THURSDAY, JULY 10, 1902.

THE RECORD OF HUXLEY'S SCIENTIFIC WORK.

The Scientific Memoirs of Thomas Henry Huxley. Vol. iv. Edited by Sir Michael Foster and Prof. E. Ray Lankester. Pp. 689; pls. 28. (London: Macmillan and Co., Ltd., 1902.) Price 30*s.* net.

THE present volume is the fourth of the promised series, and contains a collection of the scientific memoirs, addresses, and reviews, by Huxley, published throughout the period ranging from the early part of the year 1874 until his death. The first item reproduced is that on the skull and heart of Menobranchus, the last the masterly addendum to the life of Richard Owen, with the tenour of which our readers have long been familiar (NATURE, vol. li., p. 169). When it is said that the intervening memoirs include those on "Ceratodus and the Classification of Fishes"; on "The Craniofacial Apparatus of the Lamprey"; on "The Classification and Distribution of the Cray Fishes"; on "The Cranial and Dental Characters of the Canidæ" (with its prophetic passage on the future of the systematist); on "The Application of the Laws of Evolution to the Vertebrata" (than which Huxley never wrote a finer philosophic treatise); on "The Gentians" (which to the systematic botanists, headed by Hooker and the late Prof. Baillon, who heard it read, came as a surprise); and, finally, the last zoological paper which Huxley wrote, "Some further Observations on the Genus Hyperodapedon," it is evident that some of his very best work is in this volume brought before the reader.

By way of general comment, we need only say that the standard of the former volumes, upon which we have more than once passed favourable judgment, has been maintained, except, perhaps, that plates 1 to 3 have suffered somewhat, from the lack of blue-grey colour bestowed upon their originals.

In reviewing the volume which preceded the present one, we took occasion (NATURE, vol. lxiv., p. 76) to comment on the imperfection of the published list which the editors originally caused to be circulated in making their intentions known. We are pleased to find that of the three omissions to which we then more particularly drew attention, two have been made good, chief among them being the Survey memoir on "The Crocodilians of the Elgin Sandstones," which in the present volume monopolises seventeen of the twenty-eight plates provided. One omission upon which we dwelt they have passed over, viz. the Rede lecture on "Animal Forms," delivered at Cambridge in 1883 and duly reported in these columns (NATURE, vol. xxviii. p. 187); and we would remark that, if only on account of the absence of this, the words "THE END" with which the present volume closes cannot mark the completion of the editors' task, if justice is to be done to the life's record in science of the great man whose teachings the memorialists have decided to perpetuate.

To proceed, let it be said that, in addition to the omission just named there are at least six other of Huxley's scientific writings which we consider should have found recognition in the present volume. In seeking comparison with other published works dealing with Huxley's career, we naturally turn to the bibliographic record given in the "Life and Letters" by his son; and there we find duly listed addresses on "The Hypothesis that Animals are Automata and its History" and on "The Geological History of Birds," which our editors have either overlooked or withheld. The latter, a Royal Institution lecture, was first delivered in America and published in full in "American Addresses"; and it is significant that of the five addresses this book contains, the only one the present volume bears (*i.e.* that on "The Study of Biology") was reprinted elsewhere. The address on "Animals as Automata" was reported in NATURE (vol. iv. p. 362), and with elaboration was printed in "Science and Culture," side by side with the article on "Sensation and the Unity of Structure of the Sensiferous Organs," which our editors reproduce. We submit that both it and the three American addresses on "Evolution" should have been included in the present volume, since they give expression to the working of Huxley's mind on the realisation of a complete evolutionary series—*i.e.* the equine. About the Baltimore address, which the "American Addresses" volume also contains, opinions may differ.

Far more serious, however, is the omission, both from its proper place in vol. ii. and from the present volume, of the great Geological Survey memoir (decade xii.) bearing title "Illustrations of the Structure of the Crossopterygian Ganoids," which, with the Rede lecture aforementioned, is not listed in even the "Life and Letters"; and we are at a loss to conceive by what process other than a too exclusive reliance upon the Royal Society Catalogue of Scientific Papers (which for the period concerned is defective) this oversight, resulting in the omission of one of the most important and far-reaching memoirs Huxley ever wrote, can be explained, especially when it is seen that the editors have duly incorporated its preliminary correlate in its proper place.

Nor is this all. Huxley's lecture before the Fisheries Exhibition at Norwich in 1881 is duly reproduced, but why not that of 1883, which marked the opening of the congresses of the Exhibition at South Kensington, perhaps the more important of the two? This omission is the more unfortunate, since, in the hands of Prof. McIntosh, the chief conclusion reached has but lately become the leading theme in rival controversy among fishery experts. And it is pertinent to this to remark that the memoir on the Belemnitidæ, to which we alluded in reviewing vol. iii., and which at the outset escaped recognition, similarly contains the striking observation that the genus Belemnites, if a Decapod, is numerically deficient in "arms," and that this but a month or so ago, in the hands of Huxley's pupil Crick, has led to a startling generalisation, which we can personally confirm.

The editors announced in their original prospectus 151 contributions in all—they have printed 163. In doing so they have shown themselves to have been originally lacking by twelve. We have shown that others have yet to be reprinted, if the work is to be "complete" as was originally resolved, and to depict worthily the scientific labours of the great man whose reputation in the domain

of "exact science" is (according to our editors' preface) in danger of being underrated.

Moreover, it becomes a question whether the memoir on the "Oceanic Hydrozoa" should not be incorporated, to ensure absolute completeness. We are quite aware that the editors, in their preface, give reasons for excluding this; but we venture to think that if, when they took this step, they had realised the extent of the Survey memoir on the Elgin Crocodiles, and had reflected that the memoir on "The Development of the Elasmobranch Fishes," despite its bulk, was incorporated in the volumes memorialising the late Francis Maitland Balfour, they might perhaps have acted otherwise.

There are thus a possible series of six or seven important scientific communications to be yet reprinted, in order to justify the fulfilment of the memorial. As the matter stands a supplementary volume is imperative, and we leave the plea for it, with respect and full assurance, in the publishers' hands.

The frontispiece to the present volume is a highly successful photographic reproduction of the obverse of the Huxley Memorial Medal. As a likeness it transcends the statue; and it affords us pleasure to remark that the artist (Mr. F. Bowcher) who produced the model is at present engaged upon an enlargement of it, which promises to be even more true to life, and is to be mounted in the Town Hall at Ealing, the place of Huxley's birth. G. B. H.

GEOLOGICAL HISTORY.

History of Geology and Palaeontology to the End of the Nineteenth Century. By Karl Alfred von Zittel. Translated by Maria M. Ogilvie-Gordon., D.Sc. London, Ph.D. Munich. Pp. xiii + 562. (London: Walter Scott, Ltd., 1901.) Price 6*s*.

WHAT may be called the archæological side of the history of this science has been often treated; but what has long been needed is such a history that the serious student can ascertain exactly the position of any branch at the present day, and the more important steps in the advance towards its position. For a task requiring such a wide range of knowledge and such a well-balanced and unbiassed mind there is probably no one better fitted than Prof. von Zittel, while to translate, condense and adapt the work to the needs of British readers has been a congenial duty to one of Zittel's own talented pupils, Mrs. Ogilvie-Gordon.

The author, judging from his preface, is himself in doubt as to the possibility of combining the difficult task of writing a work which will satisfy the specialist and also commend itself to every man of culture. Frankly we think that to do this is impossible; the needs of the two types of readers are so wholly distinct. For even the best class of popular readers something different from the steady and level plod through division after division of the subject is required. There must be what might be called "picture-writing," colour, shading, prominence, gradation, grouping, and above all perspective. Without these the non-technical reader cannot see wood for trees; he has no landings on which to pause for breath, and, worst of all, he hardly realises when he has attained a summit and obtained a view.

But, cutting adrift the man of general culture, what is there here for the specialist? There is a most conscientious, concise, complete, and well-balanced record of the chief steps forward in each of the numerous branches of a complex subject, perfect fairness in the treatment of the different workers and of the claims of various nationalities, a remarkable clearness in indicating the general advance of the science as a whole while treating of its many subdivisions, and a powerful presentment of the significance of the inauguration and final proofs of the chief principles of geology.

About a quarter of the whole work is devoted to geological knowledge in the ages of antiquity, the beginnings of palæontology and geology, and the "heroic age" of geology (1790-1820). Under the first head we read that "fanciful hypotheses and disconnected observations cannot be acknowledged as scientific beginnings of research"; the next stage brings us to the first mineral maps and sections, the earliest ideas of mineral succession, and to primitive opinions about fossils and volcanoes. The "heroic age" was the time of Werner and Hutton, von Buch and Humboldt, Kant and Laplace, Cuvier and Buckland, and above all of William Smith. We are thus brought to the beginning of the nineteenth century, and henceforward we follow the development of the science under the following heads:—Cosmical Geology, Physiographical Geology, Dynamical Geology, Petrography, Palæontology, and Stratigraphical Geology.

The treatment of these branches is singularly even, the weakest, perhaps, being the first and last, while for the strongest it is difficult to choose between the dynamical, petrographic and palæontological sections. The translator has shifted the position of the stratigraphical section and omitted that on topographical geology, we think wisely; and she has also shortened the work, partly by abridgment and partly by omission. This difficult task has been discharged with considerable skill and discretion, though we might, perhaps, be inclined to cavil at some of the omissions; for instance, the suppression of the "kern theory" of Rosenbusch and the rock-formulæ of Michel-Lévy, to note only two examples.

One characteristic of some of the heroes of geology seems not to have died out at the present day. We read that

"It was the spoken word of Werner that carried. Of written words no man of genius could have been more chary. His dislike of writing increased as he grew older, . . ."

Again,

"Hutton's thoughts had been borne in upon him direct from nature; for the best part of his life he had conned them, tossed them in his mind, tested them, and sought repeated confirmation in nature before he had even begun to fix them in written words, or cared to think of anything but his own enjoyment of them."

And once again,

"a dinner was arranged . . . and William Smith *consented to dictate* a table of the British strata from the Carboniferous to the Cretaceous formation."

Zittel is seen at his best when dealing with the classical works of those masters of the science who have given us

its greater principles. The laws enunciated by such men as Suess, Heim, Richthofen, Sorby, Brögger, Lehmann, Smith, Sedgwick and Darwin are given with genuine appreciation and generally illuminated by a brief but telling thumb-nail picture of their lives and achievements.

The translator, while suppressing too great detail in foreign work, has helped English readers by fitting into its place the occasionally omitted work of English-speaking geologists (see pp. 358, 360, &c.). This plan might with advantage have been extended; for instance, the work of Milne and Davison on earthquakes, of Allport, Bonney and Phillips on petrology, and of Ramsay and Topley in the connexion of geology and geography, might well have received fuller notice; and the application of geology to economic questions still demands its historian, who would have many a strange tale of failure and success to tell.

While the chapter on petrography gives the reader a good summary of the chief theories enunciated, the stages of their proof and their significance in the progress of the science, the palæontological section, probably from the magnitude of the subject, is not so instructive, and does not succeed in giving the reader a clear picture of the real meaning of the successive discoveries made.

Again, the stratigraphical chapter is at the same time one of the most difficult to treat fairly, and the one which is least balanced in its treatment. The introductory part, while giving considerable weight to discoveries in palæophytology, is admirable in picking out the chief contributions to palæontology as applied to stratigraphy, and in its pronouncement upon such subjects as the Sedgwick-Murchison controversy. But the detailed portion gives less than three pages to the Devonian system, omits all account of the zoning of the earlier Palæozoic rocks, and then proceeds to devote almost forty pages to the Trias.

The translator's work has been carefully and conscientiously done, and the book reads far better than is usually the case with translations. A few slips or misprints are unavoidable, and here and there an ambiguity of expression has crept in. We read *Jorulla* (66), physician (77), Linnæus (for *limnaea*, 104), on the age of the human race (the antiquity of man, 195), Davis (David, 253), Euganian Isles (259), microscopic (macroscopic, 369), and aquo-igneous, for which we would venture to suggest the less cacophonous hydrothermal.

The publisher is evidently under the impression that the severer form of the German original requires tempering to that shorn lamb the British reader. The translation has been alleviated by portraits of eminent geologists, many of them admirable and some new. Those of Suess and of Zittel are excellent, but we can hardly bring ourselves to believe that that of Hutton is lifelike. Then, in addition to the shortening of some of the drier details, we have the wholesale omission of the bibliographies which accompany each chapter and many sections of the original. We hope and believe that this is a mistake. It is the serious student who will consult this work; to him the bibliographies are essential, and this will drive him to the original. In some future edition we hope to see these restored, and when this is done we would suggest that even the specialist is deserving of, and will certainly be grateful for, anything which helps to pilot him quickly and safely to the haven of his inquiries. Such aid as author and printer can give are his right. The solid mass of print should be broken up by the use of more sections and headings, italics and black-faced type, and above all good headlines to the pages (as in the original), so that a man in search of particular information may find it with the least possible expenditure of time and temper.

But all geologists are grateful to Prof. Zittel for his thorough and painstaking labour, for his fairness and breadth of view, and for his wonderful grasp of the whole of his science; and English-speaking geologists are under an especial debt of gratitude to Mrs. Ogilvie-Gordon for her timely, accurate, and well-written translation.

PLANE SURVEYING.

Plane Surveying. A Text and Reference Book for the Use of Students in Engineering and for Engineers Generally. By Paul C. Nugent, A.M., C.E., Associate Professor of Civil Engineering, Syracuse University. Pp. xvi+577. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1902.) Price 14*s.* 6*d.*

THIS book treats of that elementary part of the subject of surveying, especially useful to engineers, which deals generally with surveys of small areas on large scales. Any book on the subject which comes from America is worthy of attention, since American practice differs in many respects from ours, and this text-book is useful for the purpose of comparative study.

Amongst the subjects dealt with are linear measuring instruments and the measurement of lines, chain surveying, compass surveying, levelling, transit surveying (*i.e.* the use of the theodolite), topographical, hydrographic and mine surveying, and U.S. Government large-scale surveys and resurveys. There are also chapters on the theory of telescope construction, the planimeter, the slide rule and the solar instrument (sun compass), and an appendix on photo-topographic methods.

We have a good deal to learn from America in the use of steel tapes, which for many surveying purposes should supersede the chain, and some useful information on the question will be found at the beginning of the book. The method here described of cutting up the ground in a chain (or tape) survey differs from the English system, and the latter is preferable. A great deal of space is given to surveying with the compass; indeed too much space considering the essential inaccuracy of all compass methods; and on the other hand but little is said about triangulation with a theodolite or traversing with the same instrument, subjects which each deserve a chapter to themselves.

In the chapter on topographical surveying we have topographical methods described from the engineering surveyor's point of view, and for certain large-scale engineering topographical surveys the methods mentioned are useful. But they are not generally the methods used by surveyors on regular topographical surveys, such as the topographical branches of the Survey of India or the U.S. Geological Survey, and the description given of the

use of the plane-table as a topographical instrument is inadequate.

About a dozen pages are devoted to hydrographic surveying, and it is no doubt desirable that the engineer should have a bowing acquaintance with the subject, mainly to enable him to carry out the survey of small inland waters. If he had a larger task on hand, he should consult one of the recognised treatises on the subject.

In a book on surveying written by a professor of engineering it is remarkable that there is so little mention of the execution of special surveys for engineering purposes, such as railway and canal surveys. The whole theory of plane surveying is so simple that the engineer is far more likely to look up a text-book to discover what is the practical method adopted than to discover the solution of some theoretical problem, and the ideal text-book should largely quote examples of practical methods and expedients. The chapter on mine surveying contributed by Mr. W. S. Hall is, however, an example of the brief discussion of the survey methods used for a special engineering purpose, and appears to be useful and clear.

There is a long appendix of some fifty pages on photo-topographic methods and instruments, being a paper by Mr. J. A. Flemer in the Report of the U.S. Coast and Geodetic Survey for 1897. Such a system has been much advocated in various quarters during the last few years, and it is interesting and ingenious. Under certain special conditions, such as those in the Canadian North-West, where the features are bold and open and where the field season is short, and where sometimes only occasional glimpses through the clouds can be had of the higher peaks, the method is efficient and economical. But under ordinary conditions it is neither, and as a method it cannot be said to be established, nor is it likely to be; and the inclusion of a detailed report on a tentative topographic method in a book devoted to large-scale engineering survey increases the size of the book, but not its value.

As regards the nomenclature of the book, we do not like the author's division of surveying into plane surveying and geodesy, although authorities can be found in favour of it. The term geodesy should be reserved for those scientific operations of which the object is the determination of the form and size of the earth. Some of the words used are new, *e.g.* "declinator," meaning the box containing the compass. The northings and southings of a traverse are here called "latitudes," and the eastings and westings "longitudes." We are glad to see that the author uses the word "plotting" and not "platting." The latter is sometimes found in American technical works and is objectionable in spite of its greater antiquity.

C. F. CLOSE.

INSPECTION OF RAILWAY MATERIALS.

The Inspection of Railway Materials. By G. R. Bodmer, A.M.Inst.C.E. Pp. ix + 154. (London: Whittaker and Co., 1902.) Price 5*s*.

THE inspection of their products has long been a source of worry to the manufacturers of railway material, be it locomotives, bridges or rails. Consulting engineers have their own ideas as to what the tests should be; few specify alike, with the result that manufacturers have to make various qualities of material for the same purpose—a state of affairs not conducive to economy of manufacture.

The question of material is not the only trouble. Consulting engineers very often specify methods of manufacture for their material. Interference of this kind in works management is most expensive to the manufacturer; it upsets the sequence of the work, delays progress, and in the end has to be paid for by the railway shareholders.

A third complaint might be made by manufacturers, and one which very largely adds to the cost of work in many cases, and that is, what kind of man is the inspector? It is on this point the author of this book commences. He says:—

"The inspection of railway material is a class of work for which every inexperienced neophyte devoted to the engineering profession imagines himself to be qualified."

The author goes on to say that

"in reality, however, many qualifications are required to make a good inspector, and chief among these is experience, the one most likely to be wanting in a young engineer."

With this we thoroughly agree. In certain specifications the general clauses are such that the contractor is entirely in the inspector's hands, and if the inspector does not know his work the result is disastrous. Much has been written lately on the standardisation of locomotives, for instance, as a means of shortening the time of delivery; but given standard tests, non-interference in works practice and a practical man as resident inspector, there is no necessity to crystallise any design, for when all is said and done a thing of yesterday is old.

This book has evidently been written by one who has been through the "inspection mill." There is much evidence of this in the various chapters. Chapter ii. deals with rails, ordinary and tramway, fish plates, &c. We are told that in the case of fairly heavy rails it is possible to inspect four or five at a time. The reviewer could never do more than three continuously.

Steel sleepers are dealt with in chapter iii. The information is well up to date, although we cannot agree that the Indian sleeper fitted with punched up lugs cannot be gauged for gauge unless fitted with a length of rail, &c. The author might have explained that with this type of sleeper the position of the keys for normal gauge is outside the rail, for a medium curve one is moved inside, and for a very sharp curve both are placed inside.

On tyres and axles we find much useful information, and further on rolled material generally is very fully gone into, the tests being carefully explained. Chapter vii. deals very thoroughly with the condition governing the specifications for steel rails, more particularly discussing the mechanical tests, which vary very largely in present-day practice. The work concludes with a short account of the inspection of finished work dealing with various parts of rolling stock, and fulfils the intention of the author in being a brief guide to the inspection of railway material for the use of engineers.

N. J. L.

OUR BOOK SHELF.

The Watkins Manual of (Photographic) Exposure and Development. By Alfred Watkins. Pp. 124. (Hereford: The Watkins Meter Co.; London: George Houghton and Son, 1902.) Price 1*s.* net.

THE author is universally known among photographers as the inventor of the Watkins exposure meters and as having devised methods of exposure and development whereby the results are rendered more certain than by the older "rule of thumb" procedure. In this manual Mr. Watkins has systematically set forth his methods of timing exposure and development, and as these methods are sound in principle and useful in practice, a complete and orderly presentation of them as is here given results in a handbook that must be of great value to all serious students of the subject. It is the most welcome photographic manual that we have received for a long time.

We should have much preferred it if the author had remained true to his title and not endeavoured to provide a book suitable for two distinct purposes, namely, as an exposition of the procedures that he has introduced and popularised, and also as a guide for the beginner. Anyone who will be instructed by the statements that the lens forms the image and that the plate receives the "lens image," that a box of plates must be opened only in the dark room, and so on, will be quite unable to appreciate the bulk of the volume. Moreover, the author's heart is evidently in those sections of the subject that he has made peculiarly his own. In these he is full and clear, and probably no one, however much he may have studied the matter before, will read these parts without learning a good deal. The other chapters appear to have been written unwillingly, for in them accuracy is sacrificed for the sake of an apparent simplicity, and the subjects they represent cannot be said to be treated of, they are little more than referred to. In learning to photograph, as in learning to speak, the natural method is first to learn to do what it is desired to do, and finally to learn the grammar or the theory. No one tackles a subject in the opposite direction except under the compulsion of a schoolmaster, and then generally he learns the subject badly.

In dealing with chemical and physical changes, one must have a mechanical conception of the process, and Mr. Watkins is generally happy in his illustrations. But when he represents the course of development as a simultaneous reduction to the metallic state of all the particles of silver salt made amenable to the action of the developer by the exposure, so that as the image gradually grows in density these particles are at one stage each one-quarter reduced, later one-half, while finally the whole of each particle is completely reduced, he selects an illustration that is not true to fact. But this is a mere detail. We heartily commend the book to those who know how to photograph and wish to increase their knowledge and improve their practice. C. J.

Nature Study and Life. By C. F. Hodge. Pp. xv + 514; illustrated. (Boston, U.S.A., and London: Ginn and Co., 1902.) Price 7*s.*

THE author of this little volume is convinced that the only true method of nature-study is by making children thoroughly acquainted with living animals and their ways, both in the wild state and in confinement. He will have nothing to do with technicalities as to their structure and classification, leaving these, if they are ever to be taught at all, for older pupils. The keeping of tame animals as pets, and the history of domesticated animals, so far as known, are regarded as important factors in the scheme. A similar mode of study is pursued in the case of plants, where the pupil is not bothered with a long string of technical names or wearied with details as to their structure. Their life and their relations to inanimate surroundings are the only things it is sought to teach. The author's mode of procedure is to induce the members of the class to write down the names of all the animals—both wild and domesticated—with which they are acquainted, to classify them roughly, and then to discuss some of the more important types at length.

That the author's method is not a mere empirical suggestion, which may or may not prove successful in the class-room and in the field, is evident from the introduction to the volume by Prof. Stanley Hall, of Worcester, Mass., who writes as follows:—"New as his method essentially is, it is now made public only after years of careful trial in the public school grades in Worcester, until its success and effective working in detail is well assured. Thus it has passed the stage of experiment, and is so matured and approved that, with slight local adjustments, it can be applied almost anywhere for children of from six or seven to thirteen or fourteen years of age."

In the United States the success of the method seems indeed to be assured, and there is accordingly every inducement to give it a fair trial in this country. The book is brightly and pleasantly written and well illustrated. Whether the author is altogether correct in the statement on p. 8, that the mammoth was a third taller and more than twice the weight of "our elephant," and that "the mastodon" was larger still, we may be permitted to doubt. We are also at a loss to know the particular kind of fossil deer indicated by the name *Cervus americanus*, a title properly belonging to the existing Virginian white-tailed deer. R. L.

Manual of Agricultural Chemistry. By Herbert Ingle. Pp. 412. (London: Scott, Greenwood and Co., 1902.) Price 7*s.* 6*d.* net.

AGRICULTURAL chemistry deals with a very extensive range of subjects, including the whole of the materials and operations with which agriculture is concerned. The plant, the soil and the animal are each of them subjects sufficient to satisfy a whole generation of workers; but agricultural chemistry includes all these and much more besides. No book ever has been written, and none probably ever will be, attempting to deal with the entire subject; the student must, therefore, fill his shelves with a great variety of books, by many writers, if he would have at command the information available on the subjects of agricultural chemistry.

The present manual represents the course of instruction in agricultural chemistry given at the Yorkshire College, Leeds. The course of instruction is a full one, and the matter has been carefully written out by the lecturer, Mr. H. Ingle. The book thus produced will be heartily welcomed by all students of agricultural chemistry; it brings together clearly and correctly a great mass of facts which can be found in no other single volume. Especial attention is given to questions connected with pure chemistry, organic and inorganic, and with physiological and analytical chemistry; less prominence is given to the problems of practical agriculture. Thus we have the percentage composition of crops, but not the composition of average crops per acre; the subject of rotations is also omitted Again, under animal chemistry, we have no discussion of the relation of food to animal maintenance, or to the production of work or animal increase. The values of foods for the production of heat are given, but the extent to which these potential values are utilised for animal requirements is not discussed. The epoch-making researches of Kellner and Zuntz on this subject are not referred to.

The author describes Grandeau's method for the determination of humus in soil, based on the solubility of this substance in alkalis. As a good deal of work is being done with this method both in America and in this

country, it may be worth while noting that it does not show the total humus, but only the humic acids. Berthelot has, in fact, shown that even boiling with potash leaves a considerable part of the organic carbon and nitrogen of a soil undissolved.

English agricultural writers employ two names for *Beta vulgaris*—"mangel" and "mangold"; Mr. Ingle employs the latter. The former spelling is, however, more correct. The word comes from the German description "Mangel-Wurzel," or scarcity root, alluding to its resistance to drought. The spelling has probably drifted into mangold from the golden colour common to the roots. R. W.

Ueber Aehnlichkeiten im Pflanzenreich. By F. Hildebrand. Pp. iv + 66. (Leipzig: W. Engelmann, 1902.) Price 1*s.* 9*d.* net.

PROF. HILDEBRAND, in his introductory remarks, takes exception to the use of the term "mimicry." He states that it is applied by zoologists when two very different animals show similar appearances which are of apparent benefit to one, and that the explanation of zoologists infers that these similarities are developed in the struggle for existence. The latter part of this statement is distinctly misleading, as it is doubtful if any zoologists regard such similarities as being developmental. The object of the book is to show that in the plant world mimicry rarely if ever occurs, and that similarities in plants or plant forms are mainly due to environment or ecological factors. The series of comparative sketches which Prof. Hildebrand has published form light reading, but they might with advantage have been worked up in greater detail.

Index to the Literature of the Spectroscope (1887–1900, *both inclusive*). By Alfred Tuckermann. Pp. 373. Continuation of the previous index by the same author published in 1888. (Published by the Smithsonian Institution, 1902.)

IN the previous index, extending from the dawn of spectroscopy (or even earlier, for references are made to papers published in the seventeenth century) to 1886, the author arranged the books and papers under 320 different sections, placed alphabetically. In each section the titles of the papers, the authors' names, and references to the original papers and abstracts are arranged in the alphabetical order of the authors' names. The present contribution is divided into two parts, part i. being an authors' index extending to 188 pages, in which the authors' names are placed alphabetically and the full title, year of publication and references to the papers and abstracts are given; and part ii. a subject-index beginning with history, books, spectroscopy in general, followed by nearly 300 divisions arranged alphabetically. In these divisions the authors' names are first given alphabetically, followed by the references to the papers with the year of publication, but without any reference to the titles or to contents of the papers which are not given in the titles. Thus under titanium there are five references; the first is in the *Wiener Anzeiger*, and does not appear in the author-index, the second is on ultra-violet spark spectra, the third on titanium as a comparison spectrum, the fourth on the arc spectrum, and the fifth on the shifting of the arc spectrum lines under the influence of pressure. The value of the index would have been enormously increased if the papers had been arranged alphabetically according to the subjects, and with the papers on the same subject placed in order of date instead of according to the authors' names. Such a system would have entailed more printing, but it would not have caused very much more work in preparation and would certainly have been worth the additional trouble.

The list appears to be very complete; it may be said to be more than complete, for some of the papers indexed do not deal with spectroscopy. Thus five papers on meteors which we have examined do not contain any reference to spectra, and one on the yellow variety of arsenic does not deal with spectroscopy; several papers are indexed which contain only micrometric measurements of the diameters of planets. It is perhaps ungracious to criticise in this manner a work which must have been very arduous to the author, but the inclusion of papers that do not refer to the use of the spectroscope may be the cause of much loss of time and trouble to workers, and this would not have happened if the subject-index had been prepared in the way above suggested.

Dr. Tuckermann must be congratulated on the conclusion of his work, which, notwithstanding the defects which we have mentioned, cannot fail to be of service to many investigators in this important branch of science. H. M.

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.*]

Misuse of Coal.

NATURE of March 20, containing a most interesting communication by Prof. John Perry on the "Misuse of Coal," has reached me lately. Surely Prof. Perry takes an insular view of the matter. Like so many Englishmen, alas! he knows not the forest! The greater portion of the world cooks its food and makes itself comfortable on wood fuel, and though all the forests in the world would, according to European ideas, be inadequate to supply by their growth the present expenditure of coal (their fossilised remains), to overlook altogether the sun power which we can fix by growing wood fuel is surely, from even a European point of view, an oversight. Helmholtz compared the number of thermal units received by an acre of land in Germany during a year with the number of thermal units produced by burning the vegetable matter elaborated during a year. His calculation was that only the 1/1477th part of the sun's heat was thus rendered available.

On this basis it is possible roughly to calculate the maximum thermal efficiency as firewood of the wattle or Eucalyptus vegetation on the coast of Australia or South Africa. (Insolation is for the latitude somewhere about one-sixth greater at Cape Town than in mid-Germany; practically it is more on account of the clearer atmosphere.) The production of firewood is about five times as much; thus, taking Crottondorf as an example of a European forest giving one of the largest yields in timber, we have:—

Crottondorf spruce, mean yearly yield 143 cubic feet.
Quick-growing Eucalypts, S. Africa, do. 700 ,,

Or the maximum South African yield is five times the maximum European yield. But since the average weight of eucalypt wood is three times that of spruce, the heating power produced on an acre of Eucalypts must be set at about fifteen times that produced on an acre of northern and mid-European forest. Thus on the basis of Helmholtz's calculation a eucalypt plantation can, with the most favourable circumstances, in South Africa or on tropical mountains, store up, say, 15/1500 = 1 per cent. of the solar energy received on the unit of area.

The position in Cape Town to-day is that it is cheaper to plough the ground and plant a forest of quick-growing trees than to import coal from over the sea or by a long and expensive land journey. Firewood in Cape Town is worth nearly 1*s.* per cubic foot, and before the railway was extended to the diamond fields firewood there has fetched 1*d.* per lb., the price at which sugar has been retailed in England. No doubt from a British insular point of view coal at 2*l.* or 3*l.* per ton is a terrible misfortune. It certainly increases the cost of running machinery; but if this does not take place to a prohibitive extent, and if it makes the user of power careful not to waste it, it is not an unmixed evil. And if thereby afforesting is made a paying operation, it is at least open to discussion whether dear coal and good forests would not be better for England than an expenditure of 23,000,000*l.* sterling on

imported timber, and the evils, including physical degeneration of the race, and coal fogs in the big cities, which have been shown elsewhere to result from England's neglect of its forests. The reference to De Wet in Prof. Perry's communication is unfortunate: a small quick-moving army would probably have caught him. And surely cheap coal and luxury is not the *summum bonum*. Rather let us have hamlets of strong forest workers than the luxurious town dwellers of to-day with their decayed muscle and cheap mechanical power! Compare a European engine-driver with the runner castes of India and Japan. The engine-driver shows us perhaps fine inherited muscle, but going to decay for want of use; the Eastern runners show the development of muscle by both use and inheritance. Which would have the best chance of catching De Wet a hundred years hence?

As far back as 1882 the discovery was made by Sir D. Brandis and myself that Eucalypts planted on tropical mountains will produce wood fuel at the rate of 20 tons (dry weight at 60 lbs. per cubic foot) per acre per year in perpetuity. The eucalypt plantation reproduces itself when cut, without further expense, and its dry timber, heavier than coal (which, as met with commercially, weighs 50 lbs. to 52 lbs. the cubic foot) has an equal or a higher thermal power, bulk for bulk, than coal. We obtained this result as the maximum yield of *Eucalyptus globulus* on the Nilgiris, Southern India. No doubt there are other instances where higher yields are produced now, and no doubt also when the coal supply is exhausted, selection and experiment will produce a forest vegetation that will produce more than 20 tons per acre per year. The sugar beet and all the fruits and vegetables of civilisation show how the vegetable kingdom can be moulded to suit man's wants. If a chance tree on a chance mountain in a chance soil can produce the equivalent of 20 tons of coal per acre per year, it seems not unreasonable to suppose that by selection we can produce, say, double this, or 40 tons. To produce this in perpetuity we should probably have to find a tree with the moderate soil requirements of the Conifers. A powerful sun, a heavy rainfall, and a very rapid forced growth would be the essentials of such a production of wood fuel.

Looking at a rainfall map of the world, one sees that these conditions are fulfilled over about 8000 million acres of its surface (which is between one-fourth and one-fifth of the total land surface of 35,200 million acres). I take latitudes below 40° and rainfalls above 40 inches. One-half of this area under forest might thus yield the equivalent of 161,000 million tons of coal yearly. This is more than 288 times the world's present consumption of coal, assuming that coal and eucalypt timber are of approximately equal heating power. On the basis of the actual forest yields of to-day we have half this, or 80,500 million tons. In Germany, one-fourth of the total area is under forest, and this is held on the highest authority to be the suitable proportion for a thickly-peopled civilised country such as Germany. The forest should properly occupy a higher proportion in countries where large areas are pestilential and unsuited for human habitation. Putting this, however, aside, and taking the German standard of one-fourth forest, then on the basis of to-day's maximum yields we should obtain a yearly output of 40,250 million tons. And if to convert the maximum forest yield to an average forest yield we again divide by two, we obtain 20,175 million tons. Lower than this I do not think we can reasonably go for the class of forest under consideration. *It is a little more than thirty times the world's present consumption of coal.* The world's yearly output of coal recently was 663 million tons, says Prof. Perry.

Thus we see that the yield of firewood from the world's tropical and extra-tropical forests, whenever they are fully stocked and scientifically worked, will yield the equivalent of from thirty times to 122 times the present consumption of coal, or even up to 243 times the present consumption of coal if we succeed by cultivation in doubling present timber yield figures.

It may be objected that my figures are far in excess of those representing the yield of European forests and that they require confirmation. No doubt they are far in excess of European figures; but so also is the intensity of the vegetative process in these latitudes, and so also is the stature of the Sequoias of California, and the Eucalypts of Australia and South Africa above the stature of the biggest spruces and silver-firs of Europe. The Nilgiri figures I have quoted above were formally recorded in two official reports printed and published by the Madras Government in 1882.[1] They have since been confirmed by the measurements of forest officers who have subsequently had charge of the Nilgiri plantations. Similar figures have been obtained by myself and other forest officers in South Africa. They have been exceeded in several plantations in Natal, while at Johannesburg they have not been confined to Eucalypts, but have been obtained from *Acacia decurrens*, or black wattle, as well as from some other trees.

Therefore, "when our coal supply is exhausted, when all the races of the world have fought for the waterfalls and places of high tide," there will still remain that which Englishmen of all the civilised races of the world do most neglect—the forest.

D. E. HUTCHINS.

Grootvadersbosch, Swellendam, Cape Colony, May 14.

Cold Weather in South Africa.

WE have been getting exceptional weather here of late. General French was actually snowed up at Middelburg. A good general idea of the circumstances will be obtained from the telegrams abridged below from the *Diamond Fields Advertiser* of June 14.

Middelburg (Cape), June 11.—For the first time for sixteen years the town is covered to a great depth with snow. Kingwilliamstown, June 11.—A fierce thunderstorm occurred last night, accompanied by heavy rain. Port Elizabeth, June 11.—The train service between Graaff-Reinet and Rosmead is to-day stopped temporarily owing to heavy snowstorms—an unusual experience for South Africa. Cradock, June 12.—An exceptionally heavy fall of snow occurred in the Midlands on Tuesday night and yesterday. Queenstown, June 12.—The rainfall reported during the first five months of the year is the lowest recorded for the same period for the past thirty years. The drought has, however, been broken. Rain started on June 10, and during the night there was a heavy fall of snow. Kokstad, June 12.—There was a heavy snowstorm last night, accompanied by a heavy gale. The snow is several inches deep in the streets. Bloemfontein, June 12.—The weather is unprecedentedly cold. The hills round Thaba 'Nchu are covered with snow. Last night snow fell in Bloemfontein.

At Kimberley it has been intensely cold, with a low barometer, wind, rain and sleet, and afterwards heavy frost. With the one exception of July 12, 1886 (when Kimberley is said to have been under snow for the whole day), the maximum shade temperature registered is the lowest on record. For the eight days ending Sunday, June 15, the temperatures have been:—

	Observatory Screen.		Stevenson Screen.	
	Max.	Min.	Max.	Min.
June 8 ...	72°·0	34°·0	73°·7	33°·0
,, 9 ...	59°·0	39°·0	59°·8	38°·1
,, 10 ...	46°·2	38°·0	45°·9	37°·8
,, 11 ...	45°·4	36°·9	44°·9	36°·1
,, 12 ...	48°·3	31°·6	46°·8	31°·2
,, 13 ...	52°·1	25°·2	53°·7	24°·2
,, 14 ...	57°·0	26°·9	58°·0	26°·0
,, 15 ...	62°·0	29°·0	63°·2	28°·0

The maximum temperatures registered on June 10 and 11 are the lowest on record for any June. The maximum registered on July 12, 1886, was 35°·8. There was also a maximum temperature of 45° in July 1891. Both, however, were obtained under a Glaisher screen and are probably a little too low. Minimum temperatures lower than 25° have been registered perhaps three times; the lowest known is probably 20° in July 1888. All these previous instances have been quite transitory, the temperatures in each case being much higher both the day before and the day after. There seems to be no record of a cold spell having the duration of the one in question.

Kenilworth, Kimberley, June 16. J. R. SUTTON.

1 "Suggestions regarding Forest Administration in the Madras Presidency," by D. Brandis, C.I.E., Inspector-General to the Government of India (Madras, 1882).

"Report on Measurements of the Growth of Australian Trees on the Nilgiris," by D. E. Hutchins, Dep. Cons. Forests, Mysore (Government Press, Madras, 1883).

A SHORT PERIOD OF SOLAR AND METEOROLOGICAL CHANGES.[1]

IN continuation of the inquiries referred to in a former paper on Indian rainfall and solar activity,[2] attention has more recently been devoted to an examination of the variations of pressure over the Indian and other areas.

(1) It is well known that in India during the summer months (April to September) and during the winter months (October to March) low and high pressures respectively prevail. In the case of the latter, the pressure is found to exhibit very remarkable and definite variations, and is in excess every three and a half years on the average, while at these times of excess of high pressure the low pressure during the other six months of the year is deficient; so that every three and a half years or so the high pressure becomes higher and the low pressure is not so low as usual.

(2) Further, this short-period variation which appears in the mean variation of pressure over the whole of India is as well defined in the mean values for individual

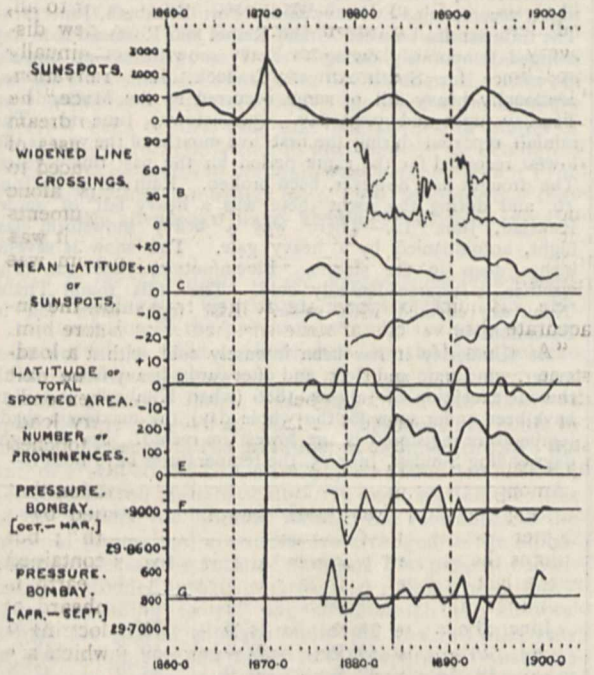


FIG. 1.

stations such as Bombay (Fig. 1, Curve F), Calcutta, Madras, Nagpur, &c.

(3) The view that the variation of pressure in question over India and its neighbourhood is not due to local causes, but is produced by some external, or extra-terrestrial action, is considerably strengthened by an examination of the pressure curve of a very distant station such as Cordoba. Dealing with the pressures at Cordoba during the high-pressure six months, April to September, the curve (Fig. 2, Curves F and E) representing the variation from the mean from year to year is exactly the *inverse* of the curve representing the Bombay and other Indian pressures for the same months over the same period of time. The cause, therefore, which raises the mean value for the low-pressure months over the Indian area would appear to lower the mean value of high-pressure months at Cordoba simultaneously. In fact we have a see-saw.

(4) Further investigation shows that not only do the pressures of practically the whole Indian area exhibit variations from year to year which present very similar features, but that this is the case with other large areas.

Thus, for instance, it is found that the yearly mean pressures for Brussels, Bremen, Oxford, Valencia and Aberdeen (the only pressures that have been at present examined) are all remarkably similar in their variations from year to year; and it might almost be said that one curve representing the variations from the normal would approximately define the pressures at all these places.

The probable extra-terrestrial origin of these short-period variations led to a detailed examination of the records of the phenomena connected with solar spots and prominences, with a view of seeing whether similar variations, indicating changes in the solar activity, could be detected.

(5) A preliminary reduction of the Italian observations

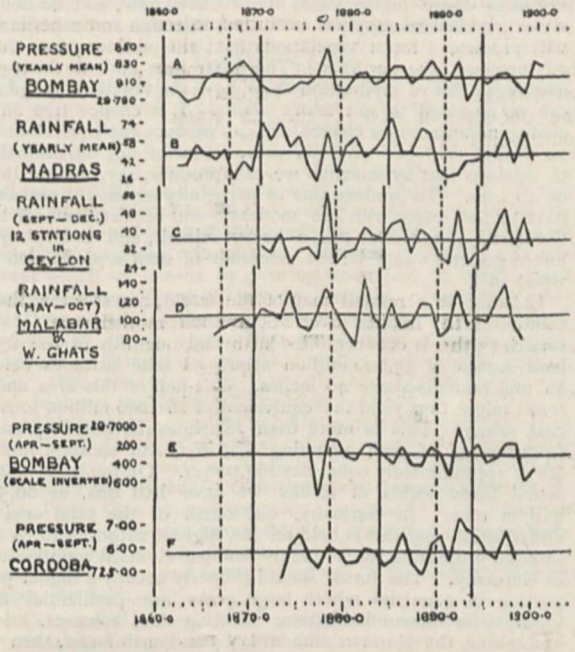


FIG. 2.

of prominences observed on the sun's limb since 1871 was first undertaken. The result of this inquiry indicates that, in addition to the main epochs of maximum and minimum of prominences which coincide in time with those of maximum and minimum of the total spotted area, there are prominent subsidiary maxima and minima having a similar short period, and also coinciding in time (Fig. 1, Curve E).

(6) Although these subsidiary prominence pulses are not distinctly duplicated in the curve representing the spotted area of the solar surface, it is to be noted that corresponding pulses are indicated in the curves which represent the change of latitude of spotted area from year to year; and in each case an increase in prominence activity is associated with a decrease of latitude of the spotted area (Fig. 1, Curves C and D).

(7) A comparison of these solar data with those already referred to relating to terrestrial pressures suggests that these simultaneous outbursts of prominences and changes of the latitudes in which the spots occur about

[1] "On Some Phenomena which Suggest a Short Period of Solar and Meteorological Changes," by Sir Norman Lockyer, K.C.B., F.R.S., and William J. S. Lockyer, M.A., Ph.D., F.R.A.S. (Read before the Royal Society, June 19.)

[2] "On Solar Changes of Temperature and Variations in Rainfall in the Region Surrounding the Indian Ocean" (*Roy. Soc. Proc.* vol. lxvii. p. 409).

every three and a half years are the true cause of the pressure changes; and that the varying intensity of solar activity within the sunspot period of eleven years produces an effect on the pressure and circulation of our atmosphere, thus affecting the whole globe meteorologically.

(8) The close correspondence between the epochs of these subsidiary pressure variations and those representing prominence frequency suggests, not only their very close relationship, but that the terrestrial pressure quickly answers to the solar changes, while so far as the work has gone it would appear that rainfall (Fig. 2, Curves A, B, C, D) and snowfall are subsequent effects.

(9) It may be remarked that we have already obtained evidence showing that this short-period variation is not the only one acting, but that the eleven-year and thirty-five-year periods apparently influence the short-period variations. But even this does not explain some anomalies already met with, and should the solar origin of these short-period pressure changes be subsequently confirmed, some of them not constant in all localities will have to be explained: and it is possible we may obtain in this way some new knowledge on the atmospheric circulation.

(10) The period of time included in this survey begins generally with the establishment of the full records of the Indian Meteorological Department in 1875 and extends to 1895, when the regularity of the widened-line phenomena was broken, as stated in a previous communication.

Addendum, dated June 26.

In continuing the above researches we have plotted the percentage frequency of the solar prominences derived from the Italian observations for each 10° of solar latitude N. and S. of the equator.

We find that the epochs of maximum prominence disturbance in the higher latitudes are widely different from those near the equator. The latter are closely associated with the epochs of maximum spotted area, the former occur both N. and S. at intervening times.

We have, then, two sets of strongly marked prominence outbursts occurring at intervals of between three and four years.

Both sets are represented closely in the Indian pressure curves.

Solar Physics Observatory.

THE FIRST MAGNETICIAN.[1]

"THIS booke is not for every rude and unconnynge man to see, but for clerkys and very gentylmen that understand gentylness and scyence."

This quotation from Caxton is prefixed by Prof. Thompson to his notes to the new edition of the "De Magnete."

Most students of electricity know that William Gilbert of Colchester is the father of the sciences of magnetism and electricity. They may have some idea of the extent of his discoveries and the general character of his work, but few who have not seen the celebrated book in which he recorded his results can have really grasped how much Gilbert knew and how thorough and complete were his investigations.

"He practised the experimental method of observation before Bacon wrote about it; his methods and discoveries excited the sneers of Bacon, the praises of Galileo and Kepler."

The book justifies the high claim put forward on its behalf by its latest editor, and the thanks of men of science are due to him and to all who have helped him for enabling them to learn what Gilbert did.

It was a happy thought to found the Gilbert Club, and the members of the club who have the chance of possessing this splendid volume, the outcome of many years of patient research and loving labour, are greatly to be envied.

The club was founded in 1889 to commemorate Gilbert's work and to issue a translation in English; at that date there was none, though one was published in America in 1893 The original edition was issued in 1600, and it was at first hoped that the translation might be ready in time for the tercentenary celebration at Colchester in 1900. This proved impossible, but the work is now complete and the result is admirable.

It will be of interest here to give a brief account of the work itself. Starting with the early history of the loadstone, its power of attracting iron known to the ancients and its property of setting in a definite direction discovered in the tenth or twelfth century, Gilbert in the first book of his treatise sets forth the various fundamental properties of a magnet and of magnetised iron, illustrating them by the experiments now familiar to all, and describing almost in every chapter some new discovery or some important law. He is continually appealing to experiment and accurate observation. "Deplorable is man's ignorance in natural science," he writes, "and modern philosophers like those who dream in darkness need to be aroused and taught the uses of things and how to deal with them, and to be induced to leave the learning sought at leisure from books alone and that is supported only by unrealities of arguments and by conjectures" But Gilbert lived too early; it was more than 200 years before the truth of his maxim was realised.

He was quick to appreciate at their true value the inaccurate observations of some who had gone before him. "Albertus Magnus writes," we are told, "that a loadstone had been found in his day which with one part drew to itself iron and repelled it with the other end; but Albertus observed the facts badly; for every loadstone attracts with one end iron that has been touched by a loadstone and drives it away with the other."

Among other things, we may note his observation that "a long piece of iron (even though not excited by a magnet) settles itself toward north and south"; but perhaps the greatest discovery in this book is contained in the last chapter, "That the globe of the earth is magnetick and a magnet," our "New and unheard of doctrine about the earth" he calls it. The doctrine is proved by the observations and experiments which are the subject of the rest of the treatise.

Book ii. deals with a number of examples of magnetic attraction, and in chapter ii., "On the magnetic coition, and first on the attraction of amber, or more truly on the attaching of bodies to amber," we find the beginnings of the theory of electricity. "For in other bodies," he writes, "a conspicuous force of attraction manifests itself otherwise than in loadstone; like as in amber, concerning which some things must first be said that it may appear what is that attaching of bodies and how it is different from and foreign to the magnetical actions, those mortals being still ignorant who think that inclination to be an attraction and compare it with the magnetic coitions," and so to illustrate electric actions he invents the straw electroscope. He divides bodies into "electricks," which are electrified by friction and attract light bodies, and "non-electricks," the metals and other conductors as we now call them. The effect of heat and moisture is studied and described, and the distinction between electrical and magnetic attraction fully made out.

With amber or other "electricks," "if indeed either a sheet of paper or a piece of linen be interposed there will be no movement. But a loadstone without friction

[1] "William Gilbert of Colchester, Physician of London, on the Magnet, Magnetic Bodies also, and on the Great Magnet the Earth." Pp. 246. Published in Latin, 1600. Translated and edited for the Gilbert Club, 1900, with notes by Prof. S. P. Thompson, F.R.S.

or heat whether dry or suffused with moisture invites magneticks, even with the most solid bodies interposed, even planks of wood or pretty thick slabs of stone or sheets of metal. A loadstone appeals to magneticks only, towards electricks all things move."

He has no mercy on those who would make a perpetual-motion machine by means of the attraction of a loadstone.

"But they have been little practised in magnetick experiments who forge such things as that. . . . Oh that the gods would at length bring to a miserable end such fictitious, crazy, deformed labours with which the minds of the studious are blinded."

Book iii. is on Direction, the property of the magnet to point north and south. At the outset Gilbert recognises that the compass needle deviates from the true North Pole by an amount which varies at different points on the earth. "But it must be understood," he says, "on the threshold of the argument (before we proceed further) that these pointings of the loadstone or of iron are not perpetually made toward the true poles of the world, do not always seek those fixed and definite points or remain on the line of the true meridian, but usually diverge some distance to the east or west."

The fundamental laws of the magnetisation of iron by contact with another magnet by induction either from a loadstone or in the earth's field are clearly set out. Gilbert knew, too, how to demagnetise a magnet. "Putting the whole iron in the fire," he writes, "blow the fire with the bellows so that it may be all aglow and let it remain a little longer time red hot. When cooled (so, however, that while it is cooling it does not rest in one position) . . . you will see that it has lost the verticity it had acquired from the stone." Verticity is the name given to the property of pointing north and south.

Book iv. deals with "Variation," the angle between the true and magnetic meridian at any point, and though we cannot agree with Gilbert that "the variation is caused by the inequality of the projecting parts of the earth," or that "the variation in any one place is constant," we can admire his skill and resource in utilising the scanty material at his disposal and in devising methods to measure the amount of the variation.

In Book v. the action of a dipping needle is described and explained, while Book vi. treats of the "Globe of the Earth the Great Magnet."

Any notice of this edition of the "De Magnete" would be incomplete without some reference to the notes contributed by the editor.

During the work of revising and editing the English translation of "De Magnete," many points, as Prof. Thompson writes, came up for discussion requiring critical consideration and the examination of the writings of contemporary or earlier authorities. The results of some portion of this labour have been collected in the form of notes. The text has with great judgment been printed just as Gilbert left it; in fact, comparison shows that throughout the English and the original Latin versions run page for page. The notes cover some seventy pages, and are replete with curious and interesting information. Take, for example, that relating to the picture of the blacksmith striking the iron while it lies north and south, given on p. 139, which we have reproduced. It appears that woodcuts containing human figures are rare in the art of the sixteenth century, and Prof. Thompson traces Gilbert's picture to a book of fables by Cornelius van Kiel, published at Cologne in 1594,

FIG. 1.—The Blacksmith making a Magnet.

where it is used to illustrate a fable of the blacksmith and his dog. The dog has been omitted in the Gilbert picture, the words Septentrio and Auster have been added and some other details modified, but there is no doubt where the picture came from.

Another note of interest is that to p. 165, dealing with the discovery of the mariner's compass, its construction, and the wind-rose or chart of the winds marked on the card of the compass. The earliest known examples of the wind-rose are on certain Venetian charts dating back to 1426 or 1436. Not less interesting is the paper which some five years since Prof. Thompson read before the Bibliographical Society on "Peter Short, Printer, and his Marks." This, however, is not in this volume. Peter Short, the hitherto unknown printer of the book, used as his mark the device of a serpent entwined round a T-shaped support, and the investigation as to why this mark was used has led to an interesting chapter in the history of the printers of the sixteenth century.

But enough has probably been said to convince even an unwilling reader of the value of the book "De Magnete" and of the services which the editor and his colleagues have rendered to science by the issue of this English edition. They are to be congratulated on the results of their labour of love, which, though it has cost them many hours of toil, has had so successful an issue.

R. T. G.

RECENT HISTORY OF THE ROYAL SOCIETY.[1]

WHEN the "Record of the Royal Society" was first issued in 1897, further editions of that interesting compilation were promised, and the Society has considered the opening of the new century an appropriate time for fulfilling that promise. Although there is not much of especial importance in the history of the Society to chronicle during the four years which have elapsed since the issue of the first edition, no one will quarrel with the Council for having taken this opportunity of issuing a work which contains additions of so much interest as does the "Record" before us.

The first edition was noticed in our columns in 1897 (see vol. lvi. p. 343), and the present volume gives us, with but slight modification, the historical material contained in the first edition. The work, however, has extended from a manual of 224 pages to a substantial volume of 427 pages, and this increase in bulk is almost entirely due to the valuable list of the Fellows of the Society elected since its foundation, arranged in chronological order of election, with an alphabetical index.

While the main portion of the contents of the first edition remains unchanged, the short period which has elapsed between the two issues of the "Record" has seen modifications in some old associations of the Society. The Botanic Gardens, Chelsea, formerly known as "The Physick Garden," established in 1721, after enduring various encroachments upon its boundaries and sundry risks of absorption into the maw of the London builder, has found salvation in that essentially modern sanctuary for neglected charities, a scheme of the Charity Commissioners. This garden was granted by Sir Hans Sloane to the Society of Apothecaries in February, 1721, on conditions mentioned in the notice in NATURE already mentioned. In the event of the Society of Apothecaries at any time failing to fulfil these conditions, or converting the garden into buildings for habitations or any other uses save as a physic garden, the premises were to be held in trust for the Royal Society, by which it was to be held under like conditions, the obligations in this case being to the Royal College of Physicians. The Society of Apothecaries appears to have carried out the prescribed terms, but in 1861 evinced a desire to be relieved of its charge, which, however, the Royal Society showed no anxiety to assume, and the garden, suffering in the meantime some curtailment on the building of the Chelsea Embankment, remained under its original tenure until 1898, when the Society of Apothecaries, anxious to be rid of the burden of its maintenance, applied to the Charity Commissioners to draw up a scheme for the administration of the garden. Under this scheme, which was drawn up in consultation with the Council of the Royal Society, the management of the garden is placed in the hands of the trustees of the London Parochial Charities, with a committee of management of seventeen, upon which each of the bodies named in Sir Hans Sloane's original deed, viz. the Society of Apothecaries, the Royal Society and the Royal College of Physicians, has one representative; there are also representatives of certain educational authorities, and nine nominees of the trustees above mentioned. The committee is to provide for the maintenance of botanical specimens of living plants for teaching purposes and for the supply of botanical specimens for external instruction, and may also provide instruction, by means of lectures or otherwise, in botany with especial reference to the requirements of elementary education.

Another and more familiar name has disappeared from the list of institutions carried on under the ægis of the Royal Society. The Kew Observatory, built by King George III. on the site of an old monastery in 1769, for observing the transit of Venus which occurred in that year, was handed over by the Government in 1842 to the British Association, who maintained it until 1871. In that year Mr. J. P. Gassiot, F.R.S., executed a deed of trust for the endowment of the Observatory with a sum of 10,000*l.*, the income to be administered by a committee of the Royal Society for the purposes of the Observatory. Such a committee was duly appointed, and assumed control of the Observatory, being subsequently incorporated under the title of the Kew Observatory Committee.

Under the scheme for the establishment of the National Physical Laboratory, the Kew Observatory Committee has been wound up, and the Observatory has become incorporated in the larger institution, of which it forms a department. The conditions of Mr. Gassiot's endowment are, however, observed by the retention, as a body independent of the governing body of the Laboratory, of the Gassiot Committee of the Royal Society, composed of those Fellows of the Society who are members for the time being of the executive committee of the Laboratory.

So much has been written lately in these columns and elsewhere about the National Physical Laboratory that there is no occasion to enlarge upon this subject further than to say that its scheme of management and organisation is set out in full in the volume before us, which also contains the full text of the Gassiot declaration of trust.

Another interesting document published in the "Record" is the royal warrant for the board of visitors of the Royal Observatory, Greenwich, granted by His Gracious Majesty the King on May 23, 1901.

The list of benefactions is extended by the addition of two bequests received since 1897—the bequest of Sir William Mackinnon, who left to the Society the residue of his estate, upon trust, for the foundation and endowment of prizes or scholarships for the special purpose of furthering natural and physical science and of furthering original research and investigation in pathology. The first award under this bequest was made last year to Mr. J. J. R. Macleod, M.B., for researches in pathological chemistry. The other bequest is one made by the late Prof. David Edward Hughes, the income "to be annually awarded either in money or in the form of a

[1] "The Record of the Royal Society of London." Second edition, 1901. Pp. vi + 427. "Year-Book of the Royal Society of London, 1902." Pp. 265. (London: Harrison and Sons.)

medal, or partly one and partly the other, for the reward of original discovery in the physical sciences, particularly electricity and magnetism, or their applications." A gold medal, to be called the "Hughes" medal, will be awarded for the first time this year.

These bequests involve corresponding obligations, as may be seen under the heading of "The Trusts of the Royal Society," and the multiplicity and variety of these and similar responsibilities, duly recorded in the volume under review, appear to have stimulated the Council to something in the nature of a protest and an appeal; for, by a memorandum facing the first page of the "Record," we learn that the Council has arrived at the conclusion that it is neither to the advantage of the Society nor in the interests of the advancement of natural knowledge that the already long list of medals should be added to, and the Council expresses the opinion that no further bequests for awards as prizes for past achievements should be accepted by the Society. The memorandum then proceeds to direct attention to the fact that the funds belonging absolutely to the Society and available without restrictions for its general purposes are very few indeed, and that the usefulness of the Society has been greatly hampered by the lack of such funds.

These facts are familiar to those acquainted with the working of the Society, but outside this circle there seems to exist a general impression, whether it be due to the Royal Society's ancient and honourable association with the throne, or to its occupying handsome premises in Burlington House, or to its entertainments in the London season, that it is a wealthy body, able to dispense material assistance to all and sundry undertakings in the wide field of natural knowledge. How far this is from the truth may be seen from the statement of the Society's income published in the "Year-Book." In this we see that the total regular income of the Society, apart from funds which it administers in a fiduciary character, amounts only to about 5000*l.*, and out of this, supplemented by various small miscellaneous, and vicarious, receipts and a portion of the Government publication grant, provision has to be found for an expenditure which last year amounted to 2572*l.* on its publications alone, and 1300*l.* for its "Catalogue of Scientific Papers," in addition to all the expenses of establishment and library. Such a condition of affairs, hampering, as we are told it does, the usefulness of the Society, which has been aptly described by a distinguished foreign savant as "the mother of learned societies," and renders almost daily to the nation important services in matters of deep concern to the people in all parts of the Empire, is testimony only too eloquent to the indifference with which the pursuit of science is regarded in this country.

Space forbids us to refer at length to other undertakings in which advance is recorded in this volume. One of the most important is the completion of the "Supplementary Volume of the Catalogue of Scientific Papers," a volume of 807 quarto pages containing a list of the papers not previously catalogued in the volumes already published, for the period ending with 1883. The Society has already embarked upon the compilation of a similar catalogue for the period 1883–1900. With the completion of this work, however, the Royal Society's direct responsibilities in this matter will cease, the task being taken up from that point by the organisation, to which attention has more than once been called in these columns, of the "International Catalogue of Scientific Literature."

Other matters of more strictly domestic interest are duly recorded. The Society's collection of portraits and medals has received some notable additions. The lists of presidents and other officers, and of the recipients of the Society's medals, are brought up to date.

But perhaps the most interesting part of the volume is the list of Fellows of the Society from its foundation up to the present time. Such a roll of worthies furnishes a wealth of suggestion to the student of natural knowledge, and their biographies, if they could be presented to us in due sequence, would form an epitome of the history of scientific advance during the past 240 years which might almost be said to be synonymous with the history of the development of modern England. A word must be added in praise of the interesting series of portraits which is begun in the "Record," reproduced from photographs made by Sir William Abney from pictures in the possession of the Society. The present volume contains portraits of Sir Isaac Newton, Henry Oldenburg, Lord John Somers and Sir James Burrow, and we are promised a continuation of the series in future editions of the work.

The principal new feature in this year's "Year-Book," now in its sixth issue, is the incorporation of the complete official list of Fellows of the Society living on January 1, 1902, in place of the abbreviated list which has hitherto done duty in this work. This expanded list has added twenty pages to the size of the handbook, which contains besides, among other current information, the statutes and standing orders of the Society, lists of its Council and its twenty-six standing committees, the regulations for the administration of the Government grant for scientific investigations, the president's anniversary address and the annual report of the Council, with a statement of accounts and obituary notices of Fellows deceased. Appended to the Council's report is the report of a committee of the Society upon the vexed question of the organisation of philosophico-historical studies, a subject which has been already much discussed in the Press. Altogether the "Year-Book" indicates clearly enough how multifarious and important are the activities of the Royal Society.

THE FUTURE OF THE VICTORIA UNIVERSITY.

DURING the next few months the Privy Council will be called upon to come to a decision on a matter vitally affecting higher education in the north of England. The Victoria University, which has been in existence for twenty-three years, has come to a stage in its career when its future must be definitely settled. Liverpool has applied for a separate charter, and Owens College gives its hearty support to the establishment of three distinct and independent universities in place of the present federation.

The ambition of Manchester to have an independent university is not of recent growth. In the year 1641 a petition was presented to Parliament asking for a charter, but rival claims were brought forward by the town of York and nothing came of the effort. A fresh start in the same direction was made in 1836, but only resulted in the affiliation of the Manchester Academy to the London University. The more recent attempts of Owens College to establish a university in the city of Manchester will be in the recollection of many readers of NATURE. The opposition of Yorkshire (history repeats itself) was again successful, and led to the foundation of the Victoria University, which has, on the whole, worked well. What, then, are the reasons for its proposed dissolution?

The functions of a university are threefold—to teach, to advance knowledge and to examine. The more intimately these three functions are interwoven, the more effectively will the university fulfil its purpose. Their separation has been the great impediment to the progress of university education in this country. This is beginning to be recognised, and the recent efforts of Wales, of Birmingham and of London all tend in the direction of subordinating examination to teaching and of giving a proper place in the university ideal to research and advance of knowledge.

The Victoria University was founded in order to establish a greater harmony between teaching and examining

than was possible under the old system, which gave the London University control of the examinations. This worked well for a time, but owing to the growth in the number of students, owing also to the different directions in which the three colleges are developing, we are rapidly drifting back to the old state. Victoria University is now practically an examining body, which unites all disadvantages, for while on the one hand it controls the teaching too much in some directions, it is unable to secure uniformity of standard in others. This is a fundamental defect of the federal system, which can only work well during the early growth of the federated colleges, and will always break down as soon as some of the colleges are strong enough to stand alone.

As a mere piece of administrative machinery, the federal university must always be clumsy and wasteful. Its statutes and regulations must be framed to satisfy the various and sometimes diverging requirements of the different colleges. This can only be done by means of endless meetings and constant compromises. It is the duty of every teacher to give up a portion of his time to administrative work, and he will be glad to do so if satisfactory results may be arrived at without a wasteful expenditure. Every man has only a certain amount of strength and energy, and every hour spent in the committee room is so much taken away from his power of promoting knowledge. Simplicity of machinery is a matter of primary importance in university organisation, and it is not too much to assert that whatever success the Victoria University has achieved, it has done at the expense of taking away a very substantial and unnecessary amount of time, which its teachers might more profitably have spent in their studies or laboratories.

The objections to the splitting of the Victoria University are chiefly based on the assumption that a multiplication of universities is bad in itself. "Union is strength" is a good party cry, but the saying is not true when the union is of the kind one gets in a three-legged race. If there are universities in Manchester, Liverpool and Leeds, it is further asked, why not one in Sheffield or in Oldham, Rochdale or Burnley? Such objections are not serious, and savour too much of the political platform. We might as well argue that we should not eat and drink enough because we might possibly eat and drink too much. Surely, if a town possesses a college of sufficient standing to supply the highest teaching in its various faculties, if it is established on such financial basis as will secure its permanence and its capability of attracting teachers of eminence in the future, and if there is a sufficient supply of students, no reason can be urged against the creation of a fresh university.

Competition and rivalry, it is argued, will lower the standard of a degree. This objection springs from that distrust of the teaching profession which has been one of the chief causes of the backward state of education in this country, and is only now being slowly overcome. Because it is believed that a teacher, if left to himself, will neglect his duties, all kinds of safeguards, external examinations and inspections are invented, which may be excellent if intended to help the teacher, but are bound to break down if used to overlook and correct him. The three Dutch universities of Amsterdam, Leyden and Utrecht are nearer to each other than Liverpool, Leeds and Manchester. Though subject to certain State regulations as regards curricula, the teachers are entirely free to fix their own standard of examination. Any of these universities could, if it wished, lower its standards and give its degrees on easier terms than the other two. If they do not do so, it is because they are not foolish enough to commit suicide, but desire to attract the best students, and keep them for post-graduate and research work. Rivalry will be found to act as a healthy stimulant and not as a temptation.

America is sometimes pointedly referred to as an example of the evil effects of the multiplication of universities, and of the danger which accompanies the complete freedom of power to confer degrees. This freedom has apparently led to the depreciation of degrees in the case of a few institutions which abuse their privilege. But the standard of university education in a country should be judged by its highest and not by its lowest work, and when we think of university education in America we think of Harvard, of Yale, of Cornell and other places of high reputation, and do not trouble about a few insignificant places, which after all do very little harm.

If we could secure another half-dozen efficient and progressive universities in England, they would not be too dearly purchased, even if by some mischance one or two were established which did not justify their existence. But there is no fear as regards the immediate question at issue that any lowering of standard will result from the separation of the three northern colleges. In this country it is the old and not the new universities which are tempted to give degrees on insufficient attainments, and can do so without loss of prestige.

There are, of course, matters in which cooperation is desirable. Different entrance or preliminary examinations would obviously be objectionable and complicate the work of the schoolmaster who prepares boys for the university. Unification is here called for, not only as between the three colleges of the Victoria University, but throughout the country. The question of separation should not be mixed up with the no doubt very important question of admission to a university course.

A plausible argument against the multiplication of degree-giving bodies is found in the case of medicine, where the degree carries a qualification with it. The fact that this objection has been very strongly urged shows that our present system is not understood, and that separation is called for in the interest of a clearer definition of the meaning of our degrees. Efficiency is most easily secured if the burden of responsibility is placed on the right shoulders. Let each college give its own stamp to its own graduates, and the college will take better care to secure good teaching than while it can shelter itself behind the nondescript "Victoria University." This holds with special force where the examination, as in medical subjects, is to a great extent of a practical character. It is impossible in these cases to secure equality, and if the public is induced to think that the training or even the examination test is necessarily identical the public is deceived. If separation means the clearer realisation of the nature of the training received, separation is an advantage.

It will be to the ultimate good of each institution, if it feels the weight of its responsibility, and is more immediately made to suffer in public estimation for deficiencies in any of its departments. The effect of this feeling of responsibility is very real and swift. Liverpool has already raised a large sum of money conditionally on a charter being granted, and Leeds has put down its wants at a high figure. What is all this money wanted for except to make the teaching more efficient? It is wanted just as much whether the Victoria University remains as it is or divides; but the probable establishment of separate universities has roused the feeling of responsibility, and brought the gaps and deficiencies home to the governing bodies and to the public.

One further and very cogent argument must be brought forward. University education is often looked upon too much as a matter standing by itself, and without relationship to the previous training of the boys at school, or the parallel training in technical colleges. If a coordination of education is desirable, a federal university of colleges situated in three large cities becomes an impossibility. It is not necessary to argue this point in detail. Those who know the conditions of educational facilities in the north of England, will realise that the great diversity

which exists in the three towns is bound to render one common organisation so cumbersome that it would necessarily check the freedom of development which is essential to success. Speaking for Manchester alone, does it need further argument that a more effective university may be formed by a close cooperation between Owens College, the Municipal School of Technology, the School of Art, the College of Music, and the various theological colleges, than is possible with the present federation, which is confined to Owens College alone? And is it not obvious that the interest in higher education which would be roused by the common feeling of the governing bodies of all these institutions for a great university in Manchester will more effectively secure a high standard of work and a progressive spirit, than the artificial union of three colleges in different towns? In our effort to secure educational freedom we count on the sympathy of all who are truly anxious for educational progress, and we count more especially on the help of those who are now working out a similar problem in the University of London.

ARTHUR SCHUSTER.

NOTES.

WE regret to see the announcement of the death of M. H. Faye, the eminent French astronomer, at the age of eighty-eight years.

DR. J. G. GARSON has been appointed assistant general secretary of the British Association, in succession to the late Mr. G. Griffith.

SPECIMENS of volcanic dust collected in St. Vincent and Martinique, during the recent eruptions, which have been placed by the Colonial Office at the disposal of the Board of Education, are exhibited in the Western Galleries of the Victoria and Albert Museum. To this exhibit there has been added some dust which fell in Barbados, with chemical analyses of the same, and drawings of the minerals which it contains.

THE United States Congress has amended the law which provided for the opening of the Universal Exposition at St. Louis, May 1, 1903, by deferring it for one year. This has been done for many reasons, the principal being that, since its inception, the scope of the exhibition has enlarged. Up to the middle of June the money available for the exhibition, including State and national appropriations, amounted to more than 4,000,000*l*.

A CORRESPONDENT sends us a cutting from the *Manchester Guardian*, announcing that Mr. Assheton Smith has consented to present to the University College of North Wales a site on the Menai Straits for the erection of a marine zoological station. A special fund for the erection of this station is being started, and already Mr. H. R. Davies, of Treborth, who has acted as treasurer of the Puffin Island station since 1892, has led off with a handsome subscription.

WITH respect to the recent coloured sunsets that have been and are being seen in this country, it is interesting to note that similar phenomena are being observed in Germany. Thus the Berlin correspondent of the *Standard* writes (July 7):—"For some time past, both at sunrise and towards dusk, there has been visible here a remarkable glow of colour on the horizon, the sky exhibiting an appearance of unusual beauty. Men of science put forth the theory that this phenomenon is caused by particles in the air emanating from the fiery mass ejected by Mont Pelée." The coloured sunsets referred to last week (pp. 222, 230) were noticed at Lewisham on the evening of June 26. Mr. R. McLachlan, F.R.S., writes to say that when facing nearly due east his attention was attracted by a peculiar tint in the sky. On proceeding to the front of the house the effect was extremely brilliant, the red predominating. Mr. McLachlan thinks the tint in the eastern sky was probably due to reflection. Mr. A. R. Tankard writes to confirm the observations of remarkable sunsets at Madeira, described by Mr. F. W. T. Krohn in NATURE of June 26. He says that the peculiar sunset effects were not visible in the district of the Canary Isles and Madeira during April. As the chief eruptions in Martinique and St. Vincent took place in the first two weeks of May, and the curious effects described made their appearance subsequently, namely, in the early days of June, their connection with the eruptions is rendered probable.

A NOTE in a recent number of the *British Journal of Photography* (July 4) gives a brief account of a balloon voyage of a very uncomfortable nature that was made by Dr. Miethe in company with Lieutenant Hildebrandt. The account, which is taken from the *Photographisches Wochenblatt*, states that the ascent was made at Tegel in the afternoon at three o'clock, and the balloon came to earth at half-past six between Nieder-Finow and Liepe. At the ascent the balloon passed first through a mist, and then suddenly into a thunder cloud. After attaining a height of 200 metres, the balloon was suddenly carried to an altitude of 2000 metres, and then as suddenly fell half that distance. Meanwhile the storm was proceeding, but although the travellers did not see the lightning they were deafened with the thunder, and pelted with rain, hail and sleet. In their rapid leaps and plunges the car was frequently on a level with the balloon, and the tow-rope above their heads. The violent rocking of the car also added to the danger. Watches were not thought of, but according to the barograph this frightful experience must have lasted half-an-hour, when, through loss of gas by pressure, the balloon fell from a height of 2200 metres upon a dense wood of beeches, but for which the travellers would probably have lost their lives. One of them descended by the rope, and obtained help from the villagers at Liepe.

WE have to record the death by drowning, on Tuesday, July 1, of Mr. A. D. Hogg, a student of the Royal College of Science, London. Mr. Hogg, who had been a botanical assistant to Prof. Bayley Balfour in the University of Edinburgh, his native place, came to London and the Royal College of Science as a National Scholar in the autumn of 1901. Having obtained high qualification in botany, zoology and geology, he recently proceeded to St. Andrew's, at the suggestion of Prof. Howes, to study under Prof. McIntosh, in preparation for his return to South Kensington and zoology in the coming autumn. On the evening of his first day in the Gatty Marine Laboratory, seeking quietude and respite from the western sands, which were crowded at the time, he wandered to the mouth of the river to bathe. Not knowing the dangers of the spot, he swam out and was overcome, and in his loss science has become the poorer by an earnest and promising student.

REPORTS from Vienna, published in the *Daily Mail*, state that a severe earthquake lasting twenty seconds occurred at Salonica at 4.20 p.m. on Saturday, July 5. Before the news reached Vienna the instruments at the Laibach Seismological Observatory registered a great disturbance towards the south-east at an estimated distance of 600 miles. Later telegrams state that the earthquake was felt right across the Balkan peninsula. The shocks began on Saturday afternoon, and continued with frequent intervals until midday on Monday. A very cold wind is said to have accompanied the earthquake. More than 200 houses were wrecked at the village of Bani, three miles from Salonica.

IT is reported that two slight shocks of earthquake occurred in the neighbourhood of Cheadle, Cheshire, on July 8.

WE regret to learn of the death of the Abbé Maze, on June 17, at the age of sixty-six years. He had been for many years one of the editors of our contemporary, *Cosmos*; his first connection with that journal was as meteorologist after the Franco-Prussian War of 1870-1, and he was for some time secretary of the French Meteorological Society. About twenty years ago he undertook a laborious investigation into the periodicity of rainfall, which he has left uncompleted; it is said that he had established a double period of 6, and 6 × 7, or 42 years, for the recurrence of similar general phenomena. He was also engaged for many years on a history of the thermometer, and has left in manuscript a large amount of valuable information upon this subject, collected from every available source, and which we hope will eventually be brought to light.

THE *Morning*, the auxiliary ship of the National Antarctic Expedition, sailed yesterday for Lyttelton, New Zealand, *en route* to the Antarctic regions, where it is intended to meet the *Discovery* with supplies, and to render any other services which may be required. From an article in the *Times* we learn that while the main object of the *Morning* is to act as tender to the *Discovery*, still she is well equipped with scientific instruments of various kinds, some of which have been supplied by the Admiralty, including survey instruments, a large photographic equipment, sounding gear, and apparatus for collecting at least the surface fauna of the ocean. Constant meteorological observations will be taken, and in other respects as far as possible the staff on board the *Morning* will do its best to supplement the work of the *Discovery*. The captain of the *Morning* and commander of the relief expedition is Mr. William Colbeck, who was one of the staff of the *Southern Cross* Antarctic Expedition, on which he took the observations and drew the charts.

ACCORDING to a recent paragraph in the *Times*, the arrangements for the Scottish National Antarctic Expedition, under the leadership of Mr. W. S. Bruce, are making satisfactory progress. The Norwegian whaler *Hekla*, which Mr. Bruce recently purchased for the expedition, is to be renamed the *Scotia*. The ship is now being reconstructed on the Clyde, at Troon, by the Ailsa Shipbuilding Company, under the guidance of Mr. G. L. Watson, the well-known yacht designer. The *Scotia* is a barque-rigged auxiliary screw steamer of about 400 tons register. New deckhouses are being built, a larger one aft and a smaller one forward divided into a laboratory and cook's galley. A second laboratory and dark room is to be fitted between decks. The ship is being specially fitted to carry on oceanographical research, both physical and biological. Two drums, each containing 6000 fathoms of cable, for trawling in the deepest parts of the Southern and Antarctic Oceans, are being taken. Mr. Bruce intends to follow the track of Weddell and to explore the Ross deep, working eastwards from the Falkland Islands.

A NUMBER of papers dealing with various aspects of the recent eruptions in the West Indies appear in the current issues of the geographical and other scientific journals. A short article on "Martinique und sein Vulkanismus," in the June number of *Petermann's Mitteilungen*, by Dr. Emil Deckert, is accompanied by an excellent map of the island. Dr. Michel-Levy, director of the geological survey of France, contributes a paper on the Mont Pelée eruptions, with some admirable geomorphological diagrams, to the *Revue générale des Sciences*. In the *Geographical Journal* for July Mr. E. André describes a visit to St. Vincent, and some excellent photographs are reproduced, while Mr. H. N. Dickson gives a narrative of events, advancing the view that the destruction of St. Pierre was caused by a tornado originating in the hot gases issuing from the crater of Mont Pelée. A paper on the Windward Isles, by Dr. J. W. Spencer, appears opportunely in the *Transactions* of the Canadian Institute; it is illustrated by a number of plates and six valuable charts showing the contour of the sea-bottom.

THE fate of M. Andrée is still a subject of speculation. A Reuter telegram from Winnipeg states that the Rev. Mr. Fairies, an Anglican missionary among the Eskimos within the Arctic Circle, has arrived there and repeats the story, which was brought two years ago by an Eskimo to Port Churchill, that a band of natives found M. Andrée and party 300 miles to the north of Port Churchill. On approaching them M. Andrée fired a gun. The natives interpreted this as a hostile act and set upon the explorers and killed them. The Hudson Bay Company offered a large reward to the messenger to bring some relic. He departed, but never returned. Mr. Fairies described an instrument resembling a telescope, which was taken from the outfit and carried with other loot to the Arctic Circle by the Eskimos.

THE seventeenth annual meeting of the Photographic Convention of Great Britain was opened at Cambridge on Monday, when Sir Robert Ball, the new president, delivered an address on astronomical photography.

THE Brazilian Minister and the staff of the Brazilian Legation will attend the meeting of the Aëronautical Society to be held on Thursday next, July 17. The following papers will be read:—"The 'Peace' Balloon of the late Senhor Augusto Severo," by Dr. Carlos Sampaio and Mr. Eric Stuart Bruce; "Balloon Ascents in Thunderstorms," by the Rev. J. M. Bacon; "A Performance of the Bristol War Balloon during the South African War," by Captain H. B. Jones, R.E.; and "The Cycala Flying Machine," by Dr. Charles Zimmerman.

THE Sydney correspondent of the *Daily Mail* reports that the drought has become intensified in Queensland and in parts of New South Wales, while there has been rain elsewhere. The New South Wales rainfall for June on the coast to the south of Sydney is 95 per cent. below the average of the corresponding month in past years. In the immediate neighbourhood of Sydney the deficiency is 91 per cent., on the Hunter River 85 per cent., on the North Coast 93 per cent., on the Darling River 84 per cent., and between the Darling, the Lachlan and the Bogan Rivers 87 per cent.

A FEW examples of the practical application of scientific education in Germany are given in the *Journal* of the Society of Arts. The sugar industry is the first illustration of the progress of industry through science. In 1840, 154,000 tons of beetroot were crushed, from which 8000 tons of raw sugar were produced, showing about 5½ per cent. of raw sugar extracted from the root. Twenty years later, 1,500,000 tons were treated, which produced 128,000 tons of sugar, or about 8 per cent. Last year about 12,000,000 tons were crushed, which produced 1,500,000 tons of raw sugar, raising the percentage to 13. This advance is due entirely to scientific treatment. The production of dry colours, chemicals and dyes in Germany shows a corresponding increase in production and dividend-paying capacity. The great increase of earning capacity is due largely to the constant labour of trained men, who by application of their technical knowledge have so cheapened production that they have succeeded in getting this trade out of the hands which previously controlled it. A great advance has also been made in the scientific instrument industry. The value of the exports from Germany of scientific instruments in the year 1898 was about 250,000*l*.—three times what it was in 1888—and the work gave employment to 14,000 people. These are a few of the many instances showing the close connection between the scientific education of the German people and their commercial prosperity.

THE United States Weather Bureau has just issued a paper by Prof. Alfred J. Henry on wind velocity and fluctuations of water level on Lake Erie. Continuous automatic records of the variations of level at Amherstburg and Buffalo for December, 1899, to November, 1900, are correlated with wind records at Buffalo for the same period, and the material applied to analysis of seiches of different types, including the "fair weather" seiches and those accompanying storms. The period of the smaller seiches is about fourteen hours, that of the larger about sixteen hours. The occurrence of a severe seiche at Buffalo cannot be foretold many hours in advance, but sufficient time could generally be given to warn property interests along the wharves.

THE report of the Californian section of the climate and crop service of the Weather Bureau, for April, contains an interesting note on a statement in the article on Francis Drake in the "Dictionary of National Biography." Referring to the position of Drake's anchorage near the Golden Gate in June, 1579, the article says:—"The one doubtful point is the account of the climate, which is described with much detail as excessively cold and foggy. (Vaux, pp. 113-118). This is now said to be an exaggeration, but to speak of the climate near San Francisco or anywhere on that coast in July in these terms is not exaggeration, but a positive and evidently wilful falsehood (Greenhow, 'History of Oregon and California,' 1845), credulously inserted by the original compiler of the 'World Encompassed.'" The Weather Bureau station at Point Reyes Light, probably not more than three miles from Drake's anchorage, amply confirms the correctness of Drake's description. Fog is specially prevalent during the months June, July and August, and it is generally accompanied by strong north-westerly winds, often reaching a velocity of fifty miles an hour; a comparison of the records with those from the stations at San Francisco and on Mount Tamalpais shows an astonishing contrast as regards temperature, relative humidity and duration of sunshine. Prof. George Davidson, who was in charge of the work of the Coast Survey in this region, and has published a paper on the "Identification of Sir Francis Drake's Anchorage on the Coast of California," says "that from July 2, 1859, the fog hung over the promontory of Point Reyes for thirty-nine consecutive days and nights."

IN an article in NATURE of April 18, 1901, attention was directed to the commercial uses made of peat in Sweden, where it is coming largely into use as a substitute for coal for steam engines. In a recent number of the *Engineer* (June 27) an account is given, with illustrations, of the peat fuel works at Stangfiorden, in Norway, where electricity generated by water power has been in use since 1898 for the manufacture of peat for fuel, which is of the more interest because it is reported that negotiations are now in progress for the introduction of this system for the development of one of the water powers on the west coast of Ireland. So far peat fuel and moss litter are the only two products that have been obtained from a very limited number out of the numerous peat bogs to be found in this and other countries. The chief difficulty in manufacturing peat fuel is the extraction of the water, which comprises about 85 per cent. of the whole bulk, and which must be removed before the remaining carbonaceous matter can be rendered available for fuel. At Stangfiorden the wet peat is brought direct from the bog to the factory in boats of 100 tons capacity; the material is removed from these by electric agency and submitted to a preliminary operation of drying and pressing. The briquettes thus formed are then transported on small iron trolleys with shelves to the interior of the drying chamber. Warm air is driven through this by electric fans. From the drying chamber the blocks are taken on the same trolley to the retorts, where they are packed round spiral resistance coils and the electric heating agent set in operation. The peat yields—besides the fuel briquettes, which form 33 per cent. of the whole—tar, charcoal, creosote, sulphate of ammonia and other bye-products. The electric power is derived from five 80-kilowatt dynamos coupled direct to five turbines of 128 H.P. The plant is capable of turning out 1000 centners of air-dried peat a day. The fuel burns well, yields little soot or ash, and is readily disposed of in Bergen and other towns.

FROM a paper communicated by Prof. Höfer to the Vienna Academy of Sciences it appears that spring waters from a large number of different petroleum districts either contain no sulphates or at most a minimal quantity of these salts. Under the influence of the petroleum and marsh gas, the sulphates have probably undergone reduction. It is pointed out that the absence of sulphuric acid in waters from petroleum provinces may be advantageously made use of in a practical way for ascertaining the whereabouts of petroleum deposits or inversely for determining the source of the waters in question.

MESSRS. SANDERS AND CROWHURST have sent us a catalogue of the photographic apparatus which is made and sold by them. The list contains almost everything that a photographer can desire; many useful novelties are included.

MESSRS. A. W. PENROSE AND CO. are making Mr. Alex. Tallent's diffraction spectroscope camera, an account of which instrument is given in a small pamphlet published by Messrs. Penrose. The main feature of this camera is that we have in a small compass a light, compact, handy and inexpensive spectroscope, ready for use at any moment. Such an instrument is rendered possible only by the introduction of the Thorp diffraction prism-grating, which does away with the necessity of a train of prisms to obtain large dispersion and what is also an important item, the outlay of considerable expense. The compactness of the instrument is due chiefly to the fact that the prism-grating forms a direct vision system. The instrument, a full account of which is given in the pamphlet, only costs from forty-five to sixty-three shillings, according to the requirements of the user, and will be found very serviceable in many directions, such as the composition of various light sources, colour sensitiveness of plates, examination of dark-room filters, &c. The plate which accompanies the text describes better than words the different uses to which the instrument can be applied, and the scale on which the spectra are obtained.

A COMPARATIVE study of the permeability of living and dead animal membranes by measurement of the electrolytic resistance has recently been made by Mr. G. Galeotti, and the results are published in *Lo Sperimentali, Archivio di Biologia norm. e patol.*, vol. lvi. The living membranes were first investigated, and then after remaining in chloroform vapour for some time were again placed in the electrolytic cell and the resistance of the solution measured as before. Various salt solutions were employed, the strengths of these being in the majority of cases one-tenth normal. The author finds that the resistance of membranes, which in the animal body separate solutions of different nature and concentration from one another, is ten to forty times greater in the living condition than when the membranes are dead. The resistance of membranes, which have no functions of this character in the animal system, is, on the other hand, unaltered by the action of chloroform vapour. The conclusion is drawn that membranes of the first class, for example, from the cæcum of the rabbit and the bladder of the turtle, behave as semipermeable membranes in the living condition, but this semipermeability is lost when the cells are dead. Membranes of the second class, on the other hand, act simply as diffusion membranes, and the permeability of these is the same whether living or dead.

ALTHOUGH the question as to whether the nitrogen of the albuminates present in the animal body is partly set free in the form of free gaseous nitrogen has been experimentally studied on several occasions, yet the conclusions drawn by different investigators working under different conditions are by no means concordant. The first series of such investigations was carried out by Regnault and Reiset, who found, in the great majority of their experiments, a considerable increase in the quantity of nitrogen in the respired air. About one hundred experiments were made and animals of totally different classes were subjected to investigation. Seegen and Nowak, with an improved apparatus which permitted of the experiments being continued over much longer periods of time, obtained results which agreed with those of the first observers. Hans Leo, working under different conditions, concluded, on the other hand, that nitrogen, as a product of the decomposition of albuminates, is not set free from the animal system. In Leo's latest experiments, the bodies of the animals under investigation were immersed in water, and under these conditions it was found that the alteration in the amount of nitrogen of the air was scarcely perceptible. To promote the further investigation of this subject, Prof. J. Seegen has placed 6000 kronen at the disposal of the Vienna Academy of Sciences, which sum is offered by the Academy as a prize for the solution of the question. The formulation of the problem reads:—"Es ist festzustellen, ob ein Bruchtheil des Stickstoffes der im thierischen Körper umgesetzten Albuminate als freier Stickstoff in Gasform, sei es durch die Lunge, sei es durch die Haut ausgeschieden wird." Papers sent in for competition are to be written in German, French or English, and should be sent to the office of the Academy before February 1, 1904.

THE *American Naturalist* for June contains an article, by Mr. W. R. Coe, on the Nemertean worms parasitically infesting certain crabs, in the course of which the new genus Carcinomertes is described.

MODERN refinements of description render it of the utmost importance that skins of small mammals should be made up on one uniform plan. Mr. G. S. Miller has accordingly published in the *Bulletins* of the U.S. Museum a revised edition of directions for making such preparations, with abstracts in German, French and Spanish.

AMONG other articles, part 4 of vol. lxxi. of the *Zeitschrift für wissenschaftliche Zoologie* contains one by Dr. K. Escherich on the development of the nervous system in flies, and a second, by Prof. P. Bachmetjew, on the effects of heat on the development of the pupæ of butterflies and moths. The nerves of the skin form the subject of a third communication, by Dr. Tretjakoff.

THE thoroughness of American methods is well exemplified in a review of the horned larks (Otocoris), by Mr. H. C. Oberholser, forming No. 1271 of the *Proceedings* of the U.S. Museum. In addition to four maps illustrating the distribution and breeding areas of these larks, this memoir contains photographs showing the different kinds of country inhabited by the various local races of certain species. These birds vary so much according to environment that their classification and identification are the despair of the systematist. The manner and degree of this variation—and not the mere identification of specimens—should be the aim of the investigator.

IN the June issue of the *American Naturalist* Mr. J. F. McClendon describes the life-history of the insect commonly known as *Ulula hyalina*, a near relative of the so-called ant-lion of Europe. The larva "hides in some slight depression or under the edge of a stone, with its body covered with sand and its mandibles widely extended so as to touch the fringe of hairs on each side of the head. Its brown colour simulates the colour of the sand. Its body is hidden by the covering of sand, and the head is somewhat concealed by its peculiar covering of hairs, so that small insects may crawl, unawares, too near the extended mandibles. In this case the larva thrusts out its head and snaps the mandibles together, pinioning the victim on the curved points. It then proceeds to suck out the juices of its prey like an ant-lion."

AN appendix to the twentieth annual *Report* of the Scotch Fishery Board contains notes on the digestive tract of salmon and sea-trout kelts from the Tweed by Mr. J. K. Barton, illustrated with some beautiful reproductions from photographs of microscopic preparations. The author is of opinion that sea-trout continue to feed to within a shorter interval of their entering fresh-water than is the case with salmon, although when in the rivers both fishes are equally abstemious. No trace of the desquamative catarrh of the mucous coat which has been supposed to characterise the intestines of river fish was observed. It must be left for subsequent examinations to determine whether salmon-disease is due to the fungus Saprolegnia, or whether the presence of that fungus is merely the precursor of death owing to other diseased conditions.

MUCH interest attaches to an article in the *American Naturalist* for June on aggregated colonies in madreporiform corals, by Dr. J. E. Duerden. The fact that coral larvæ will occasionally attach themselves to the cups of adult corals of the same species has been noticed by previous observers. The author finds, however, that in certain West Indian corals an analogous process is quite a common method of formation of composite corals, the larvæ of Siderastræa frequently fixing themselves close together in small groups upon some convenient base. In course of time they grow together to form a colony, which thus differs from an ordinary colony in consisting of several individuals. Such an aggregate colony may be distinguished, for a time at least, from one of the ordinary type, by the fact that the component items are not in communication at the base.

THE search for the missing link forms the subject of an article, by Mr. R. S. Baker, in this month's *Idler*, mainly based on the discovery of "Pithecanthropus" and Prof. Haeckel's expedition to Java in search of further remains of that mysterious creature. The author traces the gradual "evolution" of the conception of the origin of one group of animals from another, and illustrates his subject with excellent portraits of Darwin, Haeckel, Huxley and Wallace. We are afraid that the illustrated table of man's descent will be apt to prove a stumbling-block to the uninitiated, and that the gorilla, gibbon, opossum, iguana, &c., will be regarded as among man's direct ancestors. The inclusion of marsupials in man's genealogical tree is, we fear, an error which it will take some time to eradicate from popular writings. The author would have done well to have shown his proof to some zoological friend, which would have resulted in the elimination of the sentence as to the association of Pithecanthropus with *the* elephant, rhinoceros, hyæna, &c. What may be the animal designated in the same sentence as "the gigantic pangolin" we are at a loss to conceive.

A BRIEF summary of progress in archæological and ethnological research in the United States during last year is given by Prof. F. W. Putnam in a reprint from vol. xiv. of the *Proceedings* of the American Antiquarian Society (1901, pp. 461–470). Since the paper was read at the annual meeting of the Society in October 1901, the Carnegie Institute has been founded at Washington, and the broad spirit in which it has been organised gives satisfaction to all who are anxious to extend

the boundaries of scientific knowledge. Referring to the Institute, Prof. Putnam remarks: "The scope of this foundation embraces all the sciences, and its purpose is the encouragement and patronage of research. Such an institution will have the power to render incalculable service to American archæology and ethnology, where so much needs to be done without loss of time."

WE have received the first two numbers of a series of occasional reports on the agriculture and forest culture of German East Africa, issued by the Central Government at Dar-es-Salam, and published by Carl Winter at Heidelberg. These reports, which are to be continued as occasion requires, contain the results of valuable scientific investigations by officials, dealing with such matters as the tse-tse fly, analyses of soils, climatology, &c. Extracts of reports from numerous civil and military stations are given, and accounts of exploring journeys into less-known regions of the colony.

THE current issue of the *British Medical Journal* (July 5) is a special vaccination number, and contains several interesting contributions on Jenner's life and works, and on small-pox and vaccination. Much valuable material—scientific, clinical and administrative—connected with the disease and its remedy, is described by writers of recognised authority.

MESSRS. DUCKWORTH AND CO. will publish immediately a book on "European Fungus-Flora," by Mr. George Massee, principal assistant at the Royal Herbarium, Kew. The work will be a synopsis of the European Agaricaceæ, giving the specific characteristics of 2750 European species, of which 1553 are British.

MESSRS. DAWBARN AND WARD have commenced the publication of a series of practical handbooks designed to be of service to dwellers in the country. The first book of the series, on "Outdoor Carpentry," by Mr. S. Walter Newcomb, gives brief instructions, with plans, sketches and details, for constructing rustic work of many kinds. Among the subjects of future volumes will be water-supply and distribution, sanitation and drainage, and planning gardens, grounds and outbuildings.

THE *English Illustrated Magazine* for July contains an article upon the supposed portrait of Christ on the Holy Shroud of Turin, translated from the French, and based upon Dr. Vignon's work on "Le Linceul du Christ." The article leaves the question whether the markings upon the shroud were really produced by the body of Christ undecided, but it is held that there is sufficient evidence for the belief that the image was naturally imprinted upon the shroud by the action of vapours arising from a human body. Another article in the magazine, by Mr. J. J. Ward, gives an instructive illustrated account of May-flies and related insects.

THE "Technolexicon," or technical dictionary, to be published by the Society of German Engineers, has previously been referred to in these columns. The editor, Dr. Hubert Jansen, Berlin (N.W. 7), Dorotheenstr. 49, is anxious to include in the dictionary all technical terms used by French, German and English engineers, so that the dictionary shall contain equivalent words and expressions in each of the three languages. Collaboration is invited from societies, individuals and engineering works. The editor would be glad to receive technical catalogues, price lists, hand-books, or lists of words and terms for which correct renderings cannot be found in ordinary dictionaries. The work will be so useful when ready that all who are able to contribute to its completeness should do so.

THE additions to the Zoological Society's Gardens during the past week include two White-eared Conures (*Pyrrhura leucotis*) from Brazil, presented by Lady Lindsay; two Peregrine Falcons (*Falco peregrinus*), European, presented by Dr. R. Lawton Roberts; a European Pond Tortoise (*Emys orbicularis*), European, presented by the Earl of Dudley; a Common Viper (*Vipera berus*), British, presented by Mr. E. Ball; two Snowy Egrets (*Ardea candidissima*) from America, two Vinaceous Amazons (*Chrysotis vinacea*), two Red-tailed Amazons (*Chrysotis brasiliensis*) from Brazil, seven Roofed Terrapins (*Kachuga tectum*) from India, a Black Sternothere (*Sternothoerus niger*) from West Africa, a Wrinkled Terrapin (*Chrysemys scripta rugosa*) from the West Indies, a Blue-tongued Lizard (*Tiliqua scincoides*) from Australia, a Madagascar Tree Boa (*Corallus madagascariensis*) from Madagascar, deposited; a Proboscis Monkey (*Nasalis larvatus*) from Borneo, two White Storks (*Ciconia alba*), European, purchased.

OUR ASTRONOMICAL COLUMN.

THE PERIODICAL COMET OF TEMPEL-SWIFT (1869-1880).—This object is one of the most interesting of the somewhat numerous class of comets which at aphelion pass just outside the orbit of Jupiter and perform their revolutions in periods ranging from about 5 to 9 years. First seen by Tempel in 1869 November 27, the character of the orbit was not determined until its independent discovery by Lewis Swift in 1880 October 10. It was then found to be moving in an orbit of short period for the elements deduced by Bruhns, for the apparition of 1869 very closely resembled those obtained by Chandler for the return of 1880, and the latter pointed out the true character of the orbit early in 1880 November. Messrs. Schulhof and Bossert, of Paris, also published elements indicating a periodic time of $5\frac{1}{2}$ years.

The average period for the four returns which occurred between 1869 and 1891 was 2009 days, or 5 years and 183 days. At every alternate return, however, the comet is invisible. The perihelion is reached at a distance of about 10,000,000 miles outside the earth's orbit, and the three previously observed perihelion passages having occurred between November 6 and 18, the conditions were extremely favourable, the longitude of the comet's perihelion being 43° and the longitude of the earth on November 6 being 43°. The comet and earth were, in fact, mutually situated in or near those parts of their orbits which make the nearest approach to each other. At alternate returns such as in 1875, 1886, 1897, 1908 and 1919, the earth is on the opposite side of the sun to the comet when the latter passes through perihelion. In such circumstances the object is altogether beyond reach, for at one of these unfavourable returns it is placed nearly 200,000,000 miles from the earth, whereas under the best conditions, similar to those which prevailed during the apparition in 1880, the distance may be less than one-tenth of that mentioned.

As in 1869, 1880 and 1891, so in 1902, the comet will be very favourably visible in the autumn and winter months, and it will probably be re-detected in one of our large telescopes in about September next. The object will be by no means conspicuous, nor is it likely to display any attractive variety of aspect, but any moderately good telescope will show it as a large faint nebulosity. One of the best known of the ever-increasing group of Jovian comets, it will be sure to attract considerable attention during its forthcoming return, not so much, perhaps, on account of its visible characteristics as from the example it affords of a numerous class of bodies and from the interesting history attached to its previous appearances.

MR. TEBBUTT'S OBSERVATORY AT WINDSOR, N.S.W.—The annual report of this observatory for 1901 shows that much useful work was done last year. Measures of the positions of Venus, Ceres, Parthenope, Melpomene and Diana were made and the results forwarded to the *Astronomische Nachrichten* (Band clvi. p. 105).

Under "Comet Observations" we find that 273 determinations of the position of Comet I. 1901 were made between May 3 and June 13, 1901, and the full results were published in the *Astronomische Nachrichten* (Band clvi. p. 95 and Band clvii. p. 187). Encke's comet was fruitlessly sought on the evenings of October 2 and 8.

During twenty evenings the measures of twenty-eight double stars were made and the results published in the *Monthly Notices* R.A.S. (vol. lxi. p. 51).

The tables of meteorological observations show a temperature above, and a rainfall below the average, the year 1901 being the driest year recorded (excepting 1888) since 1862.

Many astronomers will regret the necessity for the inclusion of the following paragraph in the report, for it announces a great loss to observational astronomy generally, and especially to that of the southern hemisphere:—"In consequence of the author's advancing years, it is probable that there will be a considerable relaxation in his efforts for the year 1902."

EXTENSION OF THE KATHODE RADIATION HYPOTHESIS TO NEBULÆ.—At the meeting of the Académie des Sciences held on June 23, M. Janssen presented a note from M. Deslandres, in which the latter extends the kathode ray hypothesis, which he had already proposed in order to explain solar phenomena, to nebulæ.

The author says that the hypothesis of Arrhenius which attributes the light emitted by nebulæ to electrified particles, and also that of Nordman which attributes it to Hertzian rays gathered from space, are both wrong, for if they were true, the terrestrial atmosphere itself would, at night-time, display similar light; therefore, he adds, the light must be in the nebulæ themselves.

PERSONAL EQUATION IN THE MEASUREMENT OF SPECTROSCOPIC NEGATIVES.—In a note to the *Memorie della Società degli Spettroscopisti Italiani*, M. Hasselberg makes some interesting statements on the part that the personal equation of the observer plays in the measurement of photographic spectra. Quoting the note on this subject, by Mr. Reese, in *The Lick Observatory Bulletin*, No. 15, wherein it was demonstrated that the tendency in the case of Mr. Reese was to place the dark lines of the spectrum negative, as contrasted with the bright lines, a little too much to the right of the field of the microscope, M. Hasselberg goes on to demonstrate that in his own case the tendency is exactly opposite. Consequently, he finds that, in general, his personal equation makes his wave-lengths come out systematically less than those published by Rowland for the same lines.

The author gives three sets of measurements of metallic spectra which he has observed, compares them with the analogous values obtained by Rowland, and, after meaning the differences to eliminate accidental errors, he finds that there remains a systematic difference of ±0·007 Ångström units, and this he ascribes to purely physiological causes.

In the third table given by M. Hasselberg he compares his measurements of the lines in the tungsten spectrum: (1) when the lines are brought to the centre of the field from the left to the right, and (2) when they are brought to the centre from the right to the left, and here he finds that in the first case his values are too great, whilst in the second case they are too small.

The author concludes by pointing out that, although these errors are very small, yet they are too pronounced to be neglected, and shows that by a curious coincidence his personal error would, if introduced into the determination of radial velocities, produce a difference of exactly 1 kilometre per second from the true velocity.

APPARENT DEFORMATIONS OF THE SUN'S DISC NEAR THE HORIZON.

ALTHOUGH curious deformations of the apparent shape of the sun and moon near the horizon have been noticed from the earliest times, observations are not very frequently made, and the apparent changes of the appearances of these bodies when near the horizon cannot be said to be very commonly known. Among the earliest descriptions of this phenomenon may be mentioned one during "The strange and dangerous voyage of Captaine Thomas James, in his intended Discovery of the Northwest Passage into the South Sea," London, 1633. He states:—"I obserued the Sunne to rise like an Ouall, alongst the Horizon: I cald three or foure to see it, the better to confirme my Judgement: and we all agreed, that it was twice as long as it was broad." On March 26, 1632, James observed the same phenomenon at the time of the rising of the moon. Biot, in his "Traité élémentaire d'Astronomie physique," writes:—"C'est encore par un effet de la réfraction atmosphérique que le Soleil à l'horizon paraît ovale et aplati dans le sens vertical, même dans les temps les plus calmes et les plus sereins. Tous les points de son disque sont alors élevés par l'effet de la réfraction, mais ils le sont inégalement: les points inférieurs le sont plus que les supérieurs, parce qu'ils sont plus près de l'horizon, où la réfraction est plus forte. Le disque du Soleil doit donc alors sembler aplati, dans le sens vertical."

Among more recent papers upon this phenomenon may be mentioned one by Lieut. F. Křifka, entitled, "Refractionserscheinungen der aufgehenden Sonne" (*Meteorologische Zeitschrift*, 1891, p. 101). During the trigonometrical survey of Brno in Bohemia, Colonel von Sterneck directed attention to the remarkable shape of the rising sun, and careful observations were taken by himself with a telescope, and by Lieut. Křifka with the naked eye, until the sun rose above the horizon. Illustrations are given of the shape and colour of the sun during fifteen phases; the colour was first a deep red and gradually faded into yellow as the sun regained its globular appearance. The forms were very curious, some resembling a basin with a projecting lid; others appeared very much like the shape of a mushroom, with its stalk; later, an oval shape was assumed.

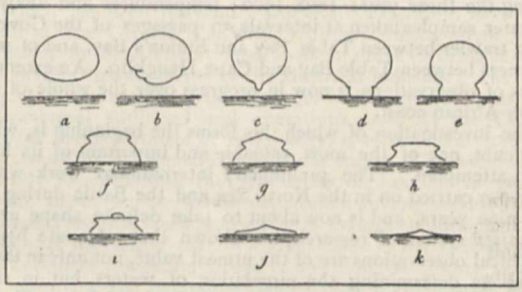


FIG. 1.

During the voyage of the Belgian Antarctic ship *Belgica*, M. H. Arctowski, a member of the scientific staff, made frequent observations of the phenomenon in question between Rio de la Plata and the Straits of Magellan, both when the sun was rising and setting, and he has communicated the results in an interesting paper published in the *Bulletin* de la Société belge d'Astronomie, accompanied by outline sketches. The description given of the phenomenon seen on November 23, 1897 (Fig. 1), off the coast of Patagonia is typical of other observations. On approaching the horizon the lower portion of the sun became flattened, and continued to become more deformed as it descended. At about 3° above the horizon there was a thin film of cloud, and the part of the sun which was still above the level of this little cloud preserved its regular shape. Gradually the lower part assumed a triangular shape, a little point or stem appeared, and became enlarged as it touched the horizon. The sketches show that all the zone comprised between the fine belt of cloud and the horizon possessed the property of deforming the sun's disc, and that in every case the cloud was the principal seat of the deformations. After the sun had set it was scarcely possible to see the cloud. The sketches very closely resemble the Bohemian illustrations already mentioned.

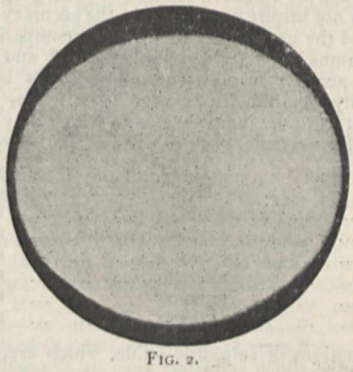


FIG. 2.

The accompanying figure (Fig. 2) is a reproduction of a photograph showing deformation of the setting sun, taken by Prof. W. Prinz, of the Royal Observatory of Belgium, at Uccle, near Brussels, and communicated to the *Memorie della Società degli Spettroscopisti Italiani*, by Prof. A. Riccò. The dark background is drawn exactly circular, in order that the deformation of the sun's disc may be seen more clearly. In this case the ratio of the vertical to the horizontal diameter is 75 : 84 mm. = 0·893.

OCEANOGRAPHICAL INVESTIGATIONS IN SOUTH AFRICAN WATERS.[1]

THE observations published in the pamphlet of which the title is given below are the first of a series undertaken in connection with the fishery investigations recently inaugurated at the Cape. They include observations made in March and April, 1900, by the Government steamer *Pieter Faure*, consisting of temperatures and analyses of water samples from points to the west of the Cape Peninsula; observations of surface temperature made on February 11 to 18 and March 3, 1898, at intervals of about five miles, to a distance of fifty miles west of Cape Town, and on a voyage to St. Helena Bay; daily records of air and sea temperatures taken at Robben Island in Table Bay, and at Roman Rock in Simon's Bay during the three years 1898–1900; temperatures and analyses of water samples taken at intervals on passages of the Government trawler between Table Bay and Simon's Bay, and of mail steamers between Table Bay and Cape Hangklip. An extended series of observations is now in progress over the whole of the South African coast.

The investigation of which this forms the beginning is, without doubt, one of the most valuable and important of its kind ever attempted. The preliminary international work which has been carried on in the North Sea and the Baltic during the last nine years, and is now about to take definite shape as an organised system of research, has shown that adequate hydrographical observations are of the utmost value, not only in themselves as determining the circulation of waters, but in their relation to climatology and to fishery work of all kinds. Similar research in South African waters has the additional interest of dealing with a region where the current system is not only unusually complex, but is very strongly and clearly developed; and the fact that the services of a special ship are available renders the opportunity of studying the relations existing amongst the different current elements unique.

Unfortunately, however, the methods employed in the present series of observations seem to leave much to be desired. Nothing is said about the thermometers employed in taking temperatures, or about their corrections, and the observations at different depths are made with little reference to the changes of temperature; many of them are unnecessary, and there are frequent gaps which leave the true form of the temperature curve undetermined. The curves and sections shown suggest that the boundaries between masses of water are often very sharply defined, and that a high degree of accuracy, in the instruments employed, in their working, and in the determinations of ship's position, is essential. The laboratory analyses of the samples of water collected are still more unsatisfactory. In most cases the chlorines have been determined, by a method not stated, and the results are, for a reason left unexplained, expressed in grains per gallon, thereby rendering them incomparable with any other determinations except those of county analysts. A study of the chlorine values in relation to their geographical distribution does not inspire confidence in the accuracy of the determinations, and the uncertainty increases on comparison with the values in columns headed "specific gravity" and "sulphuric oxide." No account is given of the methods by which the specific gravity determinations have been made, nor is there any statement as to the temperatures to which they are referred, and we find, for example, such records as the following :—

Temp. °F.	Specific gravity.	Chlorine in grains per gallon
63·0	1·02712	1412·0
63·0	1·02696	1414·5
63·0	1·02700	1409·5
63·0	1·02700	1422·0
63·0	1·02696	1402·0
63·0	1·02723	1414·5

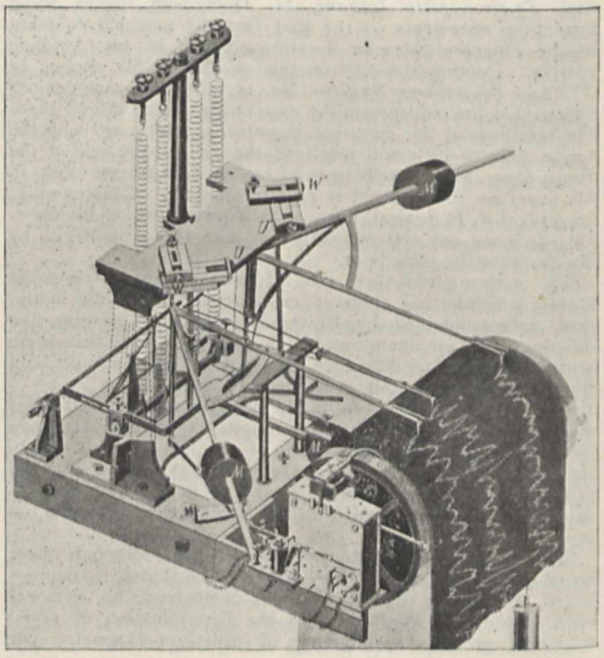
The determinations of sulphuric oxide, which are, presumably, also stated in grains per gallon, give, on a series of averages (p. 215), values of the chlorine ratio ranging from 11·8 to 12·2, and on a single set (p. 213) from 10·4 to 13·1. Such determinations fall distinctly short of the standard required for work of the kind, and as there is no continuity in the variations, we must regard the whole of the tabular matter in the paper with considerable suspicion. Finally, we note that in a region where meteorological observations are of the greatest interest and value, a specially equipped scientific expedition makes its barometer readings "direct from Aneroid."

We direct attention to these points because the importance of the work imperatively requires that it should be thoroughly well done when there is an opportunity of doing it at all. The detailed reports on methods, published by participants in the international work already mentioned, and the tables produced by Knudsen under the direction of the International Committee, leave no excuse for doing it otherwise.

[1] "Cape of Good Hope. Department of Agriculture. Marine Investigations in South Africa. Observations on the Temperature and Salinity of the Sea around the Cape Peninsula." By J. D. F. Gilchrist, M.A., B.Sc., Ph.D.

A NEW FORM OF SEISMOGRAPH.

IN the *Bollettino della Societa Sismologica Italiana* (vol. vii. No. 7), Dr. G. Agamennone gives a detailed description of a seismograph, consisting of two horizontal pendulums each of which carries a mass of 1½ kg. and a vertical spring seismograph with a mass of 2 kg., which write their records side by side on a band of smoked paper 25 cm. broad.



A reference to the accompanying figure shows the manner in which these three well known pieces of apparatus, which stand on a bed plate 55 cm. square, are arranged. The screws W alter the inclination of the vertical axes of the horizontal pendulums and hence their period. The screws U are to give horizontal adjustment for the same. By shifting the position of the weights MM, assuming the same to coincide with centres of oscillation, the multiplication of the writing pointers, which are at the extremities of arms attached at 45° to those carrying the weights, may be made twice that of the movement of the ground. It is almost needless to remark that with so small an amplification the instrument is only intended to record earthquakes which can be felt and are severe. When such an earthquake occurs, the electromagnet F is brought into action to release the clockwork, and the smoked paper then moves beneath the writing pointers at a rate of 25 metres per hour—a speed sufficiently high to give an open diagram of vibrations with periods of 1/10th second. But is it not desirable to record vibrations with a frequency greater than 10 per second, and in addition to obtain a trace of the preliminary tremors? Dr. A. Cancani, who uses films which move continuously at a rate of 6 metres per hour, obtains something to show the latter, but the rate is not sufficiently high to give open records of movements the period of which is very short. Then again, it must not be overlooked that the large movements of severe earthquakes are undulatory in character, and both horizontal pendulums and vertical spring

seismographs are simply swung from side to side or up and down under the influence of the tilting of their supporting bed plate.

Dr. Agamennone's new arrangement will no doubt give records which are valuable, but the seismograph which is suitable to record all forms of earthquake motion has yet to be designed. J. M.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—During the long vacation, beginning on July 7, courses of lectures will be given as follows:—Mathematics and astronomy, by Sir Robert Ball, Mr. Richmond, and Mr. Coates; practical histology, by Dr. Hill and Dr. Barclay-Smith; pharmacology, by Prof. Bradbury and Dr. Dixon; osteology, by Dr. Barclay-Smith; geology, by Mr. Marr; crystallography, by Mr. Hutchinson; chemistry, by Mr. Fenton; metallurgy, by Mr. Dootson; analysis of foods, &c., by Mr. Purvis; practical physics, by demonstrators in the Cavendish Laboratory; pathology and morbid histology, by Prof. Woodhead and Mr. Strangeways-Pigg; bacteriology and preventive medicine, by Dr. Nuttall; animal parasites, by Mr. Shipley; medicine, by Dr. Humphry and Dr. Lloyd-Jones; surgery, by Dr. Griffiths and Mr. Wherry; hygiene, by Dr. Anningson.

THE Nature-Study Exhibition to be held at the Royal Botanic Gardens will be opened on July 23 by the Duchess of Devonshire, the Duke of Devonshire being in the chair. A number of interesting conferences have been arranged in connection with the exhibition. Among the subjects to be brought forward in addresses and short papers are:—"The Study of Nature," by Lord Avebury, F.R.S.; "Seasonal Studies in Natural History," by Prof. J. Arthur Thomson; "Nature-Study in Elementary Schools," by Prof. C. Lloyd-Morgan, F.R.S.; "Visual Instruction," by Prof. Bickmore; "Nature-Study in Colleges and Higher Schools," by Prof. Miall, F.R.S.; "Plant-Life as Nature-Study," by Mr. Scott Elliott; "School Gardens," by Mr. T. G. Rooper; "Geology as a Branch of Nature-Study," by Prof. Grenville Cole; "The Training of Teachers in Nature-Study," by the Rev. Canon Steward; and "The Relation of Nature-Study to School Work and to the Home," by Sir Joshua Fitch.

MANUFACTURERS and others interested in paper-making have been invited to give their support to a scheme for the establishment of special scientific and technical instruction in connection with this industry at the Battersea Polytechnic. It is suggested that the scheme should provide for both day courses (extending over two or three years) and evening classes for employés who cannot be spared during the day; and that it should include thorough and systematic scientific and technical instruction (theoretical and practical) in chemistry and engineering so far as is necessary for the science of the subject and helpful for its practical carrying out, combined with experimental work in a laboratory or workshop specially fitted up for the actual manufacture of paper and complete testing of the finished product. Such a department when organised would naturally become a centre of research in questions connected with the paper-making and cellulose industries. The circular states that the paper-makers in the North of England have taken up the question in a very practical way and are supporting one of the large technical colleges, where they have put down a small model paper machine, which has been made in Germany, no English manufacturer being found willing to undertake the making of it.

THE Calendar of the Tokyo Imperial University for 1901-1902 shows that provision is made for the study of many branches of pure and applied science. In the College of Engineering, practical work and excursions are arranged outside the College, in addition to the laboratory work. In connection with the College of Science there are museums of zoology, geology and anthropology, and a herbarium. At the Astronomical Observatory the principal work carried on consists of observations of position and the compilation of almanacs. The director of the Botanic Garden is prepared to exchange seeds with foreign botanists or institutions. Earth-movements are continually studied at the seismological observatory, and on the occurrence of a great earthquake an expedition is at once sent to make all possible investigations. The Marine Biological Station is situated on the extremity of the peninsula jutting out between the Bay of Sagami and the Gulf of Tokyo; it thus has access to localities rich in remarkable animal forms. Though the station is primarily intended for the use of instructors and students of the University, its facilities are extended to other persons who are qualified to avail themselves of the opportunities of research there afforded. The College of Agriculture is a very active part of the University, and the numerous investigations carried on in the experimental farm have often been noticed in NATURE. Connected with the zoological laboratory of this department are four buildings for the study of silk-worm culture, containing all the apparatus required for experiment and research. Rooms are also provided for special work in the study of the pebrine disease—the most formidable obstacle to silk-worm culture.

SEVERAL matters of interest are mentioned in the report of the Council of the City and Guilds of London Institute, a copy of which has been received. Important extensions have been made at the Central Technical College, among them being additions to the electrical department in order to bring it up to the present requirements of the electrical industry. The total cost of the extension of the College, including equipment and all structural additions and alterations, both for the College and for the department of technology, is estimated at 10,000*l.*, and the additional annual cost at about 1000*l.* The Institute has recently received from the University of London an offer to devote 1425*l.* a year to the department of engineering in the Central Technical College, subject to certain conditions. This amount is the larger part of a grant made to the University by the Technical Education Board of the London County Council for improving and extending the teaching of engineering in the metropolis. It involves the appointment of the professor of engineering of the College as a "transferred teacher" of the University, and it is a recognition by the University that the College occupies the foremost position among engineering colleges in the metropolis. The organisation and work of the College have not otherwise been affected by reason of its inclusion as a school of the University. At the Technical College, Finsbury, the only change recorded in the educational scheme is the addition of a laboratory class in electrochemistry for second-year chemical students. The development of the use of electricity in the chemical industries has shown the necessity of making more complete the training which has been given to chemical students in this branch of physics.

A COPY of an address on the University of London, delivered by Dr. E. H. Starling, F.R.S., at University College, London, on June 5, has been received. Some of the prominent points brought forward in the address have already been described (p. 164), and are the same as those stated in these columns on more than one occasion. What are wanted in London are great University centres, adequate to the higher intellectual needs of the seven million inhabitants. The main features of the University of London sketched by Prof. Starling are as follows:—"Under the control of the Senate, but administered by local councils appointed by the Senate, would be these four or more centres, by which the main teaching and research of the University in all Faculties would be carried out. In addition to these centres there would be a number of *schools of the University* which would preserve their autonomy, but would direct their teaching according to the requirements of the University. Such schools would be essentially post-graduate in character, in that it would be their office to graft on the general training in method, acquired within the walls of the University itself, the special professional training necessary to fit the man for the pursuit of medicine, law, commerce, administration, &c. The relation of the Polytechnics to the University will require careful consideration. In any policy decided upon, it must be remembered that the whole object is the improvement of the mental training of our fellow citizens and not the distribution of degrees. It is vital to the welfare of the country that as many as possible of its inhabitants should have received a thorough university training, and be competent to use their brains in solution of the new problems which must continually meet them, whatever their trade or profession. The whole progress of the nation depends on the mental equipment of its members. At no time more than the present have the words of Bacon on this subject been so full of counsel: 'If any man thinks philosophy and universality to be idle studies, he doth not consider that all professions are from thence served and supplied. . . . For if you will have a tree bear more fruit than it used to do, it is not anything you can do to the boughs, but it is the stirring of the earth and putting new mould about the roots that must work it.'"

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 15.—"A Note on the Recrystallisation of Platinum." By Walter Rosenhain, B.A. (Cantab.), B.C.E. (Melbourne). Communicated by Prof. Ewing, F.R.S.

The author has observed phenomena in platinum analogous to those of recrystallisation in other metals previously described by Prof. Ewing and himself (*Phil. Trans.* A. 1900, vol. cxcv.). It is well known that platinum which has received a prolonged exposure to high temperature becomes brittle and that its surface, if it has been exposed to flame, shows crystalline markings. This has been ascribed to the action of carbon, but the author ascribes it to a process of recrystallisation and subsequent surface etching by the flame. Evidence in favour of this view is drawn from the micro-structure of this "brittle" platinum, from its behaviour on etching with aqua-regia, and from its mode of fracture when hot. The micro-structure is shown to be that characteristic of recrystallised metals, the action of aqua-regia is found to brighten the flame-etched surface, and the fracture follows lines characteristic of the surface crystals, thus proving that the surface pattern truly represents the structure of the whole thickness of metal. The author points out that cold-worked metal is very apt to undergo recrystallisation at high temperatures, and that in several well-known cases brittleness results from such a process; he believes, therefore, that recrystallisation accounts for all the phenomena except the surface markings, and these he ascribes to an etching action of the flame in which the temporary formation of a carbide may play a part.

June 19.—"On an Approximate Solution for the Bending of a Beam of Rectangular Cross-section under any System of Load, with Special Reference to Points of Concentrated or Discontinuous Loading." By L. N. G. Filon, B.A. (Cantab.), M.A., B.Sc. (Lond.), King's College, Cambridge, Fellow of University College, London, and 1851 Exhibition Science Research Scholar. Communicated by Prof. G. H. Darwin, F.R.S.

The paper investigates the elastic equilibrium of a long bar of rectangular cross-section in cases where the problem may be treated as one of two dimensions, the plane of the strain being the vertical plane through the axis of the bar.

General solutions in arbitrary functions are first obtained. These, on being applied to the particular case, lead to series involving hyperbolic sines and cosines. These series, when the length of the bar is made infinite, degenerate into integrals which can be expanded in ascending powers of the radius vector from any point, within a certain circle of convergence. The properties of these series and integrals in the neighbourhood of points of concentrated or discontinuous load are specially considered.

By means of these solutions, arbitrary conditions of stress over the top and bottom faces of the beam can be satisfied.

Various cases, including those of a doubly supported beam carrying a central isolated load, of a block resting upon a smooth rigid plane and pressed by a knife edge on its upper surface, of a beam under two equal opposite loads not in the same straight line, and of a bar under tension produced by knife-edge "grips" on either side, are considered.

The corrections that must be applied to the expressions given by de Saint Venant for stresses in the free parts of long bars, when we approach the points of application of concentrated loads, are investigated at length. It is found that, at distances from the sections where such load is applied of the order of the larger diameter of the cross-section, these corrections, *i.e.* the local perturbations, become insensible.

Finally, solutions in finite terms are discussed, and such a solution is obtained for a beam carrying a uniform load.

Physical Society, June 20.—Prof. S. P. Thompson, president, in the chair.—Mr. G. F. Herbert-Smith exhibited the three-circle goniometer recently constructed for the British Museum from his designs. In this form of goniometer the advantages of the earlier forms are combined: as with the two-circle or theodolite goniometer, a crystal is only once adjusted during the whole of the observations, and as with the one-circle goniometer observations are made in zones, and full advantage may be taken of the zonal characters of crystals and of the simple formulæ depending thereon.—A paper on the heat evolved or absorbed when a liquid is brought in contact with a finely divided solid, was read by Mr. G. J. Parks. Pouillet discovered the fact that when a powder is put into a liquid which does not exert any solvent or chemical action upon it, there is, in general, a rise of temperature. The objects of the present investigation were to obtain a relation between the quantity of heat evolved and the area of the surface exposed, to find the rate of variation of heat evolved with temperature, and to apply to the results the laws of thermodynamics. From the results of his experiments the author states that when silica, sand or glass is brought into contact with water at approximately constant temperature, the heat evolved is proportional to the area of the surface exposed by the solid, and the amount of heat developed per square centimetre is approximately ·00105 calorie when the temperature is near 7° C. Assuming that the phenomenon of Pouillet is reversible, and that it is due to a pressure at the surface of the powder, the author has, by the application of the laws of thermodynamics and the results of his experiments, arrived at the conclusion that at 7° C. the surface-pressure of water and silica diminishes at the rate of 157 dynes per centimetre for an increase of temperature of 1° C. Experiments made at different temperatures indicate that the heat evolved is roughly proportional to the absolute temperature. Experiments were also made which showed a fall of temperature on putting a finely divided solid into mercury.—A paper by Prof. R. W. Wood, on a remarkable case of uneven distribution of light in a diffraction grating spectrum, was read by the Secretary. It is a well-known fact that in the spectra formed by diffraction-gratings the light is unevenly distributed, that is, the total light in any one spectrum will not recombine to form white light. The author has been examining a most remarkable grating in which the drop from maximum illumination to minimum occurs within a range of wave-lengths not greater than the distance between the sodium-lines. In other words, the grating at a certain angle of incidence will show one of the D lines, and not the other. Experiments with polarised light have proved that these anomalies are only exhibited when the direction of vibration (electric vector) is at right angles to the ruling. The paper gives a detailed account of the appearance of the spectra at different angles of incidence when the grating is in air and when it is immersed in different liquids. It is shown that the phenomena are not due to interference between disturbances coming from widely separated lines, and the author suggests that the matter must be referred to the form of the groove.—A paper by Prof. R. W. Wood, on the electrical resonance of metal particles for light waves (second communication), was read by the Secretary. In a previous paper the author has shown that granular deposits of the alkali metals exhibit brilliant colours by transmitted light. These colours were referred provisionally to the electrical resonance of the minute particles for light waves. The present paper gives an account of experiments made with gold and silver films to determine whether the resonance is molecular, or whether it is an electrical vibration of metallic masses, smaller than the light waves, though of the same order of magnitude. Further investigations on the dispersion of the films and a more careful study with polarised light will doubtless throw light on the matter.—Prof. H. L. Callendar showed a simple apparatus for measuring the mechanical equivalent of heat.

Royal Microscopical Society, June 18.—Dr. Henry Woodward, F.R.S., president, in the chair.—The secretary read a note from Mr. Nelson on some high-power photo-micrographs of *Pleurosigma angulatum*, *Surirella gemma* and *Coscinodiscus asteromphalus*, taken by Mr. F. E. Ives.—Mr. A. Hilger exhibited a new photo-measuring micrometer attached to a microscope designed specially for accurately measuring the distances between the lines of the spectrum, but it could also be used for various laboratory purposes.—Messrs. Watson and Sons exhibited and described a new two-speed fine adjustment for microscopes. They also exhibited a microscope fitted with a new holder by which metallurgical specimens could be held in any position while under examination.—Messrs. Carl Zeiss exhibited their epidiascope, a projection apparatus by means of which large brilliantly illuminated pictures of objects can be shown on a screen. Objects such as ordinary lantern slides and transparencies up to 9 inches square, opaque objects, such as photographs, drawings, prints, bones, medals, butterflies in their natural colours, &c., were shown in illustration of its capabilities. A simplified form of microscope was then attached to the instrument, and micro-slides were projected on the screen, giving pictures about 6 feet diameter, with great brilliancy and sharpness of definition.—Prof. Marcus Hartog gave a short

account of the structure of Acinetines, from observations on a species (*Choanophrya infundibulifera*) epizoic on Cyclops. He demonstrated that the spiral marking of the tentacles was due to a double-threaded constriction, that in protrusion and retraction there was no torsion, but only an opening and closing of the spiral, and that the tentacles were continued deep into the endosarc of the creature.—Mr. C. F. Rousselet read his paper on the genus Synchæta, with a description of five new species.—Mr. Walter Wesché gave a brief *résumé* of his paper on undescribed palpi on the probosc is of some dipterous flies, with remarks on the mouth-parts in several families. Specimens showing the palpi on several species were exhibited under microscopes.

Zoological Society, June 17.—Prof. G. B. Howes, F.R.S., vice-president, in the chair.—Mr. R. I. Pocock exhibited and made remarks upon the nest of a gregarious spider (*Stegodyphus dumicola*) sent home by Captain Barrett-Hamilton from Vredefort Road, Orange River Colony, South Africa.—Mr. Oscar Neumann exhibited specimens of some new and interesting mammals which he had discovered during his recent journey through Eastern Africa, and called special attention to some monkeys of the genus Cercopithecus, and to various species of hyraxes (Procavia).—Dr. Walter Kidd read a paper on certain habits of animals as traced in the arrangement of their hair. It was an attempt to interpret, in terms of certain characteristic habits, the departures from a primitive type of hair-arrangement. Short-haired mammals, chiefly ungulates and carnivores, were considered. The habits referred to were divided into passive (those of sitting and recumbent postures) and active (chiefly those of locomotion), and these were shown to match closely the variations observed in the direction of hair in the animals concerned.—Mr. F. E. Beddard, F.R.S., described the carpal organ which he had observed in a female specimen of *Hapalemur griseus* that had lately died in the Society's Gardens. He pointed out that this organ in the female differed in some details from that in the male.—Mr. R. I. Pocock read a paper on some points in the anatomy of the alimentary and nervous systems of the false scorpions of the order Pedipalpi.—A communication from Mr. H. J. Elwes, F.R.S., called attention to Mr. Lydekker's recently published description of a new elk, *Alces bedfordiae*, based on some unpalmated antlers and a skull of an elk from Siberia, and offered a remark that he thought it unadvisable to found a new species, or even a subspecies, on the material. Mr. F. E. Beddard, F.R.S., read a paper, prepared by himself and Miss Fedarb, descriptive of a new cœlomic organ in the earthworm, *Pheretima* (*Perichaeta*) *posthuma*, which consisted of a series of sac-like structures on the floor of certain segments in the middle of the body.—Mr. Beddard also described some new species of earthworms belonging to the genus Polytoreutus, and made some remarks on the spermatophores of that genus.—A communication from Miss Igerna B. J. Sollas contained an account of the Sponges obtained during the "Skeat Expedition" to the Malay Peninsula in 1899-1900. The collection contained examples of twenty-nine species, eleven of which had proved to be new and were described in the paper.—Mr. G. A. Boulenger, F.R.S., enumerated the eight species of fishes of which specimens were contained in a collection made Mr. S. L. Hinde in the Kenya district of East Africa. Four of them were new and were described by the author.—A communication from Mr. A. L. Butler contained a list of the species of batrachians—thirteen in number— that had been added to the Malayan fauna since the publication, in the Society's *Proceedings* in 1899, of Captain Flower's paper on the reptiles and batrachians of the Malay Peninsula.

Geological Society, June 18.—Prof. Charles Lapworth, F.R.S., president, in the chair.—The Great Saint-Lawrence-Champlain-Appalachian fault of America, and some of the geological problems connected with it, by Dr. Henry M. Ami. The extent, earth-movements and striking characteristics of this fault-line and of the geological formations which occur along this line of weakness in the earth's crust, with special reference to the formations in British North America, were discussed.—At this stage of the proceedings, Mr. E. T. Newton, F.R.S., took the chair at the president's request.—The Point-de-Galle Group (Ceylon): Wollastonite-Scapolite-Gneisses, by Mr. A. K. Coomáraswámy. The chief rock-types vary from basic pyroxene-sphene-scapolite-rock, through intermediate rocks composed of pyroxene, scapolite and wollastonite, with felspar and quartz subordinate or abundant, to acid types made up of orthoclase-microperthite or coarse-grained quartzo-felspathic rocks. They differ in several respects from the normal types belonging to the Charnockite series.—On the Jurassic strata cut through by the South Wales direct line between Filton and Wootton Bassett, by Prof. S. H. Reynolds, and Mr. Arthur Vaughan. In this section a thin bed of typical Cotham Marble is followed by the "White Lias," and that by the Lower Lias, which in this district attains a thickness of about 200 feet.

Linnean Society, June 19.—Mr. W. Carruthers, F.R.S., vice-president, in the chair.—Dr. W. G. Ridewood described a new genus of Copepoda occurring parasitically in the suprabranchial cavity of the lamellibranch Lyonsiella, and for which, on account of the great inflation of the thorax, he proposed the name Obesiella. He showed that the systematic position of Obesiella was next to Ascomyzon, in the family Ascomyzontidæ.—Mr. George Massee described some of the results of modern methods of investigation in mycology, illustrating his remarks by means of lantern slides. He pointed out the errors of some observers who urged the suppression of genera wholesale on the evidence of a few species, and pleaded for the retention of familiar names until a clear case for their suppression had been established on evidence furnished by pure cultures.—Mr. W. P. Pycraft read the second part of his contribution towards our knowledge of the morphology of the owls. This dealt with the osteology. After drawing attention to the close resemblances between the skeleton of the striges and that of the accipitres among the falconiformes, and pointing out the homoplastic character of these resemblances, he proceeded to discuss briefly the more important characters of the several genera, and of the nestling skull, which exhibited some curious relations between the squamosal, parietal and alisphenoid bones. The modifications referred to appear to fall under two heads. Especial stress was laid upon the relations of the squamosal. In some forms this bone was barely visible in the inside of the skull, whilst in others almost its entire inner surface was exposed, thus taking a prominent part in the formation of the cranial cavity.

PARIS.

Academy of Sciences, June 30.—M. Albert Gaudry in the chair.—On the structure and history of the lunar crust, remarks suggested by the fifth and sixth numbers of the photographic atlas of the moon, published by the Observatory of Paris, by MM. Loewy and P. Puiseux.—New researches on the liquid hydride of silicon, Si_2H_6, by MM. H. Moissan and S. Smiles. The vapour density of this liquid silicon hydride has been determined at 100° C. by Gay Lussac's method, and has been found to be 2·37. The formula Si_2H_6 requires 2·14. The compound is not decomposed on heating to 100° C.; it is very soluble in ethyl silicate, but is only slightly soluble in water. The compound possesses very strong reducing properties, acting instantly on solutions of mercury perchloride, silver nitrate and gold chloride. The most remarkable property of this new hydride is its action on saturated compounds rich in chlorine or fluorine. An attempt to determine its solubility in carbon tetrachloride gave rise to a violent explosion immediately the two liquids came into contact, and the very stable sulphur hexafluoride gave rise to a similar reaction with detonation.—On some new properties of amorphous silicon, by MM. H. Mcissan and S. Smiles. When liquid silicon hydride is decomposed by a series of electric sparks, amorphous silicon is obtained in a new form. It differs from the amorphous silicon prepared by the method of Vigouroux in possessing reducing properties towards potassium permanganate, sulphate of copper, mercury perchloride, and chloride of gold. These differences are attributed by the authors to the different state of division.—On appendicitis and its causes, by M. Lannelongue. A discussion of the history of appendicitis and its relations to other diseases of the intestines and peritoneum. Appendicitis is a microbial enteritis, rarely associated with a single micro-organism, several species usually being found in association.—The action of the X-rays on very small electric sparks, by M. R. Blondlot. It was discovered some years ago that the sparking distance for a given potential is increased under the influence of the X-rays; in the present paper a new action is described. Two pieces of metal are placed a small fraction of a millimetre apart, and kept at a potential difference slightly greater than that necessary to produce a spark in the absence of the X-rays. If this spark interval is now exposed to these rays, the spark becomes distinctly brighter. Suppress the X-rays, and the

spark returns to its original condition.—Signor Schiaparelli was elected a Foreign Associate in the place of the late Baron Nordenskiöld.—On a class of functional equations, by M. Ivar Fredholm.—On the integration of differential systems which are completely integrable, by M. E. Cartan.—On injection motors, by M. L. Lecornu. A thermodynamical analysis of the Diesel petroleum motor.—On the liquefaction of air, by M. Georges Claude. A description of an improved machine for the economical production of liquid air. Worked by an engine of 30 B H.P. about 20 litres of liquid air per hour is produced, and from a second engine worked by the escaping gases about 6 B.H.P. is obtained, thus producing about 1 litre of liquid air per 1 B.H.P.—Remarks on the above paper, by M. d'Arsonval. It is pointed out that, although the theoretical possibility of the method used by M. Claude has always been conceded, the attempts of Siemens and Solvay were failures, and Linde, in fact, definitely stated that such an arrangement could not possibly work. The results obtained after two years' work are very promising.—Remarks by M. Cailletet on the same subject.—The precautions necessary in the use of Ruhmkorff coils in radiography, by MM. Infroit and Gaiffe. It was noticed in comparing radiographs taken by the aid of induction coils with those taken by the use of static machines that the latter were always perfectly sharp whilst the former were often wanting in clearness. This effect has been traced to the action of the magnetic field of the coil on the kathode flux of the bulb. On removing the Crookes tube to a sufficient distance from the coil, this effect was obviated.—The action of self-induction in the extreme ultra-violet portion of spark spectra, by M. Eugène Néculcéa. Details are given of the measurements with lead and zinc.—On the speed of the ions in a salt flame, by M. Georges Moreau.—On the magnetic properties of the ferrosilicons, by M. Ad. Jouve. The points of inflections on the curves given point to the existence of two definite compounds of iron and silicon in the alloys studied and no more, Fe_2Si and FeSi.—The centre of gravity of binary accords, by M. A. Guillemin.—On the double nitrites of iridium, by M. E. Leidié. The preparation and properties of the double nitrites of iridium with potassium, sodium and ammonium are described.—On the constitution of the aloins; comparison with the glucosides, by N. E. Léger. The aloins appear to belong to a new class of compounds, glucosides not split up by dilute acids.—On two new sugars extracted from manna, manneotetrose and manninotriose, by M. C. Tanret.—The action of carbon bisulphide on the polyvalent amino-alcohols, by MM. L. Maquenne and E. Roux. The polyoxyamines are attacked on warming with carbon bisulphide, giving cyclic combinations containing only a single atom of sulphur, probably oxazolines.—On the estimation of lecithin in milk, by MM. F. Bordas and Sig. de Raczkowski.—The mechanism of the synthesis of leucine, by MM. A. Vila and E. Vallée.—On the application of hot air as a method of heating non-volatile liquids in the form of spray, by M. J. Glover.—Variations in the state of refraction of the human eye according to the illumination, by M. Auguste Charpentier.—On the effects produced by the section of the semicircular canals from the point of view of their stimulation and their paralysis, by M. Louis Boutan.—On the brain of the Phascolosome, by M. Marcel A. Hérubel.—On the existence of elements corresponding to a primitive form of the sieve tubes in Gymnosperms, by M. G. Chauveaud.—On the density of sea-water, by MM. Thoulet and Chevallier.

NEW SOUTH WALES.

Linnean Society, April 30.—Mr. J. H. Maiden, president, in the chair.—The gummosis of the sugar-cane, by Mr. R. Greig Smith. From the gum of diseased stalks, *Bacterium vascularum*, Cobb, was isolated and purified. Under suitable conditions of nutrition, temperature and acidity, the bacterium produces, in the laboratory, a gum or slime which is chemically identical with the gum obtained from diseased canes. The gum is therefore not a pathological secretion of the plant, but is undoubtedly of microbic origin. For the formation of gum, saccharose or lævulose is necessary; dextrose is not so useful, and the other commonly occurring sugars and carbohydrates are useless. Of the saline nutrients, phosphate is essential, and potash can be replaced by calcium or magnesium; sodium salts act as decided poisons to the microbe. The specific characters of the bacterium are described.—On a Gyrocotyle from *Chimaera Ogilbyi*, and on Gyrocotyle in general, by Prof. W. A. Haswell, F.R.S.—Notes from the Botanic Gardens, Sydney, No. 8, by Mr. J. H. Maiden and Mr. E. Betche.—Further remarks upon the mechanism of agglutination, by Mr. R. Greig Smith, Macleay bacteriologist to the Society.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), parts ii. and iii. for 1902, contain the following memoirs communicated to the Society:—

February 8.—Lothar Heffter: On the theory of real curve-integrals. Walther Borsche: Xanthene derivatives from *p*-nitrophenol. O. Kellogg: On the theory of the integral equation $A(s,t) - A(s,t) = \mu \int_0^1 A(s,r)\,A(r,t)\,dr$.

February 22.—W. Nernst and A. Lessing: On the migration of galvanic polarisation through platinum and palladium plates. R. Straubel: Experiments on thermoelectric effects in tourmaline.

March 8.—J. O. Müller: On the minimal property of the sphere. E. Wiechert: Observations at Göttingen of the polar light. A. Schoenflies: On a fundamental theorem of the analysis of position. J. Elster: Dr. V. Cuomo's measurements of the distribution of atmospheric electricity in the open air at Capri.

May 3.—H. Ebert: Report of observations on atmospheric electricity at Munich in the year 1901–2. F. Exner: Report of observations on atmospheric electricity at the stations of the Vienna Academy.

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