of the works before us is that which deals with the ruling races of prehistoric times in India, and consists of a series of eleven essays, six of which were published in 1894 and the remaining five in 1895. In a

somewhat lengthy preface, Mr. Hewitt explains that he intended to call especial attention by means of them to the chronological data which can be obtained from "social laws and customs, mythic history and ritual," and to show how the leading epochs of civilisation succeeded one another in prehistoric times. In the first essay he describes how he was drawn into the line of study in 1863, when he went to Chota Nagpore as Deputy Commissioner, and how the system of indigenous Indian village communities spread thence through all the countries lying between it and north-west Germany. Mr. Hewitt next thought he had found that the clues to the history of early Hindu ritual given in the Rigveda and elsewhere could only be explained by comparison with data obtained from Accadian texts, and he apparently still thinks that Hindu and Accadian mythology developed on nearly identical lines, the Zend ritual being a common link between them. He also came to the conclusion that Egyptian religious and national history in the two stages of its growth can be traced to Indian and Accadian sources, and that it was impossible that the maritime commerce, whence the wealth was earned which made the Euphratean countries and Egypt rulers of the ancient world, could have been founded except by the Indian seaman. In the essays which follow he sets out the reasons, philological, religious, and historical, which have induced him to hold these views, and adduces a number of theories, many of an astronomical character, in support of the same. We must, however, at the very outset protest against the statement that the Egyptian religion, as such, can be traced to India, and we much doubt if Hindu mythology can be compared with Accadian mythology in any way. Thanks to the labours of men like Brugsch and Maspero, we know a little about the Egyptian religion and the gods of Egypt, and the more we know the more we find that the oldest gods of Egypt were indigenous, and that the religion of the earliest period was the very characteristic product of an indigenous race of north-east Africa. Whether Mr. Hewitt is right or we are, others must decide; but any comparison between the name of the Egyptian god Osiris (As-âr) and the Accadian god Asar (or Asaru) is scientifically impossible, and when he says that Heru (or "Horus" as he spells it) was the equivalent of the Ashêra, "or rain pole of the Semites," and the "Tur or meridian pole of the Akkadians," we are obliged to disagree entirely with him. The Accadians appear to have had a god called Zu-ab or Apzu, who had something in common with the Egyptian Nu (not Nun, as Mr. Hewitt writes the name), but to say that both Accadians and Egyptians worshipped Nu is incorrect. In the first essay we also have a long dissertation about St. George, who, according to Mr. Hewitt, was:—

"the rain-god, the knight of the cross, for it was in the centre of the tortoise earth that the mountain of rain-god stood, and it is from the cross forming the ground plan of the tortoise, with the pole or mountain in the centre, that the Egyptian star of Horus was formed" (p. 17).

But in Egyptian mythology Horus had no special star, and the five-rayed star was the common symbol of stars and gods in general. If anything, St. George was a solar god, and all the details of his history go to prove

his identity, not with a rain-god, but with the sun-god Rā in Egypt and Marduk in Mesopotamia. We cannot follow Mr. Hewitt here in all his derivations, because it seems that he is influenced too much by the similarity of the sounds of roots and not by the probability of their relationship. Thus, on p. 27, he speaks of "Rāma, meaning 'the darkness' in Sanskrit and 'the heights' in Hebrew." The fact is that "Rāma" does not mean "heights" in Hebrew, but *Rāmāh* does mean "high"; even so, however, it is not in any way related to the Sanskrit Rāma, and the words Rāma and Rāmāh must not be compared in this way. The second essay, which deals with the primitive village, is more interesting, and contains a number of original remarks which show that Mr. Hewitt has thought out the subject with care; but in the third we again touch serious philological difficulties. Mr. Hewitt has followed the speculations of many masters, and has in consequence made a good many mistakes. Thus, Isis was not a star-goddess originally, but her soul went to the star Sept, and the name Āst (Isis) has no connection with Accadian at all. In this, as in many other places, Mr. Hewitt has adopted Prof. Hommel's views, which are not generally accepted either by Assyriologists or Egyptologists. At this time of day it is little less than foolish to quote Lenormant's works on Accadian, for it is now well known that his skill in reading cuneiform of any sort was very small, and that his imagination and boldness of assertion were very great. On p. 292 we have an extraordinary set of equations, e.g. Tur, the pole=taurus=Syriac *tawrā*, a bull=Hebrew *shur*, an ox=Tyre! In the fourth essay a number of astronomical myths are described, and Mr. Hewitt lays down the theory that the primitive year contained two seasons, that it was followed by one of three seasons, and that mankind eventually made use of a year of five seasons. He supports his theory by means of a large number of impossible philological comparisons, and says, among other remarkable things, that the constellation Leo

"was the Māsu or Moses, who, as the pillar of cloud and fire, led the star-worshippers to the top of Mount Nebo, consecrated to the planet Mercury, the great Nabi or prophet of the Semites" (p. 352).

We do not intend to weary the reader with further extracts from these essays, for the passages already quoted will explain Mr. Hewitt's methods, and serve to show how philology is made to run riot in them; the other remarks on the volumes generally we shall make after we have briefly described the contents of the work "History and Chronology of the Myth-making Age." The period of time which Mr. Hewitt discusses in this portly volume begins with the "first dawn of civilisation" and ends at the time when the sun entered Taurus at the vernal equinox between 4000 and 5000 B.C., his "pivot date" being B.C. 4200. About this time, he says, it ceased to be a universally observed national custom to record history in the form of historic myths (*sic*), and national history began to pass out of the mythic stage into that of annalistic chronicles recording the events of the reigns of kings and the deeds of individual heroes, statesmen and law-givers. It would be extremely interesting to know why B.C. 4200 was fixed upon as the pivot

date, for there is reason to believe that the making of myths did not cease at that period. For all practical purposes Mr. Hewitt's book on the myth-making age is divided into three parts, which treat of the age of pole-star worship, the age of lunar-solar worship and the age of solar worship. These are followed by four appendices, which give a list of the Hindu stars, versions of the "House that Jack built," the legend of Ino and a dissertation on Melgareth. The section on pole-star worship treats of the year of two seasons and of five-day weeks, the year of three seasons and of five-day weeks, and the year of three seasons and of six-day weeks; the first of these years, Mr. Hewitt asserts, was measured by the movements of the Pleiades and the solstitial sun, the second by Orion, and the third by the eel-god. The second section treats of the epoch of the three-year cycle and of the nine-day weeks, of the year of the horse's head of eleven months and eleven-day weeks; and the third section discusses the fifteen-months year of the sun-god of the eight-rayed star and the eight-days week, the years of seven-day weeks and seventeen and thirteen months, the years of eighteen and twelve months, and of five- and ten-day weeks. In proof of the views which he holds on all these difficult subjects, Mr. Hewitt quotes largely from a great many works by authorities of varying trustworthiness; and he reproduces an appalling number of equations, a few of which, taken singly, are correct, but which, when looked at as a whole, are erroneous and misleading, and confuse the mind of the reader. Thus, on p. 29, we are told that Zeus is a form of the North Pole god Tan, that Tan = the Creto-Phœnician (*sic*) I-tan-os = the Accadian I-tan-a (*sic*), and the "tree mothers" of Accad, China, Germany and other countries are declared to have a common origin and to typify the same things. Statements of this kind are difficult to understand, at least when their writer intends the reader to believe that the ideas concerning the subjects of them were common to all peoples of antiquity, irrespective of the distance of their countries from each other. Moreover, they make it exceedingly difficult for any student to accept the generalisations which they express. There are, of course, many beliefs and conceptions which are common to all races of mankind, which are on the same level of civilisation, but there are large numbers of others which are not, and there are many which belong to a particular race, or to a people who live under peculiar geographical and physical circumstances. The cosmogony and theology of mountain races are different from those of the dwellers in plains, and those of the Semites differ from those of the Aryan nations. Another point is also to be considered in connection with the matter. Mr. Hewitt quotes authorities on the Chinese, Accadian, Sanskrit, Babylonian, Assyrian, Egyptian, Dravidian, and numbers of other languages, and without meaning to be disrespectful to him or to belittle his work, we must say that we have no belief in the philological omniscience which can decide about such abstruse questions as he formulates and answers. Men like Wellhausen and Kuenen have shown us what can be done in elucidating ancient religious beliefs by means of a knowledge of a group of cognate languages, but in our opinion no man is to be

trusted when he professes to deduce relationship of words, names and beliefs in Egyptian, which is an African (Hamitic) language, and in Babylonian, which is a Semitic language, and in Sanskrit, which is an Aryan language, and in Chinese and Accadian, which, whether they be related or not, have no relationship with any one of the other three. Mr. Hewitt, like Mr. John O'Neill, in his "Night of the Gods," has done a useful piece of work in collecting a mass of facts and theories, but they want sorting and arranging and winnowing, and especially condensing, before they can be used by the students of the various religions of antiquity. What is more important, moreover, is that the derivations of the words and names should be checked by experts in the various languages in which the books of the various religious systems are written, so that the student may be quite sure that no mistake has been made. Descending from generalities to particulars, we note that Mr. Hewitt speaks of the "Hittite" as if it were a known language; but it is not, and no inscription written in the script which is commonly called "Hittite" has yet been deciphered. It is true that "translations" of certain "Hittite" texts have been printed and published, but no trained philologist admits that they really represent the meaning of the texts from which they are alleged to have been made. Even the identity of the Hittites of the Bible has not yet been established, for whilst the Khatti of the Assyrian monuments may be identical with the Kheta of the Egyptian records, there is no evidence that either name is connected with the Hittites, or that the Hittites were related to the Kheta and Khatti. Similarly, Mr. Hewitt alludes to the Accadian language as if it too were known; but every student of comparative Semitic philology is well aware that the study of Accadian is so little advanced that certain eminent Assyriologists, no doubt erroneously, even now do not regard it as a language at all!

The general impression which a careful perusal of the book leaves on the mind is that Mr. Hewitt has proved too much; but be this as it may, it is our firm conviction that if he wishes his labour and learning to receive the study and recognition which they deserve, he must condense his statements and formulate his theses in such a way that the student who is not an Oriental philologist may be able to make up his mind what are the theories which Mr. Hewitt sets out to prove, and whether he has proved them or not. A sharp distinction should, of course, be made between theory and fact, but this Mr. Hewitt fails to make. In conclusion, we cannot help wishing that he had confined his attention exclusively to Indian languages, cosmogonies, and theologies, of which, obviously, he has had abundant opportunities of obtaining knowledge at first hand, and that he had not made such lengthy excursions into the domains of Chinese, Semitic, Egyptian and other studies of which he as obviously has no first-hand knowledge whatever, not even enough to distinguish good authorities from bad. He has, in fact, lost an excellent opportunity of writing a most interesting book on the early religious myths of India, and this we sincerely deplore. The indices to the volumes before us are remarkably comprehensive and good, and merit praise.

CYCLOPEDIA OF HORTICULTURE.

Cyclopedia of American Horticulture. By L. H. Bailey, assisted by Wilhelm Miller [and others]. In 4 vols. quarto. Pp. 2016. (London: Macmillan and Co., Ltd.; New York: the Macmillan Company, 1900 to 1902.) Price 21s. net each volume.

THERE are some books which gain the title "monumental" on the sheer score of size. The present work, which has recently been completed, has earned it, not only by its bulk, but by the quality of its contents, their freshness and diversity, and the originality of their treatment.

There are two ways of producing such a work as this, one by the free use of paste and scissors, a plan not to be despised if the compiler be at once honest and judicious, and the other wherein each article inserted is treated as a monograph. Facts are accumulated, contrasted, classified, so that in the result the reader has placed before him as complete a view of the whole subject as the limitations of space will allow. This is the plan that has been followed by Prof. Bailey and his 450 contributors and assistants. The Cyclopædia was to be new, "brand new from start to finish. The illustrations were to be newly made; the cultural suggestions written directly for the occasion from American experience and often presented from more than one point of view; few of the precedents of former cyclopædias to be followed; all matters to be worked up by experts and from sources as nearly as possible original." Considering all these things, the volumes constitute a real triumph of sagacity and organisation on the part of Prof. Bailey.

The matter, so far as we have tested it, is accurate, well set forth and in due proportion—a most difficult thing to secure when the work of so many contributors has to be correlated and adjusted. It is quite clear that a large share of the work, independently of planning and supervising the whole, has fallen to Prof. Bailey. Two things specially strike us in consulting the volumes, the one the way in which science, and especially evolutionary science, permeates the whole book, the other the way in which scientific knowledge has been set forth for the special benefit of commercial horticulture. In most or all books of the kind, botanical and physiological details are given, but here they seem expressly set forth for the benefit of those who make their living out of the land or the forcing-house. Science is not allowed to suffer in the least, but its application to commercial necessities is insisted on to a degree unknown in British horticulture. Prof. Bailey knows and caters for the requirements of the commercial cultivators in all or most of the States of the Union, and not the least valuable of his articles are those concerning the natural features and economic conditions of the several States and Territories.

So far as the plants are concerned, analytical keys are framed, so as to facilitate, by means of contrasting characters, the discovery of the name of each plant and of its salient features. The enormous and irksome labour involved in the construction of these keys can only be appreciated by those who have had to construct similar ones. An error the most trifling in itself may involve the

most serious consequences as regards the construction and the use of these tables.

In a work of such magnitude and diversity, it is futile to think that errors can have been completely avoided, but from frequent consultation of the earlier volumes we can testify to their remarkable freedom from printers' errors. We think a short account of each of the principal natural orders should have been given, and the space so allotted might have been saved, in part at least, by thus obviating the necessity of some amount of repetition in dealing with the several genera.

Prof. Bailey has availed himself of the resources of Cornell University, of the "Dictionary of Gardening" by Nicholson and of the numerous standard publications issued from Kew, and, amongst other sources of information, has consulted and compared some hundred or more catalogues of nurserymen. This latter procedure needs to be followed with the utmost caution and is one to which, perhaps, the omission of the genus *Trochodendron* is to be attributed. After all, the plants that have special interest for commercial purposes are few in number as compared with those which appeal primarily to the lover of plants or to the scientific botanist.

We might extend our notice of this book to a much greater length than the editor could allow space for. We can only add that the illustrations are very numerous, uniform in treatment, often very useful, but, on the whole, not equal in value to the text. Further, that although expressly compiled to meet American conditions, it will, with the necessary modifications, be of great value in all English-speaking countries.

THE MANUFACTURE OF SUBMARINE CABLES.

Les Câbles Sous-Marins. Fabrication. Par Alfred Gay. Pp. 203. (Paris: Gauthier Villars et Fils, n.d.)

THE author of this little book, as we are informed on the title-page, is an engineer in the employment of the Société industrielle des Téléphones, the leading French firm for the manufacture of submarine cables. The volume is one of a series appearing under the name of "Encyclopédie scientifique des Aide-memoire," edited by M. Léauté, who is also, we understand, connected with the Société industrielle des Téléphones. From the title of the series we gather that this publication is designed to serve as a pocket text-book for submarine cable engineers, though the style in which it is written and the absence of an index—a fatal omission for any work of reference—make it resemble a popular treatise on the subject of cable manufacture rather than a scientific handbook. One example will serve to justify this view. In his reference to the Wheatstone Bridge—the most usual form of testing the conductor resistance of a cable—the author makes no attempt to explain the theory of the test, but merely gives the connections and the formula for obtaining the result. A book on cable testing which evades an explanation of the *Pont de Wheatstone* is as great a curiosity as a treatise on Euclid which omits all reference to the *Pons Asinorum*.

One or two other points call for comment. With regard

to the testing of the dielectric resistance, M. Gay observes that some physicists have expressed the opinion that, if sufficient time were allowed, the "spot" would return to zero and remain there. This could only happen in the case of a material which possessed an absolute dielectric resistance, and through which, consequently, no current could escape. Manufacturers have hitherto failed to discover this material. Further on, the author asks why the negative current is always the first to be applied to the cable, and answers his question by saying that he believes that there is no good reason for using one current in preference to the other. But M. Gay must know that, when testing a faulty cable under water, the chemical action of the zinc current tends to clean the fault and make it more apparent, while the copper current throws a deposit on the exposed surface and masks the fault. Thus the reason for using the zinc current first is to discover at once any fault that may exist.

Throughout his book the author pays too little attention to the question of capacity in connection with the manufacture of cables. On p. 14, in enumerating a long list of the conditions which a good dielectric must satisfy, he does not mention the desirability of a low capacity. In fact, on p. 107 he goes out of his way to lay stress on the superior importance of insulation tests to capacity tests, ignoring the fact that, *caeteris paribus*, the work to be got out of a cable depends on its capacity, its insulation being purely a secondary matter. Finally, on p. 145 M. Gay says that the engineer is not master of the capacity of a core, the dimensions of which are given him, as though the capacity could not be varied by the selection and mixture of the gutta-percha used, independently of its relative weight to the conductor.

For the rest, it may be sufficient to point out that, in connection with the table of coefficients, given on p. 85, for reducing the D.R. of the cable at the temperature at which it is tested to its equivalent at 75°, one must *divide* and not *multiply* (as instructed on pp. 147 and 149) by the coefficient given, for the D.R. at 75° is, of course, less than at a lower temperature and more than at a higher temperature. With regard to the brazing of a joint, M. Gay would find it difficult to scarf the two ends of the conductor, if he omits, as he does in the directions on p. 173, to solder them first.

Enough has been said to show that the book is not likely to prove of great value as a work of reference for cable engineers. But as a popular treatise on a process of manufacture of which the public knows little, and may like to know more, it deserves very favourable notice. The chapter on the composition and properties of gutta-percha is specially good, and on pp. 90 and 91 the author sums up very clearly and succinctly the reasons for the various conditions which specifications require the dielectric to satisfy.

"Voici, en deux mots, sur quels motifs est basée l'introduction de chacune de ces règles: on impose une limite inférieure d'isolement pour se garantir contre les défauts de fabrication; on impose une limite supérieure d'isolement pour empêcher l'emploi des guttas très résineuses qui, en général, s'altèrent vite avec le temps; on impose un résidu maximum dans le chloroforme ou le toluène pour s'assurer que le mélange a été bien nettoyé

et qu'il ne contient plus une proportion trop grande des matières étrangères ; on impose enfin un résidu minimum dans l'alcool bouillant ou, si l'on veut, un résidu maximum après décantation et évaporation du liquide ayant servi aux expériences pour obliger le fabricant à faire usage de lots contenant une proportion suffisante de gutta pure."

OUR BOOK SHELF.

Some Thoughts on the Principles of Local Treatment in Diseases of the Upper Air Passages. By Sir Felix Semon, M.D., F.R.C.P. Pp. 115 ; with Appendix pp. 130. (London : Macmillan and Co., Ltd.) Price 2s. 6d. net.

THIS little volume, reprinted from the *British Medical Journal*, consists of two lectures delivered in November, 1901, at the Medical Graduates' College and Polyclinic ; and there is an appendix consisting of two letters dealing with the controversy aroused by the publication of these lectures.

The book is evidently intended for the medical profession only, the object of the distinguished author being two-fold, that is to say, it is a serious protest against "operative intemperance" and an attempt to lay down some simple principles for the treatment of diseases of the upper air passages.

Such a protest from within the profession against "the lust of operation"—perhaps a euphemism for something still more discreditable—has long been needed, and will doubtless require periodical repetition.

For the craze for specialists for everything (even "for a child of 6 months old") has recruited the ranks of specialism with many undesirables, possessed of the minimum of really special knowledge, except such as is generally associated with one's conception of the pachydermatous and pushing commercial traveller.

The author, perhaps wisely, confines himself to the less offensive expressions, "lust of operation," "operative intemperance"—charges from which he, with everyone else, wholly exonerates all honourable members of the profession possessed of judgment and a proper sense of responsibility.

Coming to questions of treatment, the author divides the symptoms and signs arising in pathological conditions of the upper air passages into five categories:—

- (1) Affections of a purely local character.
- (2) Local manifestations of general systemic diseases.
- (3) Local manifestations in nose and throat dependent upon local diseases in correlated areas.
- (4) Affections of the upper air passages supposed to exercise direct or reflex influence upon other organs and parts of the body.
- (5) Local symptoms and sensations of obscure origin.

In conclusion, some observations are made on the necessity of a proper proportion being observed between the gravity of the disease and that of the interference, so as "to make the punishment fit the crime."

In admirably clear and concise language, the diseases included in the foregoing subdivisions are specified, and a surprising amount of detailed treatment, of the utmost value, given in the subsequent pages, for many of these conditions, e.g. the various stages of tuberculous laryngitis.

In addition, sundry more or less fashionable methods of treatment, such as breathing exercises, and catch phrases, such as "nasal insufficiency," are subjected to the most searching criticism ; whilst the dangers of ignorant "specialism" are fully exposed by a series of cases which has come under the direct observation of the author.

We congratulate the writer of these lectures, believing that he has done excellent service to his profession and to the public generally ; and we confidently recommend

the volume both to the up-to-date general practitioner and to the specialist, whether broad- or narrow-gauged.
H. C.

Flora der ostfriesischen Inseln. By Dr. Fr. Buchenau. Fourth edition. Pp. iv + 213. (Leipzig : Wilhelm Engelmann, 1901.)

IN order to incorporate the results of the systematic examination of the mosses, hepatics and lichens of the East Friesian Islands, Dr. Buchenau has brought out a fourth edition of his flora. The previous edition included the descriptive text of the phanerogams and pteridophytes and a highly interesting ecological account of the types of vegetation. A comparison of the flora of the islands and of the mainland brings out some curious points of difference. On this account the author rescinds his former opinion that the plants had travelled over from the continent ; more probably, he suggests, the insular vegetation represents the remains of an ancient *diluvial* flora. No changes are made in the previous issue, the new edition consisting in the addition of some extra pages, which contain a list, without diagnoses, of the Muscineæ and Lichenes and an appendix giving corrections and addenda. Amongst the mosses it is interesting to find recorded a group of Bryums, represented by *Bryum calophyllum*, which are found locally in this country on sandhills near the mouths of certain rivers. The fungi of the islands are now being worked by Herr E. Lemmermann, and his results will be included in a future issue.

Occultations of Stars and Solar Eclipses. By Francis Cranmer Penrose. Second edition. Pp. viii + 36. (London : Macmillan and Co., Ltd, 1902.) Price 12s. 6d. net.

THE first edition of this book was published in the year 1869, but in the present issue Mr. Penrose has not only simplified and condensed the work contained in it, but has extended it in that portion which relates chiefly to total solar eclipses. Most of us are familiar with the importance of determining one's position on the earth's surface, especially when on the ocean or on land far removed from the privileges of civilisation, and any attempt, either by a graphical or computational process, to facilitate this object is very welcome both to navigators and travellers. In this book Mr. Penrose treats the methods of predicting such phenomena as occultations of stars and eclipses of the sun by graphical construction, and he adds more rigorous methods of reduction for the accurate calculation of longitude. The very full explanation of the principle involved, the details of the working out of each case in point, the tables to facilitate the necessary computations, and the skeleton forms for actual practice, will all be found sufficiently clear to enable the worker to understand the practical use of the method.

Algebra. Part ii. By H. G. Willis. Pp. liii + 375. Rivington's Junior Mathematics. (London : Rivingtons, 1902.) Price 1s. 4d.

IN these pages we have a collection of algebraical exercises arranged in a progressive order of difficulty and suitable for elementary classes. The compiler has divided the examples in the following way : collection in groups suitable for lessons of about an hour, more advanced questions at end of each group ; exercises grouped in series of twenty-six, furnishing two lessons per week for a term ; two sets of parallel series either for alternate terms or for more lessons than in one series ; oral questions at the beginning of each exercise. The scope of the questions carries the exercises up as far as the progressions. The book should prove useful to teachers who require graduated courses ; answers to all the questions are given at the end.

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.]

Earthquake in Guatemala.

THOUGH I have been a subscriber and devoted reader of NATURE for about twenty years, I have not hitherto troubled you with any communications. Now I think it will interest you to obtain some data about a very disastrous earthquake which recently shook nearly the whole of the republic of Guatemala and the neighbouring countries, destroying many towns and causing immense loss of property and of many lives.

At 8.25 p.m. of April 18 an earthquake of more than thirty seconds duration affected a large part of Guatemala, eastern

machinery and the aqueducts ruined. The total number of lives lost may be about 800 to 900.

At the port of Ocos, only three houses remained standing and the big landing-pier was broken near the land.

In the city of Guatemala most of the churches and some houses sustained slight damages; the same happened in Antigua (Guatemala). Escuintla and Amatitlan suffered considerably.

The railways between Retalhuleu and the port of Champerico, and the one between Ocos and Catepec were interrupted by the falling of bridges and damage to the road. The railway between Guatemala and the port of San José remained unaffected and intact.

In the eastern portions of Guatemala the shock was only weak. I was at the time on my plantation "Germania," and did not feel anything at all.

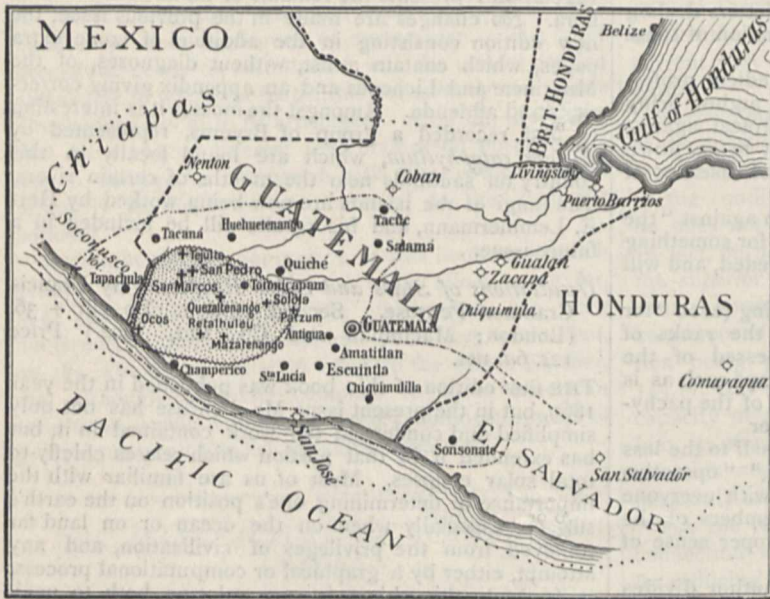
Until May 5 earthquakes of small intensity were still frequent from the city of Guatemala to the west.

A commission of engineers has been sent by the Government to Quezaltenango and San Marcos, to select new places for the rebuilding of these towns.

During the night of April 11-12 a severe thunderstorm did considerable damage to houses and other property at San Salvador, the capital of the republic of El Salvador, and at 7.25 p.m. on April 16 a powder explosion blew up the military barracks at Managua, the capital of Nicaragua, destroying a number of houses and killing many people. I mention this because later on these events might get mixed up with the earthquake.

EDWIN ROCKSTROH.

Gualan (Guatemala), May 7.



Earthquake, 8.25 p.m., April 18.

- Limits of Guatemala.
- ~~~~~ Region of greatest intensity.
- - - - - Region where buildings were destroyed.
- + Quezaltenango. Towns completely destroyed.
- Escuintla. Towns which suffered damage.
- Region from which notices about the earthquake have reached me.
- ◇ Nenton. Places where the shock was felt distinctly.

From Chiapas there is only one report about Tapachula, and from Honduras about Comayagua. It is not possible to say how far to the east and to the west the movement was felt.

Chiapas and western Salvador and Honduras. The intensity of the movement was greatest in western Guatemala, where the second and richest city of the country, Quezaltenango, was completely destroyed, with the loss of about 500 lives. Completely ruined also were Sololá, San Marcos and its sister town San Pedro Sacatepequez (more than 200 lives being lost), and the same happened to Retalhuleu and Mazatenango, important towns on the Pacific coast-plain, to the south of Quezaltenango. The places before mentioned are situated on the highlands, a little to the north of the great volcanoes.

Besides the cities named, nearly every town and hamlet in the Departamentos of San Marcos, Quezaltenango, Retalhuleu, Suchitepequez and several in Chimaltango are ruined, and perhaps every one of the many important coffee- and sugar-plantations in the western coast-region has had its buildings,

quite perceptible, difference in the *timbre* of the instrument; but this difference is not a measure of the intensities of the particular tones to which the difference is due.

If I is the intensity of the fundamental tones of the two strings, Σi the sum of the intensities of the overtones of the gut string, and $\Sigma i'$ the sum of the intensities of the overtones of the silk string, then what we distinguish in the consonant note of the instrument is

$$(I + \Sigma i) - (I + \Sigma i') \\ = \Sigma i - \Sigma i';$$

but we form no idea as to the absolute values of I , Σi and $\Sigma i'$. We cannot, in fact, say in what proportion they contribute to the intensity of the consonant note of the instrument.

(The difference observed in the *timbre* of the gut and silk strings is not, of course, necessarily due only to a difference of

intensity in their overtones. There may be a difference in number, but this does not appear to affect the question of whether the tones of the string form an appreciable part of the consonant note of the violin.)

If a vibrating tuning-fork is placed in contact with the wood of a violin, the instrument reinforces the tone of the fork; but the vibrations of the wood are here much less powerful than in the case of the string, and consequently the instrument only feebly asserts its own *timbre*. A very ordinary violin will reinforce the tone of a fork almost as perfectly as a masterpiece of Cremona.

I therefore take it that the reinforcement of the tone of the fork is chiefly the result of resonance, and that the intensity of the tone of the violin is due to the reinforcement of the tones of the string itself by resonance, plus the reinforcement contributed by the tones of the pine and sycamore, and that the latter determine the *timbre* of the instrument.

The tones of the pine and sycamore are also reinforced by resonance, in the same way as those of the string.

June 2.

W. B. COVENTRY.

The "Armorl" Electro-Capillary Relay.

ON p. 129 of vol. lxxv. of NATURE, a description is given of an electro-capillary relay. The writer states that the actual apparatus was not seen by him, "but only a working model." It would be highly interesting to know the exact meaning of this expression. Does it mean a model which will work, or only a model in which the different parts of the apparatus are shown, say, in wood or cork or any other substance. In the illustration, the mercury when acted on electrically is shown as moving the lever of a relay. A well-made capillary electrometer is highly sensitive to a small change of potential, but the movement of the mercury column is so minute that it is very difficult to see how any lever of a relay could possibly be worked by means of its movement. Some further information about the "Armorl" relay would, I feel sure, be acceptable to many, showing the potential difference required to cause the mercury to work the lever *k*, and also the approximate E.M.F. set up at, say, ten miles from the sending station of a wireless telegraphic system.

J.-S.

Prehistoric Pygmies in Silesia.

UNDER the above heading, Prof. G. Thilenius, of the University of Breslau, has recently (*Globus*, Bd. lxxxi. No. 17) made an important contribution to European ethnology. His deductions result from an examination of a quantity of osseous remains preserved in the Museum of Silesian Antiquities at Breslau, consisting of four groups obtained at different sites in the region between Breslau and the Zobten. They are, unfortunately, very fragmentary; but it has been ascertained that they are the remains of a number of persons of both sexes, all adult and all of very short stature. The mean height of one group is about 4 feet 8 inches (1.429 m.), of two others about 4 feet 11 inches (1.496 m.; 1.506 m.), and of the fourth about 5 feet (1.523 m.). With these Prof. Thilenius compares the remains of the Swiss pygmies described by Prof. Kollmann, of Basel, who estimates their height as ranging between 4 feet 5½ inches (1.355 m.) and 4 feet 11 inches (1.499 m.), and comparison is also made with the similar remains found at Egisheim (in Lower Alsace, near Colmar), which belonged, according to Herr Gutmann, to people whose stature ranged from about 3 feet 11 inches (1.200 m.) to something under 5 feet (1.520 m.). Further, the museum at Worms furnishes the remains of an individual of the estimated height of 4 feet 9 inches (1.445 m.). In all these cases, the bones show no trace of any pathological degeneration, and the consequent inference is that they represent a special race of low-statured men, or dwarfs. Profs. Kollmann and Thilenius seem to prefer the term "pygmy" as most appropriate in denoting a special race, "dwarf" (*Zwerg*) being regarded as applicable to abnormal specimens of a race of ordinary size. Most writers, however, make no such distinction; and, indeed, "pygmy" is far from being strictly accurate when applied to people of 4 or 5 feet in height. Prof. Windle states that a people may be described as "pygmy" in which the average male stature does not exceed 1.450 m. (4 feet 9 inches).

Prof. Thilenius gives a wide range for the period in which these little people lived. While those of the Rhine valley are placed far back in time, some of the Silesian dwarfs are

assumed to have been contemporaneous with the Romans and the Slavs, the most recent being placed at about a thousand years ago. But, before arriving at anything like a final conclusion on any of the questions relating to the mid-European pygmies, Prof. Thilenius desires a much greater accumulation of evidence in the shape of skeletal remains, and there is good reason to hope that this will be forthcoming in due time. Most of our information on the subject has been obtained within recent years, and fresh evidence can hardly fail to present itself to investigators in the future.

DAVID MACRITCHIE.

Flames from Mud on a Sea-Shore.

WE should like to draw your attention to the following spectacle which some of us witnessed on the sea-shore at Blundellsands on Thursday evening, June 5, at about eight o'clock.

The evening was dull and grey, a strong north-westerly wind was blowing in from the sea and the tide was flowing in. In the distance we first saw smoke with frequent jets of fire bursting forth from the mud of a shallow channel. Drawing near, we perceived a strong sulphurous odour, and saw little flames of fire and heard a hissing sound as though a large quantity of phosphorus was being ignited. It was impossible to detect anything which caused the fire, only the water where the flames appeared had particles of a bluish hue floating on the surface. The area over which the tiny flames kept bursting forth was about 40 yards.

A gentleman present stirred up the mud with his walking-stick, and immediately large yellow flames nearly 2 feet in length and breadth burst forth. The phenomenon lasted some time, until the tide covered the part and quenched the fire. As we returned from our walk the atmosphere was impregnated with a strong odour of sulphur. An old resident of Blundellsands, who also witnessed the sight, said he had never before seen anything of a similar nature.

H. T. DIXON.

9 Agnes Road, Blundellsands, near Liverpool, June 8.

Cuckoo's Egg Thrown out of Bunting's Nest.

ON the morning of May 25 I found a nest of the reed bunting (*Emberiza schoeniclus*) with a cuckoo's egg in it besides three eggs of the bunting itself. When I took some friends to see it two or three hours later, the hen bird was sitting on the three eggs, but the cuckoo's egg was lying smashed outside the nest. It is impossible that any person could have broken it, for there were no traces of bootmarks in the soft mud on the side of the dyke where the nest was, besides it being very unlikely for anyone to have passed the spot during the short time I was away. It would interest me to know if any of your readers are acquainted with cases of small birds pitching the cuckoo's egg out of the nest instead of hatching it in the orthodox style.

Higham, May 27.

T. G.

VOLCANIC ERUPTIONS IN THE WEST INDIES.

IN the notes already published relating to the disasters which so recently overwhelmed Martinique and St. Vincent, reference has twice been made to the possible connection between seismic efforts and displays of volcanic activity. In connection with this, it has been suggested that had the sudden movements which on April 19 shattered cities in Guatemala been postponed, Mont Pelée and La Soufrière might still have been quiescent. By this it is not intended to convey the idea that if we take earthquakes generally and compare the registers of the same with the registers of volcanic eruptions we shall recognise any direct connection between the two. In Japan there are annually at least 1000 distinct earth shakings, but years may pass without the record of a volcanic eruption. Mount Fuji in that country has remained quiescent for the last 195 years, during which period it has been shaken at least 15,000 times, but in spite of this repeated aggravation the *mons excelsus et singularis* of Dai Nippon still watches peacefully over thirteen provinces round its base.

Like many other mountains in the world, if we may rely upon the records of its past history, it is yet engaged in raising steam, and when by this process the volcanic strain has sufficiently increased, some unusually large relief in seismic strain—even at a distance—may be the ultimate cause of a renewal of its activity. Volcanoes, like mines, require to be charged before they can be exploded, and the final cause of such explosions seems at times to be connected with bodily movements of their foundations, which movements may originate locally or be the *propter hoc* of corresponding disturbances originating at a distance. The shiverings which constitute local earthquakes, which are so frequent throughout the world, play but little part in these violent awakenings, and the giants sleep whilst humanity may be terrified.

To see how far such a view is sustained let us turn to the volcanic history of the West Indies. First of all attention may be directed to the fact that the volcanic activity of these islands is confined to the Lesser Antilles, from St. Martin in the north to Grenada in the south. In the larger islands, which run approximately east and west, like Cuba, Jamaica, Dominica and Puerto Rico, although there are volcanic rocks and hot springs, volcanoes proper do not exist. What we have to deal with are the peaks of "Antillia," now represented by a suboceanic ridge about 500 miles in length.

The following notes, derived from Fuchs' "Vulcane und Erdbeben" and other sources, may be taken as a summary of what is generally known respecting the vulcanicity of these outcrops. Although it is imperfect, yet it may suffice to illustrate the hypothesis that world-shaking earthquakes may be closely followed by volcanic outbursts.

Grenada.—The island is practically built up of two mountains which are joined together. The crater of Grand Etang is filled with water. Morne Rouge is built of ashes. The greatest height is 2749 feet. It contains hot chalybeate and sulphurous springs.

St. Vincent.—In 1718, on the night between March 6 and 7, a piece of land rose from the sea and then sank. There was a furious hurricane on April 24, and Morne Garou (La Soufrière) erupted. From 1718 to 1812 this mountain was quiescent, but in the latter year it erupted, changed the form of its crater, and its ashes fell in Barbados. The last violent eruption was on May 7, 1902. The intervals between eruptions have, therefore, been ninety-four and ninety years.

St. Lucia.—Qualibou, 1800 feet. At present this is in the solfatara stage. In the large crater there are small lakes, and sulphurous gas and steam escapes. It erupted in 1766. The highest peak is 2117 feet.

Martinique.—Mont Pelée, 4438 feet. It erupted at the end of the eighteenth century, on August 5, 1851, and lastly on May 8, 1902.

Dominica.—Here there are many solfataras. The highest peak is 4747 feet.

Guadeloupe.—The "Grand Terre," or the eastern side of the island, is not volcanic. Soufrière de Guadeloupe (4869 feet) erupted in 1778, 1797, February 1802, 1812 and 1836.

Montserrat.—The Soufrière is volcanic. On November 29, 1896, 20 inches of rain fell, and this was followed by many small earthquakes. For forty years before there had been but few noticeable shocks. Since the rainfall the springs give off more gas, and silver is blackened three miles away.

Nevis.—Sulphurous vapour escapes from the crater.

St. Christopher (St. Kitts).—Mount Misère erupted in 1692. At present there is a lake in the crater.

St. Eustatius.—The volcano is apparently extinct and covered with vegetation.

The eruptions we have to consider are therefore those of the years 1692, 1718, 1766, 1797, 1802, 1812 (two), 1836, 1851 and 1902 (two).

We will now compare these with seismic disturbances of which more detailed accounts are to be found in Mallet's Catalogues of Earthquakes, published in the Reports of the British Association 1852-1854, and in Lyell's "Principles of Geology."

1692.—June 7, between 11 a.m. and noon, Port Royal in Jamaica was destroyed. A piece of land of more than 1000 acres sank, carrying with it buildings and their inhabitants beneath the sea. There was great disturbance in the ocean, and houses throughout the island were shaken down. Mountains were shattered and a lake created. This was accompanied by the eruption of St. Kitts.

1718.—As already stated, this eruption in St. Vincent was accompanied by a "very violent" earthquake.

1766.—March 9, Island of Antigua, a violent shock. March 17, Island of Grenada, a violent shock. June 11 (midnight), Jamaica, especially at Port Royal, also at Cuba. In Jamaica a violent shock lasting one and a-half minutes. In Cuba it lasted seven minutes, and the shocks recurred up to August 1. July (middle of month, during the night), Ste. Marie, S. America, very violent shocks, followed by slighter ones every day up to July 21. August 13 (10 p.m.), Island of Martinique, an earthquake during a terrible hurricane. August (towards end of month), Island of Martinique, another and very violent shock. August 18, Guadeloupe. August (end of month), Cuba, an earthquake, City of St. Jago overturned. October 6, Island of St. Eustache, an earthquake accompanied by a hurricane. Very violent shocks. In the territory of Caraccas they recurred hourly (probably only at first) for fourteen months up to the end of 1767. According to tradition, the shocks were simple horizontal oscillations. At Surinam there were two other violent shocks felt besides the one here mentioned, viz on the 24th at midnight and on the 27th at 7 a.m. October 21, 3 a.m., Cumana and Caraccas in New Granada, S. America; also Island of Trinidad; also Surinam and all N.E. portion of S. America. The whole of the city of Cumana was ruined. Eruptions of sulphurous water frequently occurred, especially about Casanay, two leagues east of Coriaco. The inhabitants lived in the streets for the two years 1766-67. The Indians celebrated by feasts the approaching destruction and subsequent regeneration of the world. During these shocks a little island in the Orinoco sank and disappeared beneath the waters, and in many places disturbances of the surface were produced. The first and third of the shocks at Surinam were attended with subterranean noise, as were the shocks at the mission station of Encaramado. December 12, Martinique, a slight shock.

1797.—February 4, 7.45 a.m. On this date there was a destructive earthquake in Quito, in which 40,000 lives were lost. A great extent of country was shaken, and the ground about Tanguragua opened into enormous clefts, from which water and stinking mud (moya) issued. The mountain itself remained quiet, but the smoke from Pacto, seventy-five leagues distant, disappeared suddenly.

About this time a series of shocks began in the Lesser Antilles, and these did not cease for eight months, until the eruption of the volcano in Guadeloupe on September 27 "put an end to them."

1802.—On February 2 there was a "severe shock" in Antigua, whilst in Guadeloupe there were vibratory shocks accompanied by an eruption. Shocks were felt in the west Indian islands during February and March.

1812.—On March 26 of this year Caraccas was utterly ruined, and 10,000 of its inhabitants perished. Shocks continued until April 5. The waters of Lake Maracaybo were lowered, and Mount Silla is said to have lost 300 to 360 feet of its height by subsidence. On April 24 St. Vincent erupted, the noise of which was heard as far as Caraccas. Preceding this eruption, in St. Vincent and in the West Indian islands there had been very many shocks. In St. Vincent more than 200 had been noted. Another tremendous earth disturbance, took place before this eruption commenced on November 16, 1811, in the valley of the Mississippi, Ohio and Kansas. The ground was raised or lowered, and about New Madrid shocks occurred almost hourly for months and continued until the date of the Caraccas earthquake.

The eruptions in St. Vincent and Guadeloupe appear to have been closely associated with two unusually large seismic disturbances on the neighbouring American Continent.

1835.—On February 20 an earthquake was felt for nearly 1000 miles along the coast of Chili. Many towns were destroyed and the coast was elevated from 1 to 10 feet. Up to March 4 300 shocks were counted. A submarine volcano broke out near Bacalao Head, and the Andes for a distance of 1300 miles were before and after the convulsion in an unusual state of activity. In November of this year Concepcion was severely

shaken, and on the same day Osorno, at a distance of 400 miles, renewed its activity. "These facts," says Lyell, "prove not only the connection of earthquakes with volcanic eruptions in this region, but also the vast extent of the subterranean areas over which the disturbing cause acts simultaneously." In 1836, on June 22 (or May 22-23) different places in Central America were shaken, and this was accompanied by the eruption of a volcano east of Omoa. In this year there was an eruption in Guadeloupe.

Without continuing these extracts further, it seems that the sequence of events which has recently taken place since the catastrophe in Guatemala on April 19 is but a repetition of very similar sequences which have taken place in the same quarter of the globe during the past two hundred years. The Antillean range is apparently one that is extremely susceptible to seismic disturbances originating at a distance, and that it may be so is suggested by its recent geological history. According to Dr. J. W. Gregory, when the Isthmus of Panama was submerged it is possible that "Antillia" existed connecting North and South America, and the Caribbean Sea was then a gulf of the Pacific. In Lower or Middle Miocene times this was submerged, and abyssal ooze was deposited which are now raised in the Barbados to a height of 1095 feet above sea level. The magnitude of these movements and their rapidity, which has often been referred to by the opponents to the theory of the permanence of continental masses and oceanic basins, indicate that we have in the Antillean ridge a line of weakness characterised by unusual instability, and it is in all probability this instability which renders the Windward Islands so responsive to hypogenic changes in the neighbouring continent.

Seismic Disturbances.

The earthquake recorded at Shide on May 8, commencing at 2h. 49.5m. a.m., was also recorded at Kew, Bidston, Edinburgh and Potsdam. The times of maximum motion at Shide, Kew and Bidston were 3h. 21.7m., 3h. 18.2m. and 3h. 23m.

The time taken for this movement to travel from the West Indies to Kew would be about 37 minutes. The local time of origin in the West Indies would therefore be May 7, 10.37 p.m. This time, calculated from other data, was given in NATURE, May 29, p. 111, as being about 10.33 p.m. Two other seismograms relating to this disturbance as recorded at Shide have not yet been examined. When this is done more certainty respecting this time is to be expected.

Assuming the clock in St. Pierre, which stopped at 11.50 (or 7.50 a.m. local time) to have been correct, this earthquake took place about twelve hours before that event occurred.

It is curious that although this earthquake was noted in Potsdam it does not appear to have reached Laibach and certain other European stations.

At Shide a slight earthquake was recorded on May 25 about 5.28 p.m., and a second shock at about 4.20 next morning. They are both small, and the relationship between the preliminary tremors and maximum motion is too ill defined to state definitely the distance at which they originated.

J. MILNE.

RECORDS AND RESULTS OF RECENT ERUPTIONS.

SEVERAL interesting observations and records connected with volcanic eruptions and earthquakes have come under our notice during the past week. As has already been remarked, the exact cause of the sudden destruction of the inhabitants of Martinique after the eruption of Mont Pelée is a little difficult to determine. Witnesses who were on the *Roddam* in the bay of St. Pierre at the time of the disaster on May 8, state that when the eruption occurred the vessel was struck with such force by the material

ejected that she was nearly capsized and seemed to be enveloped in "a whirlwind of fire." Apparently what burst from the volcano was highly heated gas carrying with it immense quantities of white-hot volcanic ash. The vessel eventually reached the harbour of Castries, St. Lucia, and a survivor gave a correspondent of the *Times* the following account of his terrible experience:—

No human being could stand against that terrific deluge of molten ashes. Even those who reached the cabin or hold did not escape, almost every nook and cranny of the ship being filled with the blazing dust. Captain Freeman sought shelter in the chart-room, but, the portholes being open, the fire streamed in and burnt him badly on face and hands.

The heat was awful, for the mass of ashes which poured into the ship all aglow still retained its heat, and it was only with great difficulty and caution that it was possible to move about at all.

When the ship reached Castries, every part was found to be covered thickly with volcanic ash. More than 120 tons of ash were taken from the ship, and as this was precipitated in a white-hot condition it is remarkable that anyone passed through the burning storm alive.

The eruption of the Soufrière of St. Vincent was accompanied by the same kind of "hot blast" as that of Mont Pelée. Many victims of the St. Pierre disaster bore no outward sign of injury or scorching, but after autopsy they were found to have been burnt internally. A *Daily Mail* correspondent at St. Vincent records, from the words of a survivor, how most people died:—

A dark cloud came from the Soufrière about 4 p.m., and a fine leaden powder penetrated doors and windows and filled the air. People breathed it in, and it was so hot it burnt the flesh. The people in the house began to cry out, and struggled, shouting for water, and placing their hands on their stomachs. They gasped, fainted, and died. All was over in three minutes. It is said that this hot blast killed most people, and wherever the powder touched people it burnt their flesh.

Prof. A. E. Verrill states in *Science* the opinion that the ejection of explosive gases was one of the causes of the sudden destruction of life in the Martinique eruption. His view is as follows:—

The heat was sufficient to cause the dissociation of hydrogen and oxygen from the water on coming suddenly into contact with highly heated lava, and in case of sea-water the chlorine would also be dissociated from the sodium. These gases suddenly ejected with great violence and exploding in the air, above the crater, would produce precisely the effects witnessed on an unusually large scale at Martinique. The people were mostly killed by the sudden explosion of a vast volume of hydrogen and oxygen, which will account for the sudden burning of flesh and clothes, as well as of the buildings and vessels. The chlorine, at the same time, combining with some of the hydrogen, would produce hydrochloric acid, a poisonous and suffocating gas, which would quickly kill most of those not instantly destroyed by the explosion.

As to the changes which have occurred at St. Vincent, it is reported that a party of American investigators who ascended the Soufrière found that the lake had disappeared, leaving a cavity 2000 feet deep. Vapour was still issuing from the new crater.

The Imperial Commissioner of Agriculture for the West Indies has informed Kew that the botanic station and agricultural school in St. Vincent are untouched beyond a fall of volcanic dust.

It is reported in the *Barbados Advocate* that the volcanic ash is adding to the difficulties of sugar-making. The dust is everywhere. It has worn some mill-rollers so smooth that they can hardly draw in the canes. In places the machinery is much injured, and everywhere the dust gets into the juice and has to be strained out, flannel bags having to be used to strain the liquor. On the evening of May 19 a fine dust of a light grey colour was observed to be falling on the Oxford plantation, and it was conjectured that it came from Mont Pelée, in Martinique.

The Royal Mail steamer *La Plata* had a fall of dust on board when between St. Vincent and St. Lucia, while the barque *Jupiter* had a heavy fall far to the eastward of Barbados. From the great mass which fell in the sea around the latter ship, actually colouring the water, it was known that some extraordinary phenomenon must have occurred. There was also such a darkness that lamps were alight at an unusually early hour.

Magnetic Disturbance.

Dr. L. A. Bauer reports in *Science* that a magnetic disturbance was recorded at two magnetic observatories of the U.S. Coast and Geodetic Survey on May 8, at 7.45 St. Pierre local mean time, that is, at the time of the great eruption. The disturbance was distinctively a magnetic and not a seismic one, and hence was not recorded on seismographs. The magnetograms obtained at Cheltenham, seventeen miles from Washington, exhibit magnetic disturbances amounting at times to 0.00050 to 0.00060 C.G.S. units (about 1/350 of the value of the horizontal intensity) and from 10' to 15' in declination, beginning at the time stated and continuing until midnight of May 9.

"Until further information has been received from other observatories," says Dr. Bauer, "it cannot be determined definitely whether this magnetic disturbance was due to some cosmic cause or came from within the earth's crust and was associated with the Martinique eruption. The coincidence in time is, however, a remarkable fact."

Earthquake of April 19.

Some valuable notes on the earthquake in Guatemala on April 19 are given by Mr. Rockstroh in a letter published on another page (p. 150), with a map of the district seriously affected. Prof. Milne obtained a record of this earthquake at Shide, and it was reproduced in *NATURE* of May 29 (p. 109). Miss G. M. Johnson sends us a cutting from the *Yorkshire Post* of April 19 containing several letters upon an earthquake which was distinctly felt in parts of Yorkshire and Lincolnshire on April 14. At Beverley the time noted was 11.51 a.m., at Greetwell 11.45, and Hatfield 11.40. At Belton the disturbance shook a bedstead four inches from its place.

Volcanic Ash from Mont Pelée.

Prof. T. G. Bonney writes:—

I am indebted to Sir W. Crookes for a mounted specimen of the dust from Mont Pelée, which fell on the deck of the *Roddam*. The fragments are commonly about .007" in diameter, but range between .005" and .01", minerals and rocks being in about equal quantity, the former consisting of labradorite, augite (bottle-green) and a pleochroic (green to brown) hypersthene, the latter rather scoriaceous, a brownish-grey in colour. I have mentioned some minor details in a short communication to the Geological Society. This dust has a general resemblance to that from the Soufrière which fell in Barbados, and both represent hypersthene-andesites.

Analyses of Soufrière Dust.

For educational purposes all the agricultural colleges in this country, and a number of the principal schools—Westminster, Harrow, Eton, Rugby, &c.—have received from Mr. Harries, of the Meteorological Office, a sample of the Soufrière dust which descended on Barbados during the night of May 7-8. It had been collected by Dr. Morris, the Imperial Commissioner of Agriculture, as it fell, and a portion submitted to investigation at the Government Laboratory on the spot yielded the following results:—

Prof. d'Albuquerque's chemical analysis showed the substances soluble in strong hydrochloric acid to be:—

Percentage.		Percentage.	
Iron oxide ...	4.7	Silica1
Alumina ...	12.5	Sulphuric anhydride...	.1
Lime ...	5.9	Insoluble in hydro-	
Magnesia78	chloric acid:—	
Soda ...	1.2	Silicates ...	75.2
Potash08		

Also a trace of sulphides and a faint trace of sulphurous anhydride—a product of the combustion of sulphides and sulphur.

The mineralogical examination by Dr. Longfield Smith gave the following as the results of the sieve analysis:—

Diameter of particles.	Percentage.
1 to .5 millimetre ...	0.01
.5 " .35 " ...	3.06
.35 " .20 " ...	7.21
.20 " .15 " ...	66.20
.15 " .10 " ...	0.89
.10 and less " ...	22.63

The particles from .5 to .35 mm. diameter were wholly composed of volcanic glass crowded with gas inclusions and containing small lath-shaped crystals of felspar. The gas inclusions in many instances were so numerous as to render the particles quite opaque. The particles of .35 to .2 mm. were of similar volcanic glass and partly of crystals of felspar. Those of .2 to .1 mm. were almost entirely composed of mineral crystals, consisting chiefly of lime and soda felspar and of a ferromagnesian mineral not yet definitely determined. They also contained a quantity of magnetite and a very few crystals of a dark blue doubly-refracting mineral not yet determined. The particles finer than .1 mm. were chiefly composed of comminuted fragments of felspar.

A comparison of the dusts of 1812 and 1902 points to the recent eruption as being much the more violent, it being very rare to find so many mineral particles in volcanic dust scattered so far from the seat of eruption. The fact that particles of magnetite, a mineral of specific gravity 5.5 to 6.5, of more than 1 mm. diameter, should be found in the dust more than ninety miles from the seat of explosion is significant of the prodigious height to which the particles must have been ejected.

The subjoined diary of events is in continuation of those already given.

Diary of Events.

June 4, *Kingstown (St. Vincent)*.—Vessels leaving Martinique have experienced upheavals of the sea between that island and St. Lucia, indicating submarine eruptions. Clouds of steam, accompanied by flashes of flames at night, have been continually rising from the Soufrière since May 16.

June 4, *Cornwall*.—A slight shock of earthquake was felt in the neighbourhood of Camborne about 10.20 p.m. It was accompanied by a low rumbling noise. In some houses ornaments were shaken from the shelves on which they stood.

June 4, *Valparaiso*.—According to a despatch from La Paz, a volcanic eruption has occurred in the Choico (Chaco?) territory, by which two villages were destroyed and seventy-five persons killed.

June 4, *Baku*.—The journal *Kaspi* reports an eruption of the mud volcano in the neighbourhood of the village of Kobi, district of Baku. The eruption, which lasted about five minutes, was accompanied by a detonation resembling the report of cannon, and the country around for some distance was enveloped in flames.

June 4, *Rome*.—A slight earthquake shock was felt last evening at Velletri, twenty miles south-east of Rome. No damage was done.

June 6, *Melbourne*.—A slight earthquake shock was experienced in South Australia to-day.

June 6, *Seattle*.—The steamer *Berthaw*, which has arrived from Alaska, brings advices to the effect that the volcanic mountains Redoubt, Llanna and Augustine at Cook's inlet have been smoking and giving off steam for a month past. On May 26 Mount Redoubt threw up a quantity of ashes.

June 6, *Fort de France*.—Another eruption of Mont Pelée took place to-day. A gigantic cloud extended to the south, covering Fort de France with darkness, but no ashes fell. The sea here receded for several feet, and did not return for some time.

June 6, *Kingstown (St. Vincent)*.—Simultaneous with an eruption of Mont Pelée, the Soufrière in St. Vincent belched out a heavy cloud of smoke, and at 2 p.m. Kingstown was wrapped in pitch darkness.

June 7, *Fort de France*.—A terrible eruption took place. Fort de France was in darkness from 10 a.m. until 2 p.m. The plains of the Morne Rouge were covered with hot mud.

June 7, *Hawaii*.—The volcano Mauna Loa has become active.

THE NEW BOTANICAL LABORATORIES AT LIVERPOOL.

AS already announced, the new botanical laboratories, presented to University College, Liverpool, by Mr. W. P. Hartley, of Aintree, were formally opened on Saturday, May 10, by Sir William Thiselton-Dyer, K.C.M.G., F.R.S., Director of the Royal Botanic Gardens, Kew. The laboratories, of which a sketch elevation has already appeared in *NATURE* (vol. lxi. p. 454, March 5, 1900), viz, both in size and equipment, with those of the University of Glasgow, opened last year by Sir Joseph Hooker.

The building, which is plain and unpretentious externally, covers an area of 3000 square feet, and con-



FIG. 1.—Hartley Botanical Laboratories, Liverpool.

sists of three main floors, accommodating the museum, lecture theatre and elementary laboratory behind, whilst by the interpolation of two mezzanines facing the main thoroughfare, space is found for private rooms, research laboratories, herbarium, class room and workshops. All the rooms open off a central staircase, lit from a lantern in the roof, thereby avoiding waste of space in the provision of corridors. A basement contains the store-rooms, lavatories and heating chamber; the ground floor is occupied by the museum, museum preparation room and workshop. The first mezzanine carries the herbarium and class room, with an entrance to the gallery of the museum. On the first floor is placed the theatre, seated for two hundred students, the professor's private room with a private laboratory adjacent, and the departmental library. On the second mezzanine are placed the

research laboratories and dark room, whilst the second floor is occupied by the elementary laboratory, with accommodation for sixty-five students, the advanced laboratory, arranged to seat twenty students, and the assistant lecturer's private room.

The laboratories, museum and lecture rooms are fitted with pitch-pine and teak fixtures, and the building is lit throughout by electric light. All the laboratories, both public and private, are equipped with gas and water fittings, and baywood wall cases are provided for storage of apparatus and materials. The total cost of the building has been somewhat more than 13,000*l.*, including the cost of the freehold and 75*o*l. expended on museum glass and essential physiological apparatus.

The opening ceremony took place in the arts theatre of the College, where a large audience was presided over by Mr. E. K. Muspratt, vice-president of the College, in the unavoidable absence of the president, Lord Derby. Amongst other botanists present were Sir William Thiselton-Dyer, Profs. Marshall Ward, Bretland Farmer, Weiss, Potter, Bottomley and Smith, and Mr. Wager. Sir Michael Foster, who expected to be present, was detained at the last moment by parliamentary business. Among the general guests were Sir John Brunner, M.P., Sir John Willox, M.P., Prof. Miller Thompson, Prof. Lord, &c. The principal was accompanied by a large number of the College staff.

Mr. W. P. Hartley, in formally presenting the laboratories to the College, said that the citizens of Liverpool desired their city to be foremost, not only in commerce, but in knowledge, in the discovery of truth and the encouragement of science in its pure as well as in its applied branches. His object in providing the laboratories to the College was to help in the realisation of that ideal.

After the formal acceptance of the munificent gift by the chairman and the principal of the College (Prof. Dale), a vote of thanks to the donor was carried by acclamation and responded to in suitable terms by Mr. Hartley.

Sir William Thiselton-Dyer then delivered an address on the value of the study of botany as a means of cultivating the powers of observation and deduction from observed facts. He said his feeling in coming to the north from the metropolis was one of envy. He found a great commercial city full of busy life, possessing buildings and equipment for the pursuit of knowledge marked by a sumptuousness and magnificence the like of which was not possessed by them in London, and which they had little hope of obtaining. That grand municipal spirit existing among Liverpool citizens showed a height of local

patriotism to which they had not attained in the metropolis. It was a lasting glory to her that Liverpool had undertaken so great a work, and he could not doubt that a blessing would come upon her citizens in the stimulus to that higher life the seeds of which they had planted.

The new laboratories, as the generous donor had said, were not intended to teach merely that which would lead to direct profit, they were intended also, and primarily, as a centre for the prosecution of research and study not necessarily utilitarian in its aim. The study of botany was calculated to foster to the highest degree the faculties of observation and deduction. Bluntness of observation was a national calamity, for the inability to see a thing at the moment it presented itself might mean the loss of a unique opportunity. Not in botany alone, but in all

studies and occupations, the seeing eye was of infinite—
even fundamental—service.

After a brief *résumé* of the history of botany in England and an appreciation of the services rendered to the science by men like Grew, John Ray, Robert Brown and others, Sir William expressed the hope and belief that England would again attain and retain the premier place in botanical study and research, and that the botanists of Liverpool would so use their splendid opportunities as to maintain the reputation of their country. He went on to speak of the great industries which had their origin in botanical discoveries, of the value of the science to medicine, and pointed out a fact too often overlooked that plants were intimately connected with every phase and stage of human life until, in the final act of the drama, they facilitated our decay.

After a vote of thanks to Sir William Thiselton-Dyer for his address, proposed by Sir John Brunner, M.P., and seconded by Prof. Harvey Gibson, and the presentation of memorial keys to Mr. Hartley and Sir



FIG. 2.—Elementary Laboratory. Hartley Laboratories, Liverpool.

William Thiselton-Dyer, the guests adjourned to the Hartley Laboratories, which were thrown open for inspection.

THE HUGH MILLER CENTENARY.

THE proposal to celebrate the centenary of the birth of Hugh Miller during the present year has met with general approval, and the erection of an institute bearing his name in Cromarty has been admitted to be the best means of appropriately celebrating his memory.

It is intended that the Hugh Miller Institute shall take the form of a museum, where any relics pertaining to Miller can be kept; and a free library and reading room.

The centenary committee have had the promise of support from Hugh Miller's admirers in America and the colonies, as well as at home, and Mr. Carnegie, the generous supporter of such institutions as the proposed institute, has made the handsome offer to give 100% for every 100% raised by the committee.

It is desirable that the memorial should be as widely representative as possible, and the committee therefore appeal to all who appreciate the work accomplished by Hugh Miller in science and literature for contributions, in order that the scheme may be sufficiently advanced by the anniversary of his birth in October.

Contributions should be sent to the Treasurer, Commercial Bank, Cromarty.

The movement has the support of the following:—

Lord Balfour of Burleigh, Secretary for Scotland; Sir Archibald Geikie, F.R.S., LL.D.; Prof. Masson, LL.D.; Sir John Leng, M.P.; Sir Walter Foster, M.P.; C. J. Guthrie, K.C., Sheriff of Ross and Cromarty; W. C. Smith, LL.B.; Prof. Duns, Edinburgh; A. Taylor Innes, Esq., Edinburgh; Prof. Clarke, State College, New York; W. Robertson Nicol, LL.D.; A. Bignold, Esq., M.P.; Principal Rainy, D.D.; Alexander Whyte, D.D.; Colonel Ross, C.B., of Cromarty; Mr. James Barron, *Inverness Courier*; W. J. Watson, B.A., Secretary Inverness Field Club.

J. BAIN, Hon. Sec.,

Hugh Miller Centenary Committee.

Cromarty, May, 1902.

LAZARUS FUCHS.

THE name of Lazarus Fuchs will always be associated with the theory of linear differential equations, to which he gave an extraordinary impulse by his famous memoir published in the sixty-sixth volume of Crelle's *Journal*. In this paper the methods of modern function-theory are brought to bear upon the long-familiar process of solving a differential equation by series. The coefficients of the equation being supposed to be uniform analytical functions with isolated singularities, it is shown how to obtain, in the neighbourhood of an ordinary point, a complete set of independent integrals; the analytical form of these solutions is determined, and shown to depend upon a certain fundamental or indicial equation. It is proved, also, that the singularities of the integrals may be deduced from the coefficients without integration, and the notion of regular integrals is developed. The distinction is made between the integrals which involve logarithms and those which do not, and attention is drawn to those equations the integrals of which have no essential singularity. Thus in a single memoir of moderate length all the essential features of an extensive theory are presented in a clear and comprehensive outline.

In the rapid development which followed the publication of this memoir, the author naturally took a prominent part. Among his important contributions may be mentioned his researches on linear equations with algebraic integrals, on constructing linear equations the integrals of which have assigned singularities, and on equations the integrals of which are connected by algebraic relations. An instructive illustration of the general theory is given by his memoir on the equation satisfied by the elliptic integrals K, K' .

When the independent variable describes a closed curve, a set of integrals undergo a linear substitution, and all the substitutions arising from different paths form a group associated with the equation. M. Poincaré assigned the name of Fuchsian functions to functions invariant for a group of linear transformations of the variable in recognition of Fuchs's results concerning equations of the second order.

Fuchs's mathematical papers are very pleasant to read and free from that tendency to heaviness which is apt to belong to memoirs on differential equations. He had the faculty of bringing out clearly the really important points without over-elaborate detail, and he did not disdain to show the power of his methods by applying them to specific and definite problems. In these respects he may be compared with Halphen. While admitting that his way was prepared by the work of Cauchy, Briot and Bouquet, and Riemann, we may fairly claim for him that he has been the effective pioneer in a vast and fascinating region.

It is interesting to remember that Henry Smith, in a presidential address to the London Mathematical Society

in 1876, directed attention to the importance of Fuchs's then recent publications. How true was his forecast, that "they must form the basis of all future inquiries on this part of the subject," the history of the years that followed has fully shown.

Fuchs was born at Moschin (Posen), May 5, 1833; he became extraordinary professor at Berlin in 1866, ordinary professor at Greifswald in 1869, at Göttingen in 1874, at Heidelberg in 1875, and finally at Berlin in 1884. G. B. M.

CARLO RIVA.

ITALIAN geology has sustained a heavy loss in the death of the young and accomplished Docent in petrography and Assistant in the mineralogical laboratory of the University of Pavia, Dr. Carlo Riva, who was killed by an avalanche on the 3rd inst. while ascending Monte Grigna. Besides contributing descriptions of various Italian minerals, he specially interested himself in the study of the volcanic rocks of Italy, and in conjunction with his friend G. de Lorenzo he had been for some time engaged in a detailed investigation of the volcanic cones and rocks of the "Campi Phlegræi." The first fruits of this conjoint labour appeared a year or two ago in a monograph on the remarkable but seldom visited cone of the island of Vivara, which was noticed in NATURE last year. Never before had such a combination of geological and petrographical skill been devoted to any of the old volcanoes of that classic district, so that geologists who had seen the memoir looked forward with much interest to the application of the same talents to the other cones. It is understood that the account of Astroni was far advanced towards completion. But all this bright promise of a career that would have advanced the cause of science and shed lustre on the scientific work of Italy has been abruptly quenched. Those who knew Carlo Riva personally will keenly feel the untimely extinction of a nature so gentle and kindly, so enthusiastic and unwearied in pursuit of science, so full of power and yet so modest and retiring. He has died a martyr to the energy with which he followed his favourite studies, and carries with him to the grave the respect and affection of a wide circle of friends.

A. G.

NOTES.

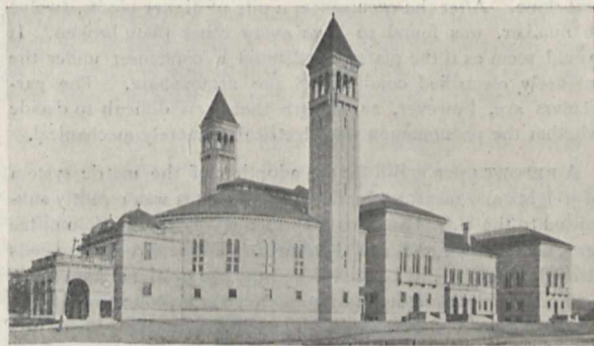
THE Prince and Princess of Wales were present at the Royal Institution on Friday last when Sir Benjamin Baker delivered a lecture on "The Nile Dams and Reservoir." Before the lecture several striking experiments were shown to their Royal Highnesses by Lord Rayleigh, Sir William Crookes, Prof. Dewar and Prof. Macfadyen.

THE Rome correspondent of the *Daily Mail* announces that the Accademia dei Lincei has decided to give Mr. Marconi a prize of 400*l.* as a reward for his work with wireless telegraphy. From the same source we learn that Mr. Pierpont Morgan has presented a set of cut precious stones, valued at 2000*l.*, to the museum of the Jardin des Plantes, at Paris.

SEVERAL correspondents have sent to the daily papers accounts of the fall of a yellow powder on June 1 and 2 during a thunderstorm. At Great Yeldham, in Essex, and at Langport, Somerset, this yellow sediment was found after the storm had subsided, and was thought to be sulphur. Mr. C. Turner has, however, pointed out in the *Times* that the substance supposed to be sulphur is in reality the pollen from pine trees. This is often produced in large quantities and has many times been mistaken in country places for "showers of sulphur."

MR. F. FINN sends us from Calcutta an account of colour variation in a family of pigeons which have sprung from a pair of homing pigeons imported from England last year. "Of the original pair," he says, "the cock is a blue chequer and hen a silver chequer. None, however, of their descendants have been silver, but all blue chequers, with the exception of one, a blue almost exactly resembling the wild *Columba livia*, but with no white on the back. As against this one case of reversion, there have been two of progressive variation; for two birds, grandchildren of the original pair, though of different broods, show white in the tail, though their parents and grandparents had none." A naturalist to whom the observations have been shown remarks:—"The production of white feathers in the tail I should hardly regard as a case of progressive variation. It is more probably a reversion to some previous ancestor. Homing pigeons are not bred for colour, and it is almost certain that some of the ancestors of the pair sent would have had white feathers in the tail."

AT the forthcoming meeting of the American Association at Pittsburg, several of the sections and affiliated societies will meet in the Carnegie Institute, where the offices and reception room of the Association will also be situated. The accompanying view of the Institute is reproduced from the preliminary programme of the meeting. The local committee is a large one and contains many leading men and women connected with Pittsburg; Mr.



Carnegie Institute, Pittsburg.

George Westinghouse, jun., is the president. It is noteworthy as evidence of sympathy with scientific efforts that the following resolutions were adopted unanimously on March 24 by the Federation of Churches at Pittsburg, Allegheny and vicinity:—"Inasmuch as all truth is one and is divine and inasmuch as all organisations for its conservation and propagation are kindred, the Federation of Churches of Pittsburg, Allegheny and vicinity records its pleasure in the fact that the American Association for the Advancement of Science is to hold its anniversary in Pittsburg this year. In behalf of the churches we desire a large and representative meeting here of the seers and prophets of science. In behalf of those interested in the advancement of education and knowledge we extend to them a hearty welcome."

THE seventh annual congress of the South-Eastern Union of Scientific Societies, held at Canterbury on June 5-7, was as successful as any of the preceding ones. Thirty-seven societies are now affiliated to the Union, a slight increase on last year; the accounts showed a small balance, and the attendance was good. An invitation to meet at Dover next year was accepted, and Sir Henry Howorth, F.R.S., was elected president for that meeting. Papers were read on "The Marine Aquarium," by Mr. Sibert Saunders, and on "Mycorrhiza," by Miss A. Lorrain Smith; Prof. Poulton gave a lecture on "Recent Researches on

Mimicry in Insects," illustrated by lantern-slides in natural colours; a discussion on the measures to be adopted for the preservation of our indigenous flora was initiated by Prof. Boulger and Mr. E. A. Martin; and papers on "Well-sections," by Mr. Whitaker, and on "Eolithic Flint Implements," by Mr. E. R. Harrison, were taken as read, but will appear in *The South-Eastern Naturalist* for 1902. The event of the meeting, however, was the address by the president, Dr. Jonathan Hutchinson, F.R.S., on leprosy, with special reference to its antiquarian aspects, with reasoned argument against the theory of contagion. The congress was held, by permission of the governors, in the Simon Langton Schools, where an excellent local museum had been got together, including marine aquaria exhibited by Mr. Saunders, Mr. Harrison's eoliths, and many fresh specimens of the British orchids, so well represented in the district. The members visited the Cathedral, and were entertained at the deanery by the Dean and Mrs. Farrar, and were also received, on the Friday evening, by the Mayor and Mayoress. The congress terminated on the Saturday afternoon in a visit to the South-Eastern Agricultural College, Wye, at the invitation of the principal, Prof. A. D. Hall, where the members were shown over the farms and laboratories by the staff of the college.

A CURIOUS effect produced by lightning is described to us by Dr. Enfield, writing from Jefferson, Iowa, U.S. A house which he visited was struck by lightning so that much damage was done. After the occurrence, a pile of dinner plates, twelve in number, was found to have every other plate broken. It would seem as if the plates constituted a condenser under the intensely electrified condition of the atmosphere. The particulars are, however, so meagre that it is difficult to decide whether the phenomenon was electrical or merely mechanical.

A REPORT upon a Bill for the adoption of the metric system of weights and measures in the United States was recently submitted to the U.S. House of Representatives by the Committee on Coinage, Weights and Measures. The report recommends strongly that the Bill be passed and the use of the system made compulsory because of its international character, educational benefits and commercial advantages. The scientific world to-day enjoys the advantages of a universal system of weights and measures, and this fact has doubtless facilitated the development and spread of natural knowledge. With regard to the introduction of the system into a country, the experience of other nations has shown that the confusion and inconvenience caused by a change in the measures used in daily life are largely over-estimated. Finally, the committee remarks:—"It should be kept in mind that the metric system is just as capable of a binary subdivision as any other, although the advantages of such a division are only apparent in the most ordinary business transactions and for the first few subdivisions. After the adoption of the metric system, the use of the half and quarter metre and half and quarter kilogramme would be as common as our half and quarter dollar—smaller quantities would be expressed in decimals precisely the same as in the case of our money. In 1866, Congress legalised the metric system. From that time on it has been growing in favour and in practical use. It is here to stay, not only in scientific work, but in commerce and manufacturing. It is now used by about two-thirds of the people of the world. . . . Your committee believe the time has come for the gradual retirement of our confusing, illogical, irrational system and the substitution of something better. The first step in this direction should be the introduction of the metric weights and measures into the departments of the Government. The use of these weights and measures will simplify their work. It will familiarise the people with them and encourage their application to the common affairs of life. Your committee have no doubt

that the benefits to be derived will far more than compensate for such inconvenience and expense as may be involved in the change."

EXPERIMENTS with a system of wireless telephony are being carried out (according to the *Scientific American*) in America by Mr. Stubblefield. The results so far have been of a promising nature, conversation having been successfully transmitted over several hundred yards on land and several hundred feet on water. The system used is an earth-conduction one, and is, therefore, similar in principle to, though doubtless differing in detail from, many other wireless telephony systems which are being tried in various countries. We have had occasion to comment on these in *NATURE* from time to time during the past year. It cannot be said that the results which have as yet been obtained by any of the experimenters are of sufficiently striking value to justify the prediction of a great future before this method of communication. But it is evident that many inventors are attacking the problem, and it is likely, therefore, that something of practical utility may be developed by their efforts. It is easy to conceive of many circumstances in which an earth-conduction telephonic system, even of limited range, would be very valuable.

A PAPER on the accuracy of an improved form of silver voltameter, by Messrs. T. W. Richards and G. W. Heimrod, is published in the *Proceedings* of the American Academy of Arts and Sciences for April. The silver anode is suspended in a porous pot, which is itself hung inside the platinum crucible serving as cathode. The level of the nitrate solution inside the porous pot is kept slightly lower than that outside, and thus outward filtration of the anode liquid is prevented. The authors not only examined the accuracy of the voltameter, but made a valuable investigation of the effects of the various impurities likely to result from irregularities in the electrolysis or anode. As a result of this, and from the data furnished by the experiments with the porous pot voltameter, corrections are deduced for the determinations of the electrochemical equivalent of silver made by Lord Rayleigh and Mrs. Sidgwick, F. and W. Kohlrausch, Kahle, and Patterson and Guthe respectively. The corrected figures give a mean result of 0.0011175, none of the four individual values differing from this by more than 0.02 per cent. Hence the number of coulombs associated with one gram-equivalent of any electrolyte is 96,580.

A PAPER on the sensitiveness of the coherer, by E. R. Wolcott, appears in No. 51 of the *Bulletin* of the University of Wisconsin. The experiments were carried out with coherers of two pieces of metal in light contact, as it was found that these gave more consistent results than "filings" coherers. Different metals were tried, and also the effect of coating different metals with a film of the same substance, such as collodion. The author concludes that both the metal and the coating affect the sensitiveness. Aluminium was found to be the most regular in response, but nickel showed the lowest critical potential, that is to say, responded to the least energy; this probably accounts for its value in long-distance wireless telegraphy. The author examines his results with reference to the theories of the coherer's action put forward by Branly, Lodge, Bose, and Guthe and Trowbridge. Guthe and Trowbridge's theory explains more of the phenomena than do any of the others, though all the observed facts are admissible on Lodge's theory. Some of the facts, it is said, are in disagreement with the theories advanced by Branly and Bose.

DR. C. DIENER contributes to the *Jahrbuch der k.-k. geol. Reichsanstalt* (Band li. Heft 2) an appreciative article dealing with the scientific work of Albrecht von Kraft, whose untimely

death in September last year brought to an end a career of great promise. Dr. von Krafft had already earned his reputation as an able geologist while occupied on the Geological Survey of Austria, previous to joining the staff of the Geological Survey of India in 1899. In that year, and subsequently, he accomplished brilliant work in the Himalayas, and showed himself to be exceptionally well qualified for the difficult tasks allotted to him. His early death at the age of thirty has caused the profoundest regret in geological circles.

THE Royal Meteorological Institute of the Netherlands has issued its fifty-first year-book, containing observations for 1899. This is the first volume of a new series, in which the results are presented in the form adopted by the International Meteorological Committee, and is a great improvement upon the form in which the observations have hitherto been published.

MR. MAXWELL HALL has published a paper (No. 275) on the temperatures of Kingston, Jamaica, for the years 1881-98. The annual mean is $78^{\circ}\cdot 8$, highest maximum $96^{\circ}\cdot 7$, in August 1891, lowest minimum $56^{\circ}\cdot 7$, in December 1887. The lowest mean maxima occurred in 1884 and 1893, near the times of the sun-spot maxima, and the highest in 1889, at the time of the sun-spot minimum, and these effects are reproduced in the mean temperature column. A table is also given showing the rainfall in Jamaica from about ninety stations between 1866 and 1900; the greatest fall was $90\cdot 6$ inches, in 1886, and the least $45\cdot 2$ inches, in 1872.

MR. R. SWORDY sends us a few particulars of a somewhat remarkable shower of hailstones which fell in Cheltenham and the surrounding district on June 7, shortly before noon. At first the hailstones were more or less round and like small crystallised raspberries; but during the latter and main part of the shower they were in the form of wedges or small cones, somewhat varied in shape. Many of these hailstones were about three-quarters of an inch in height and measured about half an inch across. Mr. Swordy suggests that these were only conic sectional parts of what had been much larger hailstones. To test this view he put some selected ice cones in a circle and added two more layers upon the first circle and a key wedge or cone at the top. By this arrangement he obtained half an ice-ball, consisting of fifteen sections. The hailstones when first formed may therefore have been about the size of "ping-pong" balls, and about an inch and a half or two inches in diameter. Mr. Swordy adds:—"The grain of the ice in these sections (which, I presume, had formed the balls originally) radiated from the centre towards the outside, and were hardest on what I suppose had been the outside; so that it is probable that the freezing, which must have commenced from the outside of each water globule and progressed towards the centre, thus bringing pressure to bear on the centre of each ball, may have caused them to explode and form the cones mentioned."

IN a note on "mathematical meteorology," Prof. Luigi de Marchi contributes to the Lombardy *Rendiconti* an investigation of the equations of motion of air-currents due to variations of temperature, with especial reference to the effect of solar eclipses. The action of an eclipse, it is pointed out, is to produce what Mr. Helm Clayton has called a cyclone with a cold centre.

WE have received from Messrs. A. E. Staley and Co. a copy of the fourth edition of "Manipulation of the Microscope," by the well-known optician, Mr. Edward Bausch. It is a small illustrated handbook specially designed to meet the wants of beginners, and the sections dealing with the use and care of the microscope have been reprinted for distribution in class-rooms and laboratories.

No. 182 of the *Bulletin* of the French Physical Society contains a note on a new "electric valve" for transforming reciprocating currents into direct currents, due to M. Nodon. This "valve" is based on the property, discovered by Buff in 1857, that an aluminium electrode plunged in an electrolyte offers a great resistance to the passage of a current in which it is the anode. The efficiency of M. Nodon's apparatus, as measured by a wattmeter, reaches 75 to 80 per cent.

AN oxy-acetylene blowpipe is described by M. Fouché in the *Bulletin* of the French Physical Society, No. 182. The flame is formed by the combustion of a mixture of one part of acetylene to 1·8 of oxygen, and in order that the explosion may not travel back into the blowpipe a jet velocity is required due to the pressure of a water column 4 metres in height. The flame melts most metals readily; it will solder iron and steel, and even silica and lime are melted by it. With a reduction of the proportion of oxygen the flame becomes luminous, and on falling on lime the free carbon goes to form carbide of lime.

IN the *Rendiconto* of the Naples Academy, viii. 2. Signor E. Cesàro deals with certain limitations of constants in the analytical theory of heat. His investigation refers to the property that in order to satisfy the partial differential equation $\nabla^2 u + ku$ throughout a given region S, subject to the boundary condition $du/dn + hu = 0$ at the surface of S, the constant k must for a given value of h belong to a discrete series of positive quantities, which all increase with h . The author also discusses the question of the expansion of the temperature due to an initial distribution in a series of functions of the form considered.

PROF. LE NEVE FOSTER has given a useful practical address on the study of mineral veins (*Trans. Royal Geol. Soc. Cornwall*, vol. xii. part vii.). Mr. J. B. Hill, in dealing with the relation of the plutonic and other intrusive rocks in west Cornwall to the mineral ores, expresses the opinion that the intrusion of the greenstones was separated by no great interval from the irruption of the granites, and that the copper and tin lodes originated in pre-Triassic times and followed closely on the cooling of the intrusive rocks.

A *Bulletin* issued by the U.S. Department of Agriculture concerning Kentucky bluegrass seed affords a striking instance of the amount of trouble which Americans will take to improve a product of comparatively trifling value. The cultivation of bluegrass is confined to a small area in the States of Kentucky, Missouri and Iowa. The harvesting is performed entirely or partially by hand, as automatic strippers do not seem to find favour.

THE latest number of the *Journal* of the Royal Horticultural Society completes the twenty-sixth volume. Two articles of an economic nature suggest to fruit-growers the possibility of making a profit out of surplus fruit. Mr. Austin claims to have devised a practical and efficient method of putting up fruit in bottles, while Mr. Udale brings forward the results obtained by drying fruits and vegetables in special evaporators. There is no apparent reason why the British farmer should not take up these industries and possibly oust imported articles. Captain Hurst having made a study of the characters of certain orchid hybrids, finds that they confirm the laws evolved by Mendel as the outcome of his experiments in hybridisation.

THE Report of the Zoological Society of Philadelphia for 1901 shows that the institution is in a flourishing condition. It is satisfactory to learn that the educational value of the menagerie is fully realised by the public schools of the city, which are in the habit of sending parties of scholars accompanied by teachers.

WE have received a copy of the second edition of the excellent little manual of the fauna and flora of Haileybury, issued by the Haileybury Natural Science Society under the supervision of Mr. F. W. Headley. The compilation and publication of similar local lists may be recommended to all school societies of a like nature.

IN the *Verhandlungen* of the Natural History Society of Prussian Rheinland, &c., for 1901, Dr. O. Follmann describes and figures an interesting new type of crinoid from the "Coblenzschichten" under the name of *Hystriocrinus schwerdii*. To the same journal Herr Leverkus-Leverkusen, of Bonn, contributes an account of the present and past distribution of the elk.

The Country for June contains several interesting and well-illustrated articles on subjects connected with natural history and domesticated animals. Mr. W. F. Kirby, for instance, writes on common garden insects, while Mr. Harrison Weir discourses on the old English game-fowl, and Mr. Edwin Brough, of Scarborough, the well-known breeder of blood-hounds, describes some of the characteristic traits of his favourites.

AN important account of the ascidians of the Bermudas, by Dr. W. G. van Name, appears in the January and February issues of the *Transactions* of the Connecticut Academy (vol. xi.). The seas around these islands are remarkably rich in ascidians, and since but little has previously been done in the way of collecting, the writer has been able to describe quite a number of new types, both generic and specific. The memoir is illustrated by several plates.

ACCORDING to *Nature Notes* for June, the Society for the Protection of Birds has just issued the regulations and conditions for the first annual competitions open to elementary schools in the East Riding of Yorkshire and in Berkshire for challenge-shields and prizes in connection with "bird and tree day." The day is to be in November—probably the 8th—and essays are to be sent in during September. Any bird killed, or any eggs or nests taken for the purposes of the competition, will disqualify not only the actual offender, but all his fellow-scholars.

AT an egg-sale recently held at Mr. Stevens's auction rooms, Covent Garden, a moa's egg from New Zealand, reputed to be the finest in existence, was offered. Since, however, it did not reach the reserve price of 200*l.* it was withdrawn. Another example was sold some years ago for 250*l.* Thirty-eight guineas was the sum realised by the largest known egg of the extinct "roc" (*Aepyornis maximus*) of Madagascar; while two eggs of the pectoral sandpiper—the first of their kind ever offered in England—fetched 8*l.* 18*s.* 6*d.*

THE insect-enemies of the pine in the Black Hills Forest Reserve form the subject of *Bulletin* No. 12 (second series) of the Entomological Division of the U.S. Department of Agriculture. According to the author, Dr. A. D. Hopkins, the forests of rock-pine in the district in question have suffered very severely of late years from insect-ravages, the dying or dead trees covering large areas. The primary cause of the mischief is a small bark-burrowing beetle of a species hitherto undescribed, for which the name *Dendroctonus ponderosa* is suggested. After the first attack by this species, several other insects aid in the work of destruction. Various remedies are suggested by the author.

THE *Eastern Morning News* of June 3 contains an account of the reopening, by the Mayor, of the museum at Hull, which was some time ago taken over by the Corporation from the Literary and Philosophical Society. Since the transference, the contents of the museum have been thoroughly overhauled and

rearranged by the curator, Mr. T. Sheppard, who has introduced order and system where chaos formerly held sway. The value of the exhibits is estimated at considerably more than 5000*l.*; many specimens of interest cannot, however, be shown for lack of proper cases. At the opening ceremony it was announced that the fine collection of British birds' eggs formed by the late Mr. J. Swailes had been presented to the museum by his brother, Mr. G. Swailes. In the rearrangement of the collections the educational value of the museum has been specially borne in mind.

A LECTURE on the natural history of the Chatham Islands, delivered by Dr. A. Dendy on March 4, is reported at length in No. 12 of vol. xlvi. of the *Manchester Memoirs*. Chatham Island and the adjacent Pitt Island appear to have once formed a portion of New Zealand, and are of especial interest as being the home of the Moriori, a race nearly exterminated by their cousins the Maori between 1835 and 1840. After giving a brief sketch of the flora of the islands, the author turns to that of the fauna, which, as might be expected, is nearly akin to that of New Zealand. Especially noticeable is the number of flightless birds, most of which are in danger of extermination owing to the introduction of predatory mammals.

TOTEMISM is a blessed word, and there is a real danger at the present time that any animal cult may be relegated in an off-hand manner to totemism. The very careful study of the relations between men and animals in Sarawak by Drs. Charles Hose and McDougall in vol. xxxi. of the *Journal* of the Anthropological Institute (p. 173) is, therefore, especially welcome, as it is the result of many years of observation on the part of one of the authors among most of the important peoples of Sarawak.

NO less than 150 periodicals and publications of scientific and technical societies are now regularly abstracted in *Science Abstracts*, so that the magazine takes a comprehensive view of progress in physical sciences and their applications. Among recent additions to publications abstracted are several Russian, Danish, Dutch, Norwegian and Swedish journals which are only accessible to a limited circle of readers, though many important papers are published in them. The abstracts will enable workers in physics and physical chemistry to keep in touch with practically every advance in their subjects.

SCIENCE is represented in the *Fortnightly Review* for June by two popular articles—one by Mr. Marconi, on "The Practicability of Wireless Telegraphy," and the other by Mr. Carl Snyder, on "Dr. Loeb's Researches and Discoveries." Beginning with the message sent in June, 1898, by Lord Kelvin "commercially paid at Alum Bay for transmission through ether" to Sir George Stokes at Cambridge, an account is given by Mr. Marconi of the messages since sent, without wires, from the Royal yacht, in connection with the international yacht race, and the United States Navy trials. Mr. Snyder describes and interprets the work accomplished by Dr. Loeb at Chicago University in the domain of chemical physiology, and that on which Dr. Matthews is engaged in the same institution in connection with nerve functions.

VOL. xl. of the *Zeitschrift für physikalische Chemie* contains a publication, by C. Benedicks, on the electrical conductivity of steel and pure iron, the investigation of which has given some very interesting results. It is shown that equivalent quantities of different elements, when dissolved in iron, increase the electrical resistance by the same amount. This is proved experimentally in the case of carbon, silicon, manganese and phosphorus, the increase of the resistance for one dissolved atom per one hundred atoms of the solution being 5.9 micro-ohms per cubic centimetre. The presence of carbide in the iron has, on the other hand, very little influence on the resistance. From the

electrical data certain conclusions have been drawn which are no doubt of considerable importance for the chemistry of steel and iron.

MESSRS. LONGMANS, GREEN AND CO. have just published new editions of two well-known works of science—Ganot's "Physics" and Schäfer's "Essentials of Histology." Dr. Atkinson's translation of Ganot's "Éléments de Physique" has long been accepted as a standard description of the groundwork of physical science, and the sixteenth edition, edited by Prof. A. W. Reinold, F.R.S., will increase the high reputation the book has gained. Though physical science, even in its most elementary stages, needs to be studied practically to be of any value, the results obtained in the laboratory can only be fully understood by considering them in relation to the investigations of makers of scientific history. The best instruction in physics is that which combines a course of practical work with such exact and philosophical descriptions as are found in Ganot's book. Practice without knowledge of theory is as bad as theory without practice. Prof. Reinold has added new matter, as well as revised the book, with the result that a comprehensive view is given of fundamental physical principles and relationships as now understood, suitable for elementary students of the science. The sections on magnetism and electricity have been greatly altered, and accounts of apparatus and machines which have ceased to be of interest have been omitted. Prof. E. A. Schäfer's "Essentials of Histology, Descriptive and Practical, for the Use of Students" has reached its sixth edition. The work has been greatly enlarged, the chief additions being in the text relating to the structure of the central nervous system. Many new illustrations have also been added. The volume is both an elementary text-book of histology and a practical manual giving students precise directions for the microscopical examination of the tissues.

THE additions to the Zoological Society's Gardens during the past week include two Cape Zorillas (*Ictonyx zorrilla*) from South Africa, presented by Capt. W. B. White; a Red-footed Ground Squirrel (*Xerus erythropus*) from West Africa, presented by Mr. P. G. Knight; a Ruddy Finch (*Carpodacus erythrinus*) from Siberia, presented by Mrs. G. A. Way; two Mountain Ka-Kas (*Nestor notabilis*) from New Zealand, presented by Dr. W. H. Hornibrook; two European Pond Tortoises (*Emys orbicularis*), European, presented by Mr. E. C. Brown; two and three Moloch Lizards (*Moloch horridus*) from Australia, presented respectively by Mr. F. Richards and Mr. W. Nichols; a Common Viper (*Vipera beris*), British, presented by Mr. E. Ball; two Striated Babblers (*Aryga earlii*), a Roofed Terrapin (*Kachuga tectum*) from India, two Blyth's Nicobar Parrakeets (*Palaeornis caniceps*) from the Nicobar Islands, two Black Iguanas (*Metopoceros cornutus*) from the West Indies, a Royal Python (*Python regius*) from West Africa, a Corn Snake (*Coluber guttatus*) from North America, deposited; a Banksian Cockatoo (*Calyptorhynchus banksii*) from New South Wales, purchased; a Thar (*Hemitragus jemlaica*) born in the Gardens.

THE ROYAL OBSERVATORY VISITATION.

ON Saturday last the Board of Visitors made their annual visit to Greenwich, and the Astronomer Royal submitted his report for the past twelve months.

It cannot be said, however, that the weather was all that could be desired for such an occasion and for this time of the year.

The following is a brief *résumé* of the report:—

Transit-Circle.

With this instrument the usual observations have been made, the undermentioned table giving the details of the number involved.

Transits, the separate limbs being counted as one observation	11,133
Determinations of collimation error	303
Determinations of level error	663
Circle observations	9,666
Determinations of nadir point (included in the number of circle observations)	681
Reflection observations of stars (similarly included)	505
The number of stars observed in 1901 was 4,327.	

Good progress seems to have been made in the observations of the reference stars for the astrographic plates, for which 10,000 stars are to be observed three times above and twice below pole—with the exception of about 1000 stars fainter than the ninth magnitude which cannot be observed below pole. A table giving the details of the progress up to date shows that for each of the five degrees of N.P.D. reckoning from the pole, 100, 90, 46, 46, and 45 per cent. respectively of the necessary observations have been secured.

The change in the method of adopting the azimuth error introduced at the beginning of 1900 has effected a satisfactory diminution of the small discordance in right ascensions taken on opposite sides of the pole.

The colatitude of the transit-circle as found from observations of about 581 stars in 1901 is $38^{\circ} 31' 21''.76$, differing by $-0''.14$ from the adopted value. The values of this correction since 1897 are—

1897	...	$-0''.17$	1900	...	$-0''.10$
1898	...	$-0''.15$	1901	...	$-0''.14$
1899	...	$-0''.14$			

Very satisfactory progress has been made with the re-reduction of Groombridge's observations, the three years 1809, 1810 and 1811 with 10,500 observations of R.A. and N.P.D. having been finished since the last report. A catalogue of the positions of the stars in the *Berliner Jahrbuch* derived from Groombridge's observations from 1806-1810 was forwarded to Dr. Auwers for use in the preparation of his fundamental catalogue, and he found that a large increase in accuracy had been effected by the re-reduction.

The Allazimuth.

Through the frequent breaking of the spider lines in this instrument, the micrometer slides have been altered to reduce the span, and the result has been very satisfactory. The instrument has been used in the meridian in four positions as a reversible transit-circle for observations of sun, moon, planets, and fundamental stars, and also for observation of the Eros reference stars, and reference stars for Sir David Gill's heliometer observations of major planets. The total number of observations made was 6556.

Further determinations of the division errors have been completed, and these have been combined with the previous results and definitive corrections for division error deduced.

The Reflex Zenith Tube.

This instrument was, as is well known, originally designed by Sir G. B. Airy for the purpose of determining the constant of aberration by observations of γ Draconis, which passes very near the zenith of Greenwich, but after many years of observations it was found that the results for parallax of γ Draconis and aberration were anomalous, and an attempt was made in the years 1882 to 1886 by a long series of transits over the wires to refer these discordances to temperature effects, but without success. The observations of zenith distance of γ Draconis were, however, continued up to 1899, when they were dropped owing to the pressure of observations for the new Ten Year Catalogue. This instrument has, however, become of great importance, for Mr. Chandler has recently shown that the apparently anomalous results previously obtained are explained by the variation of latitude, and that this instrument is specially adapted to the determination of the amount of this variation.

It has therefore in consequence been decided to resume the observations of γ Draconis without delay, and to observe such other stars as passed near enough to the zenith and were sufficiently bright. By suitable modifications it has been found possible to increase the utility of the instrument, by which several other stars down to the seventh magnitude can be observed.

The 28-inch Refractor.

This instrument has been used throughout the year for micro-metric measurements of double stars. The total number of double stars measured in the year is 382; of these 221 have components less than 1'' 0 apart, and 120 less than 0'' 5. The close pairs whose distance apart is less than 1'' 0 have been measured on the average on three nights each, and the wider pairs on an average of two nights. The wider pairs consist of bright stars with a faint companion, of third companions to close pairs, and of stars of special interest.

In addition to the list of most difficult and interesting stars measured, it is stated that good series of measures have been obtained of κ Pegasi, δ Equulei, γ Ophiuchi, and ζ Herculis. Capella also has been examined at every favourable opportunity.

Thompson Equatorial.

This instrument has been used chiefly for photographing Neptune and his satellite, and 52 measurable photographs were secured. With the 30-inch reflector long exposed photographs of Nova Persei were obtained, but unfortunately, owing to the object-glass of the guiding telescope not being quite firm in its cell, displacements during exposure occurred.

Astrographic Equatorial.

The photography for the Greenwich zone (Dec. + 64° to the Pole) having been practically completed, the work during the past year was directed to replacing such plates as were found to be inferior to the general standard. Four hundred and thirteen plates were taken, but of these fifty-seven were for various reasons rejected.

The report contains many details about the measurement of the plates, the counting of the number of stars, and various other preparations which would occupy too much space, but the following table may be given, as a good idea of the magnitude of the new work can be at once gathered:—

Limits of Declination.	Number of Stars Measured.	Number	Number in A.G.C.	A.G.C.
64°-65°	8,954	1,900	1,200	Helsingfors
65°-70°	49,210	7,782	3,700	Christiania
70°-75°	50,190	5,870	—	Dorpat
75°-77°	18,100	1,856	1,700	Kazan
77°-78° (oh. to 16h.)	5,430	613	420	"

Spectroscopic and Heliographic Observations.

For the year 1901, Greenwich photographs have been selected for measurement on 149 days, and photographs from India and Mauritius (filling up gaps in the series) on 210 days, making a total of 359 days out of 365 on which photographs are at present available.

The proportion of days upon which the sun was entirely free from spots was 80 per cent. for the year 1901, and about the same proportion for 1902 to the date of this report. But the appearance of two considerable groups this year, and the high latitudes of the spots generally, are indications that the actual minimum is passed.

Magnetic Observations.

The variations of magnetic declination, horizontal force and vertical force, and of earth currents, have been registered photographically, and accompanying eye observations of absolute declination, horizontal force, and dip have been made as in former years. The regular determinations of magnetic declination, horizontal force, and dip have been made with the new declinometer, the Gibson deflection instrument, and the Airy dip circle mounted in the Magnetic Pavilion.

The principal results for the magnetic elements for 1901 are as follow:—

- Mean declination 16° 26' 0 West.
- Mean horizontal force ... 4' 0082 (in British units).
- 1' 8481 (in metric units).
- Mean dip (with 3-inch needles) ... 67° 6' 5".

These results depend on observations made in the new Magnetic Pavilion, and are free from any disturbing effect of iron.

The magnetic disturbances in 1901 have been small and few in number. There were no days of great magnetic disturbance and 8 of lesser disturbance.

Meteorological Observations.

The registration of atmospheric pressure, temperature of the air, and of evaporation, pressure and velocity of the wind, rainfall, sunshine and atmospheric electricity has been continuously maintained.

The mean temperature for the year 1901 was 49° 3, being 0° 2 below the average for the fifty years 1841-90.

During the twelve months ending 1902 April 30, the highest temperature in the shade (recorded on the open stand in the Magnetic Pavilion enclosure) was 87° 9 on July 19. The highest temperature recorded in the Stevenson screen in the enclosure was 86° 0, and in that in the Observatory grounds 87° 1 on the same day.

The lowest temperature of the air recorded in the year was 14° 3, on February 16. During the winter there were 52 days on which the temperature fell below 32°, a number slightly below the average.

The low temperature in February is the lowest temperature recorded in that month since 1895, when, on February 8, the minimum February temperature 6° 9 occurred.

The number of hours of bright sunshine recorded during the twelve months ending 1902 April 30, by the Campbell-Stokes instrument, was 1519 out of 4457 hours during which the sun was above the horizon, so that the mean proportion of sunshine for the year was 0'341, constant sunshine being represented by 1.

The rainfall for the year ending 1902 April 30 was 17'89 inches, being 6'65 inches less than the average of fifty years. The number of rainy days was 116. The rainfall has been less than the average in each year since 1894. The total deficiency of rainfall for the seven years ending 1901 December 31 amounts to 23'70 inches.

The remaining portion of the report deals with the printing and distribution of the Greenwich publications, the examination of chronometers, time-signals, &c.

A short reference is made to the re-determination of the Greenwich-Paris longitude, and to the expedition which went out to Sumatra and Mauritius to observe the total solar eclipse of May 18, 1901.

EVIDENCE OF A "SEICHE" ON A SCOTTISH LOCH.

WHILE engaged in the survey of Loch Triage, Inverness-shire, on May 22, Dr. T. N. Johnston and Mr. J. Parsons, of the British Lakes Survey, observed what appears to be an undoubted *seiche*, i.e. a periodic variation in the level of a lake, considered by Prof. Forel, among others, to be due to sudden changes in barometric pressure, whilst others, again, consider them due to earth-movements.

The attention of Dr. Johnston was first drawn to the phenomenon by observing that certain small stones near the shore were covered and uncovered at regular intervals, the surface of the loch being perfectly calm at the time, and had been so during the day.

At a quarter to 9 p.m., a foot rule was placed vertically in the water and the surface level observed at intervals of one minute for forty minutes.

The results obtained confirmed the rougher observation that the surface of the water was undergoing slow oscillations.

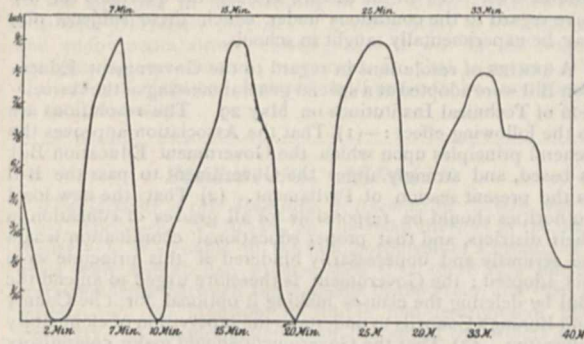
The amplitude of the wave proved to be $\frac{9}{16}$ inch, and the period, i.e. the time taken in rising from the lowest to the highest level and falling again, averaged 9'5 minutes.

Despite the smallness of the amplitude compared to that noticed on the Lake of Geneva and other lakes, the observers had no doubt that the movements were not due to surface ripples.

Loch Triage is about six miles long and three-quarters of a mile wide, its longer axis lying nearly north and south. The survey of the loch is now completed, and a depth of 436 feet has been found within two miles of the southern extremity.

Should this variation of level prove to be a true *seiche* it will

be the first recorded on a Scottish loch, with the possible exception of a considerable rise and fall of the water of Loch Tay in 1784, which has been considered an example of this phenomenon.



The accompanying curve represents the variations in level observed on Loch Tieg, the ordinates representing periods of one minute and the abscissae changes of $\frac{1}{8}$ inch in the level.

THE MINING STATISTICS OF THE WORLD.

OWING to the lack of uniformity and the want of completeness in the official statistics published in the countries where mining and quarrying are carried on, the compilation of the mineral statistics of the world is a task of extreme difficulty. The work is, however, carried out every year with conspicuous success by Prof. C. Le Neve Foster, F.R.S., in the Home Office general report on mines and quarries. The fourth part of this report, which has recently been issued, deals with the colonial and foreign statistics for 1900, and constitutes a work of reference of permanent value. It is impossible to imagine a more concise, a better arranged, or a more inexpensive collection of comparative mineral statistics. Last year's report was noticed at length in NATURE (April 4, 1901, p. 551), and as the general arrangement has been closely followed in the new issue, the nature of the work may best be called to mind by citing a few of the more important figures that furnish a comparison as regards labour, output and safety in various parts of the world.

The following figures are given for the world's mineral production in 1900:—

	The World.	British Empire.	United Kingdom.	United States.
Coal, metric tons ...	767,636,204	247,938,725	228,794,919	244,901,839
Iron, metric tons ...	40,427,435	4,987,641	4,741,835	14,014,475
Copper, metric tons ...	534,735	41,456	777	275,008
Lead, metric tons ...	787,841	73,203	24,755	245,757
Tin, metric tons ...	80,643	51,624	4,336	—
Zinc, metric tons ...	446,373	13,417	9,211	112,419
Petroleum, metric tons... ..	18,553,950	241,344	—	7,485,579
Salt, metric tons ...	12,572,076	3,131,029	1,891,217	2,650,075
Fine gold, kilogrammes ...	393,196	188,491	415	119,913
Fine silver, kilogrammes ...	5,874,284	582,932	5,936	1,862,829

The figures given show that although Great Britain has had for a second time to give to the United States the first place in the production of coal, the British Empire as a whole is still the largest producer of solid mineral fuel, yielding nearly one-third of the world's output. The gold output of the British Empire is also the largest, and will probably increase. The United States, however, comes first in the production of the ores of copper, iron and lead. The German Empire, with 153,350 tons, is the largest zinc producer, and Russia, with 9,827,822 tons, is the largest producer of petroleum. Thanks to Tasmania and the Federated Malay States, the British Empire possesses the most productive deposits of tin ore.

The comparison of the figures relating to labour gives some

interesting results. In 1900 the number of persons employed in the mines and quarries of the various countries was as follows:—The world 4,475,355, the British Empire 2,883,200, the United Kingdom 908,412, the United States 506,830 (returns incomplete), Germany 733,683, France 309,815, Belgium 171,467, Austria-Hungary 226,330, Russia 286,983, Italy 102,728, and Japan 119,667.

As regards the safety of its miners, Great Britain takes a high place. The number of fatal accidents in collieries per 1000 persons employed was as follows in the year under review:—Great Britain 1.29, Germany 2.19, Austria 1.08, France 1.42, Belgium 1.05, and United States 3.29. In the United States the death rate, both in bituminous coal mines and in anthracite mines, is considerably higher than in the United Kingdom. The rapid extension of machine mining in the United States is very remarkable. In 1891, it is stated, only 6.7 per cent. of the output of bituminous coal was obtained by the aid of coal-cutting machinery; in 1900 the proportion had risen to 25 per cent.

The abundant and accurate references to current literature given in footnotes form a very valuable feature of the report. Hundreds of books, pamphlets and newspapers in various languages have been consulted, and much interesting information derived from them is recorded.

In one or two cases, statements are quoted that are, perhaps, open to criticism. For example, the statement that Dr. Carl Peters gives many excellent reasons for supposing that Macombe's country, south of the Zambesi, in Portuguese East Africa, is the Ophir of Scripture hardly gives a correct impression of the prolonged controversy as to the site of Ophir. Moreover, so competent an authority as Prof. A. H. Keane has recently decided in favour of the south of Arabia. Ophir, he shows, was not the place at which the gold, to which it gave its name, was found; it was the emporium to which the products of the east and south were brought and from which they were distributed. Another statement which is not strictly accurate is that the yield of the oil wells of the United States almost equals that of all the rest of the world put together. In view of the fact that the Russian output is given as 2,342,243 metric tons more than that of the United States, this statement is somewhat misleading.

It is interesting to note the effect of the war in South Africa on the mineral production. In the Transvaal the output of gold was small; and in Natal until March 1900 all the collieries were in the possession of the invaders, the output of coal being consequently comparatively small. In the Orange River Colony mining was carried on under very great difficulties and upon a very reduced scale. In Cape Colony the siege of Kimberley and the war generally interfered greatly with mining. In Rhodesia, however, the output of gold showed a steady increase, and the future prospects of the industry have been much brightened by the discovery of rich deposits of coal. In the Wankie coalfield alone, which lies 190 miles north-west of Bulawayo, the workable seams are considered capable of yielding 1500 million tons of coal.

It is impossible within the limits of this notice to refer to all the points of interest suggested by the report; but enough has been said to show to how wide a circle of readers this invaluable work of reference appeals. B. H. B.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—An examination for one geographical scholarship of the value of 60*l.* will be held on October 14. Candidates, who must have taken honours in one of the final schools of the University, should send in their names to the Reader in geography not later than October 1. The scholar elected will be required to attend the full course of instruction at the school of geography during the academic year 1902-1903, and to enter for the University diploma in geography in June, 1903.

CAMBRIDGE.—The Mathematical Tripos list, Part i., was published on June 10. The senior wrangler this year is Mr. E. Cunningham, St. John's College. Mr. F. Slator, also of St. John's, is the second wrangler.

The Rede lecture was delivered in the Senate House on June 10 by Prof. Osborne Reynolds, F.R.S., the subject being "On an Inversion of Ideas as to the Structure of the Universe."

The honorary degree of Doctor of Science has been conferred upon Principal Rucker, F.R.S., and Sir H. H. Johnston.

SOME remarks upon the subject of medical education were made on June 5 by Mr. Asquith, M.P., at the festival dinner of the London Medical Graduates' College and Polyclinic. He expressed the opinion that in all the professions England compares most unfavourably with America, Germany and most other countries in the lack of provision for the continuation of education in its technical and applied forms after the ordinary term of academic life has been reached. Medicine, which is at the same time a science and an art, is every year receiving vast accumulations of new observations and new experiments which must profoundly modify the conception of both the theory and the treatment of disease. Adequate provision must therefore be made for post-graduate research if scientific knowledge of disease is to be increased.

THE thirty-seventh annual programme just received from the Massachusetts Institute of Technology contains a full statement of the courses of instruction at this well-known institution and a register of the alumni, the whole publication forming a prospectus of more than four hundred pages. The Institute offers thirteen separate courses in applied science, each of four years' duration. The laboratories of the Institute are numerous and extensive; their equipment is correspondingly ample, and is kept well up to the rapid advances in technical practice. Provision is made for exact general training in the problems of physics and chemistry for highly specialised work in these and other sciences, and for engineering tests and processes on a practical scale. The large number of students at the Institute, no less than the increasing demands of modern scientific education, have made necessary new laboratories for the departments of electrical engineering and physics. Buildings of a most complete kind have been designed for these purposes, and their erection will be begun early in the spring of 1902. They will cost, with their equipment, between 400,000 dollars and 500,000 dollars.

THE second volume of the report of the United States Commissioner of Education for the year 1899-1900 is a closely printed book of 1368 pages. The series to which it is the latest addition does for educationists what the annual reports of the Smithsonian Institution do for men of science. There is to be found brought together in these portly volumes everything of importance which has taken place, not only in American education, but in that of all the great countries of the world. The plan adopted in the Smithsonian reports, of reprinting valuable contributions collected from various sources, is followed in the volume before us, with the result that many of the addresses and essays by English educational authorities, to which attention has been directed from time to time in these columns, are here to be found printed in full. The prominence given to the higher grades of education shows very clearly that, while making strenuous efforts to perfect their systems of primary and secondary education, the authorities in the States are not losing sight of the paramount importance of technical and university work. Chapters are given to "Institutions for Higher Education," "Professional Schools," "Agricultural and Mechanical Colleges," and "Commercial and Business Schools." Though few teachers can find time to study the reports brought out from year to year, much of the information contained in the volumes is of permanent value and will often be referred to by students of education.

SEVERAL points in the revised regulations for matriculation at the University of London are worthy of notice. The list of subjects has already been given (p. 69). There are only two obligatory subjects—English and elementary mathematics. Latin is optional with one of several sciences; and two other subjects have to be selected from a list of twenty branches of knowledge. Under the new regulations, therefore, it will be possible to matriculate at the University of London, and to proceed to a degree, without taking any science subject. The short syllabus of mathematics shows the influence of the reformer. Under arithmetic mention is made of the metric system, contracted methods, approximations to a specified degree of accuracy, and practical applications. Algebra includes graphs of simple rational integral algebraic functions. In geometry the subjects of Euclid I.-IV. will be taken, but Euclid's proof will not be insisted upon. The short syllabuses of optional sciences are prefaced by the remark "The examinations in science shall aim at ascertaining whether candi-

dates possess a knowledge of fundamental scientific methods, acquired by observation of nature or by a simple course of experiment in physical measurement, or by the investigation of simple problems and commonly occurring phenomena illustrating natural laws." In all the science subjects the questions set will have regard to the conditions under which these subjects may best be experimentally taught in schools.

A SERIES of resolutions in regard to the Government Education Bill were adopted at a special general meeting of the Association of Technical Institutions on May 29. The resolutions are to the following effect:—(1) That the Association approves the general principles upon which the Government Education Bill is based, and strongly urges the Government to pass the Bill in the present session of Parliament. (2) That the new local authorities should be responsible for all grades of education in their districts, and that proper educational coordination would be seriously and unnecessarily hindered if this principle were not adopted; the Government is therefore urged to amend the Bill by deleting the clauses making it optional for the County and Borough Councils to undertake the supervision of elementary education. (3) That the Government should make compulsory the application to the purposes of higher education of the residue under the Local Taxation (Customs and Excise) Act, 1890. (4) That, inasmuch as the Local Authorities constituted by the Bill will have to make good the deficiencies in elementary and general secondary education, as well as to support and improve technical education, and will be obliged to raise increased rates in order to do this efficiently, it is feared that in many cases these authorities will shrink from the necessary expenditure unless encouraged by increased aid from the national exchequer. The Government is therefore asked to promise to provide larger sums for educational purposes. (5) That there should be no statutory limit to the amount to be expended on higher education. (6) That the majority of the Education Committee should be appointed by and from the council of the County Council or County Borough Council. (7) That any attempt to alter the provisions of the first two sections of clause 18 of the Education Bill will be resisted. (8) That London may receive attention early next year, and that it would be unwise to depart from the general principles of the present Bill in the case of the metropolis.

THE ideal University for London, described by Prof. E. H. Starling, F.R.S., in the Foundation Day oration delivered at University College, London, on June 5, was much the same as that advocated in these columns on several occasions. Prof. Starling said that in the University there would be a centre in each of the four quarters of London. Each of those centres would be in so far a complete University in that it would be a place for study and research in all branches of knowledge and would be a community of teachers and scholars. The local business affairs of each centre would be under the control of a committee or council appointed by the senate of the University, but containing representatives of the local body of professors. All those centres would be but parts of this University, with common aims, with similar curricula, and the same standard of examination. The senate of the University, which would contain representatives from all centres, would be responsible for the appointment of the local governing bodies and would keep in its own hands the power of appointing and dismissing professors. It would be possible in that way to provide for the training of 10,000 students within the University of London, and to ensure the freedom of teaching and research and the living contact of each student with men of different ideals and modes of thought, which were the most valuable factors in a University training. Such a University could not be founded without the possession of adequate means. Each centre would necessitate the erection of buildings at a cost of about 500,000*l.* on ground covering from five to ten acres. For a moderate endowment of its professorships and the maintenance of its laboratories a yearly income of 50,000*l.* should be provided in addition to the income from students' fees, which might amount to another 30,000*l.* These might seem large sums to those who were ignorant of the money spent abroad by the State on Universities or of the income which was available from ancient endowments at Oxford and Cambridge. The united income of the colleges at Oxford was 330,000*l.* a year, and at Cambridge nearly 300,000*l.* a year. The yearly Government grant to the University of Strasburg, with only 1000 students, was 50,000*l.* He was convinced that there would be no difficulty

in raising those amounts in London, either by the generosity of its rich men or by grants from public funds, if only those interested in the making of a University would combine their efforts towards a common end. The task was rendered easier by the fact that in the building of the University they could utilise for University purposes in London many of the buildings and endowments already existing, and it was in the hope of inaugurating a common movement in that direction that University College had declared itself ready to be incorporated in the University.

SCIENTIFIC SERIALS.

Transactions of the American Mathematical Society, vol. iii. No. 2, April.—E. W. Brown, on the small divisors in the lunar theory.—J. W. Young, on the holomorphisms of a group. This deals with non-abelian groups such that there is a one-one correspondence between the elements of the group and their ath powers.—F. R. Moulton, a simple non-desarguesian plane geometry. A simpler system than that given by Hilbert in his "Grundlagen der Geometrie," with a proof that his axioms I. 1-2, II., III., IV. 1-5, V. are fulfilled, while Desargues' theorem is not true.—M. Bôcher, on the real solutions of systems of two homogeneous linear differential equations of the first order. Propositions relating to $y' = Py - Qz$, $z' = Ry - Sz$ analogous to those given by Sturm for $y'' + py' + qy = 0$.—Charlotte A. Scott, on a recent method of dealing with the intersections of plane curves. The method in question is that of F. S. Macaulay (*Proc. L.M.S.* vols. xxxi., xxxii.).—E. V. Huntington, a complete set of postulates for the theory of absolute continuous magnitude. Six postulates are laid down, and shown to be consistent and independent of each other. A short paper by the same author follows, on the postulates for the theories of positive integral and positive rational numbers.

Bulletin of the American Mathematical Society, second series, vol. viii. No. 8, May.—C. J. Keyser, concerning the angles and the angular determination of planes in 4-space.—D. R. Curtiss, note on the sufficient conditions for an analytic function.—Reviews:—Scheffer's "Theory of Surfaces," by J. M. Page; "Some Recent Books on Mechanics," by E. B. Wilson; "The Galois Theory in Burnside and Panton's Theory of Equations"; and shorter notices.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 20.—"On a Peculiarity of the Cerebral Commissures in certain Marsupialia, not hitherto recognised as a Distinctive Feature of the Diprotodontia," by Prof. G. Elliot Smith, M.D., Ch.M. Communicated by Prof. G. B. H. Howes, F.R.S.

It has been known for a considerable time that some of the fibres of the ventral commissure of the cerebrum in certain marsupials, instead of passing bodily into the *external* capsule, form an aberrant bundle, which associates itself with the *internal* capsule so as to reach the dorsal area of the neopallium by a shorter and slightly less circuitous course.

This peculiarity has been recorded by the late W. H. Flower, by Johnson Symington and by Theodor Ziehen in *Macropus*, *Phascolomys*, *Aepyprymnus*, *Phascolarctus* and the *Derbian Wallaby*, and in *Phalangista* by myself.

In 1894 I showed that while in the monotreme and *Perameles* the common mammalian relationship of the ventral commissure to the external capsule was found to obtain, in *Trichosurus* and *Macropus* some fibres of the ventral commissure were found to pursue the aberrant course indicated above. It was perhaps not unnatural to suppose that the increased size of the neopallium in these two genera was wholly responsible for the presence of this aberrant bundle; for it seemed that since the commissural fibres of the neopallium had become too abundant to be wholly accommodated by the path provided by the external capsule, they, so to speak, had overflowed into the internal capsular route.

Upon examining later a much larger series of marsupials, I soon became convinced that the explanation of the causation of this peculiarity which I then suggested could not be regarded as alone sufficient. I found the aberrant bundle in all members of the genera *Macropus*, *Halmaturus*, *Hypsiprymnus*, *Dendro-*

lagus, *Trichosurus*, *Petaurus*, *Phascolarctus* and *Phascolomys*, quite irrespective of the size of the brain and extent of the neopallium; but I sought it in vain in *Perameles*, *Sarcophilus*, *Dasyurus*, *Sminthopsis*, *Didelphys*, *Myrmecobius*, and *Notoxyctes*, even though many of these genera possess larger brains than some Diprotodonts.

These facts seemed to suggest that the aberrant bundle was a distinctive feature of the Diprotodont marsupials, and it appeared that the crucial test of this hypothesis would be afforded by the brain of *Thylacinus*, which, although that of a Polyprotodont, is almost, if not quite, as large as the brain of the largest Macropod. I accordingly submitted the cerebrum of *Thylacinus* to the test, and found no trace of the aberrant bundle, wherefore it is clear that the presence of this aberrant fasciculus of the ventral commissure is distinctive of the Diprotodontia.

The most pronounced growth tendency in the earliest mammals must have been an enormous increase in extent of the neopallium, for while at the beginning of the Eocene period this was almost as insignificant as it is in the Reptilia, in most recent mammals it attains a bulk which far exceeds that of the whole of the rest of the nervous system. This sudden expanse of the neopallium would lead to the development of an enormous mass of fibres which must find some outlet from the pallium; and there are only three possible routes for commissural fibres of the neopallium to the mesial plane. There is first the external capsule, which chiefly consists in all mammals of such fibres passing to the ventral commissure; we find the second route in the path mapped out by the internal capsule from the dorsolateral neopallial area to it; and the third route can only involve the invasion of the alveus of the hippocampus.

All the neopallial commissural fibres in the Polyprotodontia and *some only* of these in the Diprotodontia and Eutheria follow the first route. The commissural fibres, which spring from the dorso-lateral region of the neopallium in the Diprotodontia, crowded out of the first route pursue the second. In the Eutheria the neopallial commissural fibres from the dorso-lateral region of the hemisphere forsake both the first and second routes and invade the alveus, so as to form a new dorsally situated neopallial commissure, which is the corpus callosum.

This hypothesis of the origin of the corpus callosum I have previously stated and discussed; and I refer to the matter now merely to point out that the same determining cause which in the Eutheria calls the "corpus callosum" into being is probably functional in bringing into existence the "aberrant bundle" in the Diprotodontia.

The development of any such commissural mass as the corpus callosum of the more highly organised Mammalia in the position occupied by its homologous fibres in the monotremes and marsupials would cause the most profound disruptions of the corpus striatum, optic thalamus, and the basal region of the brain, and the complete disorganisation of its whole; and hence the new course taken by its fibres in the Eutheria.

May 15.—"Cyanogenesis in Plants. Part II.—The Great Millet, *Sorghum vulgare*," by Wyndham R. Dunstan, M.A., F.R.S., Director of the Scientific Department of the Imperial Institute, and T. A. Henry, D.Sc. Lond.

May 29.—"On the Structure of the Gills of the Lamellibranchia," by Dr. W. G. Ridewood. Communicated by E. Ray Lankester, M.A., F.R.S.

This paper records the results of an investigation undertaken at the instance of Prof. E. Ray Lankester, F.R.S., and carried on under his supervision. 215 species of Lamellibranchia, belonging to 118 genera, were examined. The results demonstrate that although the minute structure of the gill, like the grosser structure, cannot be taken as a criterion of genetic affinity, three main types of structure can be recognised, representing apparently three grades of complexity.

The first type is distinguished by the mutual freedom of the gill leaflets into which the embryonic gill papillæ expand. In the other two types the embryonic papillæ elongate into filaments, which are held in juxtaposition by interlocking cilia, or by horizontal bars of cellular tissue.

Evidence is produced to show that Pelseneer's order Pseudolamellibranchia is based largely on a misconception of the relative value of the flatness or plication of the gill lamellæ, and the presence or absence of principal filaments.

In the family Solenidae particularly it is shown that different species and subgenera of the same genus may have their gill

lamellæ flat or plicate, and the filaments all of one kind or with enlarged principal filaments at intervals.

Avicula argentea proved to be a form of supreme interest, in that both ciliated discs and organic interfilamentar junctions are present.

Anomia aculeata is of no less interest, since it differs from the other species of *Anomia* examined, and resembles the rare *Dimya*, in that the gill filaments are not reflected.

The gills of *Vesicomya* and *Euciroa*, which were said by Dall to exhibit close resemblances with those of the Protobranchia, prove to be of the reticulate type.

The forms included by Pelseener in his order Septibranchia are, at least so far as can be judged by their branchial organs, degenerate molluscs of the *Lyonsiella* type, and the suppression of the Septibranchia as a distinct order is advocated.

Entomological Society, May 7.—The Rev. Canon Fowler, president, in the chair.—Mr. H. W. Shephard-Walwyn exhibited a gynandromorphous specimen of *Anthocaris cardamines*, taken near Winchester in 1899. The left side was that of a normal ♂, the right that of a normal ♀, with the exception of a splash of orange pigment on the underside of the primary.—Mr. H. Goss exhibited two ♂ specimens of *Saturnia carpini* from Essex, bred on whitethorn, and three ♂♂ of the same species caught in Surrey by the aid of bred (virgins) ♀♀. He remarked that as a rule bred specimens were smaller than wild, but the bred Essex specimens were much larger than those captured in Surrey. The Essex specimens were light in colour, while the Surrey specimens were not only much smaller in size, but very dark, probably because their larvæ had fed upon *Erica* or *Calluna*.—Colonel C. Swinhoe announced the emergence of *Cossus ligniperda* in the Zoological Society's Gardens from a pupa received in a piece of wood from South Africa, and said that it was remarkable that the species should have been introduced there and then brought back to Great Britain.—Prof. E. B. Poulton exhibited two *Euplectæna* captured in Fiji by Prof. Gilson, and presented by him to the Hope Department. The species, which belonged to the different genera *Nipara* and *Deragena*, bore the closest superficial resemblance to each other, affording an interesting example of Müllerian or synaposematic likeness.—Prof. Poulton also exhibited several specimens of *Smerinthus populi* which had been exposed during the pupal stage to the intense heat of July, 1900. In consequence of this "forcing," the moths emerged towards the end of that month, and were markedly different in colour from the normal, being much paler in tint with less distinct markings, and the red of the hind wings of a very different shade.—The Rev. A. E. Eaton exhibited drawings illustrating the wing of *Pampterinus latipennis*, Etn. MS., a remarkable dipterous fly of the family Psychodidae, from New Guinea, in the collection of the Hungarian National Museum, Budapest.—Prof. L. C. Miall, F.R.S., contributed a paper on a new Cricket of aquatic habits found in Fiji by Prof. Gustave Gilson, Dr. T. A. Chapman a paper on asymmetry in the males of Hemiarine and other Spingines, and Mr. E. Meyrick a paper on Lepidoptera from the Chatham Islands.

Geological Society, May 14.—Prof. Charles Lapworth, F.R.S., president, in the chair.—Pliocene glacio-fluviatile conglomerates in Subalpine France and Switzerland, by Mr. Charles S. Du Riche Preller. In the present paper the author describes a number of further deposits of typical Deckenschotter conglomerate recently examined in the Aare and Rhine valleys, near the confluence of those rivers, and shows that these, in conjunction with the Deckenschotter deposits of the Zurich district, indicate the almost unbroken outline of a Subalpine Deckenschotter cone, which extended from the base of the Alps in a north-westerly direction over a distance of about 25 miles, and was formed by the waters of the retreating Rhine (western) glacier and its affluents on a Molasse plateau, the upper and lower ends of which were at the contours of 900 metres and 500 metres respectively. He further describes a series of Deckenschotter deposits examined in the Rhone valley between Lausanne and Lyons, including the extensive plateau of the Dombes, east and north of Lyons, composed of marine marl overlain by the characteristic *conglomérat ferrugineux*, which some French geologists still regard as pre-Glacial and others as Quaternary, but which is typical Deckenschotter, and in the full acceptance of the term an *alluvion des plateaux*. The deposits thus described afford proof of the existence, in Upper Pliocene

times, of an extensive alluvial cone about 100 miles in length, which reached from Lausanne (probably even from the base of the Alps) to Lyons, and was formed by the waters of the retreating Rhone and Arve glaciers on a Molasse-and-marl plateau, the altitude of which above sea-level was 800 metres near Lausanne and 300 metres near Lyons. From this concurrent evidence in northern Switzerland and in the Rhone valley, the author is led to conclude that at the time of the deposition of those alluvial cones, the principal Subalpine valleys and lake-basins could not as yet have existed in their present form or depth, and must have been from 100 to 200 and 400 metres higher; and that the Subalpine valleys were eroded to their present depth in the course of the inter-Glacial period—now recognised to have been of very long duration—between the Pliocene and the Middle Pleistocene (or maximum) glaciations, and that the Subalpine lake-basins were formed in the same period by the contemporaneous action of fluvial erosion and of a zonal settling along the base of the Alps after these had been raised by horizontal pressure.—Overthrusts and other disturbances in the Braysdown Colliery (Somerset), and the bearing of these phenomena upon the effects of overthrust-faults in the Somerset coalfield in general, by Mr. F. A. Steart. This coalfield, although covered by comparatively undisturbed Secondary rocks, is in part the most disturbed and contorted of those known and worked in the United Kingdom. The "Radstock Seams" of the Upper Coal-measures at Radstock are traversed by a huge "overlap fault," which thrusts them forward for a great distance; this runs nearly east and west, and has parallel to it two smaller overthrusts. In one of them the coal at first dips towards the thrust, then it thickens from 2 to 6 or 8 feet, next it becomes inverted, and eventually regains its former character. The continuity of the coal has been proved in the case of three of the coal-veins. As there is practically the same sequence of strata on both sides of the fault, it is concluded that the "overthrusts" did not take place until all the coal-seams of the Radstock series had been deposited.

Royal Microscopical Society, May 21.—Dr. Hy. Woodward, F.R.S., president, in the chair.—Mr. T. W. Ersser brought for exhibition a new acetylene illuminator for the lantern which he said would give a light of 300 candle power for three hours at a cost of ninepence.—Mr. D. J. Scourfield gave an exhibition of freshwater Entomostraca. He confined himself to the Cladocera and to the illustration of their various habits of life and powers of movement, ranging from the free-swimming forms found in lakes to those which simply crawled in or on the mud. Most of the living specimens were shown in live boxes, but one specimen was attached to a pin by means of a small drop of sealing wax varnish, which permitted the creature to carry on all its movements without getting out of the field of view. A number of living and mounted specimens were exhibited under microscopes.

CAMBRIDGE.

Philosophical Society, May 19.—Prof. Macalister, president, in the chair.—Some observations on protandry and senescence in *Flabellum*, by Mr. J. Stanley Gardiner.—A note on the dispersive power of running water on skeletons: with particular reference to the skeletal remains of *Pithecanthropus erectus*, by Mr. W. L. H. Duckworth. This communication consisted in an account of the distribution of the bones of the skeleton of a horse along the bed of a mountain stream in North Wales. It was observed that the distance over which distribution had occurred was at least one hundred and fifty-three feet. This observation was applied to the case of the fossil bones found in a river bank in Java and described by their discoverer as those of an animal more closely allied to man than is any known ape and called *Pithecanthropus erectus*. One objection to this description rests on the fact that the two bones on which our knowledge of that animal is based were separated by a distance of nearly forty-nine feet, though on the same level. The present observation goes to show that this objection is not valid, inasmuch as the larger bones here mentioned were distributed over a considerably greater distance than forty-nine feet, by a stream of small dimensions.—The coral reefs of Zanzibar, by Mr. C. Crossland. The paper shows that the fringing reef which extends along the whole eastern or ocean side of Zanzibar Island is not due to recent growth, but is the result of the eroding action of the sea upon the margin of the mass of elevated coral limestone which forms this side of

the Island. The edge of the flat thus formed is protected by living organisms from further erosion, though no addition to the reef results for them. The only recently formed rocks which occur are (1) coral and nullipore growths in the boat channel, (2) the beginnings of new reefs round certain shoals and islands off the west coast. Zanzibar thus affords a comparison with the Bermudas, where the same cause, marine erosion, acting upon a differently formed but physically similar limestone, has produced a semblance, not merely of fringing reefs, but a "pseud-atoll."—On an attempt to detect the ionisation of solutions by the action of light and Röntgen rays, by Mr. J. A. Cunningham.—On the influence of molecular attraction on collisions, by Mr. O. W. Richardson. This paper is an extension of the method used by Sutherland (*Phil Mag.* [5] xxxvi. p. 507) to explain the variation of viscosity of gases with temperature. Its use is further illustrated by calculating the rate of recombination of X-ray ions in air.—On the influence of ultra-violet radiation on the discharge in a vacuum tube having a polished zinc electrode, by Mr. W. C. Baker.—On the variation of double refraction in strained glass with wave-length, by Mr. L. N. G. Filon.

EDINBURGH.

Royal Society, May 19.—Prof. Duns in the chair.—Mr. R. C. Mossman, in a note on the meteorological conditions accompanying "föhn" and up-bank thaws in Glen Nevis, gave an account of some observations he had made last winter, when he had carried out a series of hourly readings of temperature, pressure and humidity at the head of Glen Nevis. On certain occasions he found the air in the glen to be much warmer and drier than at Fort William, the barometer also being higher. The barometric gradient was from east to west, so that the air was drawn away from the base of the mountain and replaced by air from higher altitudes. Excursions were made on the surrounding hills during the föhn, which was found to extend to a height of 2000 feet. The weather was very fine, but a somewhat similar phenomenon was found in rainy weather. A number of cases of up-bank thaws were also described. In these the temperature, which normally falls as the height increases, is higher at the higher altitudes. For example, on February 1, at 10 a.m., the temperature on the top of Ben Nevis was 20°·4 F. higher than in the Glen. The phenomenon was explained as due to the sliding of the cold air down the hillsides into the valleys, which, because of the freer radiation during intense frost, become colder than the hillsides.—Mr. Mossman also read a paper on the meteorology of Edinburgh, in which he brought down his previously published historical record to the end of the last century. The present communication covered the ten years from 1891 to 1900. The paper also dealt with epidemics in relation to the weather from 1497, and with wheat prices from 1801.—Prof. A. Smith, in a paper on the influence of varying temperature and pressure on the vapour density of calomel vapour, sought to distinguish whether the vapour of calomel under ordinary conditions contains HgCl or Hg₂Cl₂ in addition to mercury and mercuric chloride, the presence of which has been demonstrated definitely although their quantity is unknown.—Two communications were also received from Dr. Thomas Muir, on vanishing aggregates of secondary minors of a perysymmetric determinant, and on the theory of orthogonants in the historical order of its development up to 1854.

DUBLIN.

Royal Dublin Society, May 21.—Prof. T. Johnson in the chair.—Dr. W. E. Adeney read a paper on the chemistry of respiration in bacteria. The experiments described in this communication have been made with a view of gaining some information as to the actual course of respiration within the protoplast. The course of physiological oxidation has been studied by determining the atmospheric oxygen consumed, the carbon dioxide formed, and also the ammonia formed, during different stages of fermentation, from commencement to completion, in very dilute unsterilised distilled water solutions of asparagine, of albumose and of Rochelle salt, these substances being selected on account of the simple nature of the result, of their aerobic fermentation. The asparagine was found to be quickly hydrolysed during the earlier stages of the fermentation into ammonia and aspartic acid, the last-named substance then undergoing complete oxidation in regular gradations, the final amounts of carbon dioxide and ammonia formed accounting for about 70 per cent. of the carbon and 85 per cent. of the nitrogen originally present in the aspara-

gine. The course of oxidation of the albumose took place in approximately regular gradations throughout the course of fermentation, and is graphically represented by an approximately straight line, both when the carbon dioxide formed is taken against the oxygen consumed and when it is taken against the ammonia which is also formed in the process of oxidation. The course of oxidation of the asparagine, after being hydrolysed into aspartic acid, is also graphically represented by an approximately straight line, whether the carbon dioxide formed be taken against the oxygen consumed or against the ammonia formed. The oxidation of the Rochelle salt occurs in two separate and approximately equal steps, and its course in each takes place in equal gradations, since in both it is graphically represented by straight lines. The quantity of salt completely oxidised amounts to about 75 per cent. of the whole. A similar proportion of the albumose was also found to be completely oxidised during its fermentation. It appears to the author as most probable from the results here referred to, and from others obtained from his experiments on dissolved gases and fermentative changes, already published in the *Transactions and Proceedings* of the Society, that the course and nature of physiological oxidation under aerobic conditions in solutions of similar composition will be found to be similar in nature for all unicellular organisms, and will only vary in degree as the supply of energy required for vital activity may vary for different organisms.—Prof. J. Joly, F.R.S., described some experiments on the influence of light on sedimentation.—Mr. Richard J. Moss gave an account of a deposit from a steam boiler fed with the water of the river Vartry with which Dublin is supplied.

PARIS.

Academy of Sciences, June 2.—M. Bouquet de la Grye in the chair.—On Abelian functions with complex multiplication, by M. G. Humbert.—The experimental study of the dissociation of the constitutive elements of the energy used in motors employed in the production of positive work, by M. A. Chauveau. A comparison of the energy losses in the production of a given amount of work in the cases of inanimate and animate motors.—The mean distribution of the stellar images in the negatives of the map of the sky obtained at the Observatory of Toulouse, by M. B. Baillaud. The examination of forty-two negatives taken at Toulouse gave results agreeing with those recently published by Turner from observations made at Oxford.—The viscosity in the neighbourhood of the critical point, by M. P. Duhem. Theoretical considerations are developed which appear to render a satisfactory account of all the peculiarities presented by fluids in the neighbourhood of the critical point.—Magnetic work round the central *massif* of Madagascar, by M. P. Colin. The magnetic declination was determined at thirty-five stations, the inclination at twenty-four, and the intensity at twenty-five, the results being given in a table.—On the cranial characters and the affinities of *Lophiodon*, by M. Ch. Deperet.—On the constitution of nebulae, by M. Charles Nordmann. It has recently been shown by the author that the hypothesis of an electromagnetic radiation from the sun is sufficient to explain in a simple manner many celestial and meteorological phenomena. The same hypothesis may also be extended to explain some of the phenomena exhibited by nebulae.—Connection between the photographs of the solar corona taken at the total eclipse of May 18, 1901, and those of the entire solar chromosphere obtained on the same day at Meudon, by M. H. Deslandres. Among the results of the expedition to Sumatra organised by the Lick Observatory for the observation of the total eclipse of May, 1901, was a negative showing a good image of the solar corona. From this it appeared that in the latitude of 9°, in the north-east quadrant, there was a disturbance of the coronal rays special to this region. A comparison of this photograph with ordinary negatives of the solar photosphere taken at Greenwich and in India showed no sign of spot or even of special activity of the surface on May 17 and 18, but on May 19 a spot appeared in latitude 9°, in the north-east quadrant, which was remarked by Perrine as being intimately connected with the coronal disturbance. An examination of the negatives obtained at Meudon at the same time completely confirms this view.—On differential equations of the second order which admit of a finite continuous group of algebraic transformations, by M. Obriot.—On two problems in geometry, by M. Servant.—On a method of comparing motors of different powers, by M. Max. Ringelmann. The amount of fuel used per hour in internal

combustion engines is regarded as a linear function of the power of the engine. Considerations deduced from this formula were applied to the discussion of the relative merits of alcohol motors at a recent competition.—On the specific inductive capacity of dielectrics at low temperatures, by MM. Jacques Curie and P. Compan. The soakage effects in glass tend to disappear at low temperatures. The dielectric capacity varies as a linear function of the temperature, the temperature coefficient being determined for glass, ebonite, mica and quartz.—The influence of the voltage in the formation of ozone, by M. A. Chassy. When the voltage is sufficiently high for the discharge to take place, the production of ozone is proportional to the square of the difference of potential which exists between the armatures.—Contribution to the study of the magnesium light. Measurement of the speed of combustion and the chronophotography of the light, by M. Albert Londe. It has usually been considered that the average time of exposure in taking a photograph by means of a magnesium flash light powder was of the order of 1/100 of a second. Exact measurements, however, have shown that the time is much slower, varying from $\frac{1}{4}$ to $\frac{1}{25}$ of a second and averaging 1/10 of a second. This time is too great to permit of photographs of rapidly moving objects being made in this way.—Stereoscopic examination in radiology, and illusions in the appreciation of relief, by M. Th. Guilloz.—On the electrocapillary properties of organic bases and their salts, by M. Gouy.—Preparation of the anhydrous chlorides of samarium, yttrium and ytterbium, by M. Camille Matignon. The anhydrous chlorides of ytterbium and samarium were obtained for the first time by heating the hydrated salts in a current of hydrochloric acid gas.—Ammoniacal copper oxide, by M. Bouzat. Starting from copper hydrate and ammonia, the cuprammoniacal base is formed with a slight disengagement of heat, the base formed being much stronger than ammonia.—The action of monochloroacetic ester upon diazobenzene chlorides, by M. G. Favrel. The reaction is similar to that described by Japp and Klingemann for methylacetoacetic and ethylacetoacetic esters. The acetyl group is eliminated and hydrazones are formed.—On some salts of benzylamine, by M. René Dhommée. A description of the preparation and properties of the nitrate, sulphate, borate, chromate, oxalate and benzoate of benzylamine.—On *Staurosoma parasiticum*, by MM. M. Caullery and F. Mesnil.—Bacterial parasites of the intestine of the larvæ of *Chironomus plumosus*, by M. Louis Léger.—The quantitative variations of plankton in the lake of Geneva, by M. Emile Yung.—On the presence of osseous tissue in certain fishes of the Palæozoic strata of Canyon City, Colorado, by M. Leon Vaillant. In the fauna of these strata, which is one of the oldest known, not only are there undoubtedly vertebrates, but these were sufficiently advanced for the conjunctive tissue to have evolved up to a perfectly osseous state.—On the presence of the Lower Devonian in the Western Sahara, by M. G. B. M. Flamand.—On the seismic movements and magnetic disturbances at the commencement of May at the station of Uccle, Belgium, by M. Eug. Lagrange.—On the ashes from the eruptions of Mont Pelée in 1851 and 1902, by M. A. Lacroix. The products of the present eruption are different from those thrown out in 1851.—On vaccination against plague, cholera and typhoid, by M. Besredka.

DIARY OF SOCIETIES.

THURSDAY, JUNE 12.

ROYAL SOCIETY, at 4.30.—(1) The Influence of an Atmosphere of Oxygen on the Respiratory Exchange. (2) The Influence of High Pressure of Oxygen on the Circulation of the Blood: L. Hill, F.R.S., and J. J. R. Macleod.—On the Parasitism of *Pseudomonas destructans* (Potter): Prof. M. C. Potter.—On the Toxic Properties of the Saliva of certain "Non-Poisonous" Colubridæ: Prof. A. Alcock, F.R.S., and Dr. L. Rogers.—The Dissipation of Energy by Electric Currents induced in an Iron Cylinder when Rotated in a Magnetic Field: Prof. E. Wilson.

FRIDAY, JUNE 13.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Observations of Jupiter made at Mr. Crossley's Observatory, 1901: J. Gledhill.—Further Observations of Nova Persei: A. Stanley Williams.—A Dark Reticle: C. S. Howe.—Epheméris for Physical Observations of Mars, 1902-3: A. C. D. Crommelin.—On the Distribution of the Stars in the Cape Photographic Durchmusterung: A. M. W. Downing.—Reductions of Photographs of Swift's Comet (α 1809) taken at Cambridge Observatory with a Portrait Lens: L. N. G. Filon.—On the Principle of the Arithmetic Mean: H. C. Plummer.—Observations of the Total Eclipse of the Moon, 1902 April 22: Perth Observatory, Western Australia.—Probable paper:—Experimental Reduction of Photographs of Eros for the Determination of Solar Parallax, Second Paper: A. R. Hinks.

MONDAY, JUNE 16.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Geographical and Archaeological Explorations in Chinese Turkestan: Dr. M. A. Stein.

TUESDAY, JUNE 17.

ZOOLOGICAL SOCIETY, at 8.30.—Certain Habits of Animals traced in the Arrangement of their Hair: Dr. Walter Kidd.—On the Carpal Organ in the Female *Hapalennur griseus*: F. E. Beddard, F.R.S.—On some Points in the Anatomy of the Alimentary and Nervous Systems of the Pedipalpi: R. I. Pocock.
ROYAL STATISTICAL SOCIETY, at 5.

WEDNESDAY, JUNE 18.

ROYAL METEOROLOGICAL SOCIETY, at 4.30.—English Climatology, 1891-1900: F. Campbell Bayard.—Earth Temperatures recorded in Upper India: W. L. Dallas.
ROYAL MICROSCOPICAL SOCIETY, at 8.—The Genus *Synchæta*: A Monographic Study with Description of Five New Species: C. F. Roussetlet.
CHEMICAL SOCIETY, at 5.30.—Elimination of a Nitro-group on Diazotization. Dinitro- β -anisidine: R. Meldola and J. V. Eyre.—A New Type of Substituted Nitrogen Chlorides: F. D. Chattaway.—The Colour-changes exhibited by the Chlorides of Cobalt and some other Metals, from the Standpoint of the Theory of Electro-affinity: F. G. Donnan and H. Bassett, jun.—An Accurate Method of determining the Compressibility of Vapours: B. D. Steele.—The Molecular Condition of Borax in Solution: H. S. Shelton.—Preliminary Notice of some New Derivatives of Pinene and other Terpenes: W. A. Tilden and H. Burrows.—The Preparation of Pure Chlorine and its Behaviour towards Hydrogen: J. W. Mellor and E. J. Russell.

THURSDAY, JUNE 19.

ROYAL SOCIETY, at 4.30.—Probable Papers:—On the Correlation between the Barometric Height at Stations on the Eastern Side of the Atlantic: Miss F. E. Cave-Browne-Cave and Prof. K. Pearson, F.R.S.—Note on the Effect of Mercury Vapour on the Spectrum of Helium: Prof. J. Norman Collie, F.R.S.—On Colour-physiology of the Higher Crustacea: F. W. Keeble and Dr. F. W. Gamble.—The Seed-Fungus of *Lolium temulentum*: L. the Darnel, or Poisonous Rye-grass: E. M. Freeman.—On the Measurement of Temperature. Part I. On the Pressure Coefficients of Hydrogen and Helium at Constant Volume, and at different Initial Pressures: Dr. M. W. Travers and Dr. A. Jacquesod.—On the Measurement of Temperature. Part II. On the Vapour Pressures of Liquid Oxygen at Temperatures below its Boiling Point, and the Constant Volume Hydrogen and Helium Scales: Dr. M. W. Travers, G. Senter and Dr. A. Jacquesod.—On the Measurement of Temperature. Part III. On the Vapour Pressures of Liquid Hydrogen at Temperatures below its Boiling Point on the Constant Volume Hydrogen and Helium Scales: Dr. M. W. Travers and Dr. A. Jacquesod.
LINNEAN SOCIETY, at 8.—On *Obesiella*, a New Genus of Copepoda: Dr. W. G. Ridewood.—On Modern Methods in Mycology: Mr. G. Massee.—Further Observations on the Owls, especially their Skeleton: W. P. Pycraft.

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