THURSDAY, JULY 14, 1904.

IS RADIUM AN ELEMENT?

Radio-activity. By Prof. E. Rutherford, F.R.S. Pp. viii+399. (Cambridge: University Press, 1904.) Price 10*s*. 6*d*. net.

Radio-activity. By F. Soddy, M.A. (The *Electrician* Printing and Publishing Co., 1904.)

Radium. By L. A. Levy and H. G. Willis. (London: Percival Marshall and Co., 1904.)

IN February, 1896, M. Henri Becquerel found that uranium salts emit rays capable of affecting a photographic plate and of penetrating black paper and other bodies opaque to ordinary light. In the eight years which have elapsed since, a startling series of discoveries of extraordinary interest to the physicist and chemist has rewarded those experimental investigators who followed up the clue given by Becquerel's observation just mentioned. As the result of their labours, a new branch of physical chemistry has been created which already possesses a bulky literature, growing with ever-increasing velocity. The following are approximately the number of papers on radio-activity published in scientific journals for each year since Becquerel's original discovery:—1896, 7; 1897, 6; 1898, 7; 1899, 18; 1900, 39; 1901, 36; 1902, 41; 1903, 90. Thus at present the literature of the subject comprises several hundred papers, and new papers are appearing at the rate of several per week.

Among those who have contributed most to the exact study of radio-activity, Prof. Rutherford occupies a foremost place, so that a connected account of the experimental results obtained and theories proposed to explain them from his pen cannot but be welcomed by all those interested in the subject. The volume under consideration is the third of the "Cambridge Physical Series," edited by Mr. F. H. Neville, F.R.S., and Mr. W. C. D. Whetham, F.R.S. The first volume was "The Theory of Solutions," by Mr. Whetham, and the second "The Conduction of Electricity through Gases," by Prof. J. J. Thomson. The remarkably high standard of scientific excellence set by the first two volumes of the series is fully maintained by Prof. Rutherford in the third.

The first chapter contains an historical account of the discovery of the radio-active properties of uranium and thorium, of Madame Curie's magnificent discovery of radium, and of the discovery of the other less known radio-active elements. The second chapter contains a short account of the ionization theory of conduction through gases, on which so much of the work on radio-activity depends, and the third a very useful account of the experimental methods employed in investigating the properties of the radiations emitted by the radio-active substances. The remaining chapters contain a very complete and concise account of the nature of the radiations, of the amount of energy emitted, and of the remarkable atomic transformations of radio-active matter. The book is not of a popular character; it is intended for those who wish to study the subject scientifically, possibly with the view of undertaking research work on it. For such students it is admirably adapted, and possible openings for research work are suggested implicity or explicitly on almost every page. Such a work cannot fail to be of great service to scientific students.

The remarkable phenomena exhibited by the radio-active elements have led to the adoption of theories which a few years ago would have appeared almost ridiculous. One gram of radium gives out more than 800,000 gram calories of heat per year. This heat is apparently due to the spontaneous disintegration of radium atoms into matter possessing less energy. Radium is, in fact, an endothermic compound in process of decomposition. So far as we know the process is not reversible, but it may be that at extremely high temperatures radium atoms could be formed by the combination of their products of disintegration with absorption of heat.

The radium atom first emits an α-particle which is a positively charged body having a mass about twice that of a hydrogen atom. The rest of the atom constitutes radium-X. The radium-X then disintegrates into an α-particle, and the gaseous radium emanation, this in turn disintegrates, and the process goes on through a whole series of transformations. The final product is, it is suggested, perhaps polonium. A radium atom, therefore, appears to consist of a polonium atom, and about six α-particles. But there is reason to believe that the α-particles, when their charge is neutralised by a negative corpuscle, become helium atoms. If this is so, then a radium atom is really the compound radical $PoHe_6$, and is not an elementary atom at all. On the other hand, radium is from the chemical standpoint closely analogous to calcium, strontium, and barium, and it finds a place in the periodic arrangement of the elements. If, then, radium is really a compound radical, it is probable that all the other elements, except, perhaps, helium, and a few others of small atomic weight, are compound radicals also. The chemist must, in fact, either adopt a new definition of an element or else prepare for a large reduction in the number of such bodies.

The velocity of the radio-active processes is independent of the temperature. This remarkable fact is said to indicate that the changes taking place are of a purely atomic character. It must be admitted that the meaning of this statement is not very clear. If the radium atom consists of several parts which are separated during the process of disintegration, then the radium atom is really a molecule, and its disintegration is, strictly speaking, a molecular process. Moreover, molecular processes are known the velocity of which is independent of the temperature within certain limits. For example, the rate of solidification of many supercooled liquids increases at first with the supercooling, but then attains a constant value independent of the supercooling over a considerable range of temperature. The energy set free during radio-active processes is enormous compared with the kinetic energy of the molecules due to heat motions, and there is no known reason why such irreversible decompositions should not proceed at a rate independent of the temperature. even if they are not of a purely atomic character.

The rate of disintegration of the radio-active bodies is also independent of their state of chemical combination, which indicates that the radio-active properties belong entirely to the so-called atom of the radio-active element present, and are not communicated to the other atoms present in the compound.

It thus appears that the atoms of the so-called elements contain an immense store of energy, and this discovery leads to interesting possibilities which Prof. Rutherford discusses in connection with the heat supply of the sun and earth, and other heavenly bodies. If the sun and earth draw their heat supply from this store, then it is possible that the present rate of emission may have been going on for vastly longer ages than those hitherto supposed possible, longer even than the ages demanded by geologists for the completion of the processes of formation of the earth's crust.

Exception may be taken to the terminology adopted in some parts of the book. For example, the product of decomposition of the radium emanation which is deposited on solid bodies is referred to as "emanation-X." It would probably be better to reserve the term emanation for radio-active gases; but at the same time, it must be admitted that "emanation-X" is a better name than "induced radio-activity."

The arrangement of the matter and its treatment are throughout admirable.

Mr. Soddy's book on radio-activity contains an excellent and interesting account of the subject. The arrangement of the matter and point of view adopted are very similar to those in Prof. Rutherford's book, of which Mr. Soddy's is practically an abridged and slightly popularised edition.

Messrs. Levy and Willis's book on radium is supposed to be of a popular character, and contains an account of many of the properties of radio-active bodies. The arrangement of the matter cannot be commended, and the authors' scientific knowledge does not appear to have been sufficient for the task they have undertaken. Facts and results which it is suggested might be obtained if looked for are mixed up in a manner calculated to confuse the reader; there are besides many inaccurate statements. It is difficult to see what useful purpose this book can serve.

HAROLD A. WILSON.

BOOKS ON PLANT-PHYSIOLOGY.

The Physiology of Plants, a Treatise upon the Metabolism and Sources of Energy in Plants. By Prof. W. Pfeffer. Second fully revised edition. Translated and edited by Dr. Alfred J. Ewart. Vols. i. (pp. xii+632) and ii. (pp. viii+296). (Oxford: at the Clarendon Press, 1900 and 1903.)

Vorlesungen über Pflanzenphysiologie. By Prof. Ludwig Jost. Pp. xiii+695; with 172 illustrations. (Jena: Gustav Fischer, 1904.) Price 13 marks.

PROF. PFEFFER is to be congratulated on the completion of his great task—the re-writing, in the form of a second edition, of his well known "Pflanzenphysiologie." The present edition, of which the first instalment appeared in 1897, consists of what are practically three volumes containing some 1600 pages. Of these, the two first volumes are before us in an English translation.

The book is a unique one, for it is certain that none has ever appeared giving so complete an account of the physiology of plants. It must be remembered, too, that during the past forty years this branch of science has, through the labours of Sachs, Pfeffer, and a crowd of other workers, made great advances, and has developed into a huge mass of inter-related problems, so that the subject-matter is far more extensive than that which any previous writer has had to deal with. To form some notion of the activity of this department of botany, it is sufficient to look at the references which crowd the pages of the book.

It is perhaps owing to the mass of new matter which had to be incorporated that Pfeffer has somewhat condensed his presentment of general results. This has some disadvantages, inasmuch as the reader misses the give and take of a full discussion. He gets, it is true, the matured judgment of the author, but he gets it condensed to a somewhat dry and cold essence in which the quality of attractiveness is sacrificed. In what forms the main tissue of the book—the detailed consideration of experimental evidence—Pfeffer is at his best, and rules his armies of facts with the easy authority of one who is not only deeply learned, but experienced at first hand with every part of his subject.

The book follows the broad natural division of the subject into "Stoffwechsel" and "Kraftwechsel," that is, into one volume on metabolism—roughly speaking, nutrition—and two volumes on growth, movement and development. The most notable new feature in vol. ii. of the English edition is the prominence given to "causes of specific shape"; this change is the natural outcome of the recent increase of interest in this field of work, for instance in the researches of Vöchting, Goebel, Klebs, Driesch, &c. In consequence of the greater space given to this department (in itself a decided improvement in the new edition), the attention given to the special physiology of growth is relatively diminished as compared with the old edition. The volume also contains short discussions on heredity, variation, and allied questions. It is useful to know the author's views on questions of fundamental importance, but apart from this consideration we doubt whether these sections are quite worth giving in a book of this character, since it is impossible for the author to give space for an amount of discussion such as the problems demand. However this may be, and such points are largely a matter of individual opinion, on the main point there can be no doubt; no one can question the value of such a mass of information grouped in logical sequence, connected by the thoughts and criticisms of the leading plant-physiologist of the present day, and representing the mature result of a long life of strenuous and successful work.

Dr. Ewart, who has made the English translation, is well qualified for the work, being an accomplished physiologist, and his occasional remarks added in the capacity of editor are of value. The task of translating German requires a certain courage as well as

skill; the original sentences have to be individually annihilated before endurable English equivalents can be raised from their ashes. This Dr. Ewart has done so well that the book reads as though it had been written in English.

No one can nowadays write a physiological text-book without being largely indebted to Pfeffer's "Pflanzenphysiologie," and this, in his preface, Prof. Jost acknowledges in the fullest way; but his book is so different from Pfeffer's in scope and manner of presentment that it is essentially an original work.

It is an eminently readable and useful book; it is written in a clear and easy style, and steers a skilful course between some of the difficulties that beset the lecturer. On the one hand the author avoids placing too much stress on what is new, while he by no means neglects the recent literature, and is thoroughly up-to-date in his treatment of the subject. He is not afraid of facing a difficulty or of pointing out where our knowledge fails to solve the problem. He has produced a book admirably suited to the advanced student of an English university, and one that may also be read with advantage by more advanced workers. Jost's manner of stating his case is so suggestive, and he is so open in pointing to possible lines of inquiry, that the book cannot fail to be useful to a wide class of readers.

It is divided into three parts:—(1) Stoffwechsel, (2) Formwechsel, (3) Energiewechsel. Part i. deals with the absorption, transport, and loss of water, with the assimilation of carbon and nitrogen, and with respiration and fermentation. Under Formwechsel (part ii.) we have a general statement of the fundamental problems of development, then come growth and development under constant conditions. This is followed by the effects of the environment on growth, &c., and finally comes a section on periodicity, inheritance, and variation. Part iii. (Energiewechsel) deals with hygroscopic movements, growth-curvatures ("tropisms"), the movements of tendrils, of sleeping plants, &c., and chemotaxis, &c. The whole of part iii. seems to us particularly good, and contains much that is interesting and valuable in the way of discussion. We confidently recommend Prof. Jost's lectures, but since it is the duty of the reviewer to find some fault, we may direct attention to Fig. 141, which is printed upside down.

F. D.

CHRONOLOGICAL CALCULATIONS.

Astronomical and Historical Chronology in the Battle of the Centuries. By William Leighton Jordan, F.R.G.S., F.S.S., &c. Pp. 70. (London: Longmans and Co., 1904.) Price 2s. net.

THE main object of this little work is to contend that what is sometimes called the "astronomical" method of dating events prior to the Christian era is really what was intended to be used when the system of using dates before and after the birth of Christ was first introduced. Hence it is dedicated to the librarians of the cities of Florence and Pisa, in the hope of receiving from some of them "further evidence for the elucidation of the subject."

Now divisions of this kind involve the drawback of necessitating a reckoning in two directions. This is also the case, for instance, in the centigrade division of the thermometric scale, which is nearly always avoided by the general public in this country, and would be still more in countries which are nearer the equator, by using Fahrenheit's scale, the zero being below the lowest point usually reached in winter, so that a statement of the reading is sufficient, without adding above or below freezing, as the case may be. In dating an event, too, by Christian chronology, we have to state whether it occurred before or after the birth of Christ (or the year accepted as such), which is indicated by affixing the letters B.C. or A.D. But there is this further complication, as compared with a thermometric or other scale, that a degree is a definite point, and everybody knows that 1° below freezing is two degrees below 1° above it. A year is not a definite point of time, and we all know (having had a recent instance of it) what perplexity is caused in many minds when a new century has commenced with regard to which is the first year thereof. Our author reminds us, for instance, how the German Emperor insisted that the present (twentieth) century began at the beginning of the year 1900. A further complication is contained in the fact that we do not know exactly the date of Christ's birth.

But although that question is very interesting from an historical point of view, it is too late now to treat of it as a matter affecting our system of chronology. This is based on the assumed fact that the traditional date of the birth of Christ is the end of the year B.C. 1, so that one year after it was completed at the end of A.D. 1, a century at the end of A.D. 100, nineteen centuries at the end of A.D. 1900, and the twentieth century commenced on January 1, A.D. 1901.

Some people not versed in chronological calculations fancy that astronomers go out of their way to differ from ordinary people when they call the year which is commonly reckoned B.C. 1 (the year preceding A.D. 1) 0, and denominate B.C. 2 as the year − 1. But there is no such affectation of singularity in the matter; a necessity is laid upon the computer in this respect, for if we subtract 1 from 1, the result cannot be anything but 0, and if we subtract 2 from 1, the result must be −1. It is necessary, therefore, to remind ordinary people that if they desire to estimate the number of years from a date in B.C. reckoning to one at the same season in A.D. reckoning, it is not sufficient to add the years together, but unity must be subtracted from the result; from June 1, B.C. 10, for instance, to June 1, A.D. 10, is an interval of not twenty, but only nineteen years.

The author of the work before us desires to prove that those who first used Christian chronology intended that it should be reckoned in this way, the numbers being not cardinal, but ordinal. However, that is a mere matter of curiosity. An inmate of a lunatic asylum, who appeared sane to a visitor, was once asked why he was there. "Oh," he said, "I thought everybody else was mad, and they thought I was; as they were in the majority, they had their way with me, and so I am here."

The majority, in fact, must in all such questions have their way, and the existing system of chronology and its zero point (the end of B.C. 1 or of the year 0 reckoned astronomically) now so extensively pervade all history that they cannot be displaced. As regards the real date of the event on which they are nominally founded, that is another question. It seems clear that Herod the Great died in the spring of 750 by the years of Rome, corresponding to B.C. 4, and that our Lord was probably born towards the end of the preceding year, B.C. 5. Mr. Jordan refers (p. 28) to the proposal to put it back two years further, to A.D. 7, but as that theory is founded on Kepler's suggestion (which cannot be accepted) that the Star of Bethlehem was in fact a conjunction of planets, it may be dismissed as quite untenable. All who have studied mediæval writers on this subject are aware that the original proposal was to date, not from the birth, but from the incarnation of Christ, *i.e.* the Lady Day preceding the nativity; but that was soon merged in the other, which in fact superseded it. We must remind our author that astronomers when making chronological calculations do not call the vulgar era 5 B.C. (for instance) 4 B.C.; they call it A.D. −4, in the ordinary mathematical form when on the other side of the zero point.

It should be added that the book contains some interesting discussions respecting the first use of Christian chronology (superseding the era of Diocletian) and the early cycles used in the determination of Easter. In the application of a cycle there has to be taken into account not only its degree of accuracy (which is only approximate), but the date from which its use has been commenced. It is often forgotten what a twofold operation the Gregorian reformation involved; this, however, was gradually accepted in its entirety in the western church. W. T. L.

TOTEMISM AND EXOGAMY.

Social Origins. By Andrew Lang, M.A., LL.D. *Primal Law.* By J. J. Atkinson. Pp. xviii+311. (London: Longmans, Green and Co., 1903.) Price 10*s.* 6*d.* net.

MR. LANG'S critical genius has done great service to anthropology and the science of religion, and the present work, both in its criticism and constructive theory, definitely advances the study of primitive marriage and social organisation.

The essay on "primal law" deals with the origin of exogamy, and may be considered first. Its author, the late Mr. J. J. Atkinson, spent most of his life in New Caledonia, and knew the natives well. His theory, therefore, merits our careful consideration. He takes man in the semi-brutal stage, before language was evolved—living, as Darwin thought, not in hordes, but in small unsocial groups, each composed of one adult male with several wives and children. The sons of such a family would be expelled as soon as they reached maturity, owing to the fierce sexual jealousy of the father. This picture is based on what we know, little enough, of man-like apes, such as the gorilla; rightly or wrongly, evidence from cattle and other herding animals is also employed. Such, at least, according to the author, is the genesis of exogamy. He explains the well known avoidance customs between mother and son, brother and sister, as the result of the "primal law," finding a corroboration of his main point in the absence of avoidance between father and daughter. In his account of the further development he is not so successful. The theory, as a whole, is a striking one, and will have to be reckoned with, especially by those who believe in the "horde" as the first form of social organisation, and in communal "marriage" as the original type of union. We are taken so far back in the evolution of man that savage analogies can hardly be applied, and here our difficulties begin. What are the conjugal habits of the higher animals generally, and of the anthropoid apes in particular? Can zoologists give us further evidence beyond the few and possibly doubtful facts hitherto observed on which the theory is based? Another difficulty is the psychological question. We can understand *proprietary* jealousy, and an exclusion of *potential* rivals, both marital and patriarchal; but the sexual instinct of animals in a natural state is as absolutely regulated and free from excess as is that of the normal savage. With regard to the absence of avoidance in the case mentioned above, I am informed by Mr. A. W. Howitt and Prof. Baldwin Spencer that there is no evidence in Australia of such a practice as it would imply. Lastly, one is inclined to suspect single-key theories.

Mr. Lang discusses exogamy, as defined by M'Lennan, and the origin of totemism. With his usual acuteness, he fixes on essential points. In the question of exogamy, an essential phenomenon is the bisection of a tribe, as commonly in Australia, into two exogamous intermarrying moieties, which contain totem-kins; of this a luminous explanation is offered. An exogamous tendency, of whatever origin, is presupposed; then an exogamous local group, which, after the institution of totemism, finds itself composed of variously named units, owing to the presence of alien women, agrees to intermarry solely with another community similarly composed. Such is the origin of the dual phratry system. This explanation is directly opposed to the prevalent view that the bisection was deliberately arranged at a mass meeting of the primitive horde, which had at last discovered the ill effects of promiscuity. But Mr. Lang himself is bound to admit some deliberate grouping of the totems, for we never find the same in both phratries. A final theory might be expected to supply an automatic reason for this result. A more important difficulty, to my mind, is the arrangement of *connubium* between the two local groups; it does not seem clear enough why so many tribes should owe their origin to a *dual* matrimonial alliance.

The explanation of the origin of totemism is suggested by the practice, found in English and French folk-custom, and paralleled elsewhere, of "blazoning" neighbouring villages with sobriquets, which are frequently animal names. The evidence cited on this head is very interesting, and the essential fact has emerged that totem names are *group names given from without.* When accepted, they would be invested

in time, through the action of superstition and myth, with a religious garb, and thus the marriage system would come under their influence. The theory seems to me very nearly, if not quite, to solve the mystery of totemism. There is also some good criticism of recent views, such as the origin of totemism from the "external soul," or from magical cooperative societies for the control of food.

The value of the book is increased by a clear exposition and sane criticism of the chief theories and suggestions which have been put forward in the study of totemism, exogamy, and primitive marriage.

ERNEST CRAWLEY.

OUR BOOK SHELF.

Immune Sera. Haemolysins, Cytotoxins, and Precipitins. By Prof. A. Wassermann, M.D. Translated by Charles Bolduan, M.D. Pp. ix+77. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1904.)

THE subject of immune sera has not in this country received as much attention from the medical profession as its importance and interest deserve. This is not so much due to the inherent difficulties of the subject as to the complicated way in which it has usually been expounded, and to the fact that the nomenclature introduced by different authors and experimenters has been found bewildering. The difficulties have been increased by the introduction by various experimenters of different terms for the same entities, and often ones which suggest the function or properties of the substance, according to the inventor's particular views.

This neglect is the more to be regretted, as investigations upon hæmolysins, cytotoxins, and precipitins which at first seemed to possess merely scientific interest, have become of the greatest importance, owing to the close analogy which has been found to obtain between these phenomena and those of natural and acquired immunity. These studies have indeed occupied an important and striking position in the development of our knowledge of the mechanisms whereby an animal protects itself, or is protected, against the invasion of the micro-organisms of infectious diseases.

This little book of seventy-five pages is an English translation of one of the "Clinical Lecture" series, edited by von Bergman. The treatment of the subject is intended for medical men generally, and is not addressed to specialists. That Prof. Wassermann is the author is sufficient guarantee that the matter has been judiciously selected, and the manner in which it is presented could hardly be improved upon, so that it forms a clear and interesting account of the subject. The main facts and principal conclusions, including a brief but adequate *résumé* of Ehrlich's development of his side-chain theory to apply to anti-bodies in general, are given, but all unnecessary controversial matter is omitted. At the end is a very select bibliography, to which the reader is from time to time referred for fuller information.

The translation is excellent, and we confidently recommend this little book to the attention of all medical men, or others, desirous of acquainting themselves with the essential and most significant facts on the subject of immune sera. CHARLES J. MARTIN.

The Flora of the Parish of Halifax. By W. B. Crump and C. Crossland. Pp. lxxiv+316. (Halifax Scientific Society, 1904.) Price 10*s.* 6*d.* net.

THE question arises, Why should the records of a parish be amplified into a book containing 300 odd pages? in reply to which the authors explain at the outset that the parish of Halifax covers 129 square miles, and corresponds to a natural geographical division, through which flows the River Calder. But although the area is circumscribed and the vertical range is not great—the altitude varies between 500 and 1500 feet—the number of plants found within the district forms a good list, which has been worked up into an attractive historical and ecological account, and in addition, owing to the cooperation of other workers, it has been possible to include lists of all the cryptogamic plants. Looking at the plant associations, the mixed deciduous woods are the habitat of the globe-flower, the bird's nest orchid, the helleborine and the daffodil, while among the rare species of the heather moors are reckoned the bog-bell, the winter greens, and the bear berry. The bryologist, too, will find a good hunting ground, for, in addition to a fairly rich flora, the parish has yielded a new variety of Philonotis, the first record in Yorkshire for *Amblystegium Juratzkae,* and one of the few stations in the British Isles for *Jubula Hutchinsiae.* With the botany of Halifax is inseparably bound up the name of John Bolton, painter and naturalist, who in 1785 published "Filices Brittanicæ," with thirty-one copper plates all drawn by himself, and in 1791 completed "An History of Fungusses," also provided with plates, and the extent of his collections can be gauged from the numerous records which are given in the book.

While this "Flora" must naturally prove most useful to those who can traverse the parish, the ecological account and the records will serve for guidance and reference to a larger number of naturalists.

Chemisches Praktikum. By Dr. A. Wolfrum. II. Teil. Präparative und Fabrikatorische Übungen. Pp. xii+580. Price 15*s.* net. Atlas, Part ii. Atlas, price 1*l.* net; together, price 1*l.* 8*s.* net. (Leipzig: Engelmann, 1903.)

WE gather from the preface to the first part that the author's intention in compiling this work was to present the student whose aims lie in the direction of chemical technology with a course of practical exercises especially fitted for his future career. The first volume dealt with analytical work, and here the student is introduced to preparative chemistry.

The first chapter is devoted to a discussion of general matters, such as the treatment of materials for preparative and technical purposes, the general conditions of chemical reaction, and the separation, purification, and testing of reaction products. In the second chapter of 150 pages, the methods of preparation of a large number of inorganic and organic substances are described. Fifteen pages form the third chapter, which deals with the dynamics of chemical reactions, and the last two chapters are devoted to matters of a specially technical nature—descriptions of furnaces, autoclaves, filter-presses, air-pumps, condensers, centrifuges, &c., the fitting up of factories, book-keeping, patent laws, and, finally, exercises in connection with large scale technical processes are given.

Such is the programme arranged by the author for the future works chemist. It must be admitted that in many cases the practical courses provided at the universities and higher technical institutions for such chemical students might be with advantage considerably modified; in most cases the chief difficulty confronting such change is to be found in the greatly increased cost of laboratory equipment and upkeep. Without such equipment it is questionable whether the "Chemisches Praktikum" can be advantageously used by the technical student. The preparations are well chosen, but the working details would have been far more intelligible to the average student if

occasionally illustrated by diagrams of the apparatus employed.

What benefit the student will be able to derive from the technical chapters can only be decided by experience. The value of these is undoubtedly enhanced by the supplementary album containing some 560 excellent diagrams illustrating technical apparatus and actual manufacturing processes. Amongst other processes illustrated are the manufacture of liquid ammonia, liquid carbonic acid, chlorine, ether, aniline, hydrochloric, nitric, sulphuric, tartaric, citric, and carbolic acids. A careful study of such diagrams cannot but be of great service to all intending works chemists.

The Personality of the Physician. By Dr. Alfred T. Schofield. Pp. x+317. (London: J. and A. Churchill, 1904.) Price 5*s.* net.

As with all the writings of Dr. Schofield, this present work shows indubitable signs of wide reading and of careful thought.

The underlying gist of the matter is that the most potent factor in a physician's success is the personal equation. Of course, by the word "success" Dr. Schofield does not mean what is sometimes profanely styled "scooping in the shekels"! Nor does he fall into the very common error of confusing *personality* with *prestige*. The latter may, of course, be shared with the physician, who aspires to occupy the most lofty possible pinnacle of moral excellence, by the lowest and most unprincipled charlatan.

Happily, the ethical standard, recognised by the medical profession in this country, is of the highest conceivable type. Nevertheless, any publication that tends to raise, rather than to level down, that ideal is very rightly welcomed alike by the profession, by the Press, and by the people at large.

Some medical men are more comforting than others, and it is quite certain that pessimism more surely empties the consultant's waiting-room than any other quality. If the reviewer, who yields to no man in his admiration of the noblest of all professions, might be for once pardoned for a little private grumble at some of the physicians with whom he has come in contact, it is because of the grudging manner in which certain doctors, otherwise worthy and excellent men, deal out with sparing hand a remedy—Tinctura Spei—which costs them nothing, and yet is probably the most valuable drug ever dispensed!

Rustless Coatings: Corrosion and Electrolysis of Iron and Steel. By M. P. Wood. Pp. x+432. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1904.) Price 17*s.* net.

MR. M. P. WOOD may be a good "practical" man, but he has neither literary ability nor a knowledge of science sufficient to enable him to do justice to a subject which demands much more than rule-of-thumb practice to deal with it adequately. His book is a strange medley of so-called scientific statements strung together without any real acquaintance with their meaning. Its appearance of scientific erudition may serve to deceive the unwary, and we quite agree with Mr. Wood that there is much in paint and in things connected with paint that *is* calculated to deceive the unwary. But then something depends upon the guide. Mr. Wood's book is very prettily got up, and some of the illustrations are in the highest style of process-art. But like much of the subject-matter, many of them are wholly irrelevant. Mr. Wood has evidently had the ambition to make a book on a subject with which as a practical man he has been more or less intimately connected, but in this matter his ambition has overleaped itself.

Ankauf, Einrichtung und Pflege des Motorzweirades. By Wolfgang Vogel. Pp. xiii+144. (Berlin: Phönix-Verlag, 1904.) Price 2.65 marks.

ANYONE who possesses a motor bicycle or tricycle and can read the German language will find in these pages much valuable information in the form of practical suggestions as to the buying, working, and maintenance of these useful means of locomotion. The author deals fully with every part of the machine, and illustrates the text with numerous drawings which should very much assist the novice in understanding the functions of the various parts of the machine. The great improvement in design of motors, and the growing popularity of this form of transport, will no doubt call for many small treatises on the subject, of which the present one is an excellent example.

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.*]

Origin of Radium.

APROPOS of Mr. Strutt's letter in NATURE of July 7, it may be recalled that the Curies found that the artificially prepared chalcolite (the uranium copper phosphate) contained no radium, whereas the natural substance did.

It appears to me that if this fact is considered along with Mr. Soddy's result as to the failure of uranium nitrate to generate radium, the *prima facie* interpretation would be that the combined copper atom was in some way concerned. Of course the alternative view is still left that it takes a longer time than elapsed in Mr. Soddy's observations for radium to emerge from a succession of changes taking place in the uranium atom, and that this atom is the sole parent. However, in the present state of our knowledge it seems worth investigating if it may not turn out that radium results from the convection of ions from atoms of higher to atoms of lower atomic weight, producing in radium an unstable or overcharged atom.

On these grounds I have recently induced my friend Mr. Emil Werner to prepare about half a kilo. of the uranium mica or chalcolite with the view of testing at intervals its yield of radium emanation, if any is, indeed, generated. Along with this will be observed the pure uranium nitrate as well as an impure uranium nitrate recrystallised with small quantities of some of the heavy metals. My experiments are on rather a small scale. It is desirable, I think, that they should be repeated by some one commanding larger resources.

J. JOLY.

Trinity College, Dublin.

Electric Wave Recorder for Strutt's Radium Electroscope.

THE periodical discharges of a Strutt's radium electroscope can be arranged to ring a bell or print a record of every contact of the leaves; each discharge from the outside terminal, when the leaf strikes, is sufficient to act on a coherer, if any part of the coherer circuit is connected by wire, so that the discharge terminal of the vacuum tube takes the place of the aërial, as used in wireless telegraphy; the experiment never fails, every discharge producing a ring on the bell or a dot on the Morse tape as desired. For the coherer I use two pieces of No. 16 German silver wire, with nickel filings in the gap, at ordinary atmospheric pressure.

It is sometimes possible to get the coherer to respond by induction without metallic contact with the terminal, but this is rather beyond the sensibility of the apparatus employed.

I am greatly indebted to Dr. W. H. Martindale for the loan of his Strutt's radium electroscope for use in these

experiments; the performance of this instrument is very fine; the quantity of radium enclosed is nearly 3 milligrams; this produces a discharge at intervals of about 70 seconds—this rate is not in any way altered by attaching the coherer and apparatus. F. HARRISON GLEW.

156 Clapham Road, S.W., July 1.

THE MEMORIAL TO SIR GEORGE STOKES.

ON Thursday last, July 7, the memorial to Sir George Gabriel Stokes was unveiled in Westminster Abbey by the Duke of Devonshire in his capacity of Chancellor of the University of Cambridge.

The initial steps for the erection of this memorial were taken at a joint meeting of representatives of the Royal Society and the University of Cambridge, held in the Royal Society's rooms on March 12, 1903, when a committee was constituted to devise measures for providing a public memorial to commemorate the scientific career of Sir George Stokes and to take steps for carrying the project into effect. On that occasion it was decided to send a letter, in the names of the Chancellor of the University of Cambridge and the president of the Royal Society, requesting the authority of the Dean and Chapter of Westminster to place a memorial in the Abbey in the form of a medallion relief portrait of Sir George Gabriel Stokes, of the same general character as the memorials of Charles Darwin and other scientific men now in the Abbey. At the same time a subcommittee was formed to collect subscriptions for the purpose in view, and for carrying out the resolution of the full committee. In response to the committee's application the Dean gave his assent to the proposal, and agreed to take detailed plans into consideration. The subcommittee consequently, in consultation with the Dean, offered a commission to Mr. Hamo Thorneycroft, R.A., to execute a medallion.

The ceremony on Thursday was preceded by a meeting, in the Jerusalem Chamber, of subscribers to the memorial, and personal friends of Sir George Stokes. The meeting was presided over by the Dean, and was attended by many distinguished men of science and of letters. The Dean was supported by the Duke of Devonshire, Sir William Huggins, president of the Royal Society, Lord Kelvin, Lord Rayleigh, Prof. Larmor, and Prof. Forsyth (honorary secretaries to the memorial fund), and Mr. Kempe, treasurer of the Royal Society. There were present also the American Ambassador, Mr. Bryce, Sir William Crookes, Prof. George Darwin, Sir James Dewar, Sir Joseph Fayrer, Principal Carey Foster, Mr. Francis Galton, Sir John Gorst, Prof. Liveing, Sir Norman Lockyer, Sir Andrew Noble, Dr. Thorpe, and many other fellows of the Royal Society.

Prof. Larmor read letters from the Prime Minister, Lord Lister, Sir Joseph Hooker, Sir Michael Foster, Lord Goschen, Lord Avebury, and others expressing regret for their unavoidable absence.

The Dean opened the proceedings, and prefaced his remarks by directing attention to the increasing difficulty of finding space within the Abbey for such memorials as that which they were met to dedicate. He stated the history of the movement described above, and referred to the wonderful trio of famous senior wranglers occurring in successive years, Stokes, Cayley, and Adams, followed two years later by Lord Kelvin, and enlarged upon Stokes's lofty personal character, his peculiar greatness of mind, his generosity, and his humility. The Dean regretted the impracticability of devising a motto for the memorial tablet which could with sufficient terseness express the comprehensive range of Stokes's genius.

The Dean then called upon Sir William Huggins, president of the Royal Society, who, after referring to the part the Royal Society had taken in the movement for the memorial, spoke of the great services rendered to the Royal Society by Sir George Stokes during his thirty-one years' tenure of the secretaryship of the Society and his subsequent five years' occupancy of the presidential chair. Sir William referred to the wide range of Stokes's discoveries and particularly to the great advances which he made in the application of mathematics to physics. He extolled the wonderfully even balance of his powers and his remarkable soundness of judgment, and contended that his influence on his time was due as much to his greatness of character as to his intellectual accomplishments. He therefore held him worthy of a shrine by the side of Newton, Herschel, Darwin, Adams, and Joule.

Lord Kelvin described in some detail, and eulogised the great range and broad aspect of Stokes's work in science, and pointed out how fruitful it had been of great developments in recent times. He referred to his investigations upon elasticity, his paper of 1850 upon water waves, his researches in light and optics, and particularly to his discovery of fluorescence; and reminded his hearers that Stokes's work and thought are but partially represented by his published writings. He recalled the indebtedness of many authors of scientific papers to Stokes for aid and illumination received from him during his long secretaryship of the Royal Society, and in feeling terms referred to his own relations with Stokes, saying, "For sixty years of my own life I looked upon Stokes as my teacher, guide, and friend. His death was for me truly a bereavement."

Lord Rayleigh, speaking as a pupil of Sir George Stokes, described his experiences as a student at his lectures, and the unbounded admiration he always felt for him as a teacher, a man, and an investigator. He held up as an example still to be followed the simplicity of Stokes's experimental methods and his limitation of his apparatus to the bare essentials for the demonstration of the principles he was expounding. Lord Rayleigh referred more particularly to some experiments and investigations of Stokes, including those on the spectrum of the blood, on the theory of spectrum analysis, and to some of his incidental papers on acoustics, and said that Stokes's papers, whether mathematical or physical, or both, were always interesting to read.

The Vice-Chancellor of the University of Cambridge, speaking on behalf of the University, welcomed the honour done to Stokes's memory by this memorial. He paid an eloquent tribute to his great character, to his loyalty and affection for his university and college, and said that the university rejoiced that his name would now have a permanent memorial on the historic walls of that great national church.

The company then proceeded to the Abbey, where, after a prayer from the Dean, the Duke of Devonshire removed the cover from the medallion, which hangs on the wall with those of Adams and Darwin in the north aisle of the choir of the Abbey.

The Duke of Devonshire said, "Speaking on behalf of the subscribers, I offer this medallion to be added to the memorials and to be preserved in the Abbey church."

The Dean responded, "Speaking in the name of the Dean and Chapter of Westminster, I accept this medallion to keep and preserve among the memorials of the good and great men in this place."

The memorial is in the form of a bronze medallion, with a portrait head of Sir George Stokes in very high relief, and bears the inscription, "George Gabriel Stokes, 1819–1903."

A STORY OF THE PHILIPPINES.[1]

MOST people, after reading the latest work of that indefatigable traveller Mr. Savage Landor, will be disposed to question the appropriateness of his title "Gems of the East." Beyond the attraction of remoteness (which always possesses a fascination for the explorer), and the interest which still lingers round the records of the American occupation of those islands, there does not appear to be much in the humid, swamp-ridden plains, or in the volcanic hills of the Philippines to justify the suggestion of entrancing glitter and brightness; even if it justifies the production of two volumes of statistical detail about them.

FIG. 1.—Woman carrying Water in a Bamboo Cylinder. From "Gems of the East."

In some respects this latest of Mr. Landor's works differs essentially from its predecessors. There is far less effort to maintain the interest of the reader by a narrative of perilous adventures and hairbreadth escapes, and much more appeal to the student of science generally, and of anthropology in particular—in which branch, indeed, Mr. Landor shows himself to be an expert. So far, perhaps, the author is to be congratulated, for there must certainly be amongst his assortment of observations on subjects geological, botanical and ethnographical, or purely anthropological, many which are new to science, and therefore valuable. Nor are the incidents of adventure by any means wanting. There is room in the book for new records of perils by land and sea—adventurous rock-climbing, rough and ready campaigning with American troops, coast exploration, collisions with cannibals and head hunters, &c.—which recall the exploits of the Savage Landor of Tibet and Baluchistan; but they are no longer the mainstay and objective of the work.

The present book contains far more of patient and honest scientific research than of those fantastic performances as an explorer which have made Mr. Landor famous. His manner of writing is familiar and colloquial, occasionally almost ungrammatical. Taking the reader by the arm (metaphorically, for he is careful to explain that he always travels alone), he leads him gently to the outermost verge of civilised existence, and there introduces him to a race of people scattered in innumerable tribes through the islands of the Philippine group, who are so little understood, even by their American administrators, as to be amongst the most interesting of those aborigines of humanity who are still left struggling against the world-swamping waves of civilisation. They will doubtless "go under"—absorbed by the spread of those growing and expanding nations who will finally reduce the ethnographical conditions of the world to one dead level of uninteresting development. Judging from Mr. Landor's description of the countries which they occupy, and of the advance of American institutions amongst them, it will probably be long yet ere the Philippines assume a social condition analogous to that of Cape Colony or of India; but the process is none the less sure because it is slow. Mr. Landor is naturally charmed with the Americans whom he met in the Philippines, and some of the best chapters in his book are those which recount the familiar story of administrative difficulties and of tribal resistance,

FIG. 2.—Bontoc Igorrotes: showing resemblance to Ainu of North Japan. From "Gems of the East."

[1] "Gems of the East." By A. Henry Savage Landor. Pp., Vol. i., xii+328; Vol. ii., xi+460. (London: Macmillan and Co., Ltd., 1904.) Price 30s. net.

drifting finally into armed expeditions and the reduction of native strongholds.

American pluck and endurance are fully tested in these little frontier wars, which afford opportunities for the practical training of soldiers such as are rapidly disappearing on the borderland of the continental Red Indian. Cholera appears to be their deadliest foe in the field, allied to certain forms of local disease the exact nature of which is not readily recognisable from Mr. Landor's description. The author has no high opinion of modern medical science. The Filipinos (he tells us) are not yet foolish enough to believe in the mosquito theory for malaria. Nevertheless, they build their houses on piles so as to raise them sufficiently above the humid atmosphere of the ground level to ensure a free current of air. Nor does he himself believe in the efficacy of boiling water in order to render it free from germs and choleraic impurities. Precautions of any sort, indeed, do not appeal to his spirit of chivalrous adventure. When climbing precipices "I did not use ropes or other such nonsensical Alpinistic devices; my rule has always been to use common sense and avoid all accidents." This certainly is an excellent rule (if not entirely original), and one much to be commended to the Alpine Club. But combined with a proud disregard for such conventional appliances and precautions as usually become more valued by the geographical explorer the farther his experiences extend, Mr. Landor undoubtedly possesses that great faculty of human sympathy which enables him to deal with all classes of people, and to obtain the confidence (even the co-operation) of the aboriginal natives in branches of research which must have appeared to them exceedingly strange and suspicious. It is most difficult to persuade the brawny independent savage of the jungle to permit himself to be handled and measured, to have calipers applied to his head, and a minute examination made of all the features which nature has given him, for a purpose which is absolutely unintelligible to his limited understanding.

But Mr. Landor succeeded admirably, and the result is undoubtedly a valuable contribution to anthropological science, although the constant repetition of tables of measurement might very well have been dispensed with in a book which (regarded as a popular work) is already too long.

The multitude of the islands forming the Philippine group, and the excessive variety of detail which permeates them, the differentiation between the many tribes which inhabit them, and even the enumeration of their extraordinarily abundant vegetable products, become confusing after a while, and it is a relief to turn to the story of pure adventure, and the occasional interludes of graphic description, which is what the world looks for from Mr. Landor's pen. Doubtless it is Mr. Landor's intention to pose seriously as a scientific observer, and there is quite enough in the book to justify the assumption; but it might have been better had he made a little wider separation between that which belongs to the realm of statistical detail and that which is narrative of personal adventure.

T. H. H.

A PROBABLE CAUSE OF THE YEARLY VARIATION OF MAGNETIC STORMS AND AURORÆ.

IN a previous number of this Journal (vol. lxvii. p. 377) an account was given of the very close relationship which seemed to exist between the epochs of the occurrence of prominences in the polar regions of the sun and Ellis's "great" magnetic disturbances. In a later number (vol. lxviii. p. 257) it was shown that the presence of these polar prominences synchronised also with the appearances of large "polar" coronal streamers as seen during total solar eclipses. Disturbances near the solar poles seemed to play such an important *rôle* both in solar and terrestrial changes that an inquiry was made to find out whether any effect is felt on the earth when either of these solar poles is turned towards the earth during the course of the year. The result of such an investigation, recently communicated by Sir Norman Lockyer and the writer to the Royal Society, will here be briefly stated.

During the course of a year the south pole of the sun is most turned towards the earth in the beginning of March, and the north pole most towards the earth in the beginning of September. At the two intermediate epochs, in the beginning of June and December, neither pole is turned towards or away from the earth, but occupies an intermediate position. Hence we see that the *equinoxes* occur in the same

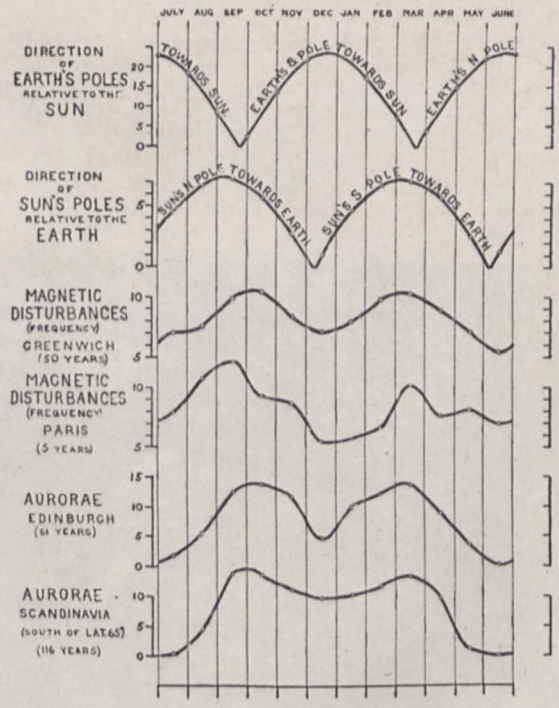

FIG. 1.—Curves showing the relationship between the positions of the earth's poles in relation to the sun, the sun's poles with regard to the earth, and the frequency of magnetic disturbances and auroræ throughout a year.

months as those in which one or other of the solar poles is turned towards the earth, while the neutral positions of the solar poles in relation to the earth occur in the same months as the *solstices*.

If, therefore, these solar polar regions are capable of disturbing the magnetic and electric conditions on the earth, then, when they are most directed to her at the equinoxes, the greatest effects during a year should be recorded, and when they are least directed the effects should be at a minimum.

With regard to the facts about the variation of magnetic disturbances and auroræ, Mr. Ellis has shown that the curves of frequency of magnetic disturbances at Greenwich and Paris are very similar, "showing maxima at or near the equinoxes, and minima at or near the solstices." These also, he further points out, are similar, with regard to the epochs of maxima, to the curve representing the

frequency of the aurora at London. In the case of auroræ observed in Edinburgh, north-east Scotland and in different regions in Scandinavia, the months in which the greatest frequency is recorded are September and October (perhaps more generally October) and March and April (perhaps more generally March).

The accompanying figure (Fig. 1) shows in a graphical form the annual variation of these magnetic and auroral frequencies, indicating their epochs of maxima and minima. Above them are the curves showing (at the top) the epochs when the *earth's poles* are turned towards the sun (the origin of our seasonal changes) and (below) when the *sun's poles* are turned towards the earth.

The coincidence in time between the epochs of the maxima of the frequency of magnetic disturbances and auroræ, and those of the greatest inclination towards the earth of the north and south solar polar regions can thus be seen at a glance.

The inquiry was pursued further to find out whether this yearly inequality of these terrestrial magnetic disturbances was influenced differently according as the sun's polar regions were, for several groups of years, in an undisturbed or disturbed condition.

It was expected that the oscillation of more disturbed solar polar regions towards and away from the earth would tend to *increase the difference* between the frequency of magnetic disturbance at the equinoxes and solstices, while this difference for those years when the less disturbed solar polar regions were in action should be somewhat *reduced*.

It was shown in the paper that this is actually the case, the frequency of the magnetic disturbances at the equinoxes being in greater excess over the solstitial frequency the greater the degree of disturbance.

There is thus reason to believe that the orientation of the solar poles with regard to the earth is the origin of these magnetic and electric annual changes.

WILLIAM J. S. LOCKYER.

THE ORNITHOLOGIST IN LAPLAND.[1]

RUSSIAN Lapland, although it has its charms during the brief summer, cannot be described as a desirable country, either for residents or tourists, since, except in a few sheltered spots, it produces little fodder save reindeer moss, while the fishing and shooting are but indifferent, and in late seasons the ground may remain covered with snow until well into June. Moreover, almost as soon as summer has set in, mosquitoes of a particularly vicious kind make their appearance in swarms, and render life well-nigh intolerable in the marshy districts which form the greater part of the country. When to these drawbacks are added the difficulties of travel, both by sea and land, there is little wonder that northern Lapland attracts

FIG. 1.—Driftwood on Beach, Kanin. From Pearson's "Three Summers among the Birds of Russian Lapland."

1 "Three Summers among the Birds of Russian Lapland." By H. J. Pearson. Pp. xvi+216; illustrated. (London: R. H. Porter, 1904. Price 21s. net.

but few tourists. Nevertheless, to the ornithologist and the egg-collector it is little short of a paradise, birds of many kinds resorting to its inhospitable shores for the breeding season in vast numbers. The variety and abundance of bird-life are, indeed, testified by the statement of the author of the handsome and exquisitely illustrated volume before us, that during his first trip he encountered no less than seventy-six species, of forty-four of which he succeeded in obtaining the eggs. This exuberance of bird life the natives do their best to keep in check, and it must be confessed that a bird protection society would find plenty of scope in the country, as all birds large enough to be eaten are shot during the breeding season, while the eggs of many species are taken by the thousand. An excuse for these practices is to be found, as the author states, in the circumstance that birds only visit this part of Lapland in order to breed, and if they did not do so then, the natives would never have a chance of killing them at all. Loons, or divers, it appears, are often taken accidentally in fishing nets, but puffins, which swarm in the country and have been described in an official publication as "ducks," are taken for food by stretching old nets across their holes.

Previous to the first of the three trips recorded in this volume, Mr. Pearson had already visited Lapland, and has described his experiences in "Beyond Petsora Eastward." Of the three trips described in the present work, the first was undertaken in 1899, and was devoted to the exploration of the northern districts of the country; in 1901 the author visited the Kanin Peninsula, while in 1903 he penetrated the interior of the country south of Kola. The year 1899 was remarkable for the late melting of the snow, which still covered the country on June 2, when the herring-gull was found nesting on little patches of clear ground in the snow. During this year the starling seems to have first extended its range into the country, the species being at that time quite unknown to the natives. Among the larger birds, white-tailed eagles were found to be not uncommon, although, owing to the rewards offered by Government for their eggs and young, they can only build in safety on inaccessible crags. Ospreys were, however, sought in vain, these birds being persecuted by the Finns on account of the fish they destroy. An immense eagle's nest in one of the few trees remaining on the Murman coast was one of the "finds" of this trip. Very notable, also, was the discovery of a nest of the rough-legged buzzard on the ground. Among the prizes in the way of eggs may be mentioned those of the little stint and the dotterel, while those of the turnstone, although by no means uncommon, were exceedingly difficult to discover. A breeding colony of glaucous gulls yielded quite a harvest of eggs. Apparently the earliest breeder is the Siberian jay, which nests in April, when the country is inaccessible, except on ski. During his trip the author was fortunate enough to come across an old Finn who collected with John Wolley forty years ago on the Gulf of Bothnia.

The accompanying picture is an example of the illustrations which render this interesting and well written volume so attractive. R. L.

PROF. CHARLES SORET.

CHARLES SORET, honorary professor of physics at the University of Geneva, whose recent death we regret to announce, was born at Geneva on September 23, 1854. After a general course of study at the college and at the university of his native town, he devoted himself especially to the study of physics. In this he followed a family tradition, his father being the Genevese physicist Jacques-Louis Soret. Like his father, from whom he inherited his deep love and respect for scientific truth and his scrupulously exact method of working, he will be remembered as one of the most distinguished representatives of the science of Geneva. During many years, until the death of Louis Soret in 1890, he was his father's colleague and collaborator.

Charles Soret took successively at Paris the degrees of licentiate in physical science in 1876 and of licentiate in mathematical science in 1878. After a visit to Germany he returned in 1879 to the University of Geneva to fill the chair of mineralogy, a subject which, by the enthusiasm of his teaching, he rendered widely popular. His earliest works date from this period; they are published in the *Archives des Sciences physiques et naturelles* of Geneva, a journal with which he was associated during more than twenty years, and to the publication committee of which he rendered many signal services. Little noticed at first, the works of Soret opened out the way for other investigators; at the present day every mineralogist is acquainted with "Soret's Law" and "Soret's refractometer." Crystallography was the science especially cultivated by Soret; the subject-matter of his course was published by him in 1893, under the title of "Éléments de Cristallographie physique," a work well known and appreciated by specialists.

On Wartmann's death in 1886, Soret was called to the chair of experimental physics in the University of Geneva, and during two years he was burdened with a double duty. By transferring the mineralogy course to one of his students, he was enabled to continue his own peculiar studies, especially in the domain of crystallographic optics, for which he showed a marked preference. He was an excellent professor of physics and gave a new impulse to the study of that science at Geneva; the laboratory was largely extended, and many serious students came to group themselves around a master so conscientious as to devote himself almost exclusively to their scientific training. Soret would certainly have published more had he not given himself with so single a mind to the exacting and fatiguing duties of directing his laboratory.

A valued member of the faculty of science, he was at the same time appreciated by the whole university. After serving during a long period as secretary of the university senate, he was, in 1898, appointed to the honourable but exacting office of rector of the university. Owing to his serious qualities, to his firm but conciliatory character, he wielded great authority, and his duties as rector were filled with rare distinction. Applying scientific method in all things, he was a remarkable administrator, and many are the services he rendered to the university. But he overtaxed his powers, and when his rectorate expired, in 1900, he was forced to resign his professorship, a step which caused profound regret among his colleagues and friends.

After a rest of two years his health seemed re-established. He resumed his scientific activity and his researches in the laboratory that he had created. He had just published in the *Archives* for March, 1904,[1] a new investigation of the refraction of tourmaline when, on April 4, he was removed from his family and friends by a sudden illness.

The death of Soret is a great loss to his country and to science in general. Much might still have been anticipated from a mind so lucid, so methodical,

[1] The completion of this work is published in the May number of the *Archives*.

and so truly scientific. In spite of his modesty, his great natural abilities made him famous in Geneva, in Switzerland, and abroad. His death leaves a gap difficult to fill. R. GAUTIER.

PROF. THEODOR BREDICHIN.

FOR the past ten years Prof. Bredichin lived in well-earned and dignified retirement in Saint Petersburg. After a life spent in directing, with consummate ability, the activities of the two great astronomical observatories of Moscow and Pulkova, he sought, while his energies were still vigorous, opportunity for cultivating with greater leisure those studies to which he had conspicuously devoted himself while in a public position. In the midst of that self-imposed work and at the zenith of his reputation, he has been removed by death to the profound loss of science in Russia. In 1857, he was called to fill the chair of astronomy in the University of Moscow, and with it to undertake the direction of the observatory. There he remained for thirty-three years, and devoted himself to astrospectroscopic observation, a subject new in Russia, to the study of variable stars, to gravity determinations by means of pendulum observations, and to a host of inquiries with which his name has long been connected. But most of all was his attention concentrated upon the formation and behaviour of comet tails, a subject which had practically lain dormant since Bessel's researches on the comet of Halley. Of this subject he never wearied, and shortly before his death he collected and published his more important papers bearing on this inquiry. This revision was perhaps the more necessary since photographs had revealed minuter details than could easily be detected in the ordinary telescope. It must be a matter of gratification to his numerous friends that the distinguished astronomer, in spite of bad health, was able to complete a task which had occupied him for so many years.

In 1890, when Prof. Otto Struve retired from the direction of the Pulkova Observatory, Dr. Bredichin took charge of that institution, but his health did not permit him to remain long at this post, and in 1894, accompanied by the regrets of the staff, he resigned his position at the observatory, but not before he had given a decided impetus to the progress of celestial photography. We have already intimated how, in the remaining years of his life, he sought to promote the interests of his favourite science.

Some 150 papers on a variety of subjects were published by Dr. Bredichin, and by the foundation of prizes for special astronomical inquiries he still further encouraged the science. As a teacher he enjoyed the reputation of being able to inspire his pupils with a lifelong interest in astronomy, and the present position of the science in Russia owes not a little to the enthusiasm which he imparted to his pupils. At the age of 73, but with his faculties acute and with his interest in astronomy unimpaired, Russia has to regret the loss of one of her most brilliant sons, while science is deprived of an ardent and enthusiastic supporter.

ROYAL COLLEGE OF SCIENCE, 1903.

SCIENCE scholars selected from the whole of Great Britain for their ability and promise, maintaining themselves on 17*s.* 9*d.* a week, were this year saved from much privation by secret gifts of small bursaries—see the subjoined audited account. Prof. Perry says he has no right to ask for help from the generous men who helped him last year, but he has all the sturdiness of a chartered beggar—he asks in a good cause.

ROYAL COLLEGE OF SCIENCE.

BALANCE SHEET.

BURSARIES 1903–1904.

Moneys Received and Paid by Prof. Perry, November, 1903, and June, 1904.

RECEIVED		PAID	
Balance in hand from last year	£31 5 0	*Nov.* 16 *to April* 25. 27 students received half-bursaries ...	£135 0 0
September, 1903. R. K. Gray, Esq....	10 0 0	*March* 23. 1 student received the second half ...	5 0 0
B. Hopkinson, Esq.	10 0 0	*June* 10 *to June* 14. 23 students received the second halves of their bursaries...	115 0 0
Sir A. Noble, K.C.B.	10 0 0	Balance in hand ...	24 2 0
October 8, 1903. W. F. Stanley, Esq.	10 0 0		
The Drapers' Co....	100 0 0		
The Goldsmiths' Co. (*Royalties.*)	100 0 0		
Prof. Perry	5 7 0		
Paid back	2 10 0		
	£279 2 0		£279 2 0

Twenty-seven students received 5*l.* each; only twenty-four of them applied for the second halves of their bursaries.

Audited and Signed by JOHN W. JUDD.

Dated June 23, 1904.

NOTES.

AN important deputation organised by the British Association will be received by Mr. Balfour to-morrow (Friday) afternoon, and will support the plea for the State endowment of higher education and research presented by Sir Norman Lockyer in his presidential address last year. Oxford and Cambridge will be represented by their Vice-Chancellors and others, London University by Lord Rosebery (Chancellor) and others, and the Birmingham University representatives will be headed by Mr. Chamberlain (Chancellor), who it is hoped will speak for all the new universities. According to a statement prepared by the president of the British Association and revised by a committee consisting of the Deputy Vice-Chancellor of Oxford, the Vice-Chancellor of Cambridge, Sir Oliver Lodge, principal of Birmingham University, Sir Michael Foster, M.P., and Sir Henry Roscoe, the British Association has taken action regarding the State endowment of universities, because at the present juncture the highest education and research is a matter not merely of academic, but of the gravest national concern.

PROF. G. GAFFKY, professor of hygiene in the University of Giessen, has accepted Prof. Koch's vacant chair in the University of Berlin.

THE following appointments are announced in connection with the Institut Marey:—Prof. A. Chauveau has been elected president and director; Prof. H. Kronecker becomes vice-President; Prof. M. Levy, treasurer; and Prof. G. Weiss, secretary.

THE sixth centenary of the birth of Francesco Petrarca will be celebrated at Arezzo from July 20 to 25. Among the festivities will be an historic *fête* in the amphitheatre of the Prato in fourteenth century costume, commemorating the arrival of Petrarca at Arezzo in 1350.

THE Mackinnon studentships of the Royal Society have been filled for the ensuing year by the election of Mr. Bryan Cookson for research in astronomy, and particularly for a new determination of the constant of aberration and

for an investigation of the mass and compression of Jupiter and of corrections to the elements of the orbits of his satellites; and to Mr. L. Doncaster for research on the early development of the egg, &c., in various species of sawflies, and for breeding experiments with certain species of Lepidoptera and with domestic animals.

A COMMITTEE has been formed in the Victoria University of Manchester to procure a portrait of Prof. Osborne Reynolds, F.R.S., the senior member of the teaching staff, as a memorial of the long and distinguished services which he has rendered to the Owens College and of his many valuable original contributions to physical science and engineering. In view of the eminent and widely recognised position which Prof. Reynolds holds as a scientific investigator, it is felt that there are many friends not immediately connected with the university who would be glad to be associated with the memorial. Any subscriptions should be sent to the treasurer of the Manchester Committee (Mr. S. Chaffers, Owens College).

SIR OLIVER LODGE, and other representatives of leading educational institutions in Birmingham, have addressed a memorial to the Lord Mayor of the city suggesting the establishment of a natural history museum on a portion of land recently acquired by the corporation. The memorial states:—"The absence of such a museum is, in our opinion, a grave defect in our municipal institutions, and is a matter of astonishment to strangers visiting our city. Several valuable collections of objects of natural history have already been lost to the city for want of a suitable building in which to deposit them, and many more collections—zoological, entomological, botanical, and geological—will find their way to metropolitan and other museums if suitable provision is not made in Birmingham for their reception."

IT is proposed to hold an optical convention in London next year. At a meeting held on Monday, in the rooms of the Society of Arts, Dr. R. T. Glazebrook, F.R.S., the president of the Optical Society, occupying the chair, an executive committee was elected, and the following were elected honorary vice-presidents:—Lord Crawford, Lord Rosse, Lord Rayleigh, Lord Blythswood, Sir William Abney, the Hon. Alban Gibbs, Mr. W. H. M. Christie (the Astronomer Royal), Mr. T. R. Dallmeyer, Mr. J. Stuart, Sir Howard Grubb, Dr. Glazebrook, and Lord Kelvin. One of the honorary vice-presidents will be asked to take the position of president of the convention.

THE report of the committee on ancient earthworks and fortified enclosures was presented to the congress of archæological societies on July 6. The committee expresses regret that more archæological societies have not taken up the idea of compiling a schedule of the ancient defensive works in their respective districts; and it is urged upon the secretaries of societies to arrange, when possible, for the survey and scheduling of all such works as are included in the inquiry. The committee concludes the report by again impressing upon archæologists the importance of doing their utmost to prevent the destruction which from time to time threatens so many defensive enclosures of earth or stone.

THE seventy-second annual meeting of the British Medical Association will be held at Oxford from July 26–29. The president is Dr. T. D. Griffiths, and the president-elect Dr. W. Collier. An address in medicine will be delivered by Sir William S. Church, Bart., K.C.B., and an address in surgery will be delivered by Sir William Macewen. A popular lecture will be delivered by Dr. G. Bagot Ferguson on Thursday evening, July 28. The annual meeting this year will comprise fourteen sections, which, with their presidents, are as follows:—Medicine, Dr. W. T. Brooks; Surgery, Mr. H. P. Symonds; Obstetrics and Gynæcology, Dr. F. H. Champneys; State Medicine, Dr. J. S. Haldane, F.R.S.; Psychological Medicine, Dr. C. A. Mercier; Pathology, Dr. J. Ritchie; Physiology, Prof. Francis Gotch, F.R.S.; Anatomy, Prof. Arthur Thomson; Ophthalmology, Mr. R. W. Doyne; Dermatology, Dr. T. C. Fox; Laryngology and Otology, Mr. C. J. Symonds; Tropical Diseases, Dr. A. Crombie, C.B.; Navy, Army, and Ambulance, Surgeon-General A. Frederick Bradshaw, C.B.; Dental Surgery, Mr. E. A. Bevers.

THE third annual meeting of the general committee of the Cancer Research Fund was held last Friday, July 8, at Marlborough House, the Prince of Wales occupying the chair. The report of the superintendent (Dr. Bashford) details the work that has been carried out during the past year. Specimens of new growths have been examined from a variety of animals, including fish and a wild mouse, showing that cancer occurs in animals in a wild state. Certain cells of malignant new growths have been found to present nuclear changes similar to those by which the sexual cells are prepared for fertilisation, and the fusion of nuclei has been demonstrated in tumours of the mouse. These observations suggest that the new growth of cancer is a mass of cells that has taken on an independent existence. Statistical investigations have also been carried out, and among other things do not support the widely spread belief that cancer is on the increase. The report of the treasurer appeals strongly for more extended pecuniary support; out of a population of 40 millions only 328 individuals and 10 city guilds have contributed, and the income has proved insufficient to meet current expenses.

ON Monday a large deputation waited on Lord Londonderry, President of the Board of Education, to urge the compulsory teaching of hygiene in elementary and secondary schools. The deputation was in support of a petition which has been signed by nearly fifteen thousand medical practitioners. The petitioners urged the central educational authorities of the United Kingdom to consider "whether it would not be possible to include in the curricula of the public elementary schools, and to encourage in the secondary schools, such teaching as may, without developing any tendency to dwell on what is unwholesome, lead all the children to appreciate at their true value healthful bodily conditions as regards cleanliness, pure air, food, drink, &c." The petitioners remark that a widespread ignorance prevails concerning not only the nature and properties of alcohol, but also its effects on the body and the mind. Central education authorities are therefore asked to include in the simple hygienic teaching desired elementary instruction at an early age on the nature and effects of alcohol. Dr. Farquharson, M.P., introduced the deputation, and short speeches in support of its objects were made by Sir W. Broadbent, Dr. D. Griffiths, Sir T. Barlow, Sir Lauder Brunton, Sir Victor Horsley, Dr. Mary Scharlieb, Dr. Hutchinson, and Prof. Sims Woodhead. Lord Londonderry, in reply, said the proposals made by the deputation had his sincerest sympathy, and he only wished it was in the power of the Board of Education to carry them out. He was as anxious as anyone to see increased instruction being given in the laws of health, but at the present time the necessary teachers did not exist, and he should be the last to wish anybody to act as instructor in such important subjects who had not received instruction in them. The Board was at the present moment

devoting itself to the training of teachers and instructing them properly in the whole question of hygiene. He trusted that as time went on its efforts in that direction would bring about the desired results.

IN forwarding to Sir C. Eliot the meteorological returns from fourteen stations in British East Africa, for 1903, Dr. Johnson gives some particulars about the rainfall, and these have been forwarded to us by the secretary of the Meteorological Office. The average amount of rain did not fall in the coast region during the period covered by the report, only 33.84 inches being recorded at Mombasa, 23.24 inches at Malindi, 35.18 inches at Rabai, and Takaungu received 33.72 inches. Shimoni fared better in this respect, as 42.51 inches fell at that station. At up country districts the amount of rain was well up to the average; 80 inches fell at Mumias, 60 at Kisumu, and 51 at Fort Hall. The number of rainy days, *i.e.* days on which at least 0.01 inch of rain fell, varied from 23 at Kismayu to 174 at Eldoma; and at Machakos the number was 93; at Fort Hall, 110; at Nairobi, 111; at Kisumu, 127; and at Mumias, 145. The greatest amount of rain which fell in one day was 5.61 inches at Machakos, on April 28, and the next heaviest rainfall was 4.77 inches at Nairobi, on April 27. The Egyptian Survey Department having asked for returns relating to the lake levels, and also for returns of rainfall from places where the amount of water in the lake would be affected by the amount of rainfall, Dr. Johnson has forwarded instruments to the stations in question, viz.:—Nandi, Kericho, and Karungu. A supply of instruments has also been sent to Morendat and to Nairobi, and it is hoped shortly to supplement those already at Fort Hall.

IN *Symons's Meteorological Magazine* for June there is a description of a new pattern rain gauge by Messrs. Lander and Smith, of Canterbury, a firm of chemists which has also recently produced some ingenious self-recording instruments. The chief novelty is that the glass receiver is permanently fixed to the funnel, and by means of a tube the contents can be emptied for measurement into an ordinary measuring glass. The latter is conical below, so that the graduation of small quantities of rainfall may be more accurately measured than is the case in an ordinary glass. A somewhat similar arrangement was proposed by Mr. John Aitken, F.R.S., in the same magazine in 1902, and Dr. Mill then pointed out that in Prof. Hellmann's rain gauges, used at official stations in Germany, the measuring glasses are constructed on the principle suggested by Mr. Aitken, the graduation of the first 10mm. being fifteen times as long as the others. The "Camden" rain glass recently designed by Messrs. Negretti and Zambra is also conical at the lower end. This arrangement enables the observer to decide, without guessing, whether in cases of very slight rainfall the amount is nearer 0.01 inch than 0.00, and consequently whether the day should be counted as a "rain-day" or whether the precipitation should be disregarded.

A NEW self-recording mercurial barometer has been devised by Mr. W. H. Dines, and is a much improved form of the instrument known as Milne's barograph. Its basis is, therefore, a glass syphon mercurial barometer, having its shorter limb, and a length of the upper portion of its longer limb, of considerably wider calibre than the remainder of the tube. In the shorter limb of the Dines pattern of the instrument, an iron float, of peculiar construction, moves freely, and through the medium of flexible lines connected to the arched heads of a lever-beam (or differential pulley) multiplication arrangement, this float actuates the recording pen. The clock movement is of Richard's type, and is enclosed within a long but light ebonite cylinder, which it drives, and on the outside of which is wrapped the chart (all the divisions on which are rectangular). The principal feature of Mr. Dines's new pattern of the instrument is a neat temperature-compensating arrangement embraced in the float. The iron float is essentially a cylinder, sealed and weighted at the top, but open underneath, below the level of the mercury in the short limb of the syphon, and when in position the cylinder contains air. It will be evident upon consideration that, given a suitable amount of air within such a float, the effect of the expansion (say) of that air on the occurrence of an increase of temperature will compensate for the alteration in the level of the mercury in the short limb of the syphon resulting from the expansion of the mercury in a syphon barometer having relatively wide upper and lower ends. Mr. Joseph Baxendell informs us that the latest pattern of the new instrument now in use at the Fernley Observatory, Southport, has been rendered practically frictionless, and that the Dines float modifications include a means of overcoming the errors commonly arising from the varying capillary effects occasioned by the reversal of the direction of motion of the mercury in the syphon.

PROF. GEORGE A. GIBSON, writing in the *Proceedings* of the Edinburgh Mathematical Society, vol. xxii., directs attention to a weak point in the conventional treatment of tangents to circles and curves by the method of limits. In proving the tangent to be perpendicular to the radius, it is shown that when a straight line meets a circle in two points A, B, the line makes equal angles with the radii OA and OB, and since this is the case however near B is to A, it is said, "therefore the same result is true when B coincides with A." But, as Prof. Gibson points out, it would be equally logical to say that if OA is the perpendicular from O on a straight line, E any point on that line, OE>OA, however near E may be to A, and "therefore" the same is true when E coincides with A, which is of course absurd. The author remarks, "It is rather disheartening to find the absurdities, so clearly pointed out by Berkeley nearly two hundred years ago, still flourishing and apparently endowed with a new lease of life."

WE have received the new volume of Dr. Otto Baschins's "Bibliotheca Geographica," covering the literature of geography to the end of 1900. The new issue does not contain any important new features, but it completes the first decade of a work recognised for its accuracy and exhaustiveness.

THE Société d'Encouragement pour l'Industrie nationale has published a valuable paper on the Port of Rosario as a supplement to its May *Bulletin*. The author is M. Georges Hersent, and the paper deals fully with the past, present, and future of the seaport. Useful information about the economic geography of the Argentine generally is also to be found in an introductory chapter.

AMONG the most important recent additions to the cartography of Canada are a map of south-eastern Alaska and part of British Columbia, showing the award of the Alaska Boundary Tribunal, and a map of the North-West Territories and the province of Manitoba. The former is reduced from the original Canadian Boundary Commission map to a scale of 1:960,000, and contours at 1000-feet intervals are retained. The map of Manitoba is on a scale of 12½ miles to an inch.

THE June number of the *National Geographic Magazine* contains a speculative article of considerable interest by Mr. R. A. Harris, in which the author discusses the indications of the existence of land in the vicinity of the North Pole, which are afforded by the known set of the currents in the Arctic Ocean and from observations of the tides. It is argued that a tract of land may exist extending from near the north-west corner of Banks Land, or from Prince Patrick Island, to a point north of New Siberia.

THE first place in the June number of *Petermann's Mitteilungen* is given to a short article on the geography of Tibet by Dr. E. Schlagintweit, accompanying an excellent map of central southern Tibet by Herr C. Schmidt. The map, which is on a scale of 1 : 2,000,000, is compiled from the most recent authoritative data, and the route of the British expedition to Gyangtse is shown. Another valuable paper on Tibet is Herr Richard Tronnier's study of the lives and journeyings of the Jesuit Fathers Johannes Grueber and Albert de Dorville, who crossed Tibet in 1661. This appears in the *Zeitschrift* of the Berlin Gesellschaft für Erdkunde.

DR. W. KOERT, of the Prussian Geological Survey, publishes in the *Naturwissenschaftliche Wochenschrift* for May an illustrated article on his observations of marine deposits and coast-erosion in many portions of the world. Among other interesting results of mineral and organic associations, he notes the formation of structureless calcareous concretions in the modern sand of Dar-es-salam, on the coast of German East Africa. These masses he compares with the "kankar" of Indian geologists.

THE fourth number of the *Boletin del Cuerpo de Ingenieros de Minas del Peru* contains an admirably illustrated account of artesian wells established at Callao. A venture started in 1901 was on the eve of being abandoned, when a copious supply of water was struck at a depth of 46 metres. Other wells have since proved equally successful, and Señor Guillet, the author of this memoir, sounds a note of hope for other areas, when he points out that there were no special geological indications to encourage hydraulic enterprise in the subsoils around Lima.

ACCORDING to the report in a local paper of a meeting recently held at Johannesburg, when Mr. W. L. Sclater, of the Cape Town Museum, occupied the chair, a South African Ornithological Union has been established. The new body has a strong and representative committee, with Mr. Sclater as president, and it is hoped that means will be found for publishing a journal.

WE have received from the United States two pamphlets connected with entomology, the one on some results of the work of the entomological division of the Department of Agriculture (*Bulletin* No. 44), and the other notes by Dr. A. S. Packard on the life-history of the silk-producing moths of the family Saturniidæ, forming No. 22 of vol. xxxix. of the *Proceedings* of the American Academy. Several articles in the former are devoted respectively to aphides affecting grain and grass, and to chestnut and other nut-feeding weevils.

PROF. HUBRECHT, of Utrecht, has favoured us with a copy of an article by himself from the *Jenaischen Zeitschrift* for 1904, dealing with the origin of annelids and chordates, and the systematic position of the ctenophora and platyhelminthes. Numerous debatable points—especially some connected with the "cœlosome"—are discussed in considerable detail, but it must suffice to mention that the author regards ctenophora and platyhelminthes as specialised side-groups, and that in his opinion the fœtal envelopes of mammals are directly derived from invertebrate ancestors, and not from those of birds and reptiles.

IN the *American Naturalist* for April, Dr. Shufeldt compares the various schemes of classification of birds which have been proposed during the last quarter of a century or so, and inquires why these are so different. The answer to the latter question is to be found, he thinks, partly in the homogeneous character of birds in general, and partly in the attempts to classify them in the same manner as other and less homogeneous groups. In this respect all classifications are more or less unsatisfactory, and it is no justification to plead that an "order" of birds has not the same systematic value as a division bearing the same name in mammals. Naturalists must make up their minds what characters are of generic and what of higher value, and then formulate a scheme which can be correlated with the classification of other groups. In another article in the same journal Mr. H. B. Bigelow records the results of certain experiments on goldfish which, in his opinion, prove that these fishes are endowed with the power of hearing.

WE have received Messrs. Merck's annual report on advancements in pharmaceutical chemistry and therapeutics. All the newer preparations and drugs receive notice, and the work contains useful bibliographical and authors' indexes and indications for treatment. No medical man or pharmacist who desires to learn the latest additions to the list of drugs can do without this report.

THE action of snake venom on cold-blooded animals has been tested by Dr. Noguchi in a long series of experiments (Carnegie Institution of Washington, *Publication* No. 12). Three venoms were employed, viz. those of the cobra, water moccasin, and rattlesnake. Snakes and frogs succumb easily to cobra venom, but are relatively insusceptible to the other venoms; turtles are more susceptible to all venoms than the foregoing, and fish are still more so. The grasshopper and some crabs are almost insusceptible, while the lobster is only moderately resistant. Excepting the earthworm, all the worms showed a low degree of susceptibility. The venoms have little effect on the Echinodermata; sea-urchins succumbed, however, but starfish and sea-cucumbers were not perceptibly affected.

"SILAJIT," an ancient Eastern medicine, forms the subject of a paper by Mr. David Hooper (*Journ.* Asiatic Society of Bengal, vol. lxxii., part ii., No. 3, 1903). There seem to be three substances known under this name; one appears as an exudation on the rocks in certain districts of the Himalayas, and consists largely of aluminium sulphate; a second, the black and probably true silajit, is said to form an exudation on rocks in Nepal, and consists mainly of alkalies and alkaline earths in combination with an organic acid related to humic acid; and a third, or white silajit, is apparently of animal origin. The substance is said to be a cure for most disorders. Mr. Hooper desires to direct the attention of other observers to this strange product, as it is possible that it has been met with in other parts of the world.

WE have received the "Year Book" of Livingstone College, of which Dr. Harford is the principal. This useful institution is designed to give to missionaries and others whose life-work may lie in the tropics a training in the elements of medicine, surgery, and hygiene such as may

be useful in districts remote from medical aid. Courses of elementary lectures are also given, both at the college and at the United Service Institution, open to all who may expect to reside or travel in the tropics. The "Year Book" contains details of the college and its curriculum, and useful directions for the preservation of health in the tropics.

IN the short notice of Mr. Cecil Hawkins's "Elementary Geometry" in NATURE of June 30 (p. 193), reference was made to the absence of numerical answers in the copy supplied. Mr. Hawkins asks us to state that the book is also supplied with answers if desired.

MESSRS. T. C. AND E. C. JACK, of Edinburgh, have submitted for our inspection four of the plates of a stereoscopic atlas of anatomy, edited by Dr. David Waterston, to be published by them in the autumn. The application of the stereoscopic principle to anatomical illustrations seems, from these examples of it, likely to prove of real assistance to medical and biological students. The plan has already been adopted with success in the teaching of geography and the illustration of books of travel, and there is every likelihood that this further adaptation of the stereoscope to educational work will meet with general approval from lecturers on anatomy. Each stereograph is accompanied by a brief description written by the editor, and the illustration and description are mounted on one card so as to facilitate reference from one to the other. The series will comprise 250 separate stereographs, and these will be contained in cases. The work will be issued at intervals in sections of about fifty stereographs.

OUR ASTRONOMICAL COLUMN.

NEW ELEMENTS AND EPHEMERIS FOR COMET 1904 *a*.—In No. 55 of the Lick Observatory *Bulletins*, Prof. A. O. Leuschner, of the Berkeley Astronomical Department, gives a set of elements and an ephemeris for comet 1904 *a*, calculated from observations made by Messrs. Aitken, Crawford, and Maddrill on April 17, 22, and 29 respectively.

No. 56 of the same publication contains a second set of elements and an ephemeris calculated by Messrs. Aitken and Maddrill from observations made at Lick on April 17, May 8, and May 24. The following are the elements given :—

$T = 1904$ March $6{\cdot}9049$ G.M.T.
$\omega = 53^\circ\ 27'\ 13''{\cdot}8$
$\Omega = 275^\circ\ 46'\ 5''{\cdot}5$ } Mean equinox of 1904 0
$i = 125^\circ\ 7'\ 33''{\cdot}1$
$\log q = 0{\cdot}432475$

The ephemeris (for oh. G.M.T.) shows that on July 14·5 the comet will occupy the following position in the constellation Canes Ven. :—True $\alpha = 12$h. 24m. 28s. True $\delta = +50^\circ\ 37'\ 50''$, and afterwards will travel very slowly in a southerly direction. As the brightness of the comet is now only 0.37 of its original magnitude, only the larger telescopes will be of any use in observing this object.

THE SOLAR PARALLAX AS DETERMINED FROM THE EROS PHOTOGRAPHS.—At the meeting of the Royal Astronomical Society on June 10, Mr. Hinks gave an interesting and instructive account of the Cambridge reduction of all the available photographs of Eros obtained during the period November 7–15, 1900. One of the chief features of the paper was a description of the various errors which appeared during the reduction and of the methods employed for their elimination.

The value obtained for the solar parallax in this preliminary result was $8''{\cdot}7966 \pm 0''{\cdot}0047$, and this agrees, within the errors of observation, with that previously obtained by Sir David Gill, whilst the probable error is as small as that obtained by him.

EXPERIMENTS ON THE VISIBILITY OF FINE LINES.—*Bulletin* No. 10 of the Lowell Observatory contains the details and results of a further series of experiments, performed by Messrs. Slipher and Lampland, on the visibility of fine lines at various distances. The experiments were exactly similar to those previously carried out with a fine wire of 0.7 inch diameter, except that a fine blue line 0.7 inch in width, drawn on a white disc 8 feet in diameter, was observed at the same time as the wire. At a distance of 1450 feet, when the angular width of the disc was 19′ and that of the lines was $0''{\cdot}86$, the wire was certainly seen, but a fictitious line was seen accompanying what was supposed to be the real one.

The general results of the experiments indicated that the wire was more *generally* visible than the line, although at distances less than 400 feet the latter was the more readily seen.

VARIABILITY OF MINOR PLANETS.—Observations of the magnitudes of the minor planets Iris, Ceres, and Pallas, made by Herr J. Holetschek at Vienna during the years 1899 and 1903, are published in No. 3955 of the *Astronomische Nachrichten*. These show that the magnitude of Iris decreased from 7.4 to 7.6 between November 1 and November 6, 1899. Observing Ceres in April, 1899, it was found that the magnitude on April 9d. 14.5h. was 7·5, on April 13d. 11h. 8.1, and on April 14d. 15h. 6.9.

In the case of Pallas the following magnitudes were observed on the various dates named :—

1903	M.T. (Vienna)	Magnitude
March 23	7·6	8·4
24	7·6	8·7
24	9·8	8·6–8·7
25	7·7	8·4–8·5
26	7·6	8·5

A VARIABLE STAR CHART.—In No. 3959 of the *Astronomische Nachrichten*, Prof. Max Wolf publishes 25 charts, each showing the relative position of one of the 25 variables in Aquila mentioned in earlier communications published by him in the same journal. An accompanying table gives the chart number and the number, the position, the variation, and the designation of the comparison star for each variable.

THE LEEDS ASTRONOMICAL SOCIETY.—No. 11 of the annual *Journal and Transactions* of the Leeds Astronomical Society contains reprints of seven very interesting lectures, on a variety of astronomical subjects, delivered at the society's meetings during last year. A number of letters on current astronomical questions, contributed to various periodicals by the past president, Mr. C. T. Whitmell, are also reproduced. The frontispiece shows a number of photographic reproductions of ancient coins on which were depicted various astronomical symbols, and illustrates a lecture on that subject delivered by Mr. A. Dodgson. The programme of the meetings for 1904 promises some very interesting papers, whilst the report for 1903 shows the society to be in a thriving condition.

"ANNUARIO" OF THE RIO DE JANEIRO OBSERVATORY (1904).—The twentieth annual publication of the Rio de Janeiro Observatory contains a large amount of useful information on astronomical, meteorological, and general physical matters. The customary calendars and astronomical tables are given in part i. Parts ii., iii., and iv. contain tables of reduction for astronomical and meteorological observations. The usual tables for the conversion of foreign standards are given in part v., whilst the sixth and last section contains many useful records of the local meteorological and magnetic conditions for past years, including the variation of magnetic declination at Rio de Janeiro since 1660.

GEOLOGICAL SURVEYS OF THE UNITED STATES.

SINCE the appearance of the notice in NATURE of December 3, 1903, the following publications of the United States Geological Survey have been received.

I. *Bulletins.*

Of very wide interest is the essay on "The Correlation of Geological Faunas: a Contribution to Devonian Palæontology," by Prof. H. Shaler Williams (*Bulletin* No. 210). The observations are based on a critical examination of the

Devonian rocks of New York, Pennsylvania, and eastern Ohio, as in that region the stratigraphical succession and the continuity of the rocks were sufficiently clear to enable the author and his assistants to work out the relations between the geological formations and the distribution of life. The term fauna is commonly used in palæontology to indicate the list of fossils contained in a single formation, but as the author admits, the limits of formations vary considerably in different localities, and do not coincide with the limits of faunas. He introduces the term *faunule* to distinguish an aggregate of fossils associated either in a single stratum, or in several contiguous strata that may be many feet in thickness—the aggregate being composed of the same set of species. The *fauna*, on the other hand, is defined as an aggregate of local and temporary faunules in which is expressed a common, corporate aggregate of species. The faunule is limited to a single set of conditions. The fauna is to be discriminated by the dominant species, and it preserves its integrity and identity so long in succession, and so far in distribution, as the dominant species retain their ascendancy among their associates. The marine fauna itself is not the universally distributed marine life of a particular epoch, but the fauna of a particular environment of that epoch.

The facts recorded by the author show that migration, not of single species, but of the whole fauna has sometimes taken place. There has been transgression of one fauna over another, thus calling for the assumption that the limits of a formation based upon sudden change in the fossil contents cannot be regarded as synchronous for two parts of even the same province, and, wherever they are thus sudden and sharp, cannot be synchronous with the limits of either the earlier or later fauna in evidence. The detailed study of the migrations and recurrence of species is of the utmost importance, and in this respect alone we have much to learn. The author rightly remarks that for the practical purposes of geological mapping and the descriptions of geological structure the formations are the essential elements, while his statistics demonstrate the intrinsic value of fossils for measuring and indicating geological time. His observations show the necessity for a dual nomenclature —stratigraphical and biological—and they indicate also that "At present we know too little about fossil faunas to be able to predict in what manner their actual time limits will be defined or discriminated, but enough light has already been thrown upon the matter to show that it will be by means of the history which organisms have expressed in their continuous life and evolution that we may expect ultimately to mark off the stages of geological time."

"Notes on the Geology of South-western Idaho and South-eastern Oregon" are contributed by Mr. Israel C. Russell (*Bulletin* No. 217). The notes are the result of a rapid reconnaissance made with the special view of studying the artesian basins; these comprise large tracts of rich agricultural land, throughout which the conditions justify the opinion that flowing water may be obtained. Particular descriptions and illustrations are given of the cinder buttes and craters of the recent, but now extinct, volcanoes. At each of the volcanic centres it seems that the first eruptions were of the explosive type, and that the elevations then produced by the accumulation of projectiles were to a considerable extent buried by the subsequent quiet effusion of vast quantities of liquid lava (basalt).

"Descriptive Geology of Nevada South of the Fortieth Parallel and Adjacent Portions of California," by Mr. J. E. Spurr (*Bulletin* No. 208), contains particulars of a great variety of formations from Archæan to Carboniferous, also of Jura-Trias, Tertiary, and later deposits, as well as of granites, rhyolites, andesites, and other igneous rocks. The work is based on a series of traverses, and is to be regarded as a preliminary survey, as the topographic map is imperfect; but the records of facts observed are full of interest.

"The Geology of Ascutney Mountain, Vermont," is by Mr. R. A. Daly (*Bulletin* No. 209). In this work we have the results of an investigation of the lithology and geology of a plexus of eruptive rocks and of the metamorphic aureole in bordering schistose rocks. The author concludes with hypotheses on the manner of intrusion, on abyssal assimilation, and on the evidences of differentiation of the igneous masses.

"Stratigraphy and Palæontology of the Upper Carboniferous Rocks of the Kansas Section" is the title of a report by Messrs. G. I. Adams, G. H. Girty, and David White (*Bulletin* No. 211). This work summarises the information on the subject, including extensive faunal lists and such data as are available concerning the flora. The plants appear to represent the topmost Carboniferous, if not the so-called permo-Carboniferous, of western Europe.

Economic geology is dealt with in *Bulletins* Nos. 212, 213, 218, 219, 223, and 225. "The Oil Fields of the Texas-Louisiana Gulf Coastal Plain" are fully described by Messrs. C. W. Hayes and W. Kennedy; "The Coal Resources of the Yukon, Alaska," are discussed by Mr. A. J. Collier, who considers that with proper development there will probably be sufficient coal to supply local demands for some time to come; "The Ore Deposits of Tonopah, Nevada," are reported on briefly by Mr. J. E. Spurr, who points out that the most important mineral veins occur in the early Tertiary andesites, and that the values in the ores are entirely gold and silver; "Gypsum Deposits in the United States," by G. I. Adams and others, are treated with especial reference to economic conditions; and "Contributions to Economic Geology," 1902 and 1903, have been prepared by a number of authors under the direction of Messrs. S. F. Emmons and C. W. Hayes; these contributions relate to metalliferous deposits, coal, oil, gas, stone, cements, clays, fuller's earth, gypsum, phosphates, mineral paints, &c.

In *Bulletin* No. 220, Mr. F. W. Clarke has tabulated the "Mineral Analyses from the Laboratories of the U.S. Geological Survey, 1880 to 1903."

In *Bulletins* Nos. 214, 215, 216, 221, 222, 224, and 227, we have a catalogue and index of the publications of the United States Geological Survey, 1901 to 1903; bibliography and index of North American geology for 1902; catalogue and index of the publications of the Hayden, King, Powell, and Wheeler surveys; results of primary triangulation; geographic tables and formulas; gazetteer of Texas, edit. 2; and "The United States Geological Survey, its Origin, Development, Organisation, and Operations."

II. *Monographs.*

Monograph No. 44 contains the last work of Prof. Alpheus Hyatt, the "Pseudoceratites of the Cretaceous"; this was almost ready for the printer at the time of his death in January, 1902, and it has been edited by Mr. T. W. Stanton. It is illustrated by 47 plates, and these, together with the descriptions of species and the reference of these and other species to new genera of Ammonoidea, were arranged or selected by the author. As the editor remarks, "The multiplication of families, genera, and species will be understood by all who are acquainted with Professor Hyatt's habit of attempting to express in the terminology every important fact observed in the course of his investigations." In some cases the classification of the forms is incomplete, as the author's opinions on certain questions had evidently become much modified since his previous publications. The Pseudoceratites he speaks of as "an artificial group, including for convenience of treatment all the retrogressive genera of the Cretacic that have sutures with simple outlines resembling those of Triassic cephalopods, formerly included under the name Ceratites." Among the British forms referred to is *Ammonites (Mantelliceras) Mantelli*, of Sowerby.

Monograph No. 45 is on "The Vermilion Iron-bearing District of Minnesota," by Mr. J. Morgan Clements, and it is accompanied by a folio atlas of geological, mining, and topographic maps. This great iron-bearing district has an area of, approximately, 1000 square miles in north-eastern Minnesota, and it resembles the other iron-bearing districts of the Lake Superior region in that the rocks are of great geological antiquity. Iron ore was first noticed in the district in 1850, but its economic importance was not realised until long subsequently. The ores occur in four areas, one of which includes the Giant's Range, which attains a height of 2120 feet above sea-level. The rocks comprise Archæan, divided in ascending order into the Ely greenstone, the iron-bearing Soudan formation, and various granites. The greenstones, though highly altered, are largely of volcanic character, but with them are associated

some intrusive rocks which present in many cases a schistose character. The Soudan formation, the oldest sedimentary group in the district, is bent into prominent anticlines, but is otherwise intricately contorted and infolded with the greenstones; it comprises conglomerates with fragments of the older greenstones, and an outlying group of siliceous rocks, largely white cherts, with red jasper and carbonate-bearing chert, grünerite-magnetite-schist, blue hematite, magnetite, and small quantities of pyrite. The cherty rocks are banded, and the hematite occurs in certain places in masses of variable size, which constitute the ore deposits. These iron-bearing rocks are considered to be of sedimentary origin. The source of the iron was, in the first instance, the Ely greenstone. From this it was removed through the action of water and collected to form part of the sedimentary marine deposits of the Soudan formation. After the folding of the rocks this disseminated iron was carried by downward-percolating waters into places favourable for its accumulation. The methods of mining are described. There are descriptions also of the later intrusive rocks, of the Huronian and Keweenawan series, of the drifts, the Glacial lakes, and other topographic features.

Monograph No. 46, on "The Menominee Iron-bearing District of Michigan," by Mr. W. S. Bayley, is the sixth and last of a series of reports on the iron-bearing districts of the Lake Superior region. The area now described is a very important one, as it has yielded since 1877 nearly thirty millions of tons of iron-ore of Bessemer grade. The rocks comprise Archæan schists and granites, which appear on the borders of the district; in the central portions the iron-bearing Algonkian rocks, with basal conglomerate, occupy a trough of highly folded rocks, distinguished as the Lower and Upper Menominee series, there being a marked unconformity between them. These divisions correspond to the Lower and Upper Marquette series, and to the Lower and Upper Huronian of other areas. Above these folded rocks lie horizontal Palæozoic beds, comprising the Lake Superior sandstone and an Ordovician limestone. The Lower Menominee series comprises quartzite and dolomite, the latter affording a key to the folding. The gap between Lower and Upper Menominee series is marked by conglomerate at the base of the Upper series, which contains pebbles of jaspilite (iron-bearing), and these are taken to represent the Negaunee formation. The Upper Menominee series comprises also slates, quartzites, and jaspilites, these last-named being banded rocks composed of alternating layers of red jasper and ore-deposits. It is noted that the larger ore-deposits all rest upon relatively impervious foundations, which are in such positions as to constitute pitching troughs. The processes of concentration were the same as those worked out in other districts by Van Hise, being due to descending waters flowing in definite channels. The concentration was commenced after the folding of the rocks, and completed before the beginning of the Upper Cambrian. The subject is treated very fully from all points of view, structural and physiographic as well as economic, and it is profusely illustrated with maps, sections of the strata, microscopic sections of rocks, and pictorial views. There are also two plates of possible organic markings from the iron-bearing rocks of Chapin Mine; these were thought by Mr. W. S. Gresley to represent impressions of plants, track-marks, &c.

III. *Professional Papers.*

The United States Geological Survey has issued a series of "Professional Papers," of which we have received several examples. No. 11 is on "The Clays of the United States East of the Mississippi River," by Mr. Heinrich Ries. It is interesting to note that while kaolins occur in several States, the local output at present is insufficient to meet the demand. No. 12, by Mr. F. L. Ransome, deals with the "Geology of the Globe Copper District, Arizona." No. 13 is on "Drainage Modifications in Southeastern Ohio and Adjacent Parts of West Virginia and Kentucky," by Mr. W. G. Tight. The subject is one which attracts a considerable amount of interest, so far as it illustrates the history of rivers and the relation of the old to the present river systems. The author concludes that the high-level valleys of the region represent a connected system of an old drainage cycle which antedates the first advance of the ice of the Glacial period; that the deposition of the silts on the old valley floors and the deflection of the streams producing the present drainage system were due to the action of the advancing ice-sheet of the first Glacial epoch; that the extensive erosion of the present river valleys to depths below the present drainage lines was accomplished during an inter-Glacial interval of great duration; and that these inter-Glacial valleys were partially filled with débris by the flood waters of the last Glacial epoch, the post-Glacial erosion being represented by the channels cut in the floor of these deposits since the rivers have acquired their present volume. Paper No. 14, by Mr. Henry S. Washington, comprises a laborious but most useful work, entitled "Chemical Analyses of Igneous Rocks Published from 1884 to 1900, with a Critical Discussion of the Character and Use of Analyses." The analyses follow on from the last date of publication of Roth's "Tabellen," and include a few analyses of 1883 omitted from that work. The author insists on the importance of careful and precise work, lamenting that rock analyses are too often entrusted to inexperienced students. The work will be of the greatest value to petrologists. Paper No. 15 is on "The Mineral Resources of the Mount Wrangell District, Alaska," by Messrs. W. C. Mendenhall and F. R. Shrader. It deals with the occurrence of ores of copper, gold, silver, platinum, tin, mercury, osmiridium and iron, and also with a few indications of coal or lignite.

No. 16 is on "The Carboniferous Formations and Faunas of Colorado," by Mr. G. H. Girty. This work is based on the extensive collections of fossils of the Geological Survey and the National Museum, and its purpose is to ascertain, by means of the invertebrata, their grouping into local and formational faunas. It brings out the close relation which existed in Carboniferous time between the Colorado seas and those of the Mississippi valley. The Leadville, Millsap, and Ouray limestones which form the base of the Carboniferous, and which include a part of the Mississippian fauna, include also in their lower portion a distinctive Upper Devonian fauna. The Lower Carboniferous was followed by an epoch of elevation and erosion, and none but the early portion of the Mississipian time is represented in the Colorado sediments. This lower group comprises (1) the Weber formation, of dark carbonaceous shales and thin limestones, with fossils of Coal-measure type, and (2) the Maroon formation, a great series of conglomeratic beds and grits, surmounted by red sandstones. The same difficulties that have been met with in Britain are encountered in Colorado, and the author discusses at some length the question whether certain red beds are Carboniferous, Permian, or Triassic. The Wyoming "Red Beds series" appears to succeed the Maroon formation in places without a break, but the author regards it as really Triassic. The numerous descriptions of fossils are accompanied by ten plates.

No. 17, by Mr. N. H. Darton, is a "Preliminary Report on the Geology and Water Resources of Nebraska West of the 103rd Meridian." The geology and topographic features are described, and some remarkable monuments of erosion known as the Chimney rock, the Smokestack rock, and the Twin-sisters are represented on photographic plates. There is also a figure of the Titanotherium, which is found in the basal portion of the Tertiary strata.

In No. 18, Mr. J. P. Iddings contributes an essay on "Chemical Composition of Igneous Rocks Expressed by Means of Diagrams with Reference to Rock Classification on a Quantitative Chemico-mineralogical Basis." In introducing this work Mr. Whitman Cross remarks, "As a successful attempt at the elucidation of a complex problem the paper is of importance to all students of igneous rocks."

In No. 19, "Contributions to the Geology of Washington," by Mr. G. O. Smith and Mr. Bailey Willis, the authors deal chiefly with the origin of the physical features. No. 20, "A Reconnaissance in Northern Alaska," by Mr. F. C. Shrader, with notes by Mr. W. J. Peters, contains much interesting information about tracts hitherto unexplored. Among the rocks described are Silurian, Devonian, Carboniferous (?), Jura-Cretaceous, Cretaceous, and Tertiary, as well as Drift deposits. The mineral resources, climate, population, and other subjects are dealt with.

IV. *Reports.*

Part i. of the twenty-fourth annual report for 1902–3 contains an account of the progress of the Survey by Mr. C. D. Walcott, director, who refers to the increase of work, and to the establishment of a separate hydrographic department under the charge of Mr. F. H. Newell. An obituary memoir, accompanied by a portrait, is given of Major J. W. Powell.

The detailed report on the "Mineral Resources of the United States," for 1902, by Mr. David T. Day, shows a continuation of the remarkable activity in the mineral industries, the total value exceeding one thousand million dollars—iron and coal being the most important products. There was a notable increase in the production of uranium and vanadium minerals, and these were nearly all shipped abroad in the crude state as mined. The production of bauxite was largely increased, while that of monazite, obtained chiefly from North Carolina and partly from South Carolina, showed a slight increase over the previous year. The production of crude petroleum and of natural gas also showed increase.

V. *Local Surveys.*

The Wisconsin Geological and Natural History Survey has sent copies of *Bulletins* Nos. 11 and 12. The former is a "Preliminary Report on the Soils and Agricultural Conditions of the North-central Portion of the State," by Dr. S. Weidman. It is illustrated by a soil map, on the scale of an inch to three miles, and this gives the general character of the soil over different "soil formations" or subsoils—in reality various alluvial and drift deposits. No. 12 is by Mr. C. D. Marsh on "The Plankton of Lake Winnebago and Green Lake," lakes of different types, one shallow, the other deep. As bearing on the question of fish-production, it is noted that Entomostraca, which furnish the basis of food for fishes, are more numerous in the deep than in the shallow lake.

We have received also vol. xiii. of the *Memoirs* of the Iowa Geological Survey, being the annual report for 1902 with accompanying papers. The papers comprise descriptions (seven in number) of various counties, by the State Geologist, Mr. Samuel Calvin, and his assistants. There is also a discussion of the requisite qualities of lithographic limestone, with a report on tests of the lithographic stone of Mitchell County, Iowa, by Mr. A. B. Hoen. The report is accompanied by a colour-printed plate drawn on the local stone and illustrating the quarry from which it was obtained. The sample, submitted for trial, was not wholly satisfactory, inasmuch as it was noticed in trueing the stone for printing that the surface-plane intercepted planes of bedding at small angle, but there is reason to hope that, as the stone is worked, larger and more perfect slabs may be obtained. H. B. W.

DISINFECTING STATIONS.

AN interesting article upon disinfecting stations, written by Prof. Henry R. Kenwood and Mr. P. J. Wilkinson, appears in the most recent issue of the *Journal* of the Sanitary Institute (vol. xxv., part i., April; London: Offices of the Sanitary Institute, Parkes' Museum, Margaret Street, W.).

It is now well recognised that the disinfection of textile articles can be effected by the use of steam more quickly, more certainly, and with less damage to the article disinfected than by the use of any other agent; and a steam disinfecting station is now considered an essential provision by sanitary authorities. As the steam penetrates into the interstices of the colder articles it undergoes condensation, and imparts its latent heat instantaneously to the colder objects in contact with it. Steam thus condensed into water occupies only a very small fraction (about 1/1600) of its former volume, and to fill the partial vacuum thus formed more steam presses forward, in its turn becoming condensed and yielding up its latent heat, and so on until the whole mass has been penetrated.

Saturated steam may be used as current steam at about atmospheric pressure; but there is an advantage, in point of time, in the employment of steam disinfecting apparatus in which saturated steam is used under pressure, and higher temperatures are thereby obtained, when very highly resistant organisms have to be destroyed.

The time required for disinfection by steam obviously depends upon the resistance of the organism to be destroyed, the bulk of the infected articles, and the pressure of the steam employed. The best researches indicate a pressure of 10 lb. (and therefore a temperature of 115° C.) for twenty minutes as trustworthy in general practice.

The steam may be generated in a special boiler, from whence it is conducted to the disinfecting chamber, and such a boiler is sometimes made to supply steam for laundry purposes; or the lower part of a jacketed oven may be filled with water, and by firing directly under the machine the steam may be raised in the jacket of the disinfector itself. This arrangement favours compactness and economy, but a separate boiler is more accessible for cleansing and repairs.

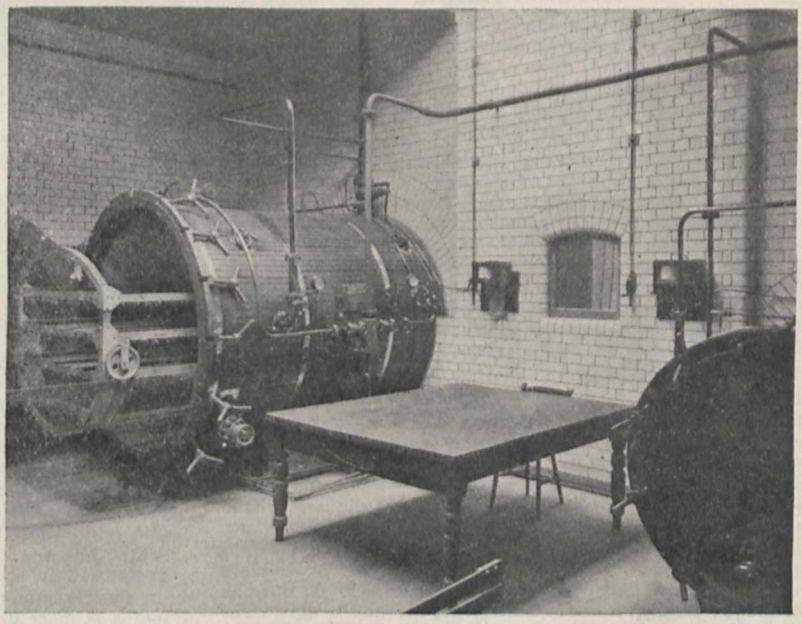

FIG. 1.—Interior of non-infected Chamber at the Fulham Disinfecting Station.

The various stoves now employed for disinfecting by steam may be classified as follows:—

(1) Stoves in which steam without pressure is employed. These are, of course, the simplest and cheapest.

(2) Those in which steam at low pressure (2, 3 or 5 lb. per sq. in.) is used. Although the temperature of 110° C. which can be reached by some of these stoves is generally sufficient, a higher temperature can never be employed in them. These stoves, though cheaper, meet with less general acceptance in this country than

(3) Those in which steam at high pressure (10 lb. and over) can be employed.

A temperature of 115° C. to 120° C. can be obtained in these stoves, and an exposure of articles for about twenty minutes will suffice for disinfection.

A disinfection station should comprise:—

(1) Two rooms completely separated from each other by

a wall, into which the oven is built, so that it communicates with both rooms. In one chamber the infected articles are placed in the oven, and when disinfection is complete the articles are taken out in the other chamber.

(2) An incinerator or destructor for the combustion of useless infected articles.

(3) Separate sheds for (*a*) vans employed to bring infected articles, and (*b*) vans employed to return disinfected articles.

(4) A laundry and bath-room.

The article describes the forms of stoves mostly used in this country at the present day, the planning and construction of the disinfecting station, the staff, the disinfection of articles (leather goods, furs, feathers and books) which are injured by steam, the destruction of useless articles in a destructor furnace; and much useful information as to cost is also given.

The article is well illustrated. The illustration here reproduced shows the non-infected chamber; the door of one of the ovens is open, and the wheeled carriage running on internal rails is seen with the racks on which the clothing and bedding are placed. The observation window in the partition wall is permanently closed.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE physiological laboratory of the University of London will remain open for post-graduate research students during the vacation months August and September. Foreign graduates who may be desirous of working in the laboratory should previously communicate with the director or with the academic registrar of the university.

A COURSE in practical and clinical bacteriology will be held at King's College, University of London, from Wednesday, August 3, to Saturday, August 13. The course will consist of lectures, demonstrations, and practical work; in the latter, the members of the class will make for themselves permanent preparations of the chief pathogenic micro-organisms, and will carry out the principal manipulations employed in bacteriological investigations. Names should be sent in as soon as possible to the secretary or to Prof. Hewlett.

WE directed attention a short time ago (June 9, p. 138) to the new illustrated quarterly review *Buddhism*; in the third number is an interesting article on education in Burma, in which it is stated that the vernacular lay schools introduced by the British Government are by no means an unqualified success, since they have been organised without due regard for native conditions. "What object," says the anonymous writer, "has education to a jungle Burman except to form his character? And can Burmese character be moulded by studying the history or geography of Europe or standard readers garbled under European supervision? A Burman should be taught Burman ethics, morals and usage. The disobedience to the authority of parents, which is so alarming a feature in the present state of things, requires to be specially dealt with. The evil goes beyond mere disobedience and truancy—cases where boys rob their parents or wantonly commit other breaches of the law are increasing." Evidently Burma also is suffering from that peculiar British attitude of mind that seeks to constrain all peoples to conform to the ideals and methods of the Britons themselves.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 9.—"On the Action of the Venom of *Bungarus coeruleus* (the Common Krait)." By Major R. H. **Elliot**, I.M.S., W. C. **Sillar**, M.B., B.Sc., and George S. **Carmichael**, M.B., Ch.B.

Experiments were performed by the authors in the pharmacological laboratory of the University of Edinburgh with the following results:—

(1) The minimum-lethal dose of the dried venom was determined for frogs and small mammals, rats and rabbits. It was found that the M.L.D. for the frog was about 0·0005 of a gram per kilo., for the rat 0·001 gram per kilo., and for the rabbit the remarkably low dose of 0·00008 gram per kilo.

(2) It was found that Calmette's anti-venomous serum in quantities sufficient to protect rats against ten minimum lethal doses of cobra venom, in the same quantities was quite powerless to protect these animals from similar doses of krait venom.

(3) The condition of various nerve terminals was studied, both in animals that die after poisoning by krait venom and in nerve muscle preparations from the frog, and it was found that the integrity of these nerve ends was invariably involved at a comparatively early stage in the poison.

(4) The blood was carefully examined, and no evidence of antemortem clotting or intravascular hæmolysis was discovered.

(5) The action of krait venom was examined when its solution was perfused through the isolated vessels and heart, respectively, of the frog. It was found that this venom, while resembling in action that of cobra venom, differs greatly in the degree of constriction of vessels and enhancement of ventricular contraction produced. Cobra venom exercises an action in these directions many times greater than that of krait venom. Cardio-plethysmographic tracings are shown.

(6) Studying the manner in which the vital functions of mammals (rabbits, cats, and dogs) are influenced when exposed to the action of this venom, the authors show by means of kymographic and plethysmographic tracings that the vaso-motor centre is strongly affected, a suspension of the activity of this centre, as shown by the great splanchnic dilatation, rapidly ensuing after its transient stimulation. There are also indications of a feeble cardio-inhibitory action. The experiments and illustrative tracings likewise show that death is brought about by destroying the activity of the respiratory centre.

(7) From these results the conclusion may be arrived at that while the symptoms produced by krait poisoning are similar to those of cobra poisoning, they differ so much in relative degree as to render it doubtful if they can properly be spoken of as identical.

"Contributions to the Study of the Action of Sea-snake Venoms. Part i." By Sir Thomas R. **Fraser**, M.D., F.R.S., and Major R. H. **Elliot**, I.M.S.

The venoms used in the research were those of *Enhydrina Valakadien* and *Enhydris Curtus*.

The minimum-lethal doses of *Enhydrina Valakadien* venom were found to be:—for rats=0·00009 gram per kilo. of body weight, for rabbits=0·00006 gram per kilo. of body weight, for cats=0·0002 gram per kilo. of body weight.

The minuteness of these doses indicates that sea-snake venom is the most lethal of all substances the lethal power of which has been determined.

Symptoms of Sea-snake Poisoning in Animals.—In the main these symptoms resemble those of cobraism, but the dyspnœa is more urgent.

Summary of Results.

(1) Enhydrina venom has no direct action on the walls of the arterioles, or at least has no action in any strength of solution which could be present in the blood of a human victim of sea-snake bite.

(2) Enhydrina venom acts directly on the isolated frog ventricle, producing a tonic and stimulating effect, but this action is produced only by very strong solutions (1 : 5000). The heart-beat is quickened, and the result is therefore similar to that produced by very weak solutions of cobra venom (1 : 1,000,000 or weaker).

(3) By experimenting with the mammalian heart exposed *in situ*, the authors have shown that Enhydrina venom has no direct action on the vagal cardio-inhibitory centre. This affords a striking contrast to the condition observed in cobra poisoning. In the latter case, the powerful tonic and stimulant action of the venom on the heart-muscle (or more probably on its nerve-ends) is masked by equally powerful and direct stimulation of the cardio-inhibitory centre. In Enhydrina poisoning, on the other hand, the complete absence of cardio-inhibition leaves the feeble tonic action on the heart free to manifest itself, as appears to be displayed in several of the tracings. The authors cannot

otherwise explain the increase in rate of the heart-beats which they not infrequently met with in their experiments.

(4) Enhydrina venom has apparently no direct action on the vaso-motor centre.

(5) The blood-pressure curve in Enhydrina poisoning is a remarkably steady one, provided that moderate doses of venom are given and that care is taken to avoid the injection of large volumes of fluid into the blood vessels. This is due to the fact that the blood pressure is exposed neither to the influence of the rival forces which act on the heart so strongly in cobraism, nor to the direct vaso-motor changes which characterise the action of certain other venoms.

(6) The respiratory mechanism is that which is chiefly affected by Enhydrina venom. If large lethal doses are employed respiration falls rapidly, and a considerable rise of blood pressure, asphyxial in origin, may precede death. The heart-beat then quickly slows, and blood pressure falls with corresponding rapidity.

Obviously, these are simply the phenomena of rapid asphyxiation. If, however, smaller lethal doses of venom are employed, no marked rise in blood pressure occurs. The ordinary level is maintained until near the occurrence of death; the beat then slows, and the blood pressure falls. Here we have an expression of gradual cardiac failure, brought about by slowly progressive asphyxiation. The absence in slow Enhydrina poisoning of the large asphyxial rises of pressure which are so characteristic of the final stages of cobra poisoning is readily explained by the fact that Enhydrina venom has no direct constrictive action on the walls of the arterioles, such as cobra venom possesses.

(7) As to the part of the respiratory mechanism that is affected by sea-snake venom, the rapidity with which respiration is affected, both when venom is injected into a vein and also when it is applied directly to the medulla oblongata, leaves no room to doubt that the respiratory centre is directly acted on by the venom. On the other hand, some degree of motor nerve-end paresis is constantly present in animals dying from the effects of subcutaneous injections of this venom. The fact is emphasised that, in experiments carried out by dropping venom on the exposed medulla oblongata, animals were not killed through the respiratory centre with their motor nerve-ends still undamaged. In this respect, Enhydrina venom differs in its action from cobra venom. It would therefore appear that, in poisoning with Enhydrina venom, motor nerve-end paresis plays a much greater part than it does in cobraism. It is not difficult to suppose that a blunting of the motor nerve-end mechanism, even though far from absolute, may seriously add to the embarrassment of a centre which has already been directly and gravely enfeebled.

"On the Structure and Affinities of Palæodiscus and Agelacrinus." By W. K. **Spencer**, B.A., F.G.S. Communicated by Prof. W. J. Sollas, F.R.S.

The method employed was that devised by Prof. Sollas (*Phil. Trans.*, B, vol. cxcvi.). This method introduces a new field of research to palæontologists, for an accurate model of the internal parts of fossils may be made by the investigator. Specimens of the above genera were ground by a special machine at uniform distances of 1/40th mm., and each successive surface photographed. From tracings of the photographs obtained wax models were built.

Palæodiscus and Agelacrinus were chosen for investigation because many observers have claimed them as possessing primitive and ancestral characters.

Palæodiscus is one of the oldest echinoids known, occuring in the Lower Ludlow beds of Leintwardine. It is shown to possess features which are only found in embryonic echinoids of the present day.

No interambulacral plates are present in the peristomial region. The interambulacrum possesses only a single initial plate proximally to the mouth. The vast majority of the plates of the interambulacrum are rhomboidal. The outer surfaces of the pyramids are concave. Other Palæozoic echinoderms may possess these characters, as shown by Jackson, but no other echinoid possesses so many undoubtedly primitive characters. This makes the important discovery of Prof. Sollas (confirmed by the author), that there are two series of plates in the ambulacrum, much easier to understand. The outer series was compared to the true echinoid ambulacrals, the inner series to the asteroid ambulacrals. Palæodiscus would then be placed at the base of the echinoid stem, and would enable us to derive the echinoids from asteroid ancestors. The asteroid series of plates of Palæodiscus is represented in other echinoids by the auricles which were shown by Lovén to have an independent origin and growth. It is noteworthy that this comparison was instituted by Johannes Müller so long ago as 1853.

Agelacrinus is a member of the recently revived group of the Edrioasteroidea. This group has been claimed as ancestral to free moving echinoderms by Neumayer, Haeckel, and Bather. The genus Edrioaster, on which most of the previous investigations have been conducted, lends support to this suggestion, for it possesses a double series of flooring plates to the ambulacral groove between which are pores. It was therefore suggested that since the Edrioasteroidea alone amongst Pelmatozoa possessed pores through which the eleutherozoan ampullæ could be protruded, they were the pelmatozoic ancestors of the free moving echinoderms.

Agelacrinus is shown, however, to possess single flooring plates, and no pores are present either through or between these plates. The pores of Edrioaster, therefore, are not so characteristic or important a feature of the Edrioasteroidea as the above authors would claim.

In conclusion, it is pointed out that the Asteroidea are the most primitive Eleutherozoa, and their structure is much too simple to be derived directly from any known pelmatozoan.

June 16.—"On the Relation between the Spectra of Sun-spots and Stars." By Sir Norman **Lockyer**, K.C.B., F.R.S.

In a previous paper on the chemical classification of the stars the author suggested the probability that, as the result of further work, the "genera" then proposed might have to be split up into "species." During more recent researches the temperature classification was tested by comparing the relative intensities of the red and ultra-violet ends of the spectra of stars, situated on various horizons of the temperature curve, including Capella and Arcturus, which, according to the original general classification, belong to the same type, viz. "Arcturian." It was found that the spectrum of Capella extended on an average about 70 tenth-metres further into the ultra-violet than that of Arcturus, whilst the red portion of the spectrum is certainly stronger in the latter. That is to say, *the general temperature of Arcturus is probably appreciably lower than that of Capella.*

The next step was to see if chemical change accompanied this reduction of temperature, and if so, whether the change was in any way related to the change from the photosphere to the sun-spot spectrum. In comparing, for this purpose, the spectra taken with the 6-inch Henry prismatic camera, it was noticed that certain lines were relatively intensified in passing from the spectrum of Capella to that of Arcturus.

Similar comparisons of the Fraunhoferic spectrum with the spectra of Capella and Arcturus respectively were next made. This work led to the following conclusions:—(1) That the line absorptions of Capella and the sun are practically identical; (2) that although, speaking generally, the same lines occur in the spectra of the sun and Arcturus, yet in the latter many lines are relatively more intense than in the former. Moreover, in the great majority of such cases *the lines so intensified are probably due to vanadium and titanium.*

Now an analysis of the widened lines observed in sun-spots since the year 1894 has shown that the *elements chiefly affected are also vanadium and titanium.*

Thus it will be seen that whilst the temperature classification certainly places Arcturus on a lower temperature level than Capella, and, therefore, the sun, the evidence obtained from a study of the line absorptions of Arcturus and of sun-spots indicates very clearly that the temperature of the Arcturian absorbing atmosphere is about the same as that of the sun-spot nuclei during the above-mentioned period. This conclusion justifies the ideas formulated by De la Rue, Stewart, and Lœwy that the spots are produced by the downrush of cooler material.

Reference is also made to Prof. Hale's suggestion that because the lines which are widened in sun-spots appear as

strong dark lines in Piscian stars, the effect may be produced because sun-spots are more numerous in such stars. From the evidence adduced above it seems a far more probable explanation to suppose that these lines are intensified in sun-spots, and strengthened in those stars which have been placed on lower temperature levels than the sun, because the general temperature conditions are similar. That is to say, the fall of temperature experienced by the metallic vapours in passing from the photosphere to the spot nucleus is of the same order as that to which an absorbing atmosphere is subjected in passing from the temperature conditions of Capella or the sun to those of Arcturus or the lower temperature stars.

"An Experiment Illustrating Harmonic Undertones." By H. **Knapman.** Communicated by Dr. G. J. Burch, F.R.S.

If a vibrating tuning-fork is pressed against a light object such as a piece of paper or a stretched string, this object may follow the vibrations of the fork, contact being continuous. This use of a tuning-fork is mentioned in Lord Rayleigh's "Theory of Sound," § 133. In the present experiment a lightly poised piece of paper is touched by the fork; with small pressure contact may be broken during part of each vibration, and the paper gives a note resembling that of a bowed violin-string, in which harmonic overtones are strong. With still less pressure, contact may be made only at every other vibration of the fork, when the paper gives a note an octave below that of the fork. Similarly, contact at every third vibration of the fork gives the twelfth below, and so on. We thus have the series of harmonic undertones, and with a c'' fork ten or more may be made easily audible.

An optical method of examining the vibrations is also described. A large tuning-fork was made to touch a small card, the edge of which was observed with a lens against a dark background, and appeared to be drawn out into a continuously shaded band, in which stationary positions were visible. The characteristics of various states of vibration were readily perceived.

Geological Society, June 22.—Dr. J. E. Marr, F.R.S., president, in the chair.—The igneous rocks of Pontesford Hill (Shropshire): Prof. W. S. **Boulton.** The hill is a "plagioclinal ridge," bounded on all sides by faults; it is made up entirely of igneous rocks. There are two distinct groups of igneous rocks: a bedded group, consisting of rhyolites and acid tuffs, with andesites and andesitic tuffs, and an intrusive group of olivine-dolerites. The northern end of the hill consists of rhyolite. The andesitic group is made up of felsitic-looking tuffs, passing up into andesitic tuffs, hälleflintas, and lavas. The intrusive rocks are basic and often amygdaloidal; they compare in composition with such olivine-dolerites as those of Rowley, the Clee Hills, and Little Wenlock.—The Tertiary fossils of Somaliland, as represented in the British Museum (Natural History): R. B. **Newton.** The new material described is that in the Donaldson-Smith collection, and one presented by Major R. G. Edwards Leckie. The large Lucinidæ and specimens of Campanile (previously considered as Nerinæa) are typical of Eocene rocks generally, and they agree with the Foraminifera in the Somaliland Limestones in supporting the reference of these rocks to this period. Two limestones seem to be represented in the collections, and appear to be capable of correlation with those of the south-eastern corner of Arabia, as well as with those of Sind and Cutch. Six new species are described and named, and sixteen species or varieties described.—The Caernarvon earthquake of June 19, 1903, and its accessory shocks: Dr. C. **Davison.** This earthquake was the strongest disturbance indigenous to the county for more than five centuries. Its disturbed area contained about 25,000 square miles. The centre of the innermost isoseismal (intensity 7) was situated beneath the sea, about 4 miles west of Pen-y-groes, and the longer axis of the isoseismal ran from N. 40° E. to S. 40° W. It is concluded that the earthquake was caused by a slip of about 16 miles in length along a fault running in the above direction, hading north-westward, and passing either through Clynnog or a mile or two either to the north-west or south-east.

Challenger Society, June 29.—Sir John Murray in the chair.—The **Chairman** exhibited the skeleton of a problematical organism, possibly allied to Heliopora, from the sea bottom off Cuba, and read a letter on its structure from the late Prof. Alleyne Nicholson.—Mr. E. W. L. **Holt** exhibited some new and rare Crustacea from the Atlantic. Mr. Holt also read a paper on the Schizopoda of the North Atlantic and its eastern slope, from the collections by Mr. George Murray in the *Oceana*, by Dr. G. H. Fowler in H.M.S. *Research* in the Færöe Channel and the Bay of Biscay, and by himself in the *Helga* off west Ireland. These collections included a number of interesting novelties, notably among those forms which appeared to live actually on the bottom in deep water, and were caught by a tow-net attached to the trawl-rope.—Mr. Stanley **Gardiner** opened a discussion on the distribution of marine larvæ, in which, mainly from his own observations, he dealt with their length of life in reference to their populating banks and shores in the Indo-Pacific and Atlantic Oceans. He concluded that the larvæ of Crustacea and Echinoderms other than Crinoids may be expected to reach almost any bank, but that results in geographical distribution may be expected from Cœlenterata and Turbellaria, and to some degree also from Chætopoda, Gephyrea, and Mollusca.

EDINBURGH.

Royal Society, June 6.—The Hon. Lord M'Laren in the chair.—An obituary notice of Dr. Charles Gatty, prepared by Prof. W. C. M'Intosh, was read.—Dr. E. G. **Coker,** McGill University, Montreal, communicated a paper on the measurement of stress by thermal methods. The paper was experimental, investigating on the one hand the effect of tension upon the coefficient of thermal expansion, and on the other the change of temperature accompanying the application of various kinds of stress. The changes of temperature were measured thermoelectrically, corrections being applied for the loss of heat by conduction, radiation, &c., as the stress was being applied. A number of results were established, the most interesting being, perhaps, the fact that the rate of heat production during the development of the strain continues constant even after the limit of elasticity has been exceeded. As regards the effect of stress on the coefficient of expansion, it was found that there was no appreciable change.—A paper was read on the spectrum of Nova Persei and the structure of the bands, as photographed at Glasgow, by Prof. **Becker.** In the earlier photographs before August, 1901, the spectrum suggested a number of bright bands fading towards the ends and overlapping one another. In the later photographs the bands become detached and suggest a line spectrum in which the lines have broadened into bands. The broadening was found to be proportional to the wave-length, and independent of the nature of the element. The sequence of alternate maxima and minima which characterised the bands, and the distances separating these, were found to be also proportional to the wave-length. This is in accordance with Doppler's principle if we assume the effects to be due to motion in the line of sight. An important part of the paper was devoted to a mathematical demonstration of the correctness of the assumption that the resultant intensity at any point of the plate where several bands are superposed is the sum of the intensities which the radiations would singly produce. The general conclusion was that the spectrum was due to hydrogen and helium.—In a note on astronomical seeing, Dr. **Halm** directed attention to Langley's ingenious method for improving definition in a telescope by agitating the air in the tube. This result, at first sight so contradictory to all preconceived ideas, suggests consideration as to the condition of the atmosphere as a whole when the best definition is obtained. The cause of the blurring is no doubt due to the changes of refraction which accompany the movements of the air. If every portion of the moving air came to its new position with exactly the temperature and density which belong to the new position, there would be no change of refraction and consequently no blurring. Now this state is realised when the air is in a condition of convective or adiabatic equilibrium, and hence definition will be clearer the more

nearly the atmosphere approximates to this condition. Definition is often very good when gales are blowing, and there is no doubt as to the better definition in summer than in winter. These and other cases seem capable of explanation along the lines indicated.

June 20.—The Hon. Lord M'Laren in the chair.—A paper was communicated by Lord **Kelvin** on the front and rear of a free procession of waves in deep water. A solution of the differential equations was obtained which represented a set of standing waves on an infinite sheet of water. At time zero this set of standing waves was conceived as taking place over one-half, to the left (say) of a line drawn parallel to the ridges, while the rest of the surface to the right was initially at rest. The standing waves were then decomposed into two equal processions moving respectively to the right and to the left. At any finite time after there would be a point to the right up to which the motion would be sinusoidal, and beyond which, further to the right, the waves would get flatter and longer. This represented the beginning of a procession of waves advancing into still water. Then to the left of the original line separating the undulating and smooth water there would be associated with the rightward moving procession of sinusoidal waves the tail end of the leftward moving procession. This would give the end of a procession of waves.—Dr. **Ashworth** and Mr. Nelson **Annandale** gave an account of some aged specimens of sea-anemone (*Sagartia troglodytes*) which had been kept in an aquarium in Edinburgh for about fifty years. They are more sensitive than younger individuals to changes of environment, and slower in expanding when conditions again become favourable. They breed very sparingly, while the younger specimens from fourteen to fifteen years old kept in the same aquarium produce hundreds of young. There is only one other recorded case of longevity in cœlenterates, a specimen of the anemone *Actinia mesembryanthemum*, which died in 1887 at the age of about sixty-six. According to unpublished observations of Mr. J. S. Gardiner, the solitary coral *Flabellum rubrum* lives to the age of twenty-four years, while colonial corals, such as Goniastræa, Prionastræa, Orbicella, and Pocillopora, reach the age of twenty-two to twenty-eight years.—In a note on the effect of transverse magnetisation on the resistance of nickel wire at high temperatures, Prof. C. G. **Knott** described a curious result recently obtained. The effect of a strong transverse field is to diminish the resistance, and as the temperature rises the percentage change of resistance falls off very steadily until 280° C. is reached. It begins then to fall off more slowly, passes through a pronounced minimum at about 290°, rises to a sharp maximum at 320°, and then falls rapidly to zero at about 346°. A similar effect, but much less pronounced, is indicated in the author's last published paper on the effect of longitudinal magnetisation.—Mr. J. R. **Milne** exhibited his new design of juxtaposiler for bringing into contact two beams of light in spectrophotometry. The instrument had been made for him by Mr. Hilger, and consisted of a special form of glass prism by means of which two beams of light originally apart were brought accurately with their contiguous edges in contact, each beam having been subjected to exactly the same treatment in the prism. The device could also be adapted to certain forms of polarimeter.

DUBLIN.

Royal Dublin Society, June 21.—Prof. G. A. J. Cole in the chair.—A general method in qualitative analysis for determining the presence of an oxide: Prof. C. R. C. **Tichborne.** The author proposed to use the reaction of phenol-phthalein with acid-carbonate of sodium. Phenol-phthalein is colourless in neutral solutions, red with alkaline carbonates, and colourless with acid-carbonates. Most metallic oxides will reduce a certain proportion of the acid-carbonate to the normal carbonate, and the solution then strikes a deep crimson colour if filtered from the oxide and tested with the phenolphthalein. Almost all hydrated oxides and oxides made in the moist way decompose the sodium acid-carbonate solution. Mineral oxides or oxides which have been ignited, with a few exceptions, behave badly in this respect. Ferric oxide and alumina do not act, as the carbonates do not exist. The following oxides will reduce the acid carbonate to the neutral salt of soda:—oxides of lead, silver, bismuth, zinc (ignited and precipitated), copper, antimony, cerium, iron (other than Fe_2O_3), mercury, and tin.—A method for the mechanical analysis of soils: T. **Crook.** The method described is a hydraulic one, and may be regarded as a modification of the Schöne process. No piezometer is used, and the speeds of flow are standardised by varying the size of the outflow aperture and the head of water. The scheme of analysis suggested is a fairly complete one, including the coarser ingredients, as well as the fine earth. The author urges that the object of a mechanical analysis should be two-fold:—(1) to enable a moderately definite idea to be formed of the way in which a soil is built up in its natural state; (2) to show something of the physical properties possessed by the soil.—The state in which helium exists in pitchblende: R. J. **Moss.** When pitchblende is reduced to powder in a vacuum, water vapour, helium, carbon dioxide, nitrogen, and oxygen are liberated. Water is the chief substance set free; of the gases, helium sometimes constitutes about half. The helium obtained by rather coarse pulverisation was about 1 per cent. of the total quantity present in the mineral, as determined by fusion with hydrogen potassium sulphate. The carbon dioxide obtained mechanically was less than 1 part in 10,000 of the total quantity present. The results support the supposition that helium exists in pitchblende in the free state, and is contained in extremely minute cavities. A specimen of pitchblende, powdered *in vacuo*, yielded gases containing 0·7 per cent. of hydrogen, which may possibly be a product of the action of radium on the water contained in the cavities of the mineral.—The Rev. H. **O'Toole** exhibited and described an apparatus for determining the expansion of rods, &c., when heated.

PARIS.

Academy of Sciences, July 4.—M. Mascart in the chair.—On certain functional equations and on a class of algebraic surfaces: Émile **Picard.**—Syntheses in the anthracene series. Triphenylanthracene dihydride and its derivatives: A. **Haller** and A. **Guyot.** Two modes of synthesis are given, the one starting from diphenylanthrone and the other from triphenylmethane-*o*-carboxylic acid methyl ester, making use of the Grignard reaction. Both give good yields.—Muscular work and expenditure of energy in dynamic contraction, with gradual shortening of the muscles: A. **Chauveau.**—*Trypanroth* in the treatment of trypanosomiasis: A. **Laveran.** The use of this dye was proposed by Ehrlich and Shiga. The effects produced by this reagent are compared with those of arsenious acid; the two have also been tried in combination, but the general results are disappointing.—On the properties of different substances as regards their ponderable emanation: R. **Blondlot.**—On the seeds of Nevropteris: M. **Grand'Eury.**—Presentation of the fifteenth *Bulletin chronométrique* (1902–1903) of the Observatory of Besançon: M. **Lœwy.**—M. Fliche was elected a correspondant of the academy in the section of rural economy, in the place of M. Lechartier.—On functions representable analytically: H. **Lebesgue.**—On the general theory of networks and congruences: Émile **Martin.**—On a general equality common to all fundamental functions: W. **Stekloff.**—On the stability of aërostats: Henri **Hervé.** Comparative effects of the β-rays and the n-rays, as well as of the α-rays and the n_1-rays, on a phosphorescent surface: Jean **Becquerel.** The radiations emitted by polonium affect a phosphorescent calcium sulphide screen, the action differing according as the radiation has passed through glass or not.—On the kathode rays. A reply to the note of M. Pellat: P. **Villard.**—On the measurement of temperature: Ernest **Solvay.** If two portions of a substance situated near to each other have widely differing temperatures, it is impossible to measure this difference with a thermometer, and a possible case of this kind is given.—On the spectrophotometric estimation of small quantities of carbon monoxide in air: L. de **Saint-Martin.** The instrument measures the ratio between the amounts of hæmoglobin combined with oxygen and carbon monoxide, up to the limit of 1 per cent. of CO.—The determination of the atomic weight of nitrogen by the volumetric analysis of nitrogen monoxide: Adrien **Jacquerod** and **St. Bogdan.**

Pure nitrogen monoxide, prepared from sodium nitrite and hydroxylamine sulphate, was reduced to nitrogen by means of a red hot iron wire, and the change of pressure at constant volume measured. The value 14.019 is deduced from the preliminary experiments as the atomic weight of nitrogen.—Allotropic states of antimony sulphide and their heats of formation: MM. **Guinchant** and **Chrétien.**—The action of ammonia gas upon trichloride, tribromide, and triiodide of arsenic: C. **Hugot.** Arsenic trichloride reacts with ammonia at −40° C., forming arsenic amide, $As(NH_2)_3$. This amide is insoluble in liquid ammonia, but is immediately decomposed by water. The same amide is formed from the bromide and iodide of arsenic. Kept at 0° C., the amide slowly loses ammonia and gives the imide, $As_2(NH)_3$, and this, heated to 250° C., gives the nitride, AsN.—On a method of splitting up fermentation lactic acid into its optically active components: E. **Jungfleisch.** The separation is based on the differences in properties of the three lactates of quinine, and full details of the method adopted are given. Syntheses of pentamethyleneglycol, of the nitrile, and of pimelic acid: J. L. **Hamonet.** The glycol has been obtained from the corresponding dibromopentane, by conversion into the diacetin, and this into the glycol. Pimelic nitrile was obtained from diiodopentane by heating in alcoholic solution with potassium cyanide.—The action of mixed organomagnesium compounds on phthalimide and phenylphthalimide: Constantin **Béis.**—Iodo compounds obtained from metanitraniline: P. **Brenans.**—New synthesis of αα-dimethyladipic acid: G. **Blanc.**—On atmospheric formaldehyde: H. **Henriet.** In a preceding note the amount of formaldehyde existing in the air is estimated to be from 2 to 6 grams per 100 cubic metres of air. M. Armand Gautier has now pointed out that air containing such a proportion of formaldehyde is absolutely irrespirable. The production of carbon dioxide by passing the air over mercuric oxide heated to 250° C. must therefore be attributed to some compound of this aldehyde.—On recent results in porcelain manufacture: F. **Garros.**—On the mechanism of the contraction of muscular fibres, and in particular those of the adductor muscles of lamellibranchs: F. **Marceau.**—On some points in the anatomy of cirripedes: A. **Gruvel.**—The culture of spermatozoids: Alphonse **Labbé.** It is possible for the spermatozoid to commence to develop by itself on a simple culture medium, and away from any organised substratum.—The colours of flowers: G. **Coutagne.**—The question of the cultivation of cotton in tropical Africa: Aug. **Chevalier.**—The presence of hydroquinone in the pear: G. **Rivière** and G. **Bailhache.**—On the lateral roots of the pepper plant: H. Jacob de **Cordemoy.**—New researches on the vegetative apparatus of certain Uredineæ: Jakob **Eriksson.**—On the culture and development of the fungus which produces anthracnosis in the vine: P. **Viala** and P. **Pacottet.**—On the variability of temperature in the Antarctic regions: Henryk **Arctowski.**

NEW SOUTH WALES.

Linnean Society, May 25.—Dr. T. Storie Dixson, president, in the chair.—The botany of south-western New South Wales: F. **Turner.** The characteristics of the indigenous and acclimatised vegetation of the country lying between 35° S. lat., and the Murray or Hume River (the boundary between New South Wales and Victoria), and 141° and 147° E. long., are discussed. The census of the phanerogams and vascular cryptogams now brought forward comprises a total of 379 genera and 949 species.—Studies on Australian Mollusca, part viii.: C. **Hedley.** In August, 1902, Mr. G. H. Halligan and the author made a single cast of the dredge in 100 fathoms, 16 miles east of Wollongong—a depth for the first time attained by local workers. The haul was very successful, and produced a large number of Mollusca. The new species largely duplicated those of the *Thetis* expedition, and were noted during the progress of the report thereon. Other species of interest are now discussed.—The bacterial origin of the gums of the arabin group, xi., the nutrition of *Bact. acaciae*: Dr. R. Greig **Smith.** *Bact. acaciae*, the arabin-former, produces gum readily in the presence of suitable nutrients. Levulose, saccharose, maltose, mannite, and glycerin are sources of carbon, while dextrose, galactose, lactose, and raffinose are not. Dextrose or galactose prevents the gum being formed from levulose or maltose. The organism acquires and readily loses the power of utilising saccharose. It temporarily loses the gum-forming faculty when subcultivated upon sugar-free media. The amides are the best nitrogenous nutrients; a trace of asparagine (0·04 per cent.) is sufficient to produce half the maximum amount of gum. Salts may accelerate, depress or prevent gum-formation. Traces of alkaline citrate or succinate were most favourable. Sumach tannin assists the formation of gum upon artificial agar media. Oak tannin hinders the formation, but the retarding effect may be neutralised by the addition of glycerin. The bacterium might be used to distinguish certain tannins. The tannin probably acts physically by making the medium more contractile, so that the bacteria are slowly supplied with nutrients in solution. The optimum temperature is 17° C. The most suitable medium, as deduced from the experiments, serves as a diagnostic for other gum bacteria. Gum acacia has not a cellulose origin. In the host plant it is formed from the wandering sugars, levulose and maltose. Manuring with saline matters does not promise to be a remedy for the prevention of gum-flux in fruit trees. Peach trees that were inoculated with *Bact. acaciae* (from *Acacia binervata*) developed gum-flux. The exudate was a metarabin gum. The host plant can convert *Bact. acaciae* into *Bact. metarabinum*, proving what had been suspected, that the latter is a variety of the former, producing an insoluble gum. This explains the uniformity of the gums from certain species of trees.—The loss of colour in red wines: Dr. R. Greig **Smith.** Two samples of dry red wine which had exhibited the phenomenon of "*vin tourné*" were found to contain acetic bacteria.

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