THURSDAY, MARCH 28, 1901.

THE BOOK OF ANTELOPES.

The Book of Antelopes. By P. L. Sclater and O. Thomas. 4 vols. Illustrated. (London: Porter, 1894-1900.) Price, 13*l.* 10*s.* net.

IT was the intention of the late Sir Victor Brooke, who for many years of his life devoted a large amount of time and attention to the study of the ruminants generally, to write an illustrated monograph of that interesting and beautiful, although ill-defined, section of them commonly known as antelopes. And with this end in view he instructed the late Mr. Joseph Wolf to prepare a number of coloured sketches of these animals, which were in due course transferred to stone, printed off, and coloured by hand. A considerable bulk of manuscript was also written by Sir Victor; but, for some reason or another, the work was never brought to anything like completion during his lifetime.

And perhaps it was fortunate for science that the material thus accumulated was left in this unfinished state. For the opening-up of Somaliland and East Africa in general, as well as continued exploration in the heart of the continent, have of late years made us acquainted with quite a number of antelopes which were altogether unknown, or but very imperfectly known, to Sir Victor Brooke, so that if the work had been published during his lifetime it would necessarily have been extremely incomplete and imperfect.

By the generosity of Sir Victor's executors the whole of these drawings, plates and manuscript were unreservedly placed at the disposal of the senior author of the splendid volumes before us, who for many years had made constant endeavours to increase our knowledge of the antelopes of Africa, and by whom many remarkable new types had been brought to the notice of the zoological world. As the work would have been too heavy for a man with as many calls on his time as has the secretary of the Zoological Society to carry out alone, Mr. Sclater secured the assistance of Mr. Thomas, of the British Museum. Such additional plates as were necessary to complete the series of the more striking types of antelopes were duly put in hand and completed. And the result of this happy union of forces has been, after several years of arduous labour, to produce a work the like of which has never before been seen, and which will remain a monument alike of the ability and industry of its authors and of a group of lovely animals which are only too rapidly and too surely disappearing for ever before the advance of an all-devouring civilisation.

Despite the fact that the new sketches lack the inimitable touch characteristic of Wolf's animal pictures, they accord fairly well with lithographic reproductions of the latter, and in certain instances are their superior in truthfulness to nature. For in sketches of this description there is always a danger lest fidelity to the model should be sacrificed to artistic effect, an instance in point occurring in the case of Mrs. Gray's waterbuck of the White Nile.

Although coloured figures of a number of the more striking South African antelopes appeared in the well-known sporting work by the late Sir Cornwallis Harris, while Dr. Gray, in the British Museum "Catalogue of Ruminant Animals," published in 1872, gave a complete list of the species then known to him, no fully illustrated monograph of this group of ruminants has, we believe, ever previously been published—at least in this country—so that the authors have the field practically to themselves. In Gray's Catalogue a total of 101 species of these animals were recognised, of which no less than 81 are African; but in a "Hand-list" published a year later the number was reduced to 98, owing to three of the African names having been found to be synonyms of others. In the present monograph, the authors, apart from a few described during the progress of the work, recognise a total of no less than 133 distinct species, about 120 of which are African. It is true that certain of these so-called species might be regarded by other naturalists (now possibly in some instances by the authors themselves) in the light of local races; but, even making allowance for such possible reductions, the increase in the number of well-established species of these animals since the date of Gray's last list is very noteworthy, and bears eloquent testimony to the energy with which African zoology has been worked up of late years. As the great majority of these new species have been described by one or other of the authors, it was only right and proper that the task of monographing the entire group should have fallen to their lot.

Although most of us have a general and vague idea of what constitutes an "antelope," yet it is somewhat remarkable that the group of animals thus designated is one that does not admit of accurate limitation or definition. Some, for instance, might consider that the chamois and the so-called white goat of the Rocky Mountains were entitled to be included in the group; but this is not the view held by the authors of the present monograph. As a matter of fact, the term is only a vague designation for a number of more or less distinct groups of hollow-horned ruminants which come under the designation neither of cattle, sheep nor goats; and in reality there ought to be a distinct English group-name for each subfamily into which "antelopes" are subdivided by our authors. But we must take things as we find them, and such subdivisions being impossible in colloquial language, we cannot do better than agree to employ the term "antelopes" in the sense in which it is used by the authors; that is to say, as indicating the animals treated of in this work, and no others.

As they have occasion to use it so frequently, it is perhaps a little remarkable that the authors have apparently made no attempt to trace the origin and derivation of the word "antelope." So far as can be determined it appears, however, to trace its origin, through the Latin, to *Pantholops*, the old Coptic, and *Antholops*, the late Greek name of the fabled unicorn. Its adoption by the languages of Europe cannot apparently be traced further back than the fourth century of our era, at which date it was employed to designate an imaginary animal living on the banks of the Euphrates. By the earlier English naturalists, and afterwards by Buffon, it was, however, applied to the Indian blackbuck, which is thus entitled to rank as *the* antelope. It follows that the subfamily typified by this species, in which are included the

gazelles, is the one to which alone the term antelopes should be applied if it were employed in a restricted and definable sense.

In their classification, the authors follow in the main the divisions sketched out by Sir Victor, although they have somewhat increased the number of sections, or sub-families, into which this assemblage of ruminants is split up. Into the limits of such sections it is quite unnecessary to enter upon the present occasion, as it is into any details with regard to species. In the main the characters of most of the species have been drawn from the magnificent series of skins in the British Museum; and where this is the case no emendation on the diagnosis given by the authors is ever likely to be required. In a few instances, however, the Museum was possessed of only very inadequate material at the date when the descriptions were written, so that in these cases there is room for revision. An instance in point is afforded by the white-eared kob of the swamps of the Upper Nile, complete specimens of which have recently been presented to the Museum. By means of these it has been ascertained for the first time that the old bucks of this handsome species are deep black, at least during the pairing season.

Nomenclature, again, is a subject on which some change of opinion has taken place among naturalists during the period in which this work has been in progress. And it is probable that one at least of its authors would not now be prepared to defend the use of all the technical names therein employed.

Although the authors have to deplore the vast decrease that has taken place in the numbers of so many species of African antelopes, in only one instance (that of the blaauwbok) have they to lament complete extermination, and that is not chargeable to the present, or even to the last two or three generations. They record, however, that several species in South Africa are only kept in existence by special protection; and in this connection it may be observed that the effect of the present troubles in that region on these dying species must be watched with the utmost anxiety by all naturalists.

As regards the manner in which the descriptions of the various genera and species are drawn up, the reputation of the authors is a sufficient guarantee that this is, in the main, beyond criticism. And no effort appears to have been spared in order to acquire as much information as possible with regard to geographical distribution. As neither of the authors (except, perhaps, the junior in his youthful days) is acquainted with the animals described in their native wilds, recourse has been necessitated to the writings of others; and the authors may be congratulated that in most instances they have had the courage to give these borrowed accounts in their original guise, instead of endeavouring to conceal their source by paraphrasing.

In one respect, and in one respect only, is there cause for regret in connection with this undertaking, namely, that the authors have not seen fit to refer, or at least in any detail, to the comparatively little that is known in relation to the past history of the group of which they so ably treat. The description and definition of species (even if they be the chief points of interest to sportsmen) are most important, but they are, and can be, only comparatively insignificant features in the philosophical study of animal life and its meaning. One of the burning questions of the day (in zoological circles) is the origin of the Ethiopian fauna; whether it is endemic in the land from which it takes its name, or whether it is due to an immigration from more northern climes. As remains of species closely allied to the giraffes and antelopes of modern Africa are met with in the later Tertiary deposits of India, Persia and Greece, it is obvious that the groups mentioned have much connection with the solution of this important problem. It is, therefore, greatly to be regretted that the authors have not seen fit to give their own views on this point, so far as the evidence to be derived from antelopes is concerned, or, at all events, that they have not informed their readers that several of the genera of these animals, now restricted to Ethiopian Africa, formerly enjoyed a much more extensive geographical range.

In the prospectus to the work it is stated that the authors "are desirous of making the book interesting and instructive to the naturalist, sportsman and general reader." While maintaining throughout a high standard of scientific excellence, and refraining from lowering their style by the inclusion of so-called purely "sporting" accounts, which are only too frequently most wearisome and distasteful to the cultured reader, the authors may be congratulated on having succeeded in their intentions in a manner deserving of the heartiest commendation on the part of all to whom this splendid and monumental work appeals. R. L.

THE SCIENCE OF ORE DEPOSITS.

Lehre von den Erzlagerstätten. By Dr. Richard Beck. ii Theil. Pp. ix–xviii + 385–724. (Berlin: Borntraeger, 1901). Mk. 8.50.

WE are thankful to find that Dr. Beck has not kept us waiting an unduly long time for the concluding portion of his valuable work, the first instalment of which was recently reviewed in these pages (see p. 245 January 10). The first part brought the description of the different classes of mineral deposits nearly up to the end of Fissure Veins; this subject is now brought to a conclusion with a number of general observations on this important group of ore deposits, the only criticism upon which need be that their limitations are somewhat too narrowly drawn. Most of the phenomena here described, such as the formation of gossans, enrichment or impoverishment of ores in depth, effects upon the surrounding "country," &c., are by no means confined to fissure veins, but are common to all classes of mineral deposits, depending as they do essentially upon the chemical composition of the mineral contents of the deposit, and either not at all or only in very remote degree upon its genetic relations or morphological features. The alterations and oscillations of mineral constitution that many veins show in depth are well but briefly described, although, perhaps, their close connection in many cases with changes in the country rock is hardly enough insisted on. It is almost certain that the well-known change in depth in the silver and copper contents of the Montana copper deposits is purely a

secondary phenomenon, and Dr. Beck is most probably in error when he ranks this among the primary modifications of ore deposits. The description of secondary alterations of deposits and the formation of gossans is extremely good, the chemical investigation of the subject being especially convincing. It must be noted that Dr. Beck only refers under this head to secondary changes above the permanent water-level (in the region of Pošepny's vadose circulation) and not to the phenomena which have recently attracted so much attention in America, and which, under the head of Secondary Enrichment of Ore Deposits, have been so ably investigated by Emmons, Weed and others; these Dr. Beck appears to omit entirely.

The section on the alteration of the wall rocks of mineral veins either by the influence of these veins themselves or by the agencies that have played an important part in the deposition of the mineral constituents of these veins, is a valuable summary of a very important subject, which has only in comparatively recent years attracted the attention that it deserves.

Coming next to the classification of other mineral deposits, or as Dr. Beck rather awkwardly designates them, "Not vein-like epigenetic ore deposits within stratified rocks," the subdivision is far from satisfactory. They are divided, first of all, as follows:—

A. Epigenetic ore beds.
B. Epigenetic ore masses.
C. Contact-metamorphic ore deposits.
D. Ore-bearing fillings of cavities.

Unfortunately, the first group contains many deposits that are generally looked upon as typical masses, *e.g.* the lenticular masses of cupriferous pyrites of the Huelva region. The group is subdivided into deposits occurring in crystalline strata and deposits in non-crystalline strata formed by impregnation, each class being then again subdivided according to its mineral contents. This classification is unfortunate, as it causes the author to describe the above-mentioned pyrites deposits as produced by impregnation; it would hardly be possible to assign a less probable genesis to such deposits as these, consisting as they do mainly of dense massive pyrites practically free from gangue, and it seems impossible to imagine that any one who has ever studied these deposits can seriously believe that they owed their origin to impregnation. It is in any case most unlikely that a system of classification that forces these deposits and the Norwegian and other similar pyrites deposits into different groups, and that takes, moreover, no account of the eruptive rocks with which they are so closely associated, can possibly be correct.

The group of Epigenetic ore masses is a rather more coherent one than its title implies, Dr. Beck confining this group to irregular deposits in calcareous rocks. It is perhaps doubtful whether this is the right place for those very puzzling deposits that are generally spoken of as the gold-bearing "reefs" of Pilgrim's Rest, Lydenburg; it is perhaps more likely that these will prove ultimately to be true bedded deposits, though their real character is to-day far from clear.

The next division of the book contains a short but good description of alluvial deposits; the objections to the independent treatment of this group of deposits have already been pointed out. Apart from these, Dr. Beck's descriptions are thoroughly satisfactory.

The work concludes with a brief but good chapter of general hints upon the search for mineral deposits. In this the author attempts, and with considerable success, to show that the scientific study of mineral deposits can give information of the greatest value to prospectors, and that his subject accordingly possesses, not merely a scientific and academic, but also a technical and commercial interest that should not be overlooked. This last chapter may more especially be recommended to the large number of mining engineers in this country who appear to think that the study of mineral deposits is one that they can venture to neglect as of no practical importance.

It is satisfactory to find that the wish expressed in the review of the first part of this book has been gratified, and that it is furnished with a good topographical as well as a general index, and it is a pleasure to be able to congratulate Dr. Beck on the production of a work of standard value upon the fascinating subject that he has done so much to advance. HENRY LOUIS.

ORGANIC CHEMISTRY.

Practical Organic Chemistry for Advanced Students. By Dr. Julius B. Cohen. Pp. xi + 284. (London: Macmillan and Co., Ltd., 1900.) Price 2*s.* 6*d.*

IN this enlarged edition Dr. Julius Cohen has increased greatly the value of the book as a manual for advanced students by adding chapters on organic analysis and the determination of the molecular weight. Under the latter heading we are glad to see he describes the preparation of the silver salts of organic acids and of the platinum salts of bases—two operations the description of which is frequently omitted from similar works. The appendix, which treats of the theory in the form of a note on each preparation, has also been enlarged. Our experience has been that students will not trouble to hunt theory in the limbo of an appendix, and the matter of these notes would have been more usefully incorporated in the preparations themselves. The explanations are necessarily condensed and frequently difficult to understand; for example (p. 193), "Aldehydes can only be obtained directly from the fatty acids by distilling the calcium salt with calcium formate; *but in no case by direct reduction, unless in the form of lactones.*"

The preparations are well and clearly described, and the apparently obvious is not ignored. Thus we read (p. 43), "A small balance with celluloid pans, for use on the bench, is indispensable." Such a balance is invariably used by German students in order to estimate their yields, but is a sufficiently rare object in an English laboratory.

Details of the preparation of ninety-seven substances are given, and consequently the book will be of great service, not only to the student, but also to the lecturer. Of the fifty-six substances usually prepared by the honour students at the Owens College, fifty-two are to be found in this book.

In a useful series of "Hints on the investigation of

organic substances" (p. 265) Dr. Cohen has made a most praiseworthy attempt to systematise the analysis of organic substances. This part of the book might advantageously have been expanded (if necessary at the expense of the appendix), when the futility of the closing hint [1] might have been avoided.

The old method for the preparation of diethyl malonate —the *pons asinorum* of the organic chemist—is still given, but a better yield is obtained by the method of Noyes (*Journal* of the American Chemical Society, 18, 1105, 1896); succinic acid melts at 185°, not 180°; the conversion of citraconic into mesaconic acid (p. 112) is due to Fittig, not to Jacobson; methyl oxalate (Prep. 24) is not indexed; and the preparation of kreatinine might advantageously have been omitted.

We must, however, congratulate Dr. Cohen on having produced the best elementary book, in the English language, on practical organic chemistry, and we have found that our students use the book with great confidence and are perfectly able to prepare any of the substances from the descriptions. The book, which is well printed and free from typographical errors, should rank with the similar works of Ludwig Gattermann in German, and of Dupont and Freundler in French.

W. T. L.

OUR BOOK SHELF.

Description of the Human Spines, showing Numerical Variation, in the Warren Museum of the Harvard Medical School. By T. Dwight, M.D., LL.D. (Memoirs of the Boston Society of Natural History). Vol. v. No. 7. Pp. 75. (Boston, U.S.A., 1901.)

THIS memoir is for the greater part a careful description, with elaborate tabulation and adequate illustration, of forty-five anomalous human back-bones which, with one exception, were obtained during many years spent by the author in the dissecting-room of the Harvard Medical School. In the introductory portion of the work the author discusses Rosenberg's methods and well-known theory of "concomitant variations," based on the appreciation of a tendency of the cervical and lumbar regions of the column to absorb into themselves the thoracic, with change progressive and retrogressive at the opposite ends of this. Accepting, without proof, the theory that the human ilium enters into relation with different vertebræ during development, the author passes on to the consideration of irregular segmentation, and a discussion of the views of Baur, Bateson and others on inter- and ex-calation, deferring the latter author's theory of "homœosis" for consideration in the body of the work. He finally denies the existence of a precise number of lumbar vertebræ, and finds refuge in Welcker's theory of the *vertebra fuleralis*. With this as a determining factor he largely deals, and the most interesting portion of his memoir is that in which he shows it to be the twenty-fourth vertebra in each of seven examples lacking one of the præsacral series. He classifies his specimens into classes, and clearly, systematically formulates the individual spines of each, and deals in some cases with correlated modification of the spinal nerves. Arguing that the "essential part of the office of the spine is to form the median support of the trunk," he deduces what he terms a "vitalistic conception," viz., that parts in corresponding situations exhibit a tendency to develop in a corresponding manner; and in finally discussing Rosenberg's view, he remarks that its success has been largely due to the fact that "it fitted in so perfectly with the doctrine of descent by gradual modifications," and gives as his opinion that, "unfortunately for science," it has "become too much the custom to make everything square with this."

The memoir as a whole is laborious, but accurate and systematic, and will be of great use to the working anthropotomist. There is appended a description of some incomplete specimens of interest in the author's collection, and we would remind him that among the quadrupedal mammals co-ossification of the atlas vertebra with the skull is at times found to be an effect of dislocation, and would recommend to his consideration the recent description by Broom of an Echidna's spine having eight cervical vertebræ, and his discovery that in some marsupials the fourth lumbar and anterior caudal vertebræ bear in the young state free ribs.

Where Black Rules White: A Journey across and about Hayti. By H. Prichard. Pp. 288. (Westminster: Archibald Constable and Co., Ltd., 1900.) 12*s*.

MR. PRICHARD visited Haïti in the year 1899 as a special correspondent of the *Daily Express*; and in the volume under notice we have his impressions and experiences described, with anecdotes and illustrations. He made a short trip into Santo Domingo, to which he devotes a chapter, but otherwise the book is concerned with the people, places and affairs of the part of the island governed by the Haïti Republic. Referring to the people of the Dominican State, Mr. Prichard remarks: "They are not nearly so likeable as the Haytian peasantry, and hospitality does not flourish in the same degree as on the western side of the border. On the other hand, the Government of San Domingo is less jealous of foreign influence. The Dominicans speak Spanish, and have preserved the purity of their language to a far greater degree than can be said of the Haytians, whose French has degenerated into a Creole patois so corrupt that it can with difficulty be understood by outsiders."

From a scientific point of view, the most important statements made relate to Voudou worship and sacrifice. The author says that the people of Haïti are practically under the control of Papalois or Voudou priests, otherwise Haïtian witch-doctors and medicine-men; and he brings charges against them of murders and human sacrifices which the Government of the Republic appears unable to prevent. As to the ceremonies connected with the worship of Voudou, he remarks: "There are said to be two sects of Vaudoux: one which sacrifices only fruits, white cocks and white goats to the serpent-god; the other, that sinister cult above referred to, whose lesser ceremonies call for the blood of a black goat, but whose advanced orgies cannot be fully carried out without the sacrifice of the goat without horns—the human child." Miss Kingsley touched upon this subject in her "West African Studies."

Mr. Prichard made a special point while in Haïti of obtaining information as to Voudou ceremonies and sacrifices, and in some cases was able to obtain direct knowledge. He gives an account of personal observations of some of the rites, which should be of interest to ethnologists.

Untersuchungen zur Blutgerinnung. By Dr. Ernst Schwalbe. Pp. 89. (Brunswick: Vieweg, 1900.)

DR. ERNST SCHWALBE herein summarises the previous researches on the chemistry and morphology of the coagulation of the blood, and adds some new observations of his own.

He has employed Reye's method of separating

[1] ["2, *Solids.*—A mixture of solids may be separated either by use of a suitable solvent which will dissolve one of the constituents more readily than the other, or by means of one of the reagents described above" p. 272)].

fibrinogen from blood plasma by fractional precipitation with ammonium sulphate, and has studied the characters of the soluble fibrino-globulin of Hammarsten, which is present in solution after the fibrinogen solution has been clotted or coagulated by heat. He finds that fibrinogen is not filtered by pressure through a Chamberlain filter, while the other proteids of plasma, including fibrino-globulin, are driven through. He has also determined the heat coagulation temperature of fibrino-globulin.

Dr. Schwalbe has studied the clotting of freshly drawn blood, the blood being suspended in microscopical sections of elder-pith and protected from drying or contact with the cover glass. He concludes that blood platelets arise by the breaking down of red corpuscles, and that agents, such as calcium salts, which promote clotting do so by accelerating the breaking down of the red corpuscles. The original observations are scarcely of sufficient importance to warrant their publication in the form of a separate monograph.

A Manual of Elementary Science. A course of work in Physics, Chemistry and Astronomy, for Queen's scholarship candidates. By R. A. Gregory, F.R.A.S., and A. T. Simmons, B.Sc. Pp. viii+429. (London: Macmillan and Co., Ltd, 1901.) Price 3*s.* 6*d.*

OF the three parts into which this book is divided, those dealing with physics and chemistry are along familiar lines, but it may be stated that they are treated with the thoroughness and attention to practical details which the authors have accustomed us to expect. It is to the third part that teachers will turn with the greatest interest, for the reason that an effort is made to extend laboratory methods in the teaching of astronomy. Hitherto, with the possible exception of two American books, there has been no guide to this class of work suitable for elementary students who can only give a comparatively small amount of time to the subject. The practical exercises described comprise the illustration of astronomical phenomena by the use of simple apparatus; suggestions for observations of the heavenly bodies themselves, including measurements of altitude, &c., with home-made instruments; the graphical representation of the paths of the sun, moon and planets with the aid of an almanac; and easy numerical exercises. Those who have endeavoured to teach chiefly by the observation of the heavens will appreciate the provision made for instructive work when outdoor observation is not possible or convenient. The course laid down is certainly a step in the right direction, but it would be too much to say that it could not be improved. The use of the globes, for instance, might have been introduced with advantage.

It may be noted that Achernar, by some slip, has been wrongly included in the list of bright stars visible in England (p. 328).

The book throughout is admirably illustrated, many of the diagrams being original. A number of useful exercises are appended to each chapter.

The Mind of the Century. By various authors. Pp. 141. (London: T. Fisher Unwin, no date.) 2*s.*

THE essays in this volume are characteristic aspects of progress during the nineteenth century, seen from sixteen different points of view; they originally appeared in the *Daily Chronicle*, and it may perhaps be doubted whether any useful purpose is served by reprinting them. A glance at the lines of intellectual development may be sufficient for a daily newspaper, but it is scarcely accurate to describe a very general view as a representation of "The Mind of the Century." It will be sufficient to say that Prof. Tilden's article on chemistry occupies five pages, and he would probably be the first to disclaim any desire to have it regarded as more than a very slight sketch of a few lines of progress. Dr. H. J. Campbell writes on medicine, Mr. Edward Clodd on natural science (in which he includes astronomy), and Mr. W. A. Price on applied science, the whole of the articles on scientific subjects occupying thirty-three pages. To what extent the minds of men of science—both pure and applied—can be faithfully reflected within these limits we leave our readers to judge. The book has no index.

Morison's Chronicle of the Year's News of 1900. Compiled by G. Eyre-Todd. Pp. 446. (Glasgow: Morison Brothers, 1901.) 3*s.* 6*d.* net.

THIS is a diary of events and news of the year 1900, and it may be taken as a convenient index to the subjects which occupied public attention in the newspaper press during that year. It is in no sense a record of scientific thought and work, and the compiler has apparently made no attempt to form an accurate estimate of the relative standing of learned societies, or to apportion space according to the value of their proceedings.

In the index, under societies, we notice the Royal Society of Edinburgh (the reference being to a single meeting in 1900), but not the Royal Society of London; a meeting of the Scottish Meteorological Society is recorded, but none of the Royal Meteorological Society; the Society of Chemical Industry appears, but not the Chemical Society, or the Physical, or the Astronomical, or the Linnean, Zoological and many others. So far as science is concerned, therefore, a reader of the diary would prevent himself from being disappointed if he assumed that the volume took no account of the scientific news of 1900. We must, however, be charitable, for, after all, the news and events recorded in the volume are, to the general public, of more interest and value than many contributions to natural knowledge.

Imitation, or the Mimetic Force in Nature and Human Nature. By Richard Steel. Pp. xii+197. (London: Simpkin, Marshall and Co., Ltd., 1900.)

THE canon of affirmative reasoning, which may be said to form the text of this book, is expressed by the author as follows:—"That which is true of a thing is probably true of its like; the degree of probability depending upon the extent and thoroughness of the resemblance." This principle is applied to the reasoning employed in connection with such subjects as habit and instinct, psychology, physics and biology, and other branches of intellectual inquiry in the natural and spiritual worlds. It is the expression of the theory of imitation, which the author propounds "as a fundamental influence in human affairs and in the natural universe generally." Many general facts of natural history lend themselves easily to this idea, and use is made of them. How the author does this, and shows that even wave motion is "essentially mimetic or imitative," can be better read than described.

In Nature's Workshop. By Grant Allen. With 100 illustrations by Frederick Enock. Pp. 240. (London: George Newnes, Ltd., 1901.) Price 3*s.* 6*d.*

IN reading this book one cannot fail to notice a considerable resemblance between Mr. Grant Allen's manner of treating his subject and that adopted by the late Dr. Taylor in his "Sagacity and Morality of Plants." But while the latter work consisted only of examples taken from the vegetable kingdom, here the animal kingdom, and especially the insect world, receives a large share of attention. Thus there are chapters on "sextons and scavengers," dealing with burying beetles; "false pretences" and "masquerades and disguises," dealing with warning colours, mimicry and such matters; "animal and vegetable hedgehogs," dealing with spiny fishes, insects, cactuses, lizards and beetles; "plants that go to sleep." The book should prove delightful reading to young people and others who can take an interest in natural history treated in an unscientific and popular

way, and Mr. Enock's skill as an artist in portraying all sorts and conditions of animal and plant life greatly add to its charm.

Elementary Organic Analysis. By F. G. Benedict, Ph.D. Pp. vi+86. (Easton, Pa.: The Chemical Publishing Co., 1900.) Price 1 dollar.

DR. BENEDICT describes processes for the determination of carbon and hydrogen in organic analysis. His manual is distinguished by completeness of detail concerning the setting up and manipulation of the analytical apparatus, and the treatment necessary for various classes of compounds. The book should be of service in directing students how to carry out organic combustions satisfactorily.

Elevation and Stadic Tables. By A. P. Davis. Pp. 42. (New York: J. Wiley and Sons. London: Chapman and Hall, 1901.)

HYDRAULIC tables showing velocities for various channels and slopes are given in this volume, as well as tables "for obtaining differences of altitude for all angles and distances, horizontal distances in stadic work, &c., with all necessary corrections." The book has been prepared and published because there is a need for such a handy manual in the field work of surveying and in practical problems connected with canal construction. As such its usefulness is assured.

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.*]

The Recent "Blood Rains."

THE quantity of dust carried over to Europe by winds from the African Continent during the present month seems to have been unusually great, for traces of the "blood-rain" are said to have been noticed as far north as Hamburg and Schleswig-Holstein, while, in most cases, such phenomena are confined to the countries immediately bordering the Mediterranean. My colleague, Prof. A. W. Rücker, who has been staying at Taormina, in Sicily, has forwarded to me some very interesting observations which he has made on the subject. Writing on March 12, he says: "We have had a rather curious phenomenon here. The sirocco was blowing, and the hills were wrapt in mist, but the fog assumed a yellow hue, and the sun, which at times could be seen through it, was a bright blue. This was caused and accompanied by a copious fall of red dust. Some which I shook off my hat was quite dry, and on looking at it through a low-power lens all the granules seemed to be spherical, except a very few grains of what looked like quartz. Of course, the question was raised whether Etna was ejecting something which corresponded to the Krakatoa dust, but this was negatived by the fact that the Italian papers state that the dust fell also at Naples and Palermo in such quantity that the streets looked red and the people were frightened. I scraped some off a marble table which I send you."

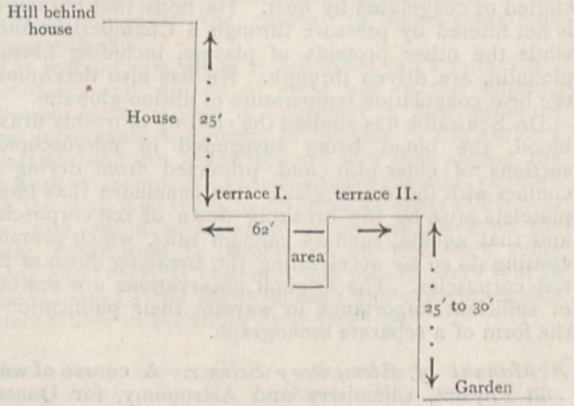
Under the microscope this dust is seen to be mainly composed of inorganic particles, chips of quartz in small quantities being mingled with minute plates of various micaceous and other minerals. There is also a fair admixture of frustules of fresh-water diatomaceæ, entire and in fragments. The number and variety of these diatomaceæ does not appear to be so striking as in some of the celebrated cases described by Ehrenberg, the organisms from which were figured by him in his "Passat Staub und Blut Regen" (1847). There are, however, a very considerable number of species represented in these recent falls.

Vague statements have appeared in some of the newspapers as to the number of millions of tons of dust which, during the present month, have fallen over Italy. The data upon which these statements have been made have not been given, so that the following memorandum on the subject, drawn up by Prof. Rücker, cannot fail to be of interest to readers of NATURE.

Royal College of Science. J. W. JUDD.

March 20, 1901. *Taormina, Sicily.*

"At 7.30 this morning the sky was copper-coloured, and it was evident that another fall of dust was taking place. The sirocco had been blowing for two days, and it was raining slightly.



The general outline of the hotel is as shown. The two terraces are connected by a bridge. On the terraces were several rectangular marble tables, and it occurred to me that it might be interesting to find the amount of dust on some of them.

It is, of course, possible that the rain may have washed some of the dust off them, but I looked at the terrace when dry and saw no signs of a specially great aggregation of dust under the tables.

The aspect of the terrace is about S.W., so that the house did not shelter the tables, as the wind was blowing towards it; but, of course, eddies may have had an effect.

The sky ceased to be copper-coloured about 8 or 8.15, and I have no reason to suppose that any large quantity of dust fell while the experiments were being made.

Table I. Was on the western half of the inner terrace I., about 13′ from the house. It measured $24\frac{1}{2}'' \times 46'' = 1127$ square inches. The mingled dust and water were scraped off with the edge of a sheet of paper into the cover of a biscuit box, then dried over a spiritine (alcohol) flame. The dust adhered rather strongly to the box, and had to be scraped off with a knife, which removed some shavings of the tinning.

Collection made at 9 a.m.

Table II. Further east, on terrace I., near a point where the level of the house fell to about 17′. Distance from house, 13′. Dimension, $22\frac{1}{4}'' \times 40\frac{1}{2}''$, or, say, 900 square inches. Collected as before but into two plates, one earthenware, and the other enamelled iron. The dust had to be scraped off, but I do not think the knife removed anything from the plates.

Collection made at 10.15 a.m.

Table III. This was the best experiment. The table was on the outer terrace, 58′ from the house, and close to the edge of the terrace. Area, $24\frac{1}{4}'' \times 46\frac{1}{2}'' = 1127{\cdot}5$ square inches. The scrapers used were rags of clean muslin, which were afterwards washed in water to get as much dust as possible out of them, and the quantity so obtained (which was small) was added to the rest. The dust and water were put in a clean bottle and preserved. No drying was done in this case.

Collection made 10.45.

In the afternoon I borrowed a balance from a photographer. The smallest weight was a gram, but the balance would turn to less, and I made smaller weights by cutting a piece of stout paper to such a length that it weighed a gram, measured its length and cut off measured lengths from it. I weighed in both pans and found there was no important difference. The whole experiment was rough, but the amounts deposited on the two tables appear to have been so different that great accuracy in weighing is not important.

Table I. Weight of dust, 1·13 grams.
Area, 1127 square inches, or, say,
0·0010 gram per square inch.

Table II. Weight of dust, 1·54 grams.
Area, 900 square inches, or, say,
0·0017 gram per square inch.

Table III. Preserved wet, and therefore not weighed.

The difference between the results is too great to be accounted for by differences in care in scraping or errors of the weighings. It is either due to the fact that more dust had been carried off one table by the rain than off the other, or it shows that near the house the distribution was uneven. Still, the mean of the two gives an idea of the order of the density on the inner terrace, which was about 0·00135 gram per square inch, or, taking 25 mm. = 1 inch, 2·2 grams per square metre, or about 5½ tons per square mile, though, of course, to argue as to the average fall over so large an area as a square mile is a big extrapolation.

Note upon a New Form of Spermatophore in an Earthworm.

IT is well known that the Oligochæta (like many other animals such as molluscs, insects, &c.) form spermatophores. Up to the present time two types of these spermatophores have been recognised in the Oligochæta. In the Lumbricidæ, *Criodrilus*, &c., they are compact cases, generally open at one end, and found invariably attached to the outside of the body in the neighbourhood of the reproductive orifices ; they are sometimes even slightly imbedded in the skin. The other type of spermatophore characterises *Tubifex* and several allied genera, as well as the Eudrilid earthworm, *Polytoreutus*. These are long thin motile bodies. They are found only in the spermathecæ of those Annelids which they characterise. I have lately studied the structure of a third variety of spermatophore which I found in the spermathecal sac of another Eudrilid genus, *Stuhlmannia*. This worm is long and slender, not measuring more than 2 mm. in diameter. The spermathecal sac in which the spermatophores are found is about 7 or 8 mm. long. I never found more than two of the spermatophores in a sac ; they measure some 3 mm. in length. The shape is peculiar. There is a "head" very similar to that of the spermatophore of *Tubifex*, a long "beak," open at the extremity, is followed by a circumferential swelling, which is again succeeded by a narrow neck ; this in its turn gradually widens until at the middle the spermatophore is large and plump. The interior was a mass of separate spermatozoa entirely uncompacted together. The site of the formation of the spermatophores has been much disputed. It seems to be clear, from the investigations of Mr. Lankester, that in *Tubifex* they are at least moulded in the spermatheca, since the collar of the head of the spermatophore not only corresponded in form with certain foldings of the spermathecal wall, but was actually observed lying *in situ*. As to the origin of the material, Mr. Lankester and Prof. Vejdovsky were disposed to trace it, partly at least, to the "cement gland" of the male efferent apparatus. I find in *Stuhlmannia* that the moulding of the head of the spermatophore must be accomplished in the spermathecal sac, since I also observed a spermatophore lying *in situ* with its convexities fitting into corresponding concavities of the walls of that sac. Further, the large size of the spermatophore necessitates the hypothesis that the whole of it is moulded in the sac, since it could not possibly be contained—even with the greatest stretching—in the spermiducal gland. As to the origin of the material of the case, I hold it to be proved that part comes from the spermiducal gland and that the rest is, in all probability, a result of the breaking down of the abundant cells which line the spermathecal sac. I may add that no spermatozoa protrude through the case. This spermatophore of *Stuhlmannia* is evidently somewhat intermediate in its characters between the two types already known.

FRANK E. BEDDARD.

Graphic Solutions of the Cubics and the Quartics.

THE note by Prof. G. B. Mathews, F.R.S., published in NATURE of November 16, 1899, has encouraged me to write the following, which may be also of some interest. I have considered not only the quartics, but also the cubics. For the quartics, the methods in this letter will be simpler than those of Prof. Mathews. We require to have a sheet of squared paper on which the curve $y=x^3$ for the cubic and the curve $y=x^2+x^4$ for the quartic have been printed.

I. For the cubic, take the curve $y=x^3$ and a straight line the equation of which is $\frac{x}{a}+\frac{y}{1}=1$. Then the abscissæ of the intersections of the curve and the straight line are the real roots of $x^3+\quad -1=0$. Now the general cubic is at once reducible to the form $z^3+pz+q=0$, and if we put $z=-x\sqrt[3]{q}$, this becomes $x^3+\frac{p}{q^{\frac{2}{3}}}x-1=0$. This is identical with the former if $a=\frac{q^{\frac{2}{3}}}{p}$; so we can calculate a very easily, then read off the real values of x, and finally take $z=-x\sqrt[3]{q}$.

II. For the quartic, take the curve $y=x^2+x^4$ and a straight line the equation of which is $\frac{x}{a}+\frac{y}{b}=1$. Then the abscissæ of the intersections of the curve and the straight line are the real roots of $x^4+x^2+\frac{b}{a}x-b=0$. Now the general quartic is at once reducible to the form $z^4+pz^2+qz+r=0$, and if we put $z=x\sqrt{p}$, this becomes $x^4+x^2+\frac{q}{p^{\frac{3}{2}}}x+\frac{r}{p^2}=0$. This is identical with the former if $a=-\frac{r}{q\sqrt{p}}$, $b=-\frac{r}{p^2}$; so we can calculate a and b very easily, then read off the real values of x, and finally take $z=x\sqrt{p}$.

For the quartic, we can take also the parabola $y=x^2$ and a circle $(x-a)^2+y^2=\rho^2$.

T. HAYASHI.

Matsuyama Chūgakkō, Iyo, Japan, December 28, 1900.

"The Principles of Magnetism and Electricity."

THERE are two points occurring in the review (p. 434) of "The Principles of Magnetism and Electricity" in which the author appears to me to be correct, though the examples are given as instancing errors into which he has fallen. The reviewer states, "The author measures magnetic force in *dynes* and difference of potential in *ergs*," thereby apparently implying that this is incorrect. Surely these are usual units for expressing these quantities. Again, the author is taken to task for stating that in the case of a dynamo or motor armature, "owing to the self-induction of each section, a certain amount of energy is used twice in each revolution to establish the current in it. *This energy is lost* so far as the external circuit or the effective output of the machine is concerned." Whilst with a dynamo running sparklessly with copper brushes this is only partially true, the difficulty of obtaining the return of the energy thus absorbed is in practice so great that we see on a very large proportion of machines that carbon brushes are used, the object of which is to enable this energy to be wasted without an actual spark, and it is well known that machines with carbon brushes thus working have a higher rise of temperature from the waste of power than when true electrodynamic commutation takes place. Actual measurements of power absorbed have also shown a waste of power from this cause sometimes exceeding 5 per cent. of the output of the machine.

London, March 12. LLEWELYN B. ATKINSON.

THROUGH the courtesy of the Editor I am able to reply to the letter of Mr. Llewelyn B. Atkinson, in which he challenges two of my criticisms in the review of "The Principles of Magnetism and Electricity," by Mr. P. L. Gray. Mr. Atkinson states that I "apparently imply" that measuring magnetic force in *dynes*, and difference of potential in *ergs*, is incorrect. To prevent any misconception, I now wish to state quite definitely that I regard the above method of measurement as hopelessly and absolutely wrong. If it be correct, then magnetic force is a quantity whose dimensions are identical with those of dynamical force, and difference of potential a quantity of the dimensions of energy. If Mr. Atkinson is satisfied with these conclusions, and is prepared to uphold them, I have no further remarks to offer on the subject. I may, however, point out that measuring difference of potential in ergs is about as logical a proceeding as measuring difference of (gravitational) level in ft.-lbs. Some eccentric people might, no doubt, be found to uphold this latter proceeding. But a falsehood does not become a truth merely because a number of people give their unreasoning assent to it.

With regard to the second criticism, that relating to the process of commutation in a dynamo, I still maintain that the statement in Mr. P. L. Gray's book is misleading and incorrect in its generality, and Mr. Atkinson practically admits as much in his letter. Nothing is said by Mr. Gray as to the particular statement in question being intended to apply to carbon brushes under certain conditions of use. It is a general statement, made without any qualifications, and as such is incorrect.

The REVIEWER.

THE LAND WORK OF THE BELGIAN ANTARCTIC EXPEDITION.

AT the present moment the Antarctic problem is mainly that of the forthcoming expeditions, and during their preparation every fact bearing upon the conditions, physical and official, in which the scientific staffs will have to work has a special interest. So far the Belgian expedition has yielded most information of a useful kind, and the two latest papers of its enthusiastic geologist, M. Henryk Arctowski, are of more than usual value.[1] The general account of the expedition contains nothing that will be new to our readers. M. Arctowski concludes it by the observation that while the scientific results have been varied and satisfactory, the chief outcome is that the great public has been acquainted with the paucity of our knowledge of the Antarctic area, and shown how trifling is the work accomplished compared with that which remains to be done.

The paper in the *Geographical Journal* is the most detailed and valuable description of land on the confines of the Antarctic region that has ever been published. It records, in the form of a narrative from day to day, the exploration of Belgica Strait, the new channel discovered by the expedition, separating the Palmer Archipelago from the mass of Graham Land with which those islands were formerly supposed to be continuous.

The twenty landings which the importunity of M. Arctowski induced the reluctant commander to permit are described in detail; but, as none of the new names given by the expedition are employed, and practically no other names exist in that region, it is impossible to follow the description without reference to the sketch map on which the landings are marked. This is accordingly reproduced as Fig. 1.

The opportunities of landing were numerous, but the time allowed on shore was usually absurdly inadequate to the importance of the work of surveying and geological investigation. In the only case where a week was spent on shore practically nothing was done because of the unnecessarily heavy equipment insisted on by the commander—a sailor of no scientific qualifications, and apparently devoid of sympathy with the more important objects of the expedition. Still, it must be remembered that but for de Gerlache's burning ambition to reach a high southern latitude (an ambition which was not gratified) the expedition would never have been dispatched, and no scientific work of any kind would have been done. The following paragraphs are a much-abridged summary of M. Arctowski's narrative.

At 7 p.m. on January 23, 1898, having passed the South Shetlands, the *Belgica* was close to a headland, which probably was Cape Cockburn, but as she went on the charts became valueless. What was seen corresponded to nothing that they represented, and Lecointe proceeded to construct a fresh chart from his own surveys. At 10.30 p.m. the first landing was made on an island in Hughes Bay (see I. on map, Fig. 1). A considerable part of the island was uncovered. The upper part was like a lava-flow of prismatic structure. Lower down the rock was completely cracked, and seemed to decompose in large superimposed blocks with straight surfaces. It was an eruptive rock of great density, very hard and brittle, and ringing on a blow with the hammer. It was not basaltic, but of granitic structure and very fine-grained; its colour was a very deep green, and M. Arctowski thought that he saw small crystals of hornblende; if so, the rock would be a diorite.

On January 24 the second landing was made (II. on map, Fig. 1) on a small narrow island, no more than 100 feet high and almost free from snow; it appeared to be surrounded by a close colonnade, on account of the regular vertical cracks in the rock, which were doubtless produced by extreme cold. The surface was frequently mammilated and worn smooth by the ice. Here, M. Arctowski says, "A little sandy clay mixed with guano was found in small pockets between the rocks, and while examining this I had the pleasure of discovering the first Antarctic insect, almost microscopic in its dimensions." The general result of that day's nautical work had been the discovery of an elevated land where Friederichsen's map bore the inscription, "No land in sight (Larsen)." Towards the east and south an uninterrupted coast-line stretched as far as the eye could

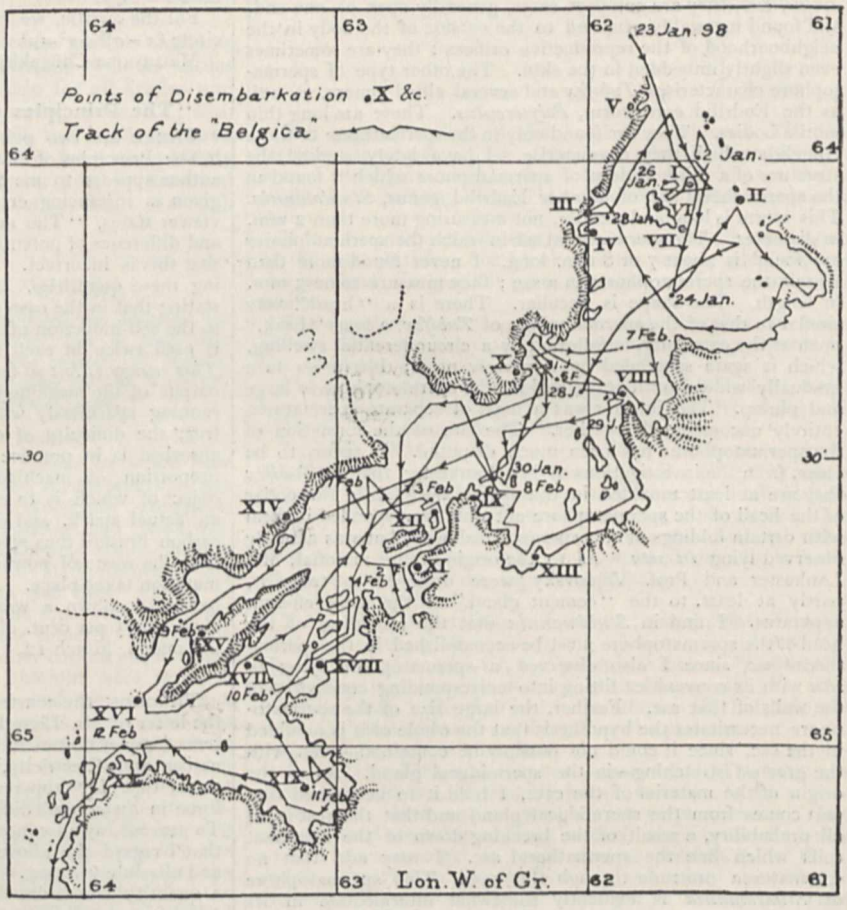


FIG. 1.—The track of the Belgian Antarctic Expedition in Belgica Strait. From the *Geographical Journal*.

[1] "L'Expédition Antarctique belge," *Revue Générale des Sciences*, 12 (1901), 87–94. "Exploration of Antarctic Lands," *Geographical Journal*, 17 (1901), 150–180.

reach, but in the south-west a large strait opened into Hughes Bay, and this it was necessary to explore. The quantity of snow on the land was found to be formidable. The westerly and northerly winds coming from the ocean doubtless brought great falls of snow, and this was always accumulating, mountains of ice were reared on the top of the mountains of rock. So far as could be judged from the ship, the ice was nowhere uncovered, but thick snow seemed to lie on the glaciers down to the very edge of the sea.

About midnight a landing was made in a little bay (III. on map, Fig. 1), where a ground moraine, or something closely resembling one, was found. There was water behind it and then a cliff of ice, the end of a great glacier which covered the whole slope of the mountain. Although it was growing very dark and the specimens were collected hurriedly, more than ten different varieties of rocks were obtained, none, however, of sedimentary formation.

The next landing was for three hours, on the 25th, in lat. 64° 6′ 24″ S., long. 61° 59′ 30″ W., on the promontory of an island (IV. on map, Fig. 1), and it was not without difficulty that all the delicate instruments were got ashore on the steep rocks. "Cook and I," says M. Arçtowski, "made use of Canadian snow-shoes to visit the higher part of the island, and found them a great aid in crossing the snowy slopes, which were usually gentle, though there were dangerous crevasses in places. A thick mantle of snow stretched to the crest of the promontory and stopped abruptly, the further side being perpendicular. . . . It was a region quite alpine in its character, but completely buried, in glaciers. The snow-fields rose towards the interior forming a veritable ice-cap, terminating in a perfectly continuous sky-line. . . . Lower down the relief of the land could be divined beneath its robe of snow, and here and there a bare peak pierced the covering. Nothing like an exposed chain of mountains was to be detected, although near the sea a coast range could be made out, its sides cut by valleys through which glaciers of various sizes made their way. Along the shore some of the promontories were bare, but on the lower ground the ends of the glaciers were covered by a field of snow, and were for the most part confluent, forming a plateau of ice which gave origin to icebergs. That valleys exist, though they do not show on the surface, is clear from the differences in the size and appearance of the glaciers. The largest are of gentle slope, the smaller steep and broken by numerous crevasses. Some of the glaciers suspended from the cliffs were of extraordinary dimensions. Thus by the appearance of the surface of the ice, without any other evidence, one could see that the configuration of the buried land was complicated, and underneath each glacier there must be a great excavated valley, along the bed of which the ice glides downward. The existence of valleys is very interesting, for it points to a time when there was no ice, but dry land being eroded by the running water of rivers. On the other hand, the thought of these buried valleys brought to my mind the channels of Tierra del Fuego as they must have appeared in the glacial period, when the end of the Andean chain lay under just such an ice-sheet."

In the afternoon of Wednesday, January 26, Cook, Amundsen and Arçtowski landed on Two Hummocks Island (VI. on map, Fig. 1), which was narrow and entirely covered with a thick mantle of snow, giving it a convex appearance. Two pyramidal mountains projected like nunataks, contrasting with the general smooth outline. The party landed on the north coast in the hope of being able to climb one of the mountains, and found that the shore was formed by a cliff of ice, with only a few promontories of bare rock. The ice was not found to be actually immersed in the water at any point; a very narrow strip of bare rock always separated it from the sea. A little snow rested even on the *roches moutonnées*, which bordered the shore, either awash or rarely rising so much as a yard or two above the surface, and the sea-leopards were sleeping upon them very tranquilly. The rock of the island was a grey granite, with thick and very regular veins of a dark and compact green rock, and also smaller red veins. There were some erratics, which might have been carried by floating ice.

At 2 p.m. on the 28th an island was visited which showed an appearance of stratification (VIII. on map, Fig. 1), but the whole surface was found to be a smoothly glaciated rock of eruptive origin, traversed by grey compact veins twenty feet thick.

On Saturday, January 29, the weather was calm; the fog had cleared away and revealed a marvellous scene. On every side the thick white covering descended to the sea, and only the most abrupt slopes were free from snow; perpendicular cliffs and steep hillsides were characteristic of all these coasts. A cliff which bordered a submerged valley where an immense glacier debouched showed an appearance of vertical stratification, but the ninth landing sufficed to prove that this appearance was due merely to cracks in the rock, as in all previous cases. This may possibly be an effect of extreme cold, for the *roches moutonnées*, which are preserved from rapid changes of temperature by a covering of snow during most of the year, do not exhibit such cracks, or only to a slight extent.

The only attempt at a land journey must be described in the author's own words. It commenced on Sunday, January 30. "The commandant decided to accompany the land-party, . . . but the preparations which had to be made were too elaborate, and the projected excursion was doomed to failure before it set out. In order to succeed, it would have been necessary to carry all the absolute necessaries on our backs and make a great and sustained effort, being prepared, if the route was bad, to return and choose a better way. . . . We took with us two sledges of Nansen's pattern, sleeping bags, a silk shelter tent, a little aluminium stove, such as was used by Jackson, Norwegian *ski*, Canadian snow-shoes, ice-axes, a 40-foot rope of raw silk, provisions for a fortnight, even changes of underclothing, and all the instruments after that. Certainly far too much baggage. . . . We landed on a little promontory at the head of a fine bay, where a large glacier entered the sea and the snow lay down to the water's edge (X. on map, Fig. 2[1]). There was no difficulty in getting ashore, but the sledges were horribly heavy. . . . At a height between 400 and 600 feet we had to cross several crevasses, which were narrow and spanned by snow-bridges solid enough to allow our loads to pass without difficulty. Higher up a great snow-field stretched before us, whence we could look down upon the glacier which cascaded towards the bay. . . . At 2.30 p.m. during lunch I placed the black-bulb thermometers on the snow, and, although the sun was slightly veiled, they showed readings of 102°·6 and 86° Fahr., while the temperature of the air, measured by a sling thermometer, was only 34°·2. The strength of the solar radiation made us all feel very warm. We enjoyed an extensive view towards the south, and saw the high mountains on the opposite side of the strait diminishing gradually in height towards the east; the direction of the chain seemed to be north-east and south-west. . . . At 7 p.m. we were still mounting upwards, the weather being remarkably good, and the view of Graham Land grew finer and finer. The relief of that land, although excessively varied, is singularly softened by the glaciers and the accumulated snow, so that it can only be because the valleys, hollowed by the running water of some former epoch, are so deep that a few crests and very abrupt slopes remain bare. At the height of 1600 feet

[1] Fig. 1. in this article.

we were stopped by a crevasse more than thirty feet wide, which we could not cross, and other crevasses appeared beyond it, the whole glacier having a terraced structure. . . . All Tuesday we were dragging our loads uselessly towards a hill in the west, but in that direction also we were stopped by numerous crevasses. . . . Again we had to retrace our steps to the ice-plain to pass the night, and there we left our camp for the two following days, seeing that it was impossible to reach any high summit. . . . From the summit of the more distant nunatak, Cook and I had a good view of the *mer de glace* in which the large glacier terminated at the head of the bay where we landed. Although the broken fragments could not give rise to icebergs as they entered the water, it seemed quite possible that in winter, when the bay is frozen, enough ice might accumulate to form one or more bergs. In any case, it appeared certain to me that the bottom of this great valley extended below the level of the sea; and I was also led to believe, judging from the distances which separated the nunataks and the angle of slope of the walls, that the same held good for the valley in which we camped. We found some lichens and mosses on the nunataks."

On Sunday, February 6, the party got on board the *Belgica*, and steered towards the east, in order to continue the survey of the coast of Graham Land. The air-temperature was high all that day, with a maximum of 45° F. At night it rained, at times very heavily, and it must have produced a great effect upon the snow-fields, a much greater effect, probably, than a day of strong sunshine.

The party succeeded in landing on February 7 at the base of a granitic cliff, near which, upon a little promontory, a metamorphic schist was discovered in contact with the granite (XIII. on map, Fig. 1). The direction of the strata was north-west and south-east, and their dip towards the north was about 45°; a very friable schist alternated with a dark quartzite, and dark green strata of a highly metamorphosed rock.

The fourteenth landing (XIV. on map, Fig. 1) was on a large island. M. Arctowski thus describes it: "I saw a channel which separates it in the south-west from another land; and to the north-west the sea-horizon was unbroken—it was the Pacific Ocean. I saw this confirmation of my theories[1] with much pleasure; there was no doubt that we were on the west coast of the continental land symmetrically placed with regard to the Southern Andes. There is no passage to the east, and the Biscoe Islands form a parallel chain belonging to the mountain system of Graham Land. . . . We remained some time on the strip of bare rock which was exposed between the field of névé and the sea. It was the same black granitoid rock traversed by thick veins and narrow threads of quartz; and there was a great variety of erratic blocks, including specimens of basalt, breccia, several blocks of conglomerate, and some fragments of quartzite. A cave was found in the large-grained porous ice-wall, along the uncovered bed of which a little stream flowed, the first glacier stream I had seen. It came from the direction of a nunatak, and consequently could not have pursued its course from a long distance under the ice; in its bed there were rolled pebbles of eruptive rocks."

On Wednesday, February 9, at 7.30 a.m., the fifteenth landing was made (XV. on map, Fig. 1). The whole coast appeared like one great *roche moutonnée* entirely free from snow, everywhere smoothly polished and scored with sharp grooves, often very deep, running in all directions and crossing each other. The larger were vacant, but others were filled with thin leaves of rock, and some with compact grey veins giving the rock a schistose appearance. The surface of the granite was strewn with splinters split off by the effects of radiation, usually from one-third to two-thirds of an inch thick, and about a foot in diameter. There were no erratic blocks. The rocks were bare up to a height of about 150 feet, but from this level snow uniformly covered the island and gave rise to a trickle of water, forming cascades, under which an abundant vegetation of mosses and algæ had accumulated. A few tufts of moss were found here and there among the stones. The sun shone strongly, and the bare rock grew quite warm. At 8 a.m. on the *Belgica*, when the air temperature was 41° F., the black-bulb thermometer in the sun read 87°·8, hence the splintering of the surface of the rocks could easily be understood. At 10.30 the *Belgica* passed the cape at the south end of the mountainous island, and the recording thermometer fell, while the hygrometer rose sharply as the influence of the ocean made itself felt; and in the distance great icebergs could be seen in the open Pacific. At 11 o'clock the sixteenth landing was made on one of a group of twelve small low islands (XVI. on map, Fig. 1). Lecointe landed for the noon observation of the sun, making use, as before, of an artificial horizon; Arctowski, Racovitza, Cook and Danco accompanied him. The whole islet was covered with moist snow almost to the water's edge; a remarkable difference in the height of the snow-line being observable in the short distance separating the fifteenth and sixteenth landings. All the islets of the neighbourhood had the same appearance, like great whale-backs rising from the sea. The polished rock extended to just below the surface of the water, and there were also several glaciated rocks scarcely emergent. The whole group seems to form a plateau which has been profoundly glaciated, and of which only the higher portions now appear; but this plateau has nothing, in M. Arctowski's opinion, in common with the continental shelf, the whole of the district presenting clear evidence of being a submerged region. From another point of view, these islands are by no means to be considered as the stumps of mountains worn down by marine erosion; they afford evidence of a great extension of glaciers in some bygone period. The whole of Belgica Strait had probably at one time been filled by a great glacier which flowed to the Pacific. The cutting off of the summits of these islands may be its work.

At noon on February 10 the eighteenth landing was made, almost opposite the seventeenth, on the other side of the large channel (XVIII. on map, Fig. 1). It was at the base of a pyramidal mountain of red rock, very different in appearance from the surrounding scenery. A great band of red granite seemed to traverse the region from north-north-west to south-south-east. The interesting feature of this landing was the discovery of a moraine, at least 70 feet in height, which was set against the mountain-side along part of the beach in the direction of the channel. The rock itself was highly glaciated to just below the level of the water. Here we must once again give the author's own words: "The commandant showed himself very obliging, but with a little goodwill we could have landed in many other places and collected much more geological material than we did. For this eighteenth landing he conducted me himself, but for ten minutes only. A few strokes of the oars brought us to the beach, amid cries of "Hurry up, Arctowski!' I gave a hammer to Tellefsen, with orders to chip here and there down by the shore, while I hurriedly climbed the moraine, picking up specimens as I ran, took the direction with my compass, glanced to the left and right, and hurried down again full speed to get a look at the rock *in situ*; meanwhile Cook had taken a photograph of the place from the ship—and that is the way geological surveys had to be carried out in the Antarctic."

At ten a.m. on February 11 the twentieth and last landing was made on the Pacific slope of the Needles,

[1] *Bull. Soc. Géol. France*, 1895, p. 590

which form the northern cape of Graham Land (XX. on map, Fig. 1. and view Fig. 2). In places the beach was quite free from snow, elsewhere there were small glaciers clinging to the slopes of the mountain and terminating seawards in cliffs of ice. The steep rocky slopes above were absolutely bare up to a height of 700 or 1000 feet, and beyond that rose fields of névé. Two of the party climbed a little ridge running at right-angles to the range of the Needles. An inclined plane of snow, interrupted here and there in the upper part by transverse crevasses easy to cross, led them to the rocky wall, which there was no difficulty in climbing, thanks to the numerous joints widened by weathering so as to cut up the face of the rock into superimposed blocks, and thanks also to the narrow chimneys down which the débris of the rock slipped. It is remarkable that these rocks remained quite bare at an elevation far above the snow-line. It is not sufficiently accounted for by the steepness of the slope, though that would make it possible for only a small quantity of snow to accumulate; but the dark walls were so strongly heated by the sun that the snow was actually melted. In making the ascent it was found that the low cloud, characteristic of these regions, was very thin and level on both the lower and upper surfaces, the belt of mist having been passed through between the altitudes of 150 and 300 feet, and above that there was an absolutely clear sky and dazzling sunshine, while the cloud extended as a smooth grey sea underneath. If such a condition often occurs, it is easy to see how the higher rocks become free of snow in summer, while those near sea-level remain covered.

After this landing the *Belgica* entered the Pacific, turned southwards into the ice-pack, and for a year drifted hither and thither, fast in the ice out of sight of land.

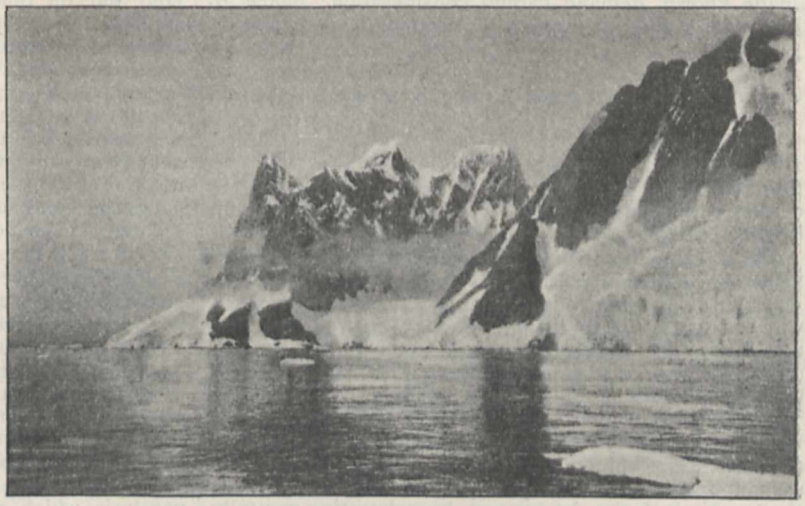


FIG. 2.—The Needles seen from the Pacific. From the *Geographical Journal*.

THE INTERNATIONAL ASSOCIATION OF ACADEMIES.

AN account by M. Gaston Darboux, permanent secretary of the Paris Academy of Sciences, of the inception and first meeting at Wiesbaden of this International Association, was given in NATURE for July 12, 1900. To the January number of the *Journal des Savants* M. Darboux contributes a further article on the same subject, in which, after again sketching the events which led to the rise of the Association, he gives an account of the Paris meeting and the arrangements for future work.

In this interesting article it is explained that the Royal Society and the Paris Academy took the initiative in the formation of this important Association, the advantages of which were pointed out by Lord Lister, as president of the Royal Society, in a letter dated November 17, 1898, addressed to the president of the Academy of Sciences of Paris. Among the questions of the first importance is that of the Catalogue of Scientific Papers, already commenced single-handed by the Royal Society. To carry this out completely it has been estimated that in the domain of the positive sciences alone the annual catalogue should comprise seventeen volumes and about two hundred thousand entries, a task evidently capable of being successfully accomplished only by combined international effort.

The academies and societies represented at the Wiesbaden conference decided to found an International Union of the principal scientific bodies of the whole world under the name of the "International Association of Academies"; the members of this Association being as follows:—

(1) The Royal Prussian Academy of Sciences, at Berlin.
(2) The Royal Society of Sciences, at Göttingen.
(3) The Royal Saxon Society of Sciences, at Leipzig.
(4) The Royal Society, at London.
(5) The Royal Bavarian Academy of Sciences, at Munich.
(6) The Academy of Sciences, at Paris.
(7) The Imperial Academy of Sciences, at St. Petersburg.
(8) The Royal Academy, at Rome.
(9) The Imperial Academy of Sciences, at Vienna.
(10) The National Academy of Sciences, at Washington.

The following academies were also invited to take part:—

(1) The Royal Academy of Sciences, at Amsterdam.
(2) The Royal Belgian Academy of Sciences, Literature and the Fine Arts, at Brussels.
(3) The Hungarian Academy of Sciences, at Budapest.
(4) The Society of Sciences, at Christiania.
(5) The Royal Society of Sciences, at Copenhagen.
(6) The Royal Academy of History, at Madrid.
(7) The Academy of Inscriptions and Literature, at Paris.
(8) The Academy of Moral and Political Sciences, at Stockholm.

Rules were also formulated regulating the admission of new academies, the constitution of the council and committee, the holding of general meetings every three years, and the mode of government during the intervals between the general meetings.

It was decided that the first reunion of the International Association should be held in Paris in July 1900. At this conference, besides formal business dealing with questions of constitution, three propositions brought forward by constituent academies were considered. The Royal Society drew attention to the desirability of connecting the measurements of Struve upon the arc of meridian 30° E. with those of Gill on the same meridian in South Africa; the Academy of Berlin raised the question of the best means of facilitating access to manuscripts and other documents; and on the proposi-

tion of the Paris Academy it was decided to assume control of the committee of physiology, having for its object the standardisation of the self-recording instruments used in physiology and increased uniformity in the methods used in that science.

M. Darboux concludes his article by mentioning a matter which proves at least the interest excited by the formation of the International Association of Academies, namely, that intended donations have already been announced. At the suggestion of M. Diels, it has been decided that any one having expressed the desire to give to the Association the means to develop its action could make the donation, with special instructions, to any of the academies taking part in it. Other less determinate projects will come before the general meeting. One, from the Academy of Munich, has reference to the publication of a "Corpus des actes et diplômes grecs du moyen âge et des temps postérieurs."

Another, suggested by the Academies of Leipzig, Munich and Vienna, is the publication of a "Real-Encyclopædie des Islam."

The committee meeting at Paris had finally to fix the date of the next meeting, the first general meeting. It is to be supposed that some, at least, of the proposals here made known demand careful consideration; hence, to leave the academies which have presented them time to give them a precise and definite form, Tuesday, April 16, which follows Easter Tuesday, 1901, has been fixed as the date of the next general meeting of the Association at Paris.

The various discussions and proposals mentioned are, without doubt, of unequal importance; they have at least the merit of being very varied and of putting in evidence the diversity of the services that may be rendered by the International Association of Academies.

The Association has been received with favour wherever science is cultivated. "Already," remarks M. Darboux, "we look to it for many works which it alone will be capable of realising. It may be recalled that the agreement between scientific men in the field of theoretical research often precedes a good understanding between peoples in the field of practice and business. There is a feeling that a new organism has been created, which should ultimately be called upon to exert a great and beneficent influence. It is important that the constituent academies should justify this feeling and forward the working of the Association by submitting carefully thought out proposals. It is important, also, that all those who expect much from the Association should bear in mind that it has time before it; that, by their very nature, academies are bodies which move with a certain slowness; and that time ought to be given to the new Association to create little by little the means by which it may be able to realise all the hopes to which it has given rise."

PROF. C. F. LÜTKEN.

CHRISTIAN FREDERIK LÜTKEN was born on October 7, 1837, at Sorö, a small town in Zealand, which at that time possessed an academy where his father was professor of philosophy. When quite a young man, even before his student days, his interest in the natural sciences was awakened, and after his examinations were completed he devoted himself heart and soul to zoology. In 1848 his studies were interrupted by the war between Germany and Denmark, in which he enlisted and served as a lieutenant. In 1852 he left the army and obtained his master's degree with distinction, almost immediately after which he was appointed assistant to Prof. Steenstrup, at Copenhagen, whose pupil he had been in his early days at Sorö. Thus began a connection with the zoological museum of the University which lasted for 47 years, terminating only when illness enforced his resignation.

His career was marked by constant devotion to the collections under his charge, and by the publication of a long series of scientific memoirs, published chiefly in the *Transactions* (Skrifter) and *Proceedings* (Oversigt over de Forhandlinger) of the Royal Danish Academy of Sciences, and the *Communications* (Videnskabeliger Meddelelser) of the Natural History Society of Copenhagen. His studies were always intimately connected with his work in the museum, and hence systematic zoology and geographical distribution and, to some extent also, palæontology constituted the main subject of his writings. Almost every one of the larger divisions of the animal kingdom owes something to Lütken's industry, but during his earlier years he concentrated his attention principally on the echinoderms, and later on ichthyology. Under the title "Dyreriget" he published a small text-book of zoology, a work which would have attracted considerable attention had it been in a language more generally understood. It is still the authorised text-book in most of the educational establishments in Denmark. Amongst his scientific writings special attention may be called to three papers on the echinodermata of Greenland and on the geographical and the bathymetrical distribution of northern echinodermata, which constituted the thesis for his doctor's degree; to a memoir entitled "Spolia Atlantica," which gives a large series of important observations on the young stages of many species of fish, and to a communication on *Himantolophus reinhardti*, a deep-sea lophioid fish, in which he first called attention to the probability that the attracting tentacles in these forms are phosphorescent.

On the death of Prof. Reinhardt, in 1883, he was appointed "inspector" of the department of vertebrates, and in 1885 he succeeded Steenstrup as professor of zoology and director of the museum. As a professor he was by no means the conventional pedagogue, and his pupils obtained from his lectures a clear and striking picture of the animal kingdom. Physical weakness, however, gradually grew upon him, and in his later years it was only with difficulty that he accomplished any teaching at all, and his auditors were frequently anxious lest he should be unable to complete his lecture, so feeble and distressing was his appearance. In 1897 he resigned the chair, and for the last year of his life was a victim of paralysis, which completely disabled him. He died on February 6, 1901, leaving behind him a record of valuable services to the University and to the science which he loved, and the memory of an intellectual and genial personality in the minds and hearts of all who had the privilege of his personal acquaintance. W. E. H.

NOTES.

REFERENCE was made in our issue for February 28 to the retirement of Sir A. Geikie from the office of director-general of the Geological Survey, and to the appointment of Mr. Teall as successor. Mr. Teall takes the title of director of the Geological Survey and Museum, and the further changes in the staff (which date from April 1) are as follows: Mr. H. B. Woodward to be assistant director (for England and Wales), and Mr. John Horne to be assistant director (for Scotland); Mr. C. Fox Strangways, Mr. Clement Reid and Mr. Aubrey Strahan to be district geologists for England and Wales; Mr. B. N. Peach and Mr. W. Gunn to be district geologists for Scotland; and Mr. G. W. Lamplugh to be district geologist for Ireland.

SIR ARCHIBALD GEIKIE will be entertained at a complimentary dinner on May 1, as a mark of recognition of his services to geology, and in commemoration of his recent retirement from the position of director-general of the Geological Survey and

director of the Museum of Practical Geology. The dinner will be given at the Victoria Hall, Criterion Restaurant, and the chair will be taken by Lord Avebury. The committee includes many distinguished and representative men of science, among them being Lord Kelvin, Lord Lister, Sir William Huggins, K.C.B., Sir Norman Lockyer, K.C.B., Sir John Murray, K.C.B., Sir Michael Foster, K.C.B., Sir William de W. Abney, K.C.B., Sir William Turner, K.C.B., Sir Henry Howorth, K.C.I.E., and Profs. Judd, Bonney, Le Neve Foster, McKenny Hughes, J. Geikie, Ray Lankester and Lapworth, as well as a number of other Fellows of the Royal Society. Tickets for the dinner can be obtained from the honorary secretary of the committee, Mr. F. W. Rudler, 28, Jermyn Street, S.W.

PROF. HUMBERT has been elected a member of the section of geometry of the Paris Academy of Sciences, in succession to the late M. Hermite.

THE summer meeting of the Anatomical Society of Great Britain and Ireland will be held in the Yorkshire College, Leeds, on Friday and Saturday, July 5 and 6.

WE learn from *Science* that Dr. Robert Bell has been appointed director of the Geological Survey of Canada, in succession to the late Dr. G. M. Dawson; and that Dr. S. W. Stratton has been appointed director of the newly-established U.S. National Bureau of Standards, by Mr. McKinley.

THE Easter excursion of the Geologists' Association will be to Kingsbridge, Salcombe and district, under the direction of Mr. W. A. E. Ussher and Mr. A. R. Hunt. The members taking part in the excursion will leave Paddington on the morning of Thursday, April 4, and return on the following Tuesday evening.

IT is announced from Berlin that the German Emperor has abandoned his original intention of opening in person the forthcoming fifth International Congress of Zoology, which is to be held in the German capital on August 12–16, and that, in consequence of a special desire on the part of the Empress, the German Crown Prince has undertaken to perform this task.

MR. VAUGHAN CORNISH has returned from an expedition in search of snow-waves in Quebec, Manitoba, the North-West Territories and British Columbia. These waves were found to be well developed on frozen rivers and lakes and on the open prairie, where photographs and measurements were taken. They are produced without the intervention of any obstruction, and sometimes occur in groups or trains of waves comprising a hundred succeeding ridges. Their movement is sufficiently rapid to be readily visible. In certain conditions of the snow true ripples are also formed, which are similar to the ripples produced by wind in loose dry sand. In both ripples and waves the steeper face is on the lee side. In moist or coherent snow, such as usually falls in England, the wind carves the surface into ridges which have their steep face on the windward side.

AN outward and visible sign of progress in the arrangements for the British Antarctic expedition which in July or August will set out under the auspices of the Royal Society and the Royal Geographical Society, was shown by the successful launch of the *Discovery*, the ship specially built for the expedition, at Dundee on March 21. Lady Markham christened the vessel, which, when completed, will cost about 50,000*l.*; and at a banquet held after the ceremony Sir Clements Markham referred to the lack of geographical knowledge of Antarctic regions and the opportunities which will be afforded for the study of the great ice barrier. The purely exploratory work of the expedition will, of course, be of interest, and as that appeals to the public mind it is perhaps expedient to give prominence to it. But the necessity for the expedition lies in the absence of information concerning the natural history, physics and meteorology of the south polar regions, and it is with the provision made for the investigation of these subjects that men of science are most concerned. We are glad, therefore, to know that the scientific work of the expedition is in the hands of Prof. Gregory.

IN the House of Commons on Friday, Sir J. Rankin asked the President of the Board of Agriculture whether he would consider the desirability of establishing pomological stations in convenient parts of the country for the purpose of making experiments in the growth of the apple and pear, so as to enable persons employed in the fruit industry to obtain trustworthy information. In reply, Mr. Hanbury said: "Stations for agricultural and horticultural experiments have not hitherto been established directly by the State itself, and in the case of apples and pears, which depend so much upon the climate in which they are grown, no one central station would be of much use, and it is only by local agency that experiment stations could be established in so many varying districts. Both in the North and South of England there are institutions, aided either by the local taxation grants or by direct grants from the Board of Agriculture, in which experiments are made in the growth of pears and apples, and this appears to be the proper system to be adopted in those districts, such as Herefordshire, where there is a special interest in the growth of these fruits."

AN account of the work of M. Théodore Moutard, the mathematician, whose death was recorded last week in these columns, is given by M. G. Darboux in the *Comptes rendus*. After leaving the École Polytechnique, Moutard for a long time devoted himself to private teaching, preferring this course to serving under the Government, and he soon established for himself a unique reputation. But in 1870 he returned to the School of Mines, and he rendered valuable services as Inspector-General of Mines. The second part of his career was thus spent in the midst of a circle of congenial and distinguished colleagues. Moutard rarely published papers, but what he did write was of great value. To him we are indebted for the theory of anallagmatic surfaces, and especially of those of the fourth order or *general cyclides*, and Moutard's theory has formed the basis of numerous developments by Laguerre, Rebacour, Mannheim and Humbert. In the theory of partial differential equations of the second order, with two independent variables, Moutard gave a complete solution of an important problem. His manuscript, presented to the Academy, was burnt by the Communists at Bertrand's house; but Moutard re-wrote the most important portions, and the remainder of the theory was re-established by Cosserat. Moutard also wrote some valuable notes to Poncelet's *Applications d'Analyse et de Géometrie*, and his use of elliptic functions in connection with Poncelet's theorems on inscribed and circumscribed polygons has been characterised by Halphen as one of the best and most profound writings on this interesting subject. Moutard sought no distinctions, and never became a candidate for membership of the Paris Academy, although the section of geometry of that body recognised his merits by awarding him the Petit d'Ormoy prize, the highest honour that could be conferred on him. He kept a great many of his writings unpublished, although repeatedly urged to allow them to be printed.

IT is with much regret that we record the death, on March 7, of Mr. Arthur Coppen Jones, known to the scientific world as the translator of Fischer's "Lectures on Bacteria," and by an important paper, published in the *Centralblatt f. Bacteriologie und Parasitenkunde* in 1895, in which he sought to establish the revolutionary discovery that the tubercle bacillus is probably no bacillus at all, but a stage in some hyphomycetous fungus. Mr. Jones was one of the last set of students who worked under

Huxley at the Royal College of Science, and he there distinguished himself by taking the Forbes medal. Full of enthusiasm, he laid his plans to return to the College in the following session for the work of investigation, but an exceptionally severe constitutional breakdown prevented him from so doing. He was ordered to Davos, and he there spent the rest of his life, with the exception of brief periods of absence passed in study at the Universities of Zurich and Berlin, he being attracted to the latter city by the now famous investigations of Koch. While at Davos, Jones developed a practice as a consulting bacteriologist, working and experimenting whenever he was able. He did not hesitate to submit even his own person to experiment, and in one of his letters he admitted himself enamoured of the Richet muscle-plasma treatment, with which he experienced an immediate success. In the closing year of his life, Jones returned to some experiments he had previously made upon the physiological effects of air at high altitudes, but to no purpose, for the end came suddenly and peacefully, a tubercular cystic trouble necessitating an operation, which, while affording relief, proved of no permanent value. He was buried at Davos, where his loss will be severely felt.

WE have received a pamphlet setting forth in concise form a history of the progress and present status of the work of the Concilium Bibliographicum at Zürich, which for the past five or six years has been maintained at considerable pecuniary risk by Dr. H. H. Field, who in successive periods has had to face a deficit ranging from 5625 francs for each of the first three years to 224 for the last. The official foundation of the institution was by a vote of the third International Congress of Zoologists, at their meeting in Holland of 1895, and the experimental stage of its work has now passed. The Swiss Society of Naturalists, who have all along been among the foremost supporters of the undertaking, have with commendable enthusiasm induced the Swiss Government, by a recent vote of its Parliament, to increase five-fold a subsidy with which during recent years it has generously endowed the work. There is hereby insured the future permanence of the enterprise, which now becomes independent of the person of its present director. The pamphlet gives, in addition, an analytical table of the cards and other bibliographic materials which have emanated from the Bureau, and a register of the distribution of the cards in the chief divisions of the bibliography. Terms of subscription, an outline scheme for future development, with an ambitious programme for the present year, bring the pamphlet to a close, except for the remark that a removal has recently been made to more spacious quarters. Acknowledgment is made of support received from the Elizabeth Thompson Science Fund, and while we would congratulate Dr. Field upon this and the encouraging circumstances under which he starts work for the new century and wish him every success, we would recommend to the consideration of zoologists and bibliographers at home the fact that Cape Colony takes about as many cards as the whole of England. This is a condition which simply should not be, and denotes a poor return for the services done.

THE April Pilot Chart for the North Atlantic and Mediterranean has just been published by the Meteorological Council. It follows the same arrangement as that for the January specimen chart described in our last number. But of course there are, in all directions, important changes in the details. There are some interesting features connected with the winds and currents, particularly the modifications in the set of the currents off our western and south-western coasts, which are, no doubt, due to the prevalence of polar winds off the coasts of north-western Europe in the spring months, causing a surface drift to the westward and south-westward, and interfering with the normal flow of the Gulf Stream. Many subjects are dealt with in the letterpress, but prominence is given to fog and ice about the banks of Newfoundland, these dangers increasing with the opening of navigation of the St. Lawrence Gulf and River for the summer. It is explained that the fogs of this locality have certain peculiarities, the knowledge of which may be of no little service to the seaman. Thus, with the wind blowing from the sea towards the land, the fog is generally of no great density, for objects can often be sighted at a distance of half a mile, but with calm fogs following strong winds nothing can be seen at fifty yards from the deck, yet at a height of fifty or sixty feet in the rigging it may be possible, at the same time, to see almost any distance round. Up to the time of going to press no ice had been reported on the Grand Banks this season, the weather off St. John's, Newfoundland, on the 8th inst. being favourable, and no ice to be seen, so that it does not look like a great ice year.

FOR several years past the Deutsche Seewarte, Hamburg, has made strenuous efforts to accelerate and improve the service of telegraphic weather reports. The subject has been discussed both at international meetings and at conferences of the heads of the German meteorological systems, and it is recognised on all sides that the present service can be materially improved by a more speedy collection, discussion and publication of observations. So long ago as 1872 a very perfect system was introduced in the United States, called the circuit-system, in which the necessary wires over certain telegraph lines are reserved exclusively for the transmission of meteorological messages for a time after each observation. This method has been found to work very satisfactorily in the United States, but in Europe, where the control of the wires is in the hands of various countries, the difficulty of introducing a similar method is insurmountable. The system recommended by the Deutsche Seewarte is called the radial-system, in which the observations pass through the central offices. Special observations have been made for nearly a year at 8 a.m. mid-European time, or at about 7 a.m. Greenwich time, at some thirty-five stations in various countries, including several in the British Islands, and forwarded to the Deutsche Seewarte, which enable the Hamburg office to issue reports as early as 9 a.m.; and the early publication of this information has been found to lead to such satisfactory results as to warrant a considerable extension of the plan in the near future. The method is fully discussed and explained by Dr. van Bebber, in the February number of *Das Wetter*, in an article entitled "The Present Condition of Weather Telegraphy."

WE have received a copy of the year-book of the Austrian Meteorological Office for 1899, containing daily observations at twenty stations, hourly observations for Vienna, and hourly means and monthly and yearly summaries for a large number of stations. During each winter the Vienna thermograms show some anomalous jumps of temperature, amounting to 3° to 5° C. and at times reaching even to 10° in half an hour, or less. The mild winter of 1898–9 exhibited several such cases, and these have been made the subject of an interesting discussion by Mr. Max Margules, who has compared the thermograms of Vienna with those of two places situated some 30 or 40 miles to the east and west of that place. In very sudden rises of temperature it is a matter of considerable importance to know what is taking place above. In all cases it was found that at a relatively greater altitude, say 500 to 800 metres above the lower stations, the warmer temperature occurred some hours or even a day earlier than at the lower stations. The subject has been discussed with reference to the following conditions:—(1) A progressive increase of temperature in the upper air; (2) a constant temperature above; (3) an increasing temperature below with a decreasing temperature in the higher strata of the atmosphere.

THE remarkable subsidences which have often occurred in and around the town of Northwich, in Cheshire, form the subject of a paper by Mr. T. Ward, recently issued by the Institution of Mining Engineers. The subsidences are chiefly due to mining in the Upper Bed of rock-salt, and the too rapid removal of brine by means of modern pumps. In a natural condition the water in or on the salt-beds becomes saturated with salt and then ceases to dissolve it, but now the brine is continually pumped up in immense quantities, and the fresh water which flows to take its place dissolves the salt pillars which have supported the roof and overlying strata, with the result that there is a depression towards each pumping centre. In almost every case the mines in the Upper Bed of rock-salt are destroyed by water rapidly eroding the salt pillars in this way. Another cause of subsidence is the pumping of brine from off the rock-head, that is, the surface of the Upper Bed of rock-salt. These are by far the most serious and widespread, and it is from them that the town of Northwich suffers so much damage. Owing to the subsidences, which show themselves first by small cracks in the buildings, and in doors and windows refusing to shut, a system of framework buildings has been allowed, so that when

a building sinks it can be lifted by screw-jacks and put back to its original position. By degrees the town is becoming one of framework buildings, and will, for England, be unique in this respect. The accompanying illustration, which we are enabled to give from Mr. Ward's paper, shows a subsiding house in a street at Northwich.

WE learn from the *Scientific American* that Mr. Edison has recently taken out a patent for a method of obtaining permanent phonographic records. The wax cylinder on which the impressions due to the speech have been made in the usual way is first coated with an extremely thin layer of gold; this is effected by revolving the cylinder in a vacuum between two gold electrodes between which a vacuum discharge is passing. This thin layer of gold is backed up with copper by electro-deposition and the wax is removed, we imagine by melting it off. Upon the copper matrix thus obtained a deposit of silver is thrown down electrolytically, and when this is of sufficient thickness the copper is dissolved off. The remaining silver deposit will retain the thin layer of gold and will be an exact reproduction of the original wax record, but one much more capable of standing repeated use. The value of the invention depends obviously on the fidelity with which the final silver record reproduces the original sounds; if the reproduction is accurate the process is a very useful one, since a phonographic record which is at once faithful and permanent should be of considerable value for historical purposes.

IN the February number of the *Victorian Naturalist* Mr. A. J. North continues his observations on the geographical distribution of Australian birds.

A RECENT issue of the *Bulletin* of the Illinois State Laboratory of Natural History (vol. v. art. 12) deals with the local fauna of leeches (Hirudinea), of which several new forms are described. The occurrence of certain European species is especially noteworthy. Several beautiful plates illustrate the morphology of some of the more remarkable types.

IN its Report for the past year the Oxfordshire Natural History Society and Field Club sets an excellent example to associations of a similar nature by the publication of the first instalment of a local fauna. The group dealt with on the present occasion is the Hymenoptera Aculeata, comprising ants, wasps and bees. The local list is also issued in a separate form, printed only on one side of the paper for cutting up to label collections.

DR. L. STEJNEGER sends us a copy of a paper on the North American wheatears (*P. U.S. Mus.* xxiii. p. 473), in which it is shown that a race of these birds habitually breed in North America. From the differentiation of this Greenland race the author thinks we are justified in inferring that the Greenland-Iceland-England line of migration must be considerably older than the Alaska-Tchuktchi-Udski route, since it has resulted in the establishment of the local variety of the wheatear forming the subject of this communication.

TWO papers in the March issue of the *Quarterly Journal of Microscopical Science* record important advances in our knowledge of the lancelets. In the first Dr. A. Willey describes a new subgeneric type of these primitive chordates from the Orissa coast, under the name of *Branchiostoma* (*Dolichorhynchus*) *indicus*. The distinctive characteristic is the anterior prolongation of the notochord and head-fin; so that this form is exactly the opposite of *Heteropleuron* (*Asymmetron*) *lucayanum*, in which these parts are extended in the other direction. In the second communication Prof. W. B. Benham describes the New Zealand lancelet as *Heteropleuron hectori*. It may be mentioned that, according to modern ideas of nomenclature, the name of the first subgenus of the typical group should be Branchiostoma, and not Amphioxus, which is a synonym.

TO the same journal Mr. R. I. Pocock contributes an important memoir on the Scottish Silurian scorpion, with a figure of the specimen discovered in Lanarkshire in 1883. This the author makes the type of a new species, *Palaeophonus hunteri*. As the result of his investigations, Mr. Pocock concludes that Palæophonus apparently occupies a position intermediate between the king-crabs (Limulus) and the Palæozoic Eurypterids, on the one hand, and modern scorpions on the other, although, if anything, rather nearer the former than the latter. The Scotch species thus supplies a few more links to the chain of evidence connecting the line of descent of the modern terrestrial scorpions from marine ancestors more allied to the king-crabs.

WE have the pleasure of congratulating Mr. T. Southwell, of Norwich, on the appearance, in the February number of the *Zoologist*, of the twentieth annual issue of his valuable "Notes on the Seal and Whale Fishery." The season's catch included 16 whales, 494 walruses, 53 seals and 145 bears, which yielded 230 tuns of oil and 219 cwt. of whalebone; in addition to which was the product of 1 whale, 138 walruses and 3400 seals, equal to 60 tuns of oil and 10 cwt. of "bone" from the Cumberland Gulf station. With oil at 22*l.* per tun, and sizable "bone" at 1400*l.* per ton, the estimated value of the take would be about 30,000*l.*, as against 38,000*l.* in 1899. Owing to the bays in which they are usually beached being blocked with ice, no white whales were taken. Mr. Southwell is informed that the Greenland seas are not to be visited by any British whalers during the coming season. Commenting on the practical disappearance of the right whale from the Greenland seas, the author doubts whether this can be attributed to extermination, but is at a loss to determine where the remnant have gone. "As to the seals, the case is much more simple; the destruction year after year of a very large proportion, often virtually of the whole brood and of a large number of old seals in addition, congregated in a limited area, must inevitably tell in course of time, and sooner or later reduce the breeding pack to such an extent that they would be no longer worth pursuing, and even lead to their final extermination. This has doubtless, to a very large extent, been the case. The British vessels have quite abandoned the pursuit, and what there is left of the Greenland sealing is now quite in the hands of the Scandinavians, whose more economical outfits enable them to continue the struggle long after we have been driven from the field."

A BULKY volume just issued by the Government of India contains accounts of the trade carried by rail and river in India in the official year 1899–1900 and the four preceding years, compiled under the direction of the director-general of statistics.

A COLLECTION of tables showing the rainfall recorded on each day of every month from 1868 to 1899 at Dehra Dun has been issued by the Survey of India Department. The daily, monthly and annual means are also given.

THE following lectures will be given at the Royal Victoria Hall, Waterloo Road, during April, on Tuesday evenings:—"Waves and Oscillations," Mr. A. W. Porter; "Wild Nature at Home," Mr. R. Kearton; "Arctic Discovery," Captain Wiggins; "Our Field Crops as a Factory of Food," Mr. J. S. Dymond; "Facts about India: Plague and Famine," Mr. Birdwood.

WE have received a copy of *Kuhlow's German Trade Review and Exporter*. This paper is published in Berlin but is written in English, and contains some interesting translations from German and other technical papers on recent electrical work. The main object of the journal is to introduce German productions to foreign markets, and it is noteworthy as an example of the energy and perseverance with which the Germans are pushing their export trade.

THE *Rendiconto* of the Bologna Academy (iii. 1) contains a paper, by Prof. Ferdinando Paolo Ruffini, on the moments of inertia of a system of points not possessing a mass centre. The author examines, with the aid of certain formulæ already indicated by the late Prof. Beltrami, the disposition in space of the axes which in a given system of points having no mass centre (the sum of the mass constants being zero) have a given moment of inertia. The quadrics which are analogous to the ellipsoids of inertia in an ordinary system are also discussed.

IN a recent number of the *Revue générale des Sciences* Prof. A. Haller describes the contact process of sulphuric acid manufacture as used by the Badische Anilin- und Soda-Fabrik. In this process a mixture of sulphur dioxide and air is brought into contact with platinised asbestos at the proper temperature. The platinised asbestos is placed on perforated trays, supported in an upright tube which is so arranged that it can be heated or cooled by means of a current of air. The temperature at which the best results may be obtained depends upon the concentration of the sulphur dioxide and must be sufficiently high to start the reaction, but lower than the dissociation temperature of sulphur trioxide. A similar process has been in operation for a considerable time in this country and in Germany for preparing "Nordhausen" acid, but it has been found only workable when the mixture of sulphur dioxide and oxygen is pure, such as the mixture obtained from sulphuric acid by dropping it on to hot platinum. Presence of water vapour and other impurities causes the platinised asbestos to become inactive. In the Badische Fabrik process the sulphur dioxide is obtained by burning pyrites, and complete combustion of the sulphur and other oxidisable matter is attained by blowing jets of air and steam into the hot gas just as it issues from the burners. The gas is then washed and dried by passing through sulphuric acid. Before passing into the "contact" apparatus the mixture is examined optically, and must show no trace of cloudiness when viewed through a long tube. It is also chemically examined and must be free from arsenic. By proper regulation of the temperature up to 99 per cent. of the sulphur dioxide is converted into sulphur trioxide. The sulphur trioxide is dissolved in water, and for the production of acid of higher concentration than 60 per cent. the process is more economical than the lead chamber method. The claim is also made that better acid is produced, since it contains no arsenic, nitric compounds or lead.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus*) from India, presented by Mrs. F. Page; a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Mrs. Horrell; a Senegal Touracou (*Turacus persa*), a Great-billed Touracou (*Turacus macrorhynchus*) from West Africa, presented by Mr. G. A. Corder; a Goshawk (*Astur palumbarius*), European, presented by Mr. C. Schaible; four Chameleons (*Chamaeleon vulgaris*) from North Africa, presented by Mr. W. F. Cornelius; a Lesser White-nosed Monkey (*Cercopithecus petaurista*) from West Africa, a Grey Ichneumon (*Herpestes griseus*) from India, deposited; a Tasmanian Wolf (*Thylacinus cynocephalus*) from Van Dieman's Land, received in exchange.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN APRIL.

April 1. 15h. 56m. Transit (egress) of Jupiter's Sat. III.
2. 8h. 23m. Minimum of Algol (β Persei).
3. 18h. 0m. Mercury at greatest elongation, 27° 48′ West.
4. 11h. 59m. to 13h. 18m. Moon occults B.A.C., 4531 (mag. 5·7).
7. 15h. 59m. to 17h. 19m. Moon occults ω^2 Scorpii (mag. 4·6).
7. 16h. 5m. to 16h. 20m. Moon occults ω^1 Scorpii (mag. 4·1).
15. Saturn. Outer minor axis of outer ring = 15″·96.
15. Venus. Illuminated portion of disc = 0·998.
15. Mars. Illuminated portion of disc = 0·924.
20–21. Epoch of Lyrid meteoric shower (Radiant 270° + 33°).
22. 10h. 5m. Minimum of Algol (β Persei).
22. 10h. 25m. to 11h. 11m. Moon occults χ^2 Orionis (mag. 5·9).
27. 7h. 40m. to 8h. 31m. Moon occults 19 Sextantis (mag. 6·0).
30. 10h. Jupiter stationary.

NEW VARIABLE STARS.—Mr. Stanley Williams announces the discovery of a new variable star in Perseus having the position

R.A. = 3h. 17m. 51·8os.
Decl. = + 43° 39′ 55″·6 (1855).

The star is B.D. +43°·726, catalogued as 8·9 magnitude, and is in the same field as Nova Persei with a low power.

The following magnitudes have been determined from photographs obtained with a 4·4-inch portrait lens.

1900.	Dec. 22	...	11·63 Mag.
1901.	Jan. 11	...	11·47
	25	...	10·97
	Feb. 11	...	10·87
	20	...	10·80
	28	...	10.53

The visual magnitude of this star is considerably brighter than the above photographic measures. Espin classes the star R in his "Stars with Remarkable Spectra."

Dr. T. D. Anderson announces a new variable in Andromeda, whose position is

R.A. = 0h. 43·5m.
Decl. = + 33° 35′ (1855).

The magnitude of the star has varied as follows:—

1900.	Oct. 5	...	<11·2
1901.	Feb. 16	...	10·7
	March 10	...	10·2.

Astronomische Nachrichten (Bd. 155, No. 3698).

LIGHT CURVE OF ALGOL.—Prof. A. A. Nijland, of Utrecht, contributes an article to the *Astronomische Nachrichten* (Bd. 154, No. 3695), containing the results of a numerous series of determinations of the brightness of Algol during its variation, and gives the light curve deduced therefrom. As shown, the variation is not symmetrical with respect to the minimum, a break occurring on the passage from maximum to minimum.

CHART FOR OBSERVATIONS OF NOVA PERSEI.—The first of a series of charts for use in observations of Nova Persei has been prepared by Father Hagen, of Georgetown College Observatory, and has recently been issued. The publication consists of a map of the region surrounding the Nova, showing stars down to the sixth magnitude, and a catalogue including all the stars shown on the chart, with their actual magnitudes and notes as to any peculiarities. A second series of charts is in preparation, and will be issued shortly.

PHOTOGRAPHY OF THE AURORA.

THE ever-changing form, and the faintness, of the aurora render this phenomenon a difficult subject to the photographer. Many have been the attempts to secure photographs of what have appeared to be brilliant displays, but the results have shown that little or no action had taken place on the photographic film, in spite of the fact that very rapid plates had been used. Herr Tromholt, who made a special study of the photography of the aurora, exposed very rapid plates to what he considered bright auroræ, and even with exposures from 4–7 minutes secured no trace of them. Later, at Christiania, he was more fortunate, and obtained an impression with an exposure of 8·5 minutes. To advance our knowledge of the changes in form of this phenomenon, it is important that photographs should be secured, if possible, in a few seconds, and not minutes. This seems now to be feasible, judging from an interesting account given in the *Meteorologische Zeitschrift* (Heft 6, 1900), by Herr O. Baschin. Herren Brendel and Baschin stayed several months, during the winter of 1891–92, at Bossekop, in Norwegian Lappland, to study the magnetic elements and the aurora.

For the photography of the aurora they employed an apparatus belonging to Herr. O. Jesse, who had used this instrument for photographing luminous night clouds. The objective had a focal length of 210 mm. and 60 mm. aperture; the dimensions of the plates used were 9 × 12 cm., the field photographed covering about 20° to 30°. Schleussner's plates were employed, and what appears to be the most important desideratum, the plates were stained (with erythrosine) and thus rendered more sensitive to the auroral light. For the first experiments the exposures given were comparatively long, namely three minutes, but these were found to be excessive; finally, seven seconds were sufficient to give good pictures. The reproductions accompanying the account of these researches illustrate the results secured with exposures of one minute and seven seconds respectively. The latter is reproduced here and shows very clearly the drapery-structure, although even this, according to Herr Baschin, is overexposed, the structure having a watery

FIG. 1.—Auroral-drapery on February 1, 1892.

and not sharp appearance. With such first results as these, there seems no reason why, with plates stained to be most sensitive to the particular colour of the aurora, and with the most rapid lenses, even shorter exposures of a second or less should not be given.

A step in the right direction has, however, been made, and the time is not far off when it will be as possible to project the ever-changing form of the aurora upon a screen as it is to exhibit in this way the phenomenon of an eclipse of the sun.

THE MISSISSIPPI RIVER.

THE Mississippi river, extending over a length of 2550 miles, has been placed by the United States Government under the charge of a Commission, whose duties include the making of a detailed survey of the channel from the headwaters to the Gulf of Mexico; a topographical survey showing the natural and artificial features lying within a mile of the river; a system of triangulation with base lines along the stream; longitudinal and cross sections of the channels; observations and records as to floods; and, for the assistance of future surveys, the placing, at intervals of three miles, of permanent marks, consisting of four stone or vitrified tile monuments placed in a line normal to the stream, two on each bank, about half a mile apart. The Commission has also the charge of the works carried out for regulating and deepening the channel.

Mr. J. A. Ockerson, who is a member of this Commission, and who, in the year 1899, made a survey of the headwaters of the Mississippi, contributed a paper on the subject to the *Proceedings* of the International Congress on Navigation held at Paris last year,[1] from which the principal part of the information here given has been obtained.

[1] "The Mississippi River: Some of its Physical Characteristics and Measures employed for the Regulation and Control of the Stream." By J. A. Ockerson, member of the U.S. Mississippi Commission Eighth Navigation Congress on Navigation. Recorded in English and French. (Paris 1900.

The Mississippi is one of the largest rivers in the world. It penetrates the heart of the most fertile portion of the United States for a distance of 2550 miles, and has 15,000 miles of navigable tributaries. Its headwaters rise amidst the pine-clad hills of northern Minnesota, where the long winters reach almost a polar cold, and winds its way through the varying conditions of climate of ten great States to the semi-tropical lowlands of southern Louisiana, finally losing itself in the Gulf of Mexico. Its drainage area, of over 1¾ million square miles, covers nearly half of the United States, and is equal to the whole of Europe exclusive of Russia. The region which it drains has no equal in any part of the world for fertility of soil and natural resources, such as vegetable products, timber, coal and minerals of various kinds. On its surface are borne immense cargoes of grain, coal and lumber gathered from the resources of a vast district and despatched across seas to all parts of the world. In its upper reaches it affords power to innumerable saw-mills and flour-mills and manufacturing industries.

The source of this great river has long been the subject of controversy. The earliest white explorers who first visited the country where the Mississippi rises were the French fur traders, but the earliest authentic account of the exploration of its source is that of William Morrison, who visited the district in 1804. The next explorer who recorded the results of his survey was R. H. Schoolcraft, in 1832, who located the head-waters in Lake Itasca. In 1872 the *New York Herald* sent a representative to visit the source of the river, with instructions to navigate the stream thence to the Gulf of Mexico. Again, in 1879, the *Louisville Courier Journal* sent an expedition to Itasca Lake. It was not, however, until 1889 that the first thorough exploration of the basin was made under the direction of the Minnesota Historical Society.

The State of Minnesota has set aside a reservation of 35 square miles, covering the basin of Lake Itasca, thus preserving for ever sacred the source of the father of rivers in the "Itasca State Park."

Unlike the origin of most large rivers which commence as mountain torrents, the Mississippi leaves its source with a width of 30 feet and a depth of 5 feet, and starts on its journey at an altitude of 1560 feet above sea-level. Commercial navigation reaches to within 25 miles of the lake, and thousands of sawn logs are floated down the stream every summer. At about 60 miles from the source the Government have constructed reservoirs, capable of holding 93,746 million cubic feet of water, for the purpose of regulating the supply of water to the channel and maintaining a navigable depth in summer. Near St. Anthony, about 500 miles from the source, are rapids which have been made use of obtaining water-power for working saw and flour mills and other manufacturing industries. Steamboat navigation commences near the junction of the Minnesota river, where the river has fallen 870 feet, 548 miles from the source.

A little above the junction with the Ohio, about 1400 miles down, the water becomes heavily charged with sediment and the country is subject to be flooded. The extreme range between high and low water at St. Louis is 37 feet. The slope of the water here falls six inches in a mile. Sand bars are numerous, and although the discharge amounts to 35,000 cubic feet a second in dry seasons there is not frequently more than four feet over the bars. Works are being carried out along this length for regulating the width of the channel and dredging away the bars so as to secure a better navigable depth. Where the banks are subject to excessive erosion they are protected by mattresses of woven willows, and the banks graded by hydraulic action. A description and illustration of this work was given in NATURE of December 19, 1896. Along this reach the river is exceedingly crooked. Between Arkansas and Greenville the distance along the river is 40 miles, the air line being only 15 miles. It also has great width, the banks, which are from 30 to 40 feet high, being in places two miles apart. The maintenance of these "levées" or banks is of vital importance to the surrounding country, as a breach would result in the inundation of 50,000 square miles of rich alluvial land.

One of the greatest difficulties which the management and the navigation has to contend with is the immense amount of drift-wood carried down in floods. This wood, if not cleared away, gets caught in the bends and accumulates, forming with the alluvial matter an effective barrier to the flow of the water and a source of danger to the banks. For the removal of this drift-wood special vessels, called snag-boats, are employed, which patrol the river and remove the snags.

Dredgers of large type, and provided with very powerful machinery, are in constant employment for removing sand bars and shoals. The type now almost universally in use for this purpose are worked by centrifugal pumps, which raise the sand and in some cases deliver it over the banks. Where the material is hard, cutters are provided at the end of the suction pipes of the pumps, which loosen the clay or hard material sufficiently to allow of its being sucked into the pipes. One of the most recent of these machines is capable of raising more than 4000 cubic yards of material an hour, and is fitted with electric light, machine shops, and all appliances necessary to repair the machinery and keep it in going order.

For the lower part of its course the river winds its way through a vast delta, twisting and turning by numerous bends until it extends its length to nearly double the point to point length of the delta. This delta is 500 miles long, and from 30 to 40 miles in width, covering an area of 400,000 square miles. It is composed of material transported by the current and deposited in the estuary, which at one time extended from the original outfall to the Gulf of Mexico. The river is still pouring solid matter into the Gulf, where it is spread out in a fan-like shape over a coast-line of 150 miles and is filling it up at the rate of 362 million tons a year. Some idea of the vastness of the silent operations of nature may be conceived when the fact is considered that this solid matter consists of the wearing away of the land through which the river flows, and that some of it must have been transported a distance of over 3000 miles; and that if the whole of it had to be carried in boats for half the total distance at the lowest rate at which heavy material is carried on the inland waterways of America, or, say, for one-tenth of a penny per ton per mile, the annual cost of transport would amount to no less a sum than 238 millions of pounds.

The channel in the lower reach is narrow, not exceeding half an mile in width, the depth in places exceeding 200 feet, and everywhere sufficient to float large sea-going craft as far as the junction of the Red river, a distance of more than 300 miles.

On this length is situated the city of New Orleans, 110 miles above the Gulf of Mexico. Ships of all nations reach this port. Its wharves extend over fifteen miles of river front, and are crowded with vessels of every description. Grain and cotton form the chief item of export.

As the river approaches the Gulf it is split up into three principal channels. The smaller of these has been improved by training walls made of mattresses and stone, which extend over the bar out into the deep water of the Gulf for more than two miles. This work was undertaken by Captain Eads, under contract with the Government to provide, for a certain sum of money, a depth of twenty-six feet at low water and to keep and maintain this depth for a period which has now expired.

The description of this mighty river above given will surely warrant its being called the "Father of Waters."

W. H. WHEELER.

HISTORY AND PROGRESS OF AERIAL LOCOMOTION.[1]

WHILE history contains no records of any past age in which men rode bicycles, the question of aërial locomotion has occupied the thoughts of man from the days of the Egyptians, to whom we are indebted for a representation of a man with wings considerably resembling the gliding machine on which Mr. Pilcher lost his life. Passing by the legend of Daedalus, whose invention of sailing ships led to the tradition that he attached wings to himself, we find in history numerous records, some such as that of Dante of Perugia or the chronicle of Busbequius, referring to gliding experiments which may not improbably have been authentic, others describing machines by which men have tried to raise themselves by their own exertions, but without success, as exemplified by Besnier, the Marquis de Bacqueville, Jacob Deghen, while a far larger number have been handed down to us of designs of fantastic machines for navigating the air, of a purely visionary character. In the latter category we must include in past times the grotesque figures

[1] Abstract of a Discourse delivered at the Royal Institution on Friday, February 8, by Prof. G. H. Bryan, F.R.S.

designed by Barthelemy Lourenço in Portugal, by the novelist Retif de la Bretonne, by Blanchard, before he became noted as a balloonist, and the prospectus of the Minerva issued by one Robertson when interest in ballooning was at its height. Even in recent times equally absurd devices have been promulgated, such as aërial tramcars supported by cigar-shaped gas vessels, not one-hundredth of the size necessary to raise such loads, and seats in such aërial tramcars with cavities filled with gas whose actual lifting power would amount to a few milligrams, and others.

The problem of aërial navigation, *i.e.* of performing *directed* journeys in the air, made no progress until Montgolfier's invention of the balloon. This rendered it possible to ascend in the air, but did not enable the motion to be directed, and from that time on aëronauts became divided into two classes: those who sought to navigate the air with balloons that rendered their apparatus lighter than air, and those who experimented with machines heavier than air but supported on structures resembling wings.

Balloons have often proved invaluable in times of war, and the war in South Africa has been no exception, thanks partly to the exertions of Major Baden-Powell. But the most practically useful application of the balloon in times of peace was inaugurated by Glaisher's ascents into the upper regions of the atmosphere for the purpose of obtaining meteorological data, and it is only recently that the balloon has been superseded for this purpose by the kite now largely used in America.

The experiments of Count von Zeppelin last summer, amounting as they did to the performance of a directed journey through the air, in some cases against a head wind, enable us to say that a solution of this problem was obtained before the end of the nineteenth century. The only previous achievement approaching von Zeppelin's was that of Messrs. Renard and Krebs in 1885 with the French war balloon, "La France." These experimenters on one occasion actually succeeded in performing a journey in the air and returning to the starting-point; but as the feat was never repeated and the speed of their balloon is stated by one writer at four and by another at fourteen miles an hour, it is somewhat difficult from such conflicting evidence to estimate the amount of success achieved. The speed attained by Count Zeppelin's balloon was about eight metres per second, say seventeen and a half miles an hour, and agreed very closely with that predicted by calculation, viz., 8·12 metres per second. With lighter and more powerful motors Count Zeppelin hopes to increase the speed by 50 per cent. The chief features of this machine are (1) its division into seventeen compartments, which prevents the gas from collecting at one end or oscillating in the balloon in such a way as to increase the resistance; (2) the distribution of the load at two points instead of at the centre, which reduces the mechanical difficulty of supporting a heavy weight by a cigar-shaped balloon.

The subject of dynamical flight without the aid of balloons opens up three fields of study:—(1) experiments on the air-resistance of planes and curved surfaces, systems of such aëroplanes and aërocurves variously arranged, and propellers; (2) the construction of motors of minimum weight per horse-power, using the sources of energy of minimum weight per foot-pound; (3) experiments on the balance, stability and control of aëroplanes and aërocurves. A historic retrospect of the work done in the past century includes Captain Le Bris's gliding experiments with his "artificial albatross" in 1854; De Villeneuve's reported feat of raising himself into the air, in 1870, by a machine driven by steam supplied from a flexible hose; the experiments on air resistance conducted in 1871; Langley's confirmation, in 1891, of Duchemin's formula for the thrust of an oblique current on a plane area, and his proof of the law according to which the horse-power per unit of weight lifted decreases with the speed; and Phillips's Wealdstone experiments on the advantages of narrow superposed planes over wide planes of equal area.

Coming to the question of horse-power, the chief interest in Sir Hiram Maxim's famous experiments centred round his engine, with which he obtained 362 horse-power, the machine weighing about 8000 lbs. Langley and Hargreave are stated to have designed motors weighing 7 and 10 lbs. per horse-power respectively; while Da Pra has made theoretical calculations in connection with designs of an aërial machine from which he concludes that such a machine could be made capable of carrying a motor weighing 15 kilograms per horse-power. A more experimental treatment of the question of horse-power is afforded by estimates of the rate at which work is done by gravity in the gliding experiments of Lilienthal, Pilcher and Chanute, from which it appears that about 2 horse-power would be required to support the machines. Mr. Chanute further estimates the possible weight of the motor per horse-power in a one-man machine at 4 lbs. for screws, 8 lbs. for wings, and 14 lbs. for aërocurves.

But the most difficult question connected with the flying machine is its balance and stability under the conditions ordinarily prevailing in our atmosphere. The very fluctuations of wind velocity which may furnish a source of energy for birds in sailing flight vastly increase the danger of experiments on artificial flight. It is easy to construct a glider which when dropped in a room from any position will right itself and begin to glide before reaching the ground; but the same glider when let fall from a window will continue to roll over and over and fall to the ground. More than thirty years ago Mr. Wenham made a model which would glide well from a window, but when let fall from a balloon in one of Glaisher's ascents it overturned after descending twelve yards.

Of the three, Lilienthal, Pilcher and Chanute, who have done most to solve this question of balance and stability, the two first met with fatal accidents just when their experiments were becoming most successful, and we are naturally led to compare their methods with those adopted by Mr. Chanute.

Both Lilienthal and Pilcher used machines with broad curved wings, the former preferring two superposed aërocurves and the latter adopting a single-surfaced machine. In both machines the wings were rigidly fixed, the operator relying on the movements of his body to counteract the effects of any sudden gust of wind tending to overturn the machine. Chanute, on the other hand, experimented with narrow superposed wings, some of his machines having as many as eleven or twelve aërocurves, arranged in pairs. Instead of balancing himself by his own agility, the wings were movable about pivots and were held in position by springs in such a way that their displacements, caused by a sudden gust of wind, gave the machine a tendency to right itself. Finally, a two-surfaced machine with narrow superposed rectangular surfaces, also with automatic balancing arrangements, was devised by Mr. Herring. With this machine, gliding was possible in winds of 31½ miles an hour, the greatest wind velocity in Lilienthal's experiments having been only 22 miles an hour, and little practice was required to control the machine. Practically no motions of the body were needed when a gust of wind struck the machine in a fore and aft direction, and but little movement was needed in the case of a side gust. The longest glide was 927 feet, and was performed by "quartering," *i.e.* sailing parallel to the side of a hill up which the wind was blowing.

The experiments of Messrs. Chanute and Herring constitute a distinct advance in the construction of gliding machines, and lead us nearer to the possibility of obtaining a true flying machine propelled by a motor. The addition of such a motor, if only by increasing the weight of the apparatus, would largely add to the difficulty of controlling it in the first trials, and the action of the propeller might considerably affect the balance. It is not improbable that after the first start is once made, the motor-driven machine may prove to possess greater steadiness in flight than the present gliders. In the former the thrust of the propeller is fixed relative to the body, in the latter the only motive force, due to gravity, is fixed in space, and Mr. Herring's experiments indicate greater stability under the first-named condition. How to perform the first experiments with the motor-driven machine is the difficulty which now awaits solution. If a large motor be used, the machine becomes too heavy to be readily controllable; if the dimensions of the machine are kept down it becomes the more difficult to construct a sufficiently light and powerful motor. The automatic regulating mechanism of Messrs. Chanute and Herring, by minimising the effort required in ordinary balancing, may render it possible for a man possessing the gymnastic skill of a Lilienthal or a Pilcher to overcome by his agility the new difficulties, introduced, at least in its early stages, by the motor. But in the transition from the gliding machine to the flying machine proper a wide gap has to be bridged, and it is little wonder that experimenters hesitate before taking a step which may introduce unforeseen dangers. It is by reducing the difficulty of balancing large machines, on the one hand, and reducing the weight of motors on the other, that we must hope to arrive at an experimental demonstration of the possibility of artificial flight.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. W. E. THRIFT has been elected Erasmus Smith professor of natural and experimental philosophy in Trinity College, Dublin, in succession to the late Prof. G. F. Fitzgerald.

WE are glad to notice in the report of the committee of the Bristol Museum that interest in nature study is encouraged by various means. In one of the rooms of the Museum, three aquaria containing the ova of the common frog, and the common and crested newts, were arranged, in order that the various stages of development passed through by these forms might be seen by visitors. The aquaria proved of especial interest to young people from schools. Lectures have been given by Mr. H. Bolton, the curator, to the students of evening continuation schools, and the Museum has been visited by a number of classes from other schools. The committee record that definite steps have been taken to provide the additional accommodation that has long been needed. The proposal took the form of providing for museum extension in conjunction with the establishment of a municipal art gallery, and the generosity and public spirit of Sir William Henry Wills has made this possible. Upon the basis that the sum of about 30,000*l.* would be required to provide a suitable building for both purposes, Sir W. H. Wills offered that if 10,000*l.* were provided for museum extension on the site adjoining the present building, he would provide for the completion of the scheme. This munificent offer was accepted by the council, who also accepted a report of the joint libraries and museum committees recommending the requisite application to Parliament, and placing the administration of the proposed art gallery in the hands of the museum committee.

IN connection with the London School of Economics and Political Science, Lord Rosebery delivered an address on commercial education at the Mansion House on Thursday last. The Lord Mayor, in opening the proceedings, stated that the object of the school was to provide a scientific training in the structure and organisation of modern industry and commerce and the general causes and criteria of prosperity as they were illustrated or explained in the policy and the experience of the British Empire and foreign countries. Mr. Passmore Edwards had generously contributed 10,000*l.* towards the erection of a building for the faculty of economics and political science; and Lord Rothschild had given 5000*l.* In the course of his address, Lord Rosebery said: "From whatever standpoint we may regard the age, I think we must all be aware that we are coming to a time of stress and of competition for which it is necessary that we should be fully prepared. It is not necessary here to indicate what form that stress or that competition may take, but in military matters, in naval matters, in commercial matters, in educational matters, we see more clearly day by day that we shall not be allowed to rest on any reputation that we possess already, but that we shall have to fight for our own hand in every department of human activity and human industry if we wish to keep our place. It is necessary for a nation in these days to train itself by every available method to meet the stress and the competition which is before it. Lord Salisbury said the other day—and I think with some truth—that it was impossible to define technical education. Well, I do not think it is impossible, but I think it is difficult. The way in which I should define it—very imperfectly, I am aware—is this. I should define it as education having a direct practical bearing on any definite industry or calling; that is to say, an education, not as we are accustomed to see secondary education as carried out in this country—an education for the training and elevation of the mind—but a practical training having a business bearing." The United States Ambassador, in proposing a vote of thanks to the Lord Mayor, said there was no doubt that colleges of economics and of political science were the latest development in the theory and practice of that education which was to fit men for the great affairs of life as they were developing in the complex and rapidly varying phases of modern civilisation. In the United States they regarded them as among the chief means of maintaining their part in that rivalry which they were maintaining, and meant to maintain with all their force, with their sister nations of the world, and especially with this country, to which they were so much attached—a rivalry not of arms or of warfare, but a rivalry of brains, of skill, of courage in the great industries of life.

SCIENTIFIC SERIALS.

Transactions of the American Mathematical Society, vol. ii. No. 1.—Invariants of systems of linear differential equations, by E. J. Wilczynski. The author has elsewhere shown that the most general point-transformation, which converts a system of n homogeneous linear differential equations into another of the same form and order, is

$$x = f(\xi),\ y_k = \sum_{i=1}^{n} a_{ki}(\xi)\eta_i \ . \ . \ . \ (k = 1, 2, \ . \ . \ n),$$

where $f(\xi)$ and $a_{ki}(\xi)$ are arbitrary functions of ξ, and the determinant $|\ a_{ki}(\xi)\ |$ does not vanish identically (*American Journal of Mathematics*, January 1901). In the present paper he considers those combinations of the coefficients of a system of linear differential equations which remain invariant when the system is transformed by the above transformation. These transformations form an infinite continuous group, and the author employs Lie's theory throughout, as Dr. Bouton has done in the *American Journal of Mathematics*, vol. xxi. No. 2. The applications of the theory are but lightly touched upon, and only a passing mention is made of covariants (p. 23) in this (first) paper.—Divergent and conditionally convergent series whose product is absolutely convergent, by Florian Cajori. Tests of the convergence of the product of conditionally convergent series have been worked out by Pringsheim, A. Voss and by Cajori (see *American Journal of Mathematics*, vol. xv. and vol. xviii., and *Bulletin* of the American Mathematical Society, vol. i. (1895). Two typical examples are discussed and also the author's general method.—Sets of coincidence points on the non-singular cubics of a syzygetic sheaf, by M. B. Porter. The points where a cubic can have an eighth order contact with cubics of the syzygetic sheaf are called by Halphen coincidence points of the cubic. The author considers certain geometrical relations that subsist between an inflexion triangle and its associated group of in- and circumscribed rectilinear triangles. The number of these triangles is 24. We give one property. Each in-circumscribed triangle is in six ways perspective with its associated inflexion triangle.—Note on non-quaternion number systems, by W. M. Strong. All number systems have been divided into the quaternion and non-quaternion systems, and Scheffers has shown that the n fundamental units of a non-quaternion system may be so chosen that the multiplication table takes a particularly simple form, which is in turn characteristic of the non-quaternion systems. The present paper shows that the choice of the units may be so regulated that the multiplication table becomes still simpler.—On the reduction of the general Abelian integral, by J. C. Field, embodies results (in 38 pp.) which were presented at the annual meeting of the Society held in 1897. MM. Appell and Goursat, in their "Théorie des fonctions algébriques et de leurs Intégrales" (pp. 344-345) give a brief sketch of Hermite's method for obtaining by rational operations the reduced form for a hyperelliptic integral, in which note they make a remark which seems to imply that the more general problem in the case of the Abelian integrals was still awaiting a solution. The present paper is the author's solution of the problem.—"Ueber flächen von constanter Gausscher Krümmung," by D. Hilbert. The greater part is concerned with Flächen von negativer and the rest with Flächen von positiver constanter Krümmung (*cf.* Dini, *Annali di Mat.* Bd. 4. 1870; Darboux, "Leçons sur la théorie générale des surfaces," Bd. 3, and Bianchi, "Lezioni di geometria differenziale").—A short note follows on the functions of the form $f(x) \equiv \phi(x) + a^1 x^{n-1} + a_2 x^{n-2} + \ . \ . \ . \ + a_n$ which in a given interval differ the least possible from zero, by H. F. Blichfeldt. This gives Tchebycheff's solution (from Bertrand, "Calcul differentiel," p. 512) and then the author's solution. As this gentleman has not had access to Tchebycheff's memoirs his method may not be altogether novel.

Annalen der Physik, March.—On the production and measurement of sinoidal currents, by Max Wien. The ideal electrical oscillations for use in wireless telegraphy would consist of a continuous, purely sinoidal current, the oscillation frequency of which could be varied slowly and continuously from a low figure up to frequencies that could be seen. The arrangement described in the present paper, although still far short of this, constitutes a considerable advance upon previous work, as a purely sinoidal current can be obtained with an oscillation frequency up to 8500 per second, and with a slight depar-

ture from the sine form, up to 17,000. The methods and special instruments for the exact measurement of these currents are also given.—The acoustical and electrical properties of the telephone, by Max Wien.—On the theory of rain precipitation in mountains, by F. Pockels. The conclusion is drawn from theoretical considerations that on the slope of a mountain chain there exists a zone of maximum precipitation, and that the inclination as well as the absolute height has an effect upon the amount precipitated. Both these conclusions are in agreement with observations upon the higher mountains.—The effect of current fluctuation, of electrical oscillations, and of an induced current upon a magnetic needle placed in a constant field, or upon a small soft iron inductor, by Max Hornemann.—Some results of capillarity phenomena, by A. Einstein.—On the so-called liquid crystals, by G. Tammann. It is shown that the effects produced by the so-called liquid crystals may be explained by the assumption that there is really present a mechanical mixture of two liquids. A partial separation was effected in the case of *p*-azoxyanisol.—On some experiments with the Becquerel and Röntgen rays, by F. Himstedt. The sparking distance for an influence machine is affected by both the radium rays and the Röntgen rays. The failure of Elster and Geitel to observe the latter effect is attributed by the author to the use of too small a Crookes' tube.—On the action of the Becquerel and Röntgen rays on the eye, by F. Himstedt and W. A. Nagel.—On the law of the distribution of energy in the spectrum, by Max Planck.—On the elementary quantity of matter and of electricity, by Max Planck.—Studies in hardness, by W. Voigt.—On characteristic curves in the electrical discharge through rarefied gases, by E. Riecke.—Experimental researches on the metallic reflection of electrical oscillations, by Karl F. Lindman.—On the distribution of electricity on an ellipsoid, by H. Dörrie.—On the transparency of hydrogen to light, by V. Schumann.—On the fundamental hypothesis of the kinetic theory of gases, by S. H. Burbury.—Remarks on the paper of E. v. Schweidler on the behaviour of liquid dielectrics on the passage of an electric current, by E. Warburg.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society.—Meeting held in University College, March 22.—Prof. S. P. Thompson, president, in the chair.—A paper on the expansion of silica was read by Prof. Callendar. The extreme smallness of the thermal expansion of silica (fused quartz) renders the determination of its coefficient of expansion more difficult than is the case with many substances. The author has made experiments upon a rod of pure silica 40 cms. long and 1 mm. diameter. This rod was enclosed in a platinum tube about 3 mms. diameter, which could be raised to various temperatures by the passage of a suitable electric current. Both the rod and the tube were firmly fixed at one end, and the positions of the other ends were accurately observed by a micrometer microscope reading to a thousandth of a mm. The expansion of the tube, in conjunction with a knowledge of its coefficient of expansion, served as a means of determining the temperature of the tube, and, therefore, of the rod. The increase in length, the original length and the range of temperature of the silica being known, the coefficient of expansion can be at once calculated. In some previous experiments the author has investigated the distribution of temperature along a heated platinum rod subjected to cooling at the ends. These experiments prove that the error due to end effect, in the case of the silica rod, can be neglected. The expansion of silica up to 1000° C. is regular, and is about one-seventeenth that of platinum. Between 1000° C. and 1400° C. silica expands more quickly than below 1000° C., and if left at any temperature for a considerable time continues to slowly increase in length. If a curve be plotted having temperatures as abscissæ, and increases in length as ordinates, a straight line will represent the expansion of silica up to 1000° C. Above 1000° C. the curve bends upwards, and upon cooling it returns along a path above the ascending curve, so that the final length of the bar is greater than the original length when the lower temperature is reached. The determination of the coefficient of expansion at these high temperatures was made by means of a variable zero, that is by using for the length of the rod that obtained by suddenly cooling from the higher to the lower temperature. At 1400° C. the properties of silica alter and the expansion is replaced by a contraction. On cooling from above 1400° C. to ordinary temperatures there is first an expansion and then a contraction. This property was illustrated by Prof. Callendar, the small changes in length of the rod being magnified by a lever and shown upon a screen by an optical arrangement. The critical point at which contraction occurs on heating has been found by Le Chetalier at about 800° C. His experiments were made by a differential method, using porcelain as a standard substance. As the expansion of porcelain is uncertain, the author thinks it probable that the effect noticed may be due to irregularities in the expansion of porcelain rather than in that of silica. Mr. Boys expressed his interest in the experiments and asked if the small coefficient of expansion of slate had ever been measured. The small expansion of silica would make it a useful suspension for pendulums on account of the small compensation necessary. Its perfect elastic properties might be made use of in hair springs for chronometers. Prof. Threlfall said that he had tried to measure the expansion of silica between 0° C. and 70° C. by weighing rods in distilled water, but the method was not accurate. He had made experiments similar in principle to the author's, using temperatures from 0° C. to 100° C. The devitrification of silica is troublesome, and he thought that the rate of devitrification in presence of air increased with the temperature. Dr. Donnan thought that the irregularities in the expansion of silica pointed to a complex composition. Mr. Porter (Eton) asked if the effect of fused quartz on polarised light had been investigated, and if this effect altered after heating to 1400° C. Mr. Boys said that quartz rods formed by fusion depolarised light. The chairman said that he had noticed the effect spoken of by Mr. Boys, due to strain, but he had been unable to detect any rotatory power. Prof. Callendar, in reply to Mr. Lupton, said that the expansion of quartz crystals was much larger than that of fused silica.—The spectroscopic apparatus of University College was then exhibited by Dr. Baly.—The Society then adjourned until April 26.

Chemical Society, March 7.—Dr. Perkin, vice-president, in the chair.—The following papers were read:—Nomenclature of the acid esters of unsymmetrical dicarboxylic acids, by J. J. Sudborough.—Additive compounds of α- and β-naphthylamine with trinitrobenzene derivatives, by J. J. Sudborough. The author describes a number of additive compounds of red or purple colour which are formed from derivatives of trinitrobenzene and the naphthylamines, and are more stable than such compounds as those of trinitrobenzene and aniline.—Acetylation of arylamines, by J. J. Sudborough. It is shown that the presence of ortho-substituents, whether of positive or negative character, accelerates the formation of diacetyl derivatives of primary arylamines.—Formation of amides from aldehydes, by R. H. Pickard and W. Carter. On oxidising an aldehyde with ammonium persulphate in presence of lime, a 30 to 40 per cent. yield of the amide of the corresponding acid is obtained.—A method of isolating maltose when mixed with glucose, by A. C. Hill. The author gives a method for separating maltose from a mixture of glucose and maltose based upon the fact that *Saccharomyces marxianus* destroys the former, but leaves the maltose untouched during its growth in a solution of the mixed sugars.—The vapour pressure of aqueous ammonia solutions, by E. P. Perman. The author has determined the vapour pressures of aqueous ammonia solutions between the temperatures 0° and 60°, and for concentrations up to 35 per cent.—The influence of sodium sulphate on the vapour pressure of aqueous ammonia solution, by E. P. Perman. The vapour pressure curves of aqueous ammonia containing sodium sulphate afford no indication that the latter exists as a hydrate in the solution.—Formation of aromatic compounds from ethyl glutaconate and its derivatives. The reduction of trimesic acid and the conversion of tetrahydrotrimesic acid into tetrahydroisophthalic acid, by W. T. Lawrence and W. H. Perkin, jun. Ethyl sodiodicarboxyglutaconate, $(COOEt)_2CNa.CH:C(COOEt)_2$, heated with alcohol at 150°, yields ethyl trimesate, and ethyl glutaconate, under similar conditions, is converted into a substance which on hydrolysis gives hydroxyisophthalic acid. Trimesic acid is reduced by sodium amalgam to a mixture of stereoisomeric tetrahydrotrimesic acids, of which one has been isolated in a pure state; this gives a double anhydride with acetic anhydride, which, when distilled, yields tetrahydroisophthalic anhydride.—Optical activity of certain ethers and esters, by P. A. Guye.—Halogen-substituted thiosinamines, by A. E. Dixon. The author describes a number of chloroallylthiocarbimides.—A form of tautomerism occurring amongst the thiocyanates of electro-negative radicles, by A. E. Dixon.

Geological Society, March 6.—J. J. H. Teall, V.P.R.S., president, in the chair.—Recent geological changes in Northern and Central Asia, by Prof. George Frederick Wright. The present paper is the outcome of a journey made by the author in company with Mr. Frederick B. Wright in 1900-1901. In North America an area of about 4,000,000 square miles was brought under the direct influence of Glacial ice during the Glacial epoch. The result of six weeks spent in Japan was to show that there are no signs of eneral glaciation in Nippon or Yesso. Neither is there any sign of glaciation along the border of the Mongolian Plateau, where the general elevation is 5000 feet, but the whole region is covered with lœss. This has usually accumulated like immense snow-drifts on the south-eastern or lee-side of the mountains, and in it houses and villages are excavated. In the mountainous region, strata of gravel and pebbles are so frequent in the loess that it is necessary to invoke both wind and water in order to explain fully the origin of the deposit. At the present time the loess in the interior is being washed away by streams much faster than it is being deposited by the wind. The journey across Manchuria from Port Arthur along the Lao-Ho and Sungari rivers was through valleys choked with alluvium, and there was no evidence that the drainage of the Amur had ever been reversed by ice, like that of the St. Lawrence; nor was there any other evidence of glaciation. The lower course of the Amur indicates subsidence. Again, there are no signs of glaciation on the Vitim Plateau. Lake Baikal appears to be of recent origin; it is 4500 feet deep and has not been filled by the great quantities of sediment brought down by the Selenga and other rivers. Although glaciers could frequently be seen on the mountains which border the Central Asiatic Plateau to the north-west, there was no evidence that the glaciers had ever deployed on the plain. The loess-region of Turkestan, and indeed the whole area from the Sea of Aral to the Black Sea, appears to have been recently elevated, in some places as much as 3000 feet. Desiccation took place at the same time, so that the larger lakes are only brackish or still fresh. Direct evidence of this in the form of deposits is given. The author thinks it likely that the absence of glaciation in Northern Asia may have been due to the rainlessness of the region, and that while America was elevated, Asia was depressed during the Glacial Epoch.—The hollow spherulites of the Yellowstone and Great Britain, by John Parkinson. A recent journey to the National Park of the United States, resulting in a study of the obsidians and rhyolites in the field and at home, suggested a direct comparison between the hollow spherulites characteristic of these rocks and those of the rhyolites of Shropshire, Jersey and elsewhere. Hypotheses framed to account for the varying structures of spherulites are: (1) Hollow spherulites are the result of some property of the original magma, or (2) are due to the decomposition of an originally solid spherulite by heated waters. Taking the second alternative first, a description is given of the effect of solfataric action on the rhyolites of the Yellowstone Cañon. The conclusion reached is "that the action of hot waters charged with silica may be to remove portions of the rock, or to permeate it without destroying its characteristic structure; that we obtain, however, no evidence to show that the spherulites are most easily attacked, but rather the reverse." Explanation, therefore, is most naturally sought in some property of the original magma, and that propounded by Prof. Iddings appears the nearest in accord with facts. Exception is taken to certain physical processes postulated by Prof. Iddings in a recent memoir, but with his earlier work the present writer is substantially in agreement. In the second part of the paper direct comparison is drawn between the structures exhibited by the hollow spherulites from Obsidian Cliff and those of examples from Shropshire, Jersey and other localities. Taking into consideration the resemblances between the hollow spherulites of the Yellowstone region and those of Great Britain, the conclusion is drawn that the hypothesis of corrosion is as inapplicable to the latter as to the former. On the contrary, the author believes that the cavities of the spherulites are the result of the hydrous state of the magma.

Royal Microscopical Society, February 20.—Mr. A. D. Michael, vice-president, in the chair.—A photograph of *Amphipleura pellucida*, taken by Mr. Brewerton, was exhibited.—Mr. Nelson said the photograph was interesting because it showed the transverse striæ as thin in comparison with the spaces between them. Some optical theorists maintained that the striæ and spaces must be of equal width, whereas he had affirmed that the striæ were much finer than the spaces. In many photographs of this object they appeared to be of equal width, but that was because the object had been badly photographed. In the example before the meeting the photograph had been properly taken, and therefore exhibited the difference in the thickness of the lines and the inter-spaces.—Mr. Rogers brought to the meeting a contrivance for exhibiting a fly in the act of feeding. This differed in some respects from Mr. Macer's arrangement for a like purpose, being a brass plate, $3'' \times 1''$, underneath which a brass cone was soldered to contain the fly, the plate lying on the stage of the microscope like an ordinary slide.—Mr E. M. Nelson read a paper on the tube-length of the microscope, explaining the difference between the mechanical and optical tube-length, illustrating the subject with drawings and formulæ.—The chairman thought there was no subject connected with the technique of the microscope about which ideas were more vague than that of the tube-length; many thought it was the length of the brass tube. Although it had often been pointed out in that room that what was really meant was the optical tube-length, the subject did not seem to be very well understood, very little practical information had been published which would enable a person to ascertain the tube-length of his microscope but Mr. Nelson had now given them a method by which this could be found.—Mr. F. W. Millett's report on the recent Foraminifera of the Malay Archipelago was taken as read.—The chairman called attention to a set of slides of bacteria and blood parasites which were exhibited by Mr. Conrad Beck.—Some mounted rotifers, sent from Natal by the Hon. Thos. Kirkman, were also exhibited.

Linnean Society, March 7.—Prof. S. H. Vines, F.R.S., president, in the chair.—Mr. F. Enock showed a series of lantern-slides illustrating the metamorphoses of a dragonfly, *Æschna coerulea*, and gave an interesting account of the life-history of that insect.—Mr. H. E. Smedley exhibited and made remarks on a collection of models of fungi, *Nepenthes*, *Sarracenia* and aroids, as also several models of sections of flowers, in wax and composition.—Dr. J. Murie, on behalf of Mr. H. Doubleday, exhibited an orange within an orange, the enclosed fruit having a complete rind, in which respect it differed from one previously shown by Dr. Rendle (*Proc. Linn. Soc.* 1890-91, p. 7).—Mr. Alfred O. Walker read a paper entitled "Contributions to the Malacostracan Fauna of the Mediterranean," in which he gave the results of dredging operations carried on at Cannes and Hyères from an open boat, in depths not exceeding 35 fathoms and with the simplest apparatus. The number of species obtained were as follows:—Podophthalmata, 10; Schizopoda, 8, including a new species, *Mysidopsis serraticauda*; Cumacea, 9; Pantopoda, 1; and Amphipoda, 41, including two new species, *Leucothoe platydactyla* and *Melphidipella* sp., with two others not previously recorded in the Mediterranean.—Miss G. Lister's paper on the occurrence in Egypt of *Tristicha hypnoides*, Spreng., communicated by Mr. Arthur Lister, F.R.S., was read by the secretary.

Entom logical Society, March 6.—The Rev. Canon Fowler, president, in the chair. Mr. H. St. J. Donisthorpe exhibited a parasite or *Brachonid* on *Centhorhynchus sulcicollis*, bred from the galls in a turnip caused by the larva of that beetle, together with the host.—Mr. A. J. Chitty exhibited a variety of *Psylliodes cyanoptera*, Ill., the coloration of the thorax dark instead of the usual red, taken by him along with the typical form in August 1892 at Wicken Fen.—Mr. H. J. Turner exhibited a long series of *Bryophila muralis* (*glandifera*) from Dawlish. The whole were either taken on, or bred from pupæ cut out of, a single roadside wall some hundred yards long, very lofty, and facing nearly north, on which aspect, however, it was protected by higher ground. They were obtained in mid-August, with the exception of a few which emerged at intervals during September and October 1900. Generally speaking the specimens were very dark, and the series was remarkable in that it contained but a few isolated examples of the forms which are prevalent in more eastern localities like Freshwater, Eastbourne or Folkestone. The hind wings of all the specimens were dark, while in the majority the black markings of the fore wings were much intensified and increased in number, and a few specimens were largely suffused with black. A considerable number showed a dark rich green suffusion, while a large proportion were of a very deep yellow or olive colour with black markings. The yellow forms were perfectly natural, as a number emerged from the pupa exactly of that hue. Only a few showed any trace of the typical delicate

dove-colour, and it was also noteworthy that the wings had a comparatively much greater area of black scaling than the eastern forms.—On the motion of Mr. H. J. Elwes, seconded by Mr. H. Goss, it was resolved that a committee be appointed to consider the question of uniformity in nomenclature for the guidance of specialists contributing to the Victoria County Histories.—The following papers were read: Centoniidæ collected by Messrs. H. E. Andrewes and T. R. D. Bell in the Bombay Presidency, with descriptions of the new species, by Mr. O. E. Janson, and a supplementary catalogue of British Ichneumonidæ, by Mr. Claude Morley.

Mathematical Society, March 14.—Dr. Hobson, F.R.S., president, in the chair.—Prof. Elliott, F.R.S., gave an account of some algebraical identities of simple arithmetical application.—Prof. Love, F.R.S., hon. sec., gave a preliminary notice concerning the theory of stability of motion.—Papers by Prof. Burnside, F.R.S., on the composition of group characteristics, and by Mr. G. H. Hardy, on the use of Cauchy's principal values in the double limit problems of the integral calculus, were taken as read.

CAMBRIDGE.

Philosophical Society, February 18.—Sir G. G. Stokes in the chair.—On the most volatile gases of atmospheric air, by Profs. Liveing and Dewar (see p. 189, December 20, 1900, for paper on same subject read before the Royal Society).—On a method of comparing affinity-values of acids, by H. J. H. Fenton and H. O. Jones. When the hydrazone of oxalacetic acid is heated with pure water, it yields the hydrazone of pyruvic acid with evolution of carbon dioxide, but in presence of dilute acids of sufficient concentration a totally different change occurs; in this case no gas is evolved and pyrazolone carboxylic acid results. Based upon these changes, a very simple method has been devised for comparing the affinity-values of acids, and the results agree remarkably well with those obtained by the well-known methods. In order to explain the nature of the changes involved, the authors attribute the evolution of carbon dioxide to the instability of the negative ion, and they have now made further experiments in order to test this hypothesis, the results being in all cases favourable. It is further shown that it is possible by this method to compare the ionising capabilities of various solvents, and experiments have now been made with pyridine in order to throw light upon the disputed question of its behaviour in this respect.—On isomeric esters of dioxymaleic acid, by H. J. H. Fenton and J. H. Ryffel. It was shown by one of the authors on a previous occasion that the ethyl ester of dioxymaleic acid exhibits the remarkable property of becoming liquid when kept in a desiccator in presence of air, although it is relatively stable in presence of moisture or in absence of oxygen. This property has now been further investigated, and it is shown that oxidation and loss of water take place with the formation of the liquid ester of dioxytartaric acid which has the anhydrous form, *i.e.* dioxysuccinic ester. Another modification of the dioxymaleic ester has also been prepared which appears to be quite stable under the circumstances above mentioned, and it is considered probable that they represent the maleic and fumaric forms respectively.—Note on the constitution of cellulose, by H. J. H. Fenton and Miss Mildred Gostling. Certain carbohydrates, when acted upon by dry hydrogen bromide in ethereal solution at the ordinary temperature, yield an intense purple colour which was shown to be due to brom-methylpurpural. This substance has been isolated in the crystalline state, and it was further demonstrated that its production is characteristic of *ketohexoses* or of substances which give rise to these on hydrolysis. Carbohydrates of the aldose type yield none of this product. Exactly similar results have been obtained by operating in other solvents at 100°, and under the latter condition it is found that all forms of cellulose give large yields of brom-methylpurpural, and it is concluded that the results definitely indicate the existence of a ketonic nucleus in cellulose.—Some substituted ammonium compounds of the type $NR'R''R_2'''X$, by H. O. Jones. This note describes some of the compounds which have been prepared in the course of the author's work on substituted ammonium compounds in which two radicles are the same.—On the molecular weight of glycogen, by H. Jackson. The important part which glycogen plays in animal metabolism renders any experiments on its constitution interesting. The only previous attempt to determine its molecular weight was by Külz a. Bornträger, who, noting the elevation of the boiling point of water when a weighed quantity of glycogen had been dissolved in it, concluded that it had the formula $(C_6H_{10}O_5)_6$. There are many objections to the boiling point method in the case of complex carbohydrates, and so it appeared important to apply Raoult's method of the depression of the freezing point, and this is easy owing to the great solubility of glycogen in cold water. The results of a number of experiments point to glycogen having a formula between $(C_6H_{10}O_5)_{40}$ and $(C_6H_{10}O_5)_{42}$. The results are somewhat similar to those obtained by Brown and Morris (*J. C. S.* 1899) for the stable dextrin obtained by the hydrolysis of starch, and it would seem to hint that glycogen is more closely related to the dextrin than the natural starches which have much higher molecular weights.—On the condensation of formaldehyde and the formation of β-acrose, by H. Jackson. An aqueous solution of formaldehyde, obtained by boiling paraformaldehyde, was treated with basic lead carbonate and heated on a water bath for one hour. After filtering it was evaporated in vacuo at 50° and the syrup treated with a mixture of methyl and ethyl alcohols. The insoluble lead salt was separated and the alcohol distilled off from the sugar. A two per cent. aqueous solution of the sugar was heated with phenyl hydrazine acetate on the water bath for four hours. The crude osazone was boiled with water; and acrosazone (Fischer and Passmore, *Ber.* 1899) remained undissolved. The filtrate from this on cooling deposited a mass of fine yellow crystals. These were recrystallised twice again from hot water. This was found to be a mixture of osazones which have been separated by a long series of fractional precipitations.

PARIS.

Academy of Sciences, March 18.—M. Fouqué in the chair.—On the determination of latitude at sea by circummeridian observations, by M. E. Guyou.—On the propagation of discontinuities in a viscous fluid, by M. P. Duhem.—M. Humbert was elected a member in the section of geometry, in the place of the late M. Hermite.—On the law of universal attraction, by M. H. Duport. By applying to a system of atoms the principle of least action there is obtained a generalisation of the formulæ of Mayer.—Remarks by M. Bouquet de la Grye on a work by M. P. Chevalier on the hydrography of the Upper Yang-Tse Valley.—The true value of the period of luminous variation of the planet Eros, by MM. Ch. André and M. Luizet. Two views have been put forward by astronomers who have studied this question: one representing it as a simple oscillation, always identical and reproducing itself at intervals of about 2h. 5m., the other representing the curve as being formed of two different branches, the whole of which is reproduced at intervals of about 5h. 3m. A discussion of the whole of the observed values tends to show that this latter view is the correct one, the true period being about 5h. 16m.—On the zeros of entire functions of n variables, by M. P. Cousin.—On the vibrations of beams supported at the ends, by M. Ribière.—On the entropy diagram, by M. L. Marchis. In recent years the entropy diagram has been applied by engineers to the representation of the quantities of heat given out or absorbed by the working fluid in the steam engine. In the present paper the conclusion is drawn that this application is not legitimate, and that similar difficulties arise in dealing with the gas engine.—On the propagation of discontinuities in fluids, by M. E. Jouguet.—On the action of acids upon the carbonates of the alkaline earths in presence of alcohol, by M. C. Vallée. The action of dilute sulphuric acid upon calcium carbonate is very slow in the presence of absolute alcohol, but the reaction is not a limited one, the neutralisation being complete if sufficient time is allowed.—On some cæsium compounds, by M. E. Chabrie. A description of the preparation and properties of cæsium bromide, iodide, fluoride, chromate and bichromate.—On the constituents of commercial ferrosilicons, by M. P. Lebeau. In commercial ferrosilicons three silicides are clearly made out, $SiFe_2$, SiFe and Si_2Fe, and methods are described for obtaining each of these in a pure state.—Action of the acid chlorides and anhydrides upon the organo-metallic compounds of magnesium, by MM. Tissier and Grignard. With acetyl chloride, magnesium methyl iodide gives trimethyl-carbinol, and with benzoyl chloride dimethyl-phenyl-carbinol is obtained. The anhydrides give similar products.—The action of caprylic alcohol upon its sodium derivative: synthesis of dicaprylic and tricaprylic alcohols, by M. Marcel Guerbet.—Vaporisation and hydration of ethylene-glycol, by M. de Forcrand.—Dissociation and thermal study of the compound Al_2Cl_6, $18NH_3$, by M. E. Baud.—On direct nitration in the fatty series, by M. A. Wahl. An attempt was made to directly nitrate ethyl crotonate and tiglate,

but no true nitro-derivative could be obtained.—On the supposed binaphthylene alcohol, by M. R. Fosse. The compound described by Rousseau as a binaphthylene alcohol is a derivative of trinaphthylmethane.—On the ββ-diacetylpropionate of ethyl, by M. F. March.—Properties of the alkyl substitution products of the ethyl ester of cyano-acetone-dicarboxylic acid. Action of cyanogen chloride upon the methyl ester of acetone-dicarboxylic acid, by M. J. Derôme.—The action of butyryl chloride upon the sodium compound of methyl acetoacetate, by MM. Bouveault and A. Bongert. Two classes of substances are produced in this reaction, there being a true carbon linkage in the one, whilst in the other the carbon atoms are joined through an oxygen atom. The separation of these isomers is described and some of their characteristic properties studied.—On the constitution of gallotannin, by M. H. Pottevin.—The production of acetylmethyl-carbinol by the *Bacillus tartricus*, by M. L. Grimbert. By the action of this bacillus upon solutions of glucose or sugar, small quantities of the alcohol $CH_3-CO-CHOH-CH_3$ are produced. This substance, which has not been previously noted as a fermentation product, was identified by means of its osazone.—On the diagnosis of tuberculosis, by MM. Albert Robin and Maurice Binet. It is found that the respiratory exchanges are much higher in tuberculous subjects than in the healthy man, and this feature is so constant that it will be of service in the diagnosis of tuberculosis.—The slow conduction of the nerve and negative variation, by M. Aug. Charpentier.—On the opacity of the vitreous body and the rigidity of this medium of the eye, by M. A. Imbert.—On the histology of the branchia and the digestive tube, by M. P. Vignon.—On the absorption of highly diluted metallic poisons by plant cells, by M. H. Devaux. Both phanerogams and cryptogams are poisoned by solutions of lead and copper salts containing only one or two parts of the salt in ten millions of water.—Influence of darkness on the development of flowers, by M. L. Beaulaygue.—Comparative anatomy of the leaf organs in the acacias, by M. P. Ledoux.—On the tabular icebergs of the Antarctic regions, by M. Henryk Arctowski.

CAPE TOWN.

South African Philosophical Society, February 6.—T. Stewart, vice-president, in the chair. Mr. E. H. L. Schwarz exhibited some photographs and copies of interesting Bushman paintings from Groot Riet River, near the boundary of the Ceres and Clanwilliam districts, on the road from the Cold Bokkeveld to Whupperthal. The drawings are on the face of a cliff overhanging a tributary of the Groot Riet River. There is no cave properly speaking, but the river has cut slightly into the cliff at the base, so as to form a shallow recess. The floor of the recess is some 20 feet above the present river level, and a fine Bushman pot (exhibited) was obtained here. The paintings themselves are done in a great number of styles, by different people. They are in red paint, except for three black and one brown figure. Mr. Sclater pointed out that one of the photographs evidently represented the drawing of a white rhinoceros, an animal of whose occurrence so far south no written record has been preserved.—Mr. A. W. Rogers read a paper on evidence of glacial action during the deposition of the Table Mountain sandstone.—Mr. Sclater having taken the chair, Mr. Stewart read a paper on the rainfall of the Cape Peninsula. The average for the last seven years at Signal Hill is 15·49 inches; at Rondebosch 41·22 inches; at Kenilworth 42·90 inches; at Disa Head (2500 feet above the sea) on Table Mountain 39·96 inches; and at Maclear's Beacon (3478 feet above the sea) on Table Mountain 86·81 inches. The heaviest rainfall in the Peninsula is registered at the last station. The rainfall during the month of January last was of an exceptional character, in fact there is no record of a previous rainfall during any of the summer months having approached the amount recorded.

DIARY OF SOCIETIES.

THURSDAY, MARCH 28.

ROYAL SOCIETY, at 4.30.—(1) On the Arc Spectrum of Vanadium; (2) On the Enhanced Lines visible in the Spectrum of the Chromosphere: Sir N. Lockyer, K.C.B., F.R.S., and F. E. Baxandall.—Further Observations of Nova Persei, No. 2: Sir N. Lockyer, K.C.B., F.R.S.—The Growth of Magnetism in Iron under Alternating Magnetic Force: Prof. E. Wilson.——To be read *in title only*; On the Electrical Conductivity of Air and Salt Vapours: Dr. H. A. Wilson.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Electrical Transmission of Power in Coal Mines: H. W. Ravenshaw.—Portable Electric Lamps: S. F. Walker.

CHEMICAL SOCIETY, at 3.—Annual General Meeting.

FRIDAY, MARCH 29.

ROYAL INSTITUTION, at 9.—Polish: Lord Rayleigh, F.R.S.

SATURDAY, MARCH 30.

ROYAL INSTITUTION, at 3.—Sound and Vibrations: Lord Rayleigh, F.R.S.

ESSEX FIELD CLUB (Essex Museum of Natural History, Stratford), at 5.—Twenty-first Annual Meeting.——At 6.30.—Neolithic Implements from the North Downs: J. P. Johnson.—On Borings of the Ash-bark Beetles (*Hylesinus*): Miller Christy.—Lantern Demonstration of Colour Photography as applied to Natural Objects: E. Sanger Shepherd.

MONDAY, APRIL 1.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Effect on the Marsh Test of some Commercial Products containing Selenium and Tellurium: A. E. Berry.—A New System for the Manufacture of Borax and Nitrates: Dr. W. Newton.—Basic Superphosphate: its Preparation and Use as a Manure: John Hughes.—The Preparation of Pure Cineol from Eucalyptus Oil by means of the Arsenate: Watson Smith.—Action of Caustic Potash and Soda on Stannous Sulphide: Dr. F. Mollwo Perkin.

VICTORIA INSTITUTE, at 4.30.—The Maori's Place in History: J. Rutland.

TUESDAY, APRIL 2.

ZOOLOGICAL SOCIETY, at 8.30.—On the Myology of the Tongue of Parrots, with a Classification of the Order based upon the Structure of the Tongue: G. P. Mudge.—On the Structure of the Larynx in *Cegia* and *Balaenoptera*: Prof. W. B Benham, F.R.S.—On a Collection of Lizards from the Malay Peninsula, made by Members of the "Skeat Expedition," 1899-1900: F. F. Laidlaw.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Burrator Works for the Water-supply of Plymouth: E. Sandeman.

ROYAL PHOTOGRAPHIC SOCIETY, at 8.—Animals and Birds in their Native Haunts: Charles Reid.

WEDNESDAY, APRIL 3.

GEOLOGICAL SOCIETY, at 8.

ENTOMOLOGICAL SOCIETY, at 8.

SOCIETY OF PUBLIC ANALYSTS, at 8.—On the Maumené Test for Oils: C. A. Mitchell.—Some Arsenic Estimations relating to Malt Kilns: T. Fairley.—The Aeration Test for Effluents: Dr. S. Rideal.

THURSDAY, APRIL 4.

LINNEAN SOCIETY, at 8.—On some British Freshwater Rhizopods and Heliozoa: G. S. West.

CONTENTS.