THURSDAY, JANUARY 17, 1907.

SOCIAL PROBLEMS IN AMERICA.

The Future in America—a Search after Realities. By H. G. Wells. Pp. 359. (London: Chapman and Hall, Ltd.) Price 10*s.* 6*d.* net.

WE opened this book fearing that, like other books by the same author, it was an attempt to extrapolate or foretell the future from a mere man's quite inadequate knowledge of the present and the past; but we have been delightfully disappointed. Mr. Wells is acute in observation, he is well informed on English social problems, and he reasons carefully. His visit to America was very short, but it was preceded by much reading. He nowhere speaks dogmatically; he evidently restrains his inclination to draw general conclusions from a sense that he may be neglecting important premises, and such conclusions as he comes to seem to us to be sound and of value.

Americans have never been tolerant of outside criticism, even when it was obviously honest and good; yet surely it is needed, and is found useful by other nations. Never was an outside critic more kindly and sympathetic than Mr. Wells, and we have no doubt that during the next twenty years this book will be referred to and quoted from by every good writer on social problems, which, after all, are not peculiar to America. The American people are like the middle classes of England, France, and Germany; there is no feudal or aristocratic upper class, there is no earth-tied peasant. The American idea is the middle-class idea everywhere, but in America it has been carried out without restrictions; it fosters that kind of individuality which thrives on open and undisciplined competition for wealth.

And the time is coming when the American formula will no longer suffice. Settled conditions and great possibilities of wealth given by nature to a large middle-class kind of population have produced their natural effects. The compound interest law of increase of wealth is in action, and gigantic fortunes in the hands of quite common men have not only destroyed the idea of equality, but have become a danger to the community. Every energetic worker feels that there are limitations now being put to his chances of getting on. It is possible quite legally for rich individuals to further their schemes by widespread corruption. Corruption everywhere, but especially in municipal governments, has assumed such large dimensions that it seems impossible to remedy the evil. The average man attends to his own personal affairs, and has no sense of his duties as a citizen. He resents all Government interference. Indeed, it is part of the American formula that the cultured and rich men, and one may say the best men, take no interest in Imperial or State or municipal affairs—to touch pitch is to be defiled—and that the ordinary citizen thinks only of his own interests in this world and the next. Immigration is no longer British and Teutonic. The German and Russian Jew, the lower classes from Austria and Italy and Turkey are—nearly one million of them a year—welcomed as necessary recruits in the serf army of the capitalists. In this serf army the children and women are the chief sufferers. No story told of an old Lancashire factory can compete with some of the horrors of New Jersey at the present time.

There has always been in America a widespread contempt, not for the law, but for abstract justice, so that even well-minded, influential people do not set themselves to remedy obvious wrong when by so doing they might hurt themselves or their party in the eyes of multitudes of base and busy, greedy and childish, malevolent and ignorant voters. The unfairness of the southerner to the negro is no longer confined to the south, and the crimes of a few negroes exasperate white people so much that they forget the kindly ways of the average man of colour, and thus the negro question is becoming more complex.

But thoughtful Americans are already feeling the inadequacy of their old formulas. New ideas are organising themselves out of the little limited efforts of innumerable men. Many universities are busy on the study of social problems. The younger generation is already raising an opposition to the tyranny of mere industrialism by cultivating religious, philosophic, literary, scientific, artistic, and political thought, and they are doing this, not as a mere matter of taste, but in their sacred duty as citizens.

One of the most interesting chapters in this book is entitled "Culture." If it were possible to get Boston to read anything of recent date, the perusal of this chapter would produce a much-needed revolution there. Between that Scylla, the fervid ignorance of the workers of Paterson, and that Charybdis, the prestige and mere knowledge and genteel aloofness and culture which make Boston useless, the creative minds of the university reformers must steer their dangerous way. At futile Washington Mr. Wells found a real man, the anxious, perplexed President, who is a microcosm of his hundred million subjects, who sees all that is wrong and the difficulty of reform. Mr. Roosevelt assimilates all that makes for reform in contemporary thought, and causes it to reverberate over the land so that it becomes familiar to all people. At the root of all reform is political reform, creating a legislature at Washington and an executive which shall be in harmony with one another, and which under proper safeguards shall be able to put aside the present obstruction of the various States. Only a great educated and sustained agitation can bring about such a revolution.

Mr. Wells would almost leave us still in doubt—may not America, after all, be a great futility? But just at the very end we find him optimistic. We are inclined to think that Mr. Wells pays too much attention to America of the present, and that if he thought more of America of the past he would be altogether optimistic. Mrs. Trollope and Cooper and Dickens differed but little in opinion, and can any candid student of their writings deny that America

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has surmounted social difficulties which looked almost insuperable sixty years ago? What Mr. Wells says is all true, but there is also much more to be said. The average American neglects politics and selfishly thinks of his own interests; yes, but every now and again he shows himself capable of the highest kind of self-sacrifice. At the back of the futile Boston culture is the spirit of Charleston Neck and Bunker's Hill; and the cultured Bostonian had this great merit, he saw that Abraham Lincoln could save the country. We consider that the worst thing in America is Philistinism, commonness or vulgarity of thought; the great merit of Boston is that she has always combated this. Then, as to immigration, we believe that an intermixture of all the European races (and, if we could only get it, an assimilation of the Jews) would produce the very finest nation ever known. These lower races of whom Mr. Wells speaks are a danger only for a time; in the second and later generations their presence will be shown in a better appreciation of music and literature and painting.

The supreme danger to any State lies in the diminution of its middle class; this is the greatest lesson of history. We see no chance of such a diminution in America for a very long time to come. Furthermore, there is an evident growing determination in this middle class that social problems shall be solved at whatever cost. Lynching is altogether evil, but it occurs only in certain parts of a country of enormous size still nearly empty of inhabitants; it certainly is altogether against the spirit of the American people, one of whose strongest characteristics has always been a respect for *law*. It was a product of the slave system, and is diminishing.

The Europeanised American who scorns politics is truly a curse to himself and his own country and to Europe, but there is now a new revelation. Mr. Roosevelt is not the only rich, educated American who has conquered his fear of touching pitch. We agree with Mr. Wells as to the inferiority of American school education, the root of all evils; but the sole cause of this is poor payment for teachers, and, like many another great mischief in America, may be altered almost by the stroke of a pen. Has not universal spitting, the habit most dreaded by Dickens, disappeared in one half-year? Anything in the way of quick reform is possible in a country like America, where everybody reads, and where the cheapest monthly magazines, published by millions, contain serious articles about the great American problems and reforms; where in all States north of the Washington parallel the people resemble the Scotch; that is, even the commonest labourers are accustomed to abstract reasoning because of their early religious education. We cannot doubt that it will work out triumphantly its own and our salvation, for it is to be remembered that all the insoluble-looking problems of America are coming for solution more slowly upon England and France and Germany. We believe that Mr. Wells has done something important towards solving such problems, and it is not merely America that ought to be grateful to him.

JOHN PERRY.

NAVAL CHEMISTRY.

Service Chemistry: a Short Manual of Chemistry and its Applications in the Naval and Military Services. By Vivian B. Lewes and J. S. S. Brame. Third and revised edition. Pp. xvi+675. (London: Henry Glaisher; Greenwich: J. Glaisher, 1906.)

THIS book was primarily designed for the use of officers passing through the Royal Naval College, Greenwich, who while requiring to know something of the practical applications of chemistry to their profession if they are to carry out its multifarious duties intelligently and efficiently, have only a very limited amount of time to give to the study of the science. The naval officer nowadays is confronted with conditions which were absolutely unknown to and undreamt of by those who were placed in charge of our old "wooden walls." Steam and steel and high explosives have completely revolutionised the navies of to-day, and modern men-of-war are the embodiment of the most advanced developments of mechanical, physical, and chemical science. He who would handle these costly creations to the best advantage needs to have acquaintance with the scientific principles upon which their construction, maintenance, and effective employment depend, and what intelligent handling means, and what momentous issues may depend upon it, was demonstrated in a manner which profoundly impressed the whole world in the ever-memorable battle of the Sea of Japan. That object-lesson has given rise to much heart searching on the part of every maritime Power. Whether we are bettering the example of our Eastern ally—whether, indeed, we are really following it—is a matter which gravely concerns this nation. It would, of course, be out of place in this connection to discuss the various factors upon which the astonishing success of Japan depended; patriotism, courage, the spirit of self-sacrifice, discipline, intelligence, and integrity—in a word, what we understand by *moral*—were no doubt at the bottom of it all. But these qualities alone might have availed little unless supplemented by skilful direction of the machinery and appliances of which our modern engines of destruction are built up, and skilful direction depends upon an intelligent appreciation of the scientific principles underlying the construction and efficient use of these appliances. The rulers of rejuvenated Japan had clearly grasped this fact, and it cannot be questioned that it is to the manner in which they have given practical effect to this recognition in the training of their naval and military leaders, even during the short space of a generation, that their supremacy in the East is mainly due.

There is, of course, much in chemistry which in no conceivable circumstances can have the slightest professional interest to the naval man, and which, therefore, it would be useless and a waste of time to trouble him with.

But every naval officer is the better for knowing something, for example, of the causes of corrosion and fouling of ships; of the nature of boiler incrustations; of the properties and composition of various forms of fuel; of the chemical characters of explosives,

&c., and it is precisely to matters like these that Prof. Lewes's scheme of instruction is mainly directed. How to develop such a scheme on scientific lines under the conditions and limitations which have necessarily been imposed upon the authors is a problem of no small difficulty. That they have completely solved it in this book, even in the amended and extended form in which it now appears, they themselves would doubtless be the first to question. At the same time, there is nothing in our language even approximately resembling it, and it still remains the only manual which deals exclusively with the chemistry of the special matters with which the naval officer is more immediately concerned.

The present volume differs from its predecessors in many important points. With the collaboration of Mr. Brame it has been largely re-arranged and in great part re-written, and care has been taken to embody the latest information so far as this was available to the authors.

The theoretical part is necessarily very restricted. Indeed, it is obvious that the philosophical aspects of chemistry have hardly more attraction for the authors than they have for the special class to whom the book is addressed. This, of course, is one of the difficulties of the problem. It is of no practical use to teach chemistry to naval officers as if they were going to be professional chemists, and the authors have therefore wisely confined themselves in the main to such theoretical aspects of the science as are related to the matters with which naval men are directly interested.

Naturally the applications of theory are constantly extending, and what is "theory" to-day becomes "practice" to-morrow—a truism of which the authors, it must be added, are not unmindful, for imperfect and partial as their treatment of doctrinal questions may be, it is probably sufficient for such developments as are likely, at all events in the near future, to occur.

In one respect the book differs very materially from the ordinary run of chemical text-books, namely, in the large amount of original information it conveys. Prof. Lewes's official connection with the Admiralty has necessarily caused him to pay special attention to chemical matters of importance to the service, and many of the results of his inquiries, some of which, indeed, are the outcome of prolonged investigation, are summarised in his manual. Although, as stated, it is primarily intended for the naval officer, there is much in the work which is of equal interest to the military man and to the practical engineer.

We have noticed one or two errors, but they are of minor importance. Silicon was first isolated by Berzelius in 1823, and not, as stated, by Davy in 1813. There is no such thing as P_2O_3; phosphorous oxide has the formula P_4O_6, just as its analogue arsenious oxide has the formula As_4O_6. The description of the mode of manufacture of the lucifer match hardly corresponds with modern practice; white phosphorus is rarely used in the "strike-anywhere" match to-day; it has been almost wholly replaced by phosphorus sesquisulphide.

FORMATION OF ICE ON THE ST. LAWRENCE.

Ice Formation, with Special Reference to Anchor-ice and Frazil. By Howard T. Barnes. Pp. x+260. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd.) Price 12*s.* 6*d.* net.

THE effects of the severe Canadian winters on such a large river, with a variable flow, as the St. Lawrence afford remarkable opportunities for studying the phenomena of ice formation, which the author has availed himself of during the last ten years; and this book records the results of his observations and the conclusions he has drawn from them. Moreover, in order to render the account of his investigations on ice formation more complete, he has introduced the subject with three chapters, on the "Physical Laws governing the Transfer of Heat," "Physical Constants of Ice," and "Formation and Structure of Ice," and has added towards the end a chapter on previous "Theories to account for Frazil and Anchor-ice," which would more suitably have preceded the exposition of his own views in the fourth chapter. Lastly, in the final chapter, the author gives a practical application to his investigations by indicating the causes which, in severe winters, are liable to occasion the stoppage of water-power works, and suggesting measures by which accumulations of ice at critical points, tending to arrest the flow of water, may be reduced.

Three forms of ice are found in the St. Lawrence in winter, namely, sheet- or surface-ice, frazil-ice, and anchor-ice, differing in their mode of formation, their general appearance, the position they occupy in the river, and the effects which they produce. Sheet-ice is the well-known form of ice which, when the temperature falls below the freezing point, gradually forms on the surface at the sides of a sheet of still water, spreads out into deeper water if the cold continues, and increases slowly in thickness. Frazil-ice is the French-Canadian term, signifying cinder-ice, for a peculiar spiky form of ice supposed to resemble cinders, which is formed on the surface in open channels where the current is too rapid for the border-ice to extend across them; and this ice, which is sometimes called slush-ice, varies in its formation according to the amount of agitation of the water, appearing as flat plates on the smooth surface of a current, or as numberless minute needles in rapids and at the base of waterfalls. These needles of ice increase in bulk in traversing open water for some distance, and eventually fill up the open channel during the prevalence of great cold and strong winds often experienced in Canadian winters. This fine ice is often carried by the current a long way under surface-ice which has formed lower down, and, becoming attached to the under-side of this sheet, and gradually accumulating and becoming consolidated, it is liable to dam up the channel completely down to observed depths of 80 feet, and, consequently, raise the level of the river considerably above.

Anchor-ice, as it is called in Canada, and known as *glace-du-fond* in France and *Grundeis* in Germany, has been long observed in most countries where ice

forms in rivers, and is the term applied to ice formed on and attached to the bottom of rivers. This anchor-ice is only formed in rivers where the current is too swift for surface-ice to form, and not in depths exceeding 40 feet to 45 feet, though in the clear sea-water off the coast of Newfoundland it is largely formed at depths of 60 feet to 70 feet. Its formation appears to be rightly attributed to loss of heat in the bed of the river from radiation, for it occurs on clear, cold nights, and is impeded by any form of shelter interfering with radiation, such as under a bridge; it does not form at all under surface-ice arresting radiation, and is less below a turbulent river than in a clear, still sea. Frazil-ice is the cause of the packing up of the ice and of the floods of the St. Lawrence, and also of the obstruction to the working of the power plants in the winter. When a river is completely frozen over, the channel is protected from the formation of frazil-ice or anchor-ice, unless there is an expanse of open water above, from which frazil-ice, and in mild weather anchor-ice, is carried down. To prevent the stoppage of the power works in the latter case, the author suggests that the gates, the rack for arresting débris, and the wheels should be placed under shelter; that the iron bars of the rack should be heated; and that the passage of the frazil-ice should be facilitated as much as possible, and prevented from agglomerating by the occasional injection of steam.

ROMANTIC INDIA.

Under the Sun: Impressions of Indian Cities. By P. Landon. Pp. xii+288; illustrated. (London: Hurst and Blackett, Ltd., 1906.) Price 12*s.* 6*d.* net.

THIS is one of the crop of books on India by Press correspondents who visited the great Eastern dependency during the recent tour of the Prince of Wales. Its author had previously on one or two occasions spent some weeks in the country, and now presents part of his already published letters "recast in a more permanent form." It is perhaps inevitable that the great bulk of the impressionist literature on the East should issue from the hurried pens of the cold-weather globe-trotters, whose "butterfly zigzags" over the country undoubtedly enable them often to see things from fresh and comparative, if somewhat superficial, standpoints. With all India to roam over, it would be surprising did the oft-told tale of Indian cities not bear some repetition at the hands of such an imaginative journalist as Mr. Landon. He certainly has produced a readable book, though many of his sketches convey less clear-cut impressions of the places than those of some other writers who have gone over the ground before, Steevens, for instance; and they lack proportion. Some point is seized on and overstrained with a discursiveness that causes the reader at times to lose the thread of the narrative, whilst other more characteristic features of the picture are omitted.

The author betrays a weakness for unnecessarily dragging in vernacular names (some of which are misspelt, *e.g.* "bebel," which occurs a dozen times for "bābul," the *Acacia arabica*), with no word of explanation to the reader as to what the thing is, and his too frequent use of superlatives leads him into meeting the most transcendental thing "on earth" many times on his trip. Thus we are told within a hundred pages that at Udaipur "one room is without rival on earth." The Indian antelope and cheetah are "two of the fastest animals on earth—the cheetah is beyond all question the swiftest." Jaipur has "colours that only Mandalay of all places in the world can hope to rival." A "dishonest and fugitive jeweller from France" is "the first decorator of all known periods." The Delhi grand trunk-road is "the most historic highway in the East." Although the Taj is "the crown and goal of all that India has of beauty and romance," the Queen's monastery at Mandalay is "the most picturesque place in the East, probably in the world," though a few pages previously we read that the Shwe Dagon pagoda at Rangoon also is "the most picturesque place in all the East."

As to details, he is not over careful; he speaks of bread-fruit "palms," and of the reedy banks of Calcutta "flaming with patches of rose lotus"—this might be the case if lotuses grew on banks, but they do not. At Darjiling, he says, "the valley stretches out ten miles wide from the foot of the precipice"; as a fact, the valleys there are narrow ravines, none of which has a width of more than a quarter of a mile at its bottom. The photographs of the hackneyed views one has so often seen before are good and well reproduced; the same, however, cannot be said for the coloured prints, which are unpleasantly low-toned from a too liberal application of dull paint; the sombre view of "the sunset glories of the Hugli" is utterly unlike what it is meant to represent.

A chapter is added on the later life of the notorious rebel and fugitive of Mutiny days, Nana Sahib, purporting to give "historical facts here presented for the first time." No one, however, can seriously be expected to accept as evidence the old re-discovered bazaar rumours picked up by a passing traveller and set down without absolutely any proof whatever in support of them, all the more so as such an experienced Anglo-Indian magistrate as Sir Dennis Fitzpatrick, commanding the resources of the Imperial secret police, was specially deputed to sift such rumours at the time, and finally rejected them as wholly unfounded. There is no index, but this, perhaps, is unnecessary for fugitive sketches.

OUR BOOK SHELF.

Species and Varieties: Their Origin by Mutation. Lectures delivered at the University of California. Second Edition, Corrected and Revised. By H. De Vries; edited by D. T. MacDougal. Pp. xviii+847. (Chicago: Open Court Publishing Co.; London: Kegan Paul and Co., Ltd., 1906.)

IT is not surprising that the first edition of De Vries's lectures in America should be followed by a second after the lapse of a year. All the misprints that we pointed out in our review of the first edition have been corrected; and even our suggestion that uniformity in the termination of the adjectives derived from such terms as physiology was

desirable has been adopted. But, curiously enough, the uniformity is intra-verbal and not inter-verbal; for whilst the physiologics and physiologicals of the first edition appear as physiologics in the second, and whilst the same course has been followed with the adjectival forms of morphology and palæontology, the empirics and empiricals of the first edition appear as empiricals in the second. We condemn the manner in which this uniformity has been introduced. We are perfectly aware that morphologic is correct, and that morphological is hybrid and redundant, containing as it does a Greek and a Latin adjectival termination, but we hold that the former is ugly and that the latter is not. If the customary termination is allowed in the case of empirical, on what grounds is it refused in that of physiological? If in our choice of the forms of terms we have to choose between those with the meaning and sound of which we have become familiar, be they never so hybrid, and those forms of them that we are told are strictly log*ic*, let us by all means choose the former.

There is no need to commend the book. It is indispensable, inasmuch as it is the only available account of Prof. de Vries's work in English, so far.

A. D. D.

Time and Clocks: a Description of Ancient and Modern Methods of Measuring Time. By H. H. Cunynghame, C.B. Pp. 200. (London: Archibald Constable and Co., Ltd., 1906.) Price 6*s.* net.

IN this volume the author has gone much further than the title and subtitle would lead one to expect. Not only are the "ancient and modern methods of measuring time" discussed, but an attempt has been made to lead the non-scientific reader to a knowledge of the many principles involved in a series of logical steps. Mass, gravity, space, harmonic motion, &c., &c., are all discussed at length, whilst excursions into the ancient concepts of various phenomena are by no means infrequent.

We rather fear that the reader who has not gone through a course of dynamics will find it hard to grasp the significance of the various discussions, despite the clear reasoning and simple examples, whilst to the science student a greater part of the matter is unnecessary.

Still, in the hands of a youth trained in the ideal fashion suggested by the author at the end of the book (p. 186), the volume, carefully digested, should prove of service and tend "to keep the young rascal from worrying his sisters and stoning the cat."

W. E. R.

Conduction of Electricity through Gases. By Prof. J. J. Thomson, F.R.S. Second edition. Cambridge Physical Series. Pp. vi+678. (Cambridge: University Press, 1906.) Price 16*s.*

THIS book, the first edition of which was fully noticed in NATURE (vol. lxix., p. 74), will be welcomed by all those who are striving to keep up with the rapidly growing literature of an increasingly important subject. It was the author's researches in this field which first paved the way for the rapid extension of our knowledge which has taken place in the last few years. Much still remains to be done before the innumerable phenomena encountered in the study of the electrical behaviour of gases can be considered fully elucidated, and to the thoughtful worker these still unoccupied regions will probably be the most attractive. While this book has been waiting notice on the reviewer's table, frequent reference has been made to it for work that has appeared since the issue of the first edition, and in no case in vain. It maintains in an enhanced degree its good qualities as a work of reference none engaged in the subject can be without, and as an authoritative exposition of a field of work the author has made his own it has its own place among a wide circle of readers.

The New Physics and Chemistry: a Series of Popular Essays on Physical and Chemical Subjects. By W. A. Shenstone, F.R.S. Pp. vii+360. (London: Smith, Elder and Co., 1906.) Price 7*s.* 6*d.* net.

WHEN a collection of essays upon the chief problems in physical science engaging the attention of investigators at the present time is published without an index, its value to students of scientific progress is greatly diminished. Mr. Shenstone evidently does not intend the book to be used for reference, otherwise he would have provided a key to its contents. His essays, which originally appeared in the *Cornhill Magazine*, represent popular science at its best, and rehearse the outstanding features of the new physics and chemistry in a style easy of comprehension. The book should serve a useful purpose in revealing to readers familiar with the concepts of physical science the richness of fact and theory relating to the properties and constitution of matter and the ether.

The Manufacture of Light. By Prof. Silvanus P. Thompson, F.R.S. Pp. vi+67. (London: Macmillan and Co., Ltd., 1906.) Price 1*s.* net.

PROF. THOMPSON'S evening lecture delivered at the York meeting of the British Association in August last is here presented in an attractive form. Twenty-eight clearly reproduced illustrations assist greatly in a thorough comprehension of the discourse. After a brief description of primitive sources of light and a reference to the inventions of gas and electric lighting, the general question of incandescence is discussed. This is followed by an account of photometry and an explanation of the inequality in different directions of the light from various sources. After dealing with the sensitiveness of the eye to radiations of particular wave-lengths, the measurement of emission, and the temperature and quality of radiation, Prof. Thompson describes various incandescent gas-lights, new kinds of glow-lamps and arc-lamps, and concludes with a consideration of the cost of the manufacture of light. The little book should have a wide popularity.

Lichtstrahlung und Beleuchtung. By Paul Högner. Pp. ix+66; illustrated. No. 8 of Dr. G. Benischke's "Elektrotechnik in Einzel-Darstellungen." (Brunswick: Vieweg and Son, 1906.) Price 3 marks.

THIS book gives a clear exposition of illumination by means of electric arc lamps. The theory of the subject is well set forth, and starts from a sufficiently elementary foundation to be easily followed by the average student. The chief feature of the work is a number of tables giving data concerning illumination under different conditions, and these might be profitably consulted by those wishing to arrive at the best results in a given case. The book is well printed and the diagrams are good.

A Synonymic Catalogue of Orthoptera. Vol. ii., Orthoptera Saltatoria, Part i. (Achetidæ et Phasgonuridæ). By W. F. Kirby. (London: Printed by Order of the Trustees of the British Museum, 1906.) Price 15*s.*

THIS volume is the continuation of Mr. Kirby's synonymic catalogue the first part of which was published in November, 1904. The present work includes the Achetidæ, or crickets, and the Phasgonuridæ, or long-horned grasshoppers, often improperly called Locustidæ. The true Locustidæ, or short-horned grasshoppers—often called Acridiidæ—will form the third and concluding volume of this work.

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.]*

Production of Radium from Actinium.

IN a recent letter to this Journal (November 15, 1906) Dr. Boltwood has given an account of experiments which show that radium is continuously produced in a solution of actinium, and concludes that radium is a disintegration product of actinium, the latter occupying an intermediate position in the family of disintegration products between uranium and radium. The radium is produced from the actinium at about the theoretical rate, and he deduces in a simple way that the time for radium to be half transformed is about 3000 years. These results of Dr. Boltwood are of great interest, and mark an important stage in the search for the somewhat elusive parent of radium.

It may be of interest to the readers of NATURE to give a brief account of some experiments I have made on this subject, the results of which were communicated to the American Physical Society at New York on December 28, 1906. In the Bakerian lecture of 1904 (Phil. Trans., A, p. 169, 1904) I briefly described some experiments that had been commenced to see whether actinium produced radium. Some of Giesel's actinium was taken, dissolved in acid, and the greater part of the radium then present was removed by precipitating barium in the solution. The amount of radium left in the solution was determined by the emanation method, using an electroscope carefully calibrated by means of a standard radium solution. Over a period of three months no very certain evidence was obtained that the amount of radium had increased. The solution of actinium was then set aside in a closed vessel with the intention of testing it for the presence of radium at regular intervals. In the meantime, the great danger of possible contamination, in testing solutions for radium in a laboratory where considerable quantities of radium were continually in use, was recognised, and for this and other reasons the solution was not again tested until two and and a half years had elapsed.

When Dr. Boltwood informed me of the growth of radium in his actinium, I at once tested this solution for radium by the emanation method. A preliminary observation showed that there had been a large increase in the quantity of radium in the solution in the interval since the early experiments. In the course of making an accurate determination, the solution was unfortunately contaminated with radium, probably through the use of a lubricant on a stop-cock attached to the vessel. Under such conditions I could place no reliance on the final measurement. Happily, however, I had placed aside, at the time of preparing the original actinium solution, a sample of the actinium salt the radium content of which at that time had been accurately determined. This was now tested, and the amount of radium in it was found to have increased at least four times the initial value in the two and a half years' interval, showing a rate of growth of radium in the actinium of much the same magnitude as that observed in the experiments recorded later. I think that my failure to observe an increase in the amount of radium in the actinium solution over a period of three months was due to the unsuitable chemical treatment used initially to remove the radium from the actinium. An excess of sulphuric acid must have remained in the solution, and this would tend to precipitate the radium when formed as sulphate—a condition in which probably only a fraction of the emanation would be released. A considerable increase in the amount of radium might consequently only show a small increase in the amount of emanation carried away by aspirating air through the solution.

Experiments were at once undertaken to remove the radium again from the contaminated solution by a simpler and better method. This proved successful, and only a minute fraction of the radium was left in the solution. The latter was then placed in a glass vessel, and the amount of radium in it determined weekly by boiling out the emanation, and then introducing it into a suitable emanation electroscope. A progressive increase in the amount of radium has been observed, amounting to 80 per cent. of the initial value over a period of five weeks. If this rate of growth continues at a constant rate, the amount of radium in the solution at the end of a year should be more than eight times the initial value. The actinium used in this experiment was equivalent to about half a gram of an actinium preparation of activity about 250 times uranium, and the rate of growth of radium observed corresponds to about 3×10^{-9} gram of radium per year.

There is one important point that suggests itself in considering the results as given by Dr. Boltwood. The growth of radium observed in his actinium solution possibly might arise, not from the actinium itself, but from another distinct substance, normally separated from the radioactive mineral with the actinium. In order to throw some light on this question, I compared the rate of production of radium observed in my actinium with the rate of production to be expected on the simple theory, supposing that the actinium is transformed directly into radium. Without going into details, it suffices to say that this can be done by comparing the α-ray activity of a known fraction of the actinium solution in the form of a very thin film with that of a thin film containing a known quantity of radium. In this way I calculated that the growth of radium observed agreed with the disintegration theory, if the period of half transformation of radium was about 2600 years. The period so deduced is not very different from that determined by Boltwood from quite distinct considerations. This is satisfactory so far as it goes, but such an agreement between the periods obtained by the two methods implies that the activity, due to the actinium in pitchblende, is about the same as that due to radium and its products. As a result of careful measurements, Boltwood, however, found that this is not the case, for the activity due to the actinium is only a small fraction of that due to radium. Further experiments are required to explain this anomaly.

There is one other point on which I have made a number of experiments. If radium arises from actinium, it should be produced by the active deposit of actinium which contains the last products of the actinium series, namely, actinium A and B. In order to test this, a platinum plate was made the negative electrode in a vessel containing a very active actinium preparation, and the active deposit was collected for a week or more. The platinum plate was then removed and immersed in a closed vessel containing dilute hydrochloric acid. After standing for a week, the accumulated emanation was boiled out, and the amount determined in an electroscope. Knowing the amount of the α-ray activity due to the active deposit on the platinum plate compared with the activity due to a thin film of radium, and also the time of exposure, it is a simple matter to calculate the growth of radium to be expected on the assumption that radium is half transformed in about 3000 years. Using a small platinum plate, the amount of radium observed was certainly not greater than one-tenth the theoretical amount, and, with a much larger plate, not more than one-fifth. In these experiments the greatest care was taken to avoid any possible radium contamination. The observations were made in the chemistry building which is free from radio-active material, and I was fortunate in having the use of the emanation electroscopes of low natural leak, set up by Mr. Eve, who kindly assisted me in these experiments. The plates and solutions employed were initially tested for the presence of radium, so that the growth of radium observed, though much smaller than the theoretical amount, was still quite definite. These experiments are being continued. The smallness of the amount of radium observed may either be due to the presence of another change between actinium B and radium, or, what is more probable, to the loss in an electric field of the radium formed on the platinum plate. Such a possibility is suggested by the results of Meyer and Schweidler, who observed that there was always a small residual activity on substances, exposed for a long time in the presence of the actinium emanation, which gradually disappeared.

Further experiments are in progress to examine in the early stages the growth of radium in actinium, initially freed from radio-actinium and all its products. If actinium changes directly into radium, the initial growth of the radium should be much smaller than that to be obtained three months later, when the products are in approximate equilibrium.

The results of my experiments are thus substantially in agreement with those of Dr. Boltwood. There is no doubt that the immediate parent of radium is present in actinium separated from pitchblende, but certain points remain to be settled before it is definitely proved that radium is the direct lineal descendant of actinium. Since the proof of this relationship between actinium and radium involves many important theoretical consequences, I think it is advisable to await the results of further experiment in this direction before basing far-reaching conclusions upon it. E. RUTHERFORD.

McGill University, Montreal, January 3.

Helium and Argon in Common Rocks.

THE quantity of radium found in granites and kindred rocks (Proc. Roy. Soc., A, vol. lxxvii., p. 472), about 10^{-11} grams per c.c., suggested that the associated helium might be present in sufficient quantity for spectroscopic detection. This has proved to be the case. Thus 250 grams of Matopo granite yielded 3 c.c. of nitrogen on heating. This nitrogen, on sparking down, gave a residue of about 1/100th part of its own volume. The residue was introduced into a vacuum tube, and showed the spectra of argon and helium quite brilliantly, and in about equal intensity. Similar results were obtained with syenite rocks from Mt. Sorrel in Leicestershire, and from Norway.

It seems more than probable that these observations afford an explanation of the nature of the gases evolved by mineral springs. The invariable presence of a notable quantity of helium in such gases has always been considered remarkable. It would seem that it may be sufficiently explained by the action of hot water in disintegrating common rocks and liberating the gases contained.

It is my intention to examine a large selection of common rocks and minerals, and particularly with the view of determining whether helium in them is always associated with radium, or whether its presence can ever be attributed to radio-activity of ordinary materials.

R. J. STRUTT.

Sunnyside, Cambridge, January 13.

Ionisation and Absorption and Anomalous Dispersion.

DR. STARK (NATURE, vol. lxxiii., pp. 78, 389, 533) has given a theory, based on his canal-ray experiments, according to which spectrum series are due to positive ions. It occurred to me that its applicability to thermal emission might be tested by experiments on the ionisation accompanying the anomalous dispersion in sodium vapour. Accordingly, together with Mr. Needham, I made some preliminary experiments, using a slight modification of Prof. Wood's well-known apparatus ("Physical Optics," p. 340), of which the results seem to be of sufficient interest to deserve publication.

We used a steel tube, 40 cm. long, with an insulated iron wire stretched inside and along it about 1 cm. from the sodium surface. The poles of a battery were connected to the wire and tube through a liquid resistance and galvanometer (1 division = 10^{-8} ampere about); the tube was placed between the collimator and grating of a spectroscope, and the image of a horizontal fine wire stretched across the slit was observed in the first spectrum with a micrometer eye-piece. The separation, due to anomalous dispersion, of the two halves of the image on opposite sides of the absorption band was assumed to be a sufficient measure of the anomalous dispersion.

Curves constructed from observations of anomalous dispersion and current show that every variation of the ionisation, due to some irregularity of pressure and temperature, is accompanied by a corresponding variation in the anomalous dispersion.

The simplest explanation of the parallelism between the curves is that the D lines of sodium are due to positive ions rather than to neutral atoms, in accordance with Stark's theory. G. A. SCHOTT.

Physical Laboratory, University College of Wales, Aberystwyth, December 20, 1906.

THE MILLAIS BRITISH MAMMALS.[1]

WITH the appearance of this volume we have the pleasure of congratulating the author on the completion of a very heavy task. As we have had occasion to remark in our notices of the two earlier volumes, from the point of view of pictorial illustration the work is in the main all that can be desired, and there is little doubt that in this respect it will long remain absolutely without a rival. Our very heartiest congratulations may accordingly be tendered to Mr. Millais and his fellow artists on the result of their endeavours to illustrate in an adequate and exhaustive manner the living and recently exterminated mammals of the British Isles. In giving as the

FIG. 1.—The Hare. From "The Mammals of Great Britain and Ireland."

frontispiece of the present volume a picture of a southern right-whale attacked by a party of grampuses, or killers, it may possibly be objected that the author has introduced a scene which cannot now be witnessed in British waters. Since, however, the past as well as the present state of the fauna of our islands enters into the purview of the work, there may be justification for such an illustration; and even if this be not the case, the privileges of artistic license may be pleaded as sufficient excuse. Had space been available, we should have had much pleasure in reproducing one of the full-page illustrations which form by far the most striking feature of the work. Failing this, we have to be content in presenting to our readers (by the courtesy of the publishers) three of the smaller illustrations as examples of the pictorial merit of the work.

The groups included in the present volume comprise the hares and rabbit; the ungulates, of which (if we exclude the white park-cattle, which are obviously not wild animals) the red deer, the fallow deer, and

1 "The Mammals of Great Britain and Ireland." By J. G. Millais. Vol. iii. Pp. xii+384; illustrated. (London: Longmans, Green and Co., 1906.) Price 6*l.* 6*s.* net.

the roebuck are the only survivors in a wild, or half-wild, condition; and the cetaceans.

In regard to the hare, the author discusses, without coming to any very definite conclusion, the popular idea that this animal sleeps with its eyes open. Without having any first-hand information to offer on the question, we venture to suggest that the idea has no foundation in fact, as it must be obvious that when an animal is unconscious it can make no use of its eyes, whether open or shut. Many persons, it appears, doubt whether the rabbit can swim; but on this point Mr. Millais has ample testimony, and he describes in detail the manner in which this rodent makes its way in the water on the rare occasions that it takes to that element.

In "British Deer and their Horns" Mr. Millais

FIG. 2.—Head of an English Red Deer killed in 1905. Points, 15. Generally considered to be the finest example taken within recent years. From "The Mammals of Great Britain and Ireland."

has already shown that he is well acquainted with the habits of the three surviving British representatives of the Cervidæ, and on this subject his observations in the volume before us are well worthy the best attention of the reader. Of special interest is the statement that the new antlers of deer begin to grow before the old ones are shed, this, so far as we are aware, not having been previously recorded.

In the course of his account of the red deer Mr. Millais devotes a considerable amount of space to the contention that the division of this widely distributed species into local races is not supported by the evidence available. "All the needless names on the part of scientific zoologists, who in most instances have worked on insufficient evidence, have," he writes, "only resulted in endless chaos, to the somewhat supercilious amusement of sportsmen, who in this case have shown that they know more about the red deer than the zoologists."

To the allegations in this statement we have no hesitation in giving a flat denial, and it is nothing short of presumption on the part of an amateur naturalist like Mr. Millais to set up his opinion against those of specialists of the calibre of Prof. Einar Lönnberg, of Upsala, and Dr. Satunin, of Tiflis.

The plain fact of the matter (and there are occasions when it is necessary to write strongly) is that our author does not realise what naturalists mean by local races or subspecies, as may be gathered from his remarks concerning the intergradation of different local forms of red deer. Is he aware, we may remark, that the essential idea of a subspecies is that it should intergrade with the typical or some other form of the species, and that many naturalists claim that when such connecting links have died out the aberrant form must rank as a species? Lack of knowledge characterises also his remarks concerning minor local differences in animals. The fact that Perthshire grouse are distinguishable by an expert from the birds found in Caithness, and Tay salmon from Tweed salmon, is, for instance, no argument against the validity of subspecies. On the contrary, it tends exactly the other way, merely giving rise to the question as to the degree in which it is advisable, or practicable, to recognise such local differences in zoological nomenclature.

That the large, black-bellied eastern red deer, or maral, and the small North African red deer are perfectly distinct from the typical red deer of Sweden does not admit of argument. Dr. Lönnberg, in a paper (*Arkiv Zool.*, vol. iii., No. 9, 1906) which may have appeared too late for mention by Mr. Millais, goes further than this, and separates the Norwegian red deer as *Cervus elaphus atlanticus* and the Scotch animal as *C. e. scoticus*; but these local forms, as might be expected, are much nearer one another than are those mentioned above.

In treating of the white park-cattle, Mr. Millais, we are glad to see, recognises the fact that they are essentially descendants of albino domesticated breeds, and in no sense wild animals. He believes, however, that they are derived from Continental rather than British breeds. In this respect he runs counter to the opinion of Low, who knew more about these cattle than many later writers; and it would seem that he is unacquainted with the white Pembroke breed, of which specimens are now living in the Duke of Bedford's park at Woburn. Anyone who has seen these animals will have little doubt as to where to look for the ancestry of all breeds of park-cattle.

In regard to relics of the old wild ox or aurochs, Mr. Millais states, on the alleged authority of the present writer, that two horns, formerly used as drinking cups, are preserved in Paris. If he will refer to "Mostly Mammals" he will find it stated that, up to the French Revolution, both these horns were preserved in Alsace, and that only one, which probably did not belong to the aurochs at all, was mounted as a drinking cup. Both have now disappeared, so far as can be ascertained. Since Mr. Millais is sceptical as to the view now generally accepted with regard to the colour of the aurochs, or urus, it may be well to quote the observations on

this subject of Prof. T. Noack, who, after referring to certain errors by the copyist in the German edition of Herberstain's work published in 1556 or 1557,[1] concludes as follows:—"Der *Bos primigenius* hat sich aber zweifellos in verschiedene Lokalrassen gespalten, die viellicht auch verschieden gefärbt waren, den wir haben keinen Beweis dass alle Ure schwarz mit weissgrauem Rückenstreif waren, der auch bei dem Herberstainchen Exemplar sehr gut angedeutet ist." As the late Prof. Nehring was also convinced that Herberstain's aurochs was black, it will require much more evidence than is offered in the present volume to make us believe that it was more probably red.

As regards the section on British Cetacea, which occupies a large portion of the volume, we are glad to be able to accord almost unstinted praise to the author. Mr. Millais has seen for himself a considerable number of the species he discusses in their native waters, and he is therefore able to write with authority regarding their habits and appearance. Many of his sketches and photographs are therefore of special value and interest. He has, of course, much to say with regard to the recent occurrence of a number of sperm-whales in northern British waters, and as the result of these observations it may be hoped that the statement as to this species being an exclusively tropical and subtropical cetacean will in time disappear from text-books. It may be added that our author appears to be in some degree of uncertainty whether the right-whales, on the one hand, and the finners and humpbacks on the other, represent families or subfamilies, since in one passage he refers to the two groups as being of subfamily rank, and yet gives their titles as Balænidæ and Balænopteridæ. In referring to the horny "bonnet" and tubercles on the head of the southern right-whale, the author makes no reference to the important observations of Prof. E. Lönnberg in his account of the cetaceans of South Georgia; this, however, may be due to the latter having been published too late for mention.

FIG. 3.—The Common Rorqual. From "The Mammals of Great Britain and Ireland."

That the present volume and its fellows will do something to arouse greater interest among the wealthy classes (for it is not a poor man's book) in the mammals of the British Isles may be sincerely hoped. In all that relates to the habits of the animals he describes, and likewise in matters connected with sport, the author, who is an energetic and enthusiastic field-naturalist, may be taken, at all events in the main, as a trustworthy guide. On the other hand, from what has been stated above, it is evident that in matters connected with systematic zoology it will be advisable for his readers to consult the writings of trained zoologists before taking all Mr. Millais has to say as gospel. R. L.

[1] In one place Noack gives the date as 1556 and in a second as 1557.

THE MATHEMATICAL TRIPOS AT CAMBRIDGE.

NOT only have physicists and engineers and other men who apply mathematics been anxious for many years for reform at Cambridge, but everybody who has wished to see the study of mathematics retain its place in general education. Again, nearly all who are interested in the training of those mathematicians who are expected to devote their lives to original investigation have expressed much the same anxiety. The long-considered principles of a proposed large reform were brought before the Senate eight months ago in a report of the mathematics board, to which were appended twelve resolutions supported by every one of the mathematical professors and university lecturers in mathematics; and these resolutions, after they had been before the Senate five or six months, were voted upon and carried by majorities varying from 10 per cent. to 40 per cent. on October 25, 1906.

To carry out these resolutions, regulations for the examination have been prepared, and must be approved at an early meeting, but at this late hour a force is being organised which means, not merely to oppose the regulations, but to kill all hopes of reform by reversing the recent decision of the Senate.

The proposed syllabus of subjects for part i. includes geometry, algebra and trigonometry, and analytical geometry, with elementary work in the infinitesimal calculus, dynamics, and optics. It seems to us very good, and will no doubt in time in the hands of the mathematics board become excellent. Six papers will be set, each paper possibly containing questions from all parts of the syllabus. The questions in the physical subjects will be of such a character as to test knowledge of the physical phenomena and their relations, and not merely an ability to deal with the analytical developments of hypotheses. A large proportion of such riders as are set will consist of simple examples illustrating numerically or otherwise the corresponding theory. In their answers candidates will not be restricted to the use of the methods indicated in the syllabus. The most important regulations are that a student may take part i. in his second term, and that the three lists of honour men shall be placed in alphabetical order.

Schedule A of part ii. is not only an excellent course on mathematics, including elementary parts of the theory of functions and differential equations, but it includes those parts of dynamics, hydromechanics, astronomy, electricity, and optics (we wish we could say physical optics) which give the best illustrations of the applications of the mathematical part, illustrations which must be interesting even to

those students who are likely to proceed to the highest work in pure mathematics. Schedule B comprehends the highest kind of work in all parts of pure and applied mathematics which may be expected from men of the age and experience of the best candidates.

The examination in part ii. comprises the subjects in Schedules A and B. Schedule A contains the ordinary subjects to be taken by all candidates, the B subjects being taken only by men who are candidates for a mark of distinction. Six papers will be set on A and not more than six papers on B. In each of the papers on A there will be set some simple questions specially indicated, partly on the syllabus of part i.; a candidate who answers these questions sufficiently well will be entitled to honours. The questions on the various subjects will be distributed among the papers at the discretion of the examiners. Some months before the examination the registrary must be furnished with names of students who intend to present themselves as candidates *for distinction* in subjects B, specifying their special subjects or branches of subjects; and still some time before the examination students will specify the range of subjects B in which they desire to be examined. It is again laid down, as in part i., that there will be tests of knowledge of phenomena in the physical questions, and simple numerical or other illustrations will be given. Also the questions on even the subjects of Schedule B will consist in part of questions of an elementary or simple character. Part ii. cannot be taken earlier than in the eighth term. The list of successful candidates for honours will be in three classes, wranglers, senior optimes, and junior optimes, the names in each being in alphabetical order. The class in which a man is placed depends usually on his answers in Schedule A, but in case of doubt his answers to B may be consulted. A distinctive mark is attached to the name of a man who has done fairly well in Schedule B, and a different mark if he deserves special credit for his answers to B.

Now there is no doubt that much depends upon the spirit in which an examiner acts; he may greatly help or hurt the desires of the reformers, but surely this reform is a great step in the right direction. The old order of merit did incalculable harm. Candidates spent far too much time in the details of the general mathematical course, and as straightforward questions would have been answered equally well by all the good men, to differentiate them it was necessary to set questions which were complex and indeed tricky. Again, a just order of merit can be arranged only if all students are examined in the same subjects, and to compel all students to study the same subjects in the one way that leads to success in such an examination is uneducational. Not only has the course of study been mischievous for physicists and engineers, who ought to be allowed to advance quickly to those parts of higher mathematics which are necessary for them, but it is utterly uninteresting and hateful to the general student, for whose culture it might be made valuable. The greatest sufferer hitherto, however, has been the real mathematician, who is drilled so long on elementary work that even after he becomes a wrangler he is only ready to begin that higher work which he might have studied years before. In nineteen cases out of twenty he has become stale, so that even when he becomes a teacher of mathematics he is no longer a student. It would be useless for us to express an opinion as to the effect of the examination upon those Cambridge pure mathematicians from whom an advancement of knowledge might be expected; a senior wrangler of European reputation has given a curious opinion in NATURE, February 12, 1903, p. 339.

This reform will be far-reaching; it will extend to all places in Great Britain where a Cambridge man teaches, and to all examinations in which the Cambridge examiner has been in the habit of setting riddles and conundrums as questions. A large general committee has been formed of men who think that the regulations should be approved. It is representative of Cambridge at its best, not merely in men who teach, but in men who are doing original work in pure mathematics and mathematical physics and engineering, as well as in history and literature, scholars and workers of all kinds. It would be invidious to compare with these the names of the men who have organised the opposition. A scrutiny of the October votes shows that the members of Senate who are resident in Cambridge are in favour of reform by majorities considerably more than in the case of the general members. The opponents of reform now call upon all country members to come to Cambridge and record their votes. Should they persist in their intention, it is just possible that they may succeed in reversing the recent decision of the Senate; but if they do they are establishing a precedent which cannot conduce to the smooth and consistent working of the University.

There is another matter for these gentlemen to consider. Should they succeed, it is certain that the reformers will ask for and obtain a Parliamentary Commission. Is it likely that such a commission will inquire only into the question of mathematics? There is the Greek question, and there are others which the opponents of reform surely do not wish to have examined. Some of us wish that they would persevere and defeat the reformers, so that our greatest university might through a commission get those other reforms which it is hopeless to expect from the Senate.

JOHN PERRY.

THE INTERNATIONAL SEISMOLOGICAL ASSOCIATION.

THE first meeting, since its definite organisation, of the committee of the International Seismological Association was held at Rome on October 16, 1906, and was attended by representatives of each of the States belonging to the association. The United States having quite recently joined, the only important outstanding countries at present are Great Britain and France. The answer of France has not yet been received, while Great Britain has signified its intention to join under certain conditions, among which the simultaneous adhesion of France is the only one which at present prevents our country from being a member of the association. Nevertheless, both countries sent representatives to the meeting, M. Bigourdan acting for France and Prof. Schuster for Great Britain.

The time of the meeting was taken up in great part by questions of organisation, as, for instance, the drawing up of regulations concerning the procedure of the committee itself. Prof. Palazzo, of Rome, occupied the chair, and was re-elected president until the general meeting of the association, which is to take place in September. Reports were presented from the various States showing the organisation of the seismic service in the different countries, and these reports gave evidence of the great interest now generally taken in the seismic tremors of the earth.

The more important scientific questions submitted to the conference were deferred for decision to the general meeting in the present year, but it was decided to supply the Arctic station of Disko with an instrument for measuring the vertical component of disturbances, and to open a competition for the

construction of a seismograph which shall be suitable for the measurements of tremors having their source near the place of observation. Advertisements giving details of this competition have appeared in various papers in this country (see NATURE, January 3, p. xci).

It may be remembered that an organisation for studying the propagation of earthquakes was discussed at the last meeting of the International Association of Academies held in London in 1905, and that a committee was then appointed to formulate the views of the united academies, the originally proposed scheme for the seismic organisation not having met with general approval. This committee met, and its recommendations were subsequently approved by the council of the International Association of Academies. The International Seismological Association has accepted the suggested modifications, the general tenor of which was to safeguard the internal organisation of the earthquake observations in different countries, confining the international work to those physical questions of earthquake propagation which can obviously only be dealt with on an international basis. It is to be hoped that the spirit of these modifications will be adhered to, and that no attempt will be made to encroach on the functions which more definitely concern each country separately. We are glad to note, therefore, from the proceedings of the recent conference that both the questions of a more particular study of the districts surrounding Vesuvius, which primarily concerns Italy, and the foundation of a station in Iceland, which primarily concerns Denmark, were postponed.

The social functions of the international meeting were well looked after at Rome, the members being most hospitably entertained, and also provided with tickets enabling them to travel at about half-fare over all State railways during the meeting, and for several days before and after.

SCIENCE IN HIGHER EDUCATION.

IT is satisfactory to notice the attention now being given to scientific methods in education, not only by teachers and others actively engaged in educational work, but also by prominent statesmen. During the past week several important educational conferences have been held, and a report of one specially organised by science teachers appears elsewhere in this issue. But the dominating note of other conferences concerned with the school curriculum in general and subjects belonging to the literary side of education in particular is that of scientific method. Whether in the study of ancient or modern languages, in the cultivation of mental attitudes or the development of the body, it is clear that authoritative opinion considers the best methods of teaching should be based upon principles which have long been advocated by men of science. The little leaven of science is leavening the whole lump of educational effort, and the result is gratifying to contemplate.

Provided that scientific methods are adopted, that is, methods which aim at making pupils work out their own intellectual salvation, it does not matter much what subjects are studied. What we have always wished to avoid, and what we are glad to see now meets with unanimous disapproval, is instruction which is not education, the drudgery of learning phrases or performing mental gymnastics in literature, mathematics, or science without attention to the more valuable faculties of critical thought and originality. From the condition of a passive absorber of teachers' notes and the pemmican of text-books of former days, the pupil is gradually being recognised as an active agent who may be led to make his own observations and form his own conclusions, whatever the subject of study may be. It can scarcely be said at present that the old methods have disappeared from our schools and colleges—the requirements of the old universities and examining bodies prevent this end from being reached—but the feeling of practically all active thinkers and workers in the world of education is in favour of the adoption of principles with which we are completely in sympathy, and their influence is gradually giving the spirit of life to what have been the dead bones of school work.

Our statesmen, also, and in particular Mr. Haldane, Secretary of State for War and president of the British Science Guild, are taking opportunities to impress upon the nation the essential part which science and higher education must play in the polity of the modern State if progress is to be secured. We are glad, therefore, to extract from reports of speeches made last week by Mr. Haldane and Mr. Asquith some remarks expressing conviction of the value of factors which have long been recognised in these columns as essential to national welfare.

SCIENTIFIC THOUGHT.

An international economic congress, arranged by the council of the Royal Economic Society, was held on January 9 and 10 at the London School of Economics. Mr. Haldane, M.P., occupied the chair during the earlier portion of the morning session on the first day as president of the society, and delivered the introductory address. Mr. Haldane is reported by the *Times* to have said:—Whatever other differences there may be between the nations, there is a brotherhood—a brotherhood the reality of which is asserting itself more as year succeeds year—the brotherhood of science. We are to-day recognising that in science, as well as in other things, international cooperation is essential, and perhaps in no department is that more marked than in the department which deals with the science of the State. It is not only in economics that this kind of wider outlook is beginning to come to people. In science of every kind we have witnessed the tendency of the nations to specialise. Perhaps it is more easy to preserve a common basis in those sciences which do not touch human nature; but there is one thing that is true of all sciences, and that is that their methods are necessarily abstract. Do not let us be carried away with the notion that because a method is abstract, therefore it is not an indispensable method for getting at the truth. It is obvious that the chances of reaching the truth are greater in certain cases, the greater the abstractness of the method.

I have at this moment two books in my mind, books which, in a sense, are to-day out of date, but which, in another sense, will never be out of date, because they are the most perfect illustrations of true scientific method—the method which does not allow itself to shut out of view facts by the narrowness of its conceptions. One is Darwin's "Origin of Species," the other is Adam Smith's "Wealth of Nations," a book written by a man who had profoundly freed his mind from every kind of narrowness.

After dealing with the value to statesmen of the study of economics, Mr. Haldane spoke of the internationalism of science. He remarked:—It seems to me that this tendency to the internationalism of science, which is again, after 300 or 400 years, beginning to set in, which does not depend on our speaking a common language, but does depend on our becoming more and more specialists working out different departments of great and complicated questions—it seems to me that this new tendency is one which should fill us with hopefulness for the future. It has been said, and said with truth, that this is not an age of great men. We do not seem to be producing a Newton or a Gauss, a Helmholtz or a Laplace with the frequency with which former generations produced these outstanding figures; and yet, on the other hand, who will doubt that the general level of science is far higher to-day than it was a generation ago, and still higher than it was a generation before that? People have realised that it is

because of the necessity of specialisation, just because of the vast amount of work which people will have to do if they are to do anything successfully, that the men of science to-day have to know a great deal more, and therefore have to specialise a great deal more, before they can work usefully for the realisation of a common purpose. It is an age in which we recognise the enormous strides which science has made, the vast amount that has to be known before an individual contribution is possible. It is an age in which we are coming to see more and more clearly that the man who will contribute anything, who wishes to serve his country, who wishes to serve the world, does best to confine himself to that which he is sufficiently furnished to undertake. "He," wrote a great man, "who would accomplish anything in this world must learn to limit himself," and that is essentially true of science to-day.

The University Spirit and Function.

Mr. Haldane delivered his address as Lord Rector of the University of Edinburgh on January 10. He referred at length to the function of the university in the modern State. The first purpose of a nation—and especially of a modern nation—ought, he said, to be to concentrate its energies on its moral and intellectual development; and this means that, because it requires leaders as the instruments of this development, it must apply itself to providing schools where leaders can be adequately trained. At this point the history of the modern State shows that the university plays an important part. For the production of that small body of men and women whose calling requires high talent, the university alone, or its equivalent, suffices. It is the almost indispensable portal to the career of the highest and most exceptionally trained type of citizen. If universities exist in sufficient numbers and strive genuinely to foster the moral and intellectual virtue, the humanity which has the ethical significance that ought to be inseparable from high culture, then the State need not despair. For from among men who have attained to this level there will emerge those who have that power of command which was born of penetrating insight. In a university it is not merely the lecture-rooms and laboratories and libraries that are important—the places where those who are busy in the pursuit of different kinds of learning meet and observe each other are hardly less so. The union, the debating society, the friendship of those who are struggling to maintain a high level—all these things go to the making of the scholar. Certainly in the Scottish university of to-day there is no lack of either opportunity or provision for the formation of the tastes of the scholar and the habits of the worker. A man may go from these surroundings to devote his life yet more completely to literature, or science, or philosophy, or he may go to seek distinction in a profession or success in commerce. Whatever occupation the student chooses, he is the better the greater has been his contact with the true spirit of the university. The university training cannot by itself supply capacity, but it can stimulate and fashion talent, and, above all, it can redeem from the danger of contracted views. Thus the university becomes a potent instrument for good to a community, the strength of which is measured by the capacity of the individuals who compose it. The university is the handmaid of the State, of which it is the microcosm—a community in which also there are rulers and ruled, and in which the corporate life is a moulding influence.

Speaking of the true and two-fold function of the university, Mr. Haldane said it is a place of research where the new and necessary knowledge is to be developed. It is the place of training where the exponents of that knowledge—the men who are to seek authority based on it—are to be nurtured and receive their spiritual baptism. Such a university cannot live or thrive under the domination either of the Government or the Church. Freedom and development are the breath of its nostrils, and it can recognise no authority except that which rests on the right of the Truth to command obedience. It was Lessing who declared that were God to offer him the Truth in one hand and the Search for Truth in the other, he would choose the Search; and it is in the devotion to this search after the most high—a search which may assume an infinity of varied forms—that the dedicated life consists; the life dedicated to the noblest of quests, and not to be judged by apparent failure to reach some fixed and rigid goal, but rather by the quality of its striving.

Mr. Asquith, Chancellor of the Exchequer, delivered his address as Rector of Glasgow University on January 11. He took as his subject "Ancient Universities and the Modern World." He said the mediæval universities had two characteristics; they were always in theory and almost always in practice cosmopolitan, and the true university has always been, in addition, catholic in its range. A university never was, is not, and never ought to become a technological institute for the creation and equipment of specialists. The limits of the knowable, wherever they are to be placed, have in these days expanded so far that no ambition and no assiduity is equal to the task of taking all that lies within them for its province. Nothing can be more alien, then, from the business of a university than to produce the shallow and fluent omniscience which has scratched the surface of many subjects and got to the heart of none. The fidelity of a university to the intellectual side of its mission must now, as always, be judged by the degree in which it has succeeded in enlarging and humanising the mental outlook of its students and developing the love of knowledge for its own sake. Such an ideal does not imply a divorce of knowledge from practice. When James Watt in 1756 came back to Glasgow from London, the Corporation of Hammermen refused him permission to set up his business in the burgh, because he was neither son of a burgess nor an apprentice. The Faculty of Professors, of whom Adam Smith was one, at once appointed him mathematical instrument maker to the University, and gave him a room in the college buildings for his workshop. It is often out of the mouths of professors and at the hands of universities that the practical man learns for the first time the real meaning and the latent possibilities of his own business. In the long run a university will be judged, not merely or mainly by its success in equipping its pupils to outstrip their competitors in the crafts and professions. It will be judged also by the influence which it is exerting upon the imagination and the character; by the ideals which it has implanted and nourished; by the new resources of faith, tenacity, aspiration with which it has recruited and reinforced the untrained and undeveloped nature; by the degree in which it has helped to raise, to enlarge, to enrich, to complete the true life of the man, and by and through him the corporate life of the community.

Universities and the Schools.

Presiding at a meeting of the Scottish Education Reform Association, held in Glasgow University on January 12, Mr. Haldane spoke of the necessity for reform in Scottish university arrangements. If teachers are to be trained there must be considerable elasticity; access to the university must be easy and yet difficult. A man should not go there who is not fit to take a university training, and if he is not fit to take that he is not fit to be a Scottish teacher. On the other hand, access to the university should not be a straight and narrow gate, accessible only to people who approach by one particular path. If a high standard is to be secured in fashioning that elasticity, greater individual freedom must be given to each of the Scottish universities. The Act of 1889 was passed in the days when what was called the federal idea was dominant. If the Scottish universities were freed so that they might pass ordinances which would open their territories still wider and give a larger range in subject and vision, a greater elasticity in fashioning their degrees, it is certain that there would be no lowering of the standard; there would be a heightening. In education, primary, secondary, and higher schools cannot be separated one from the other; they must be treated as one, and the teachers matter more to the schools than anything else. Mr. Haldane protested against the superstition that it is possible to form a judgment upon things that require a great deal of knowledge without possessing that knowledge. The leadership in education in Scotland must be in competent hands, and the key to the situation is the raising of the *status* of the teachers in Scotland, and that is to be done by binding them more and more closely with the universities.

CORNELIUS O'SULLIVAN, F.R.S.

THE death of Mr. Cornelius O'Sullivan, F.R.S., which took place on January 8, at the age of sixty-five, has removed from amongst us a worker of great originality who, during the past thirty-five years, made his mark in various branches of pure and applied chemistry connected more or less directly with the industrial processes of brewing.

A native of Bandon, co. Cork, O'Sullivan developed a taste for science at a very early age, and having obtained a scholarship at the Royal School of Mines went through the three years' course with distinction, and became attached to the teaching staff of the Royal College of Chemistry, then in its old quarters in Oxford Street. In 1866 he became private assistant to Prof. A. W. von Hofmann, whom he accompanied to Berlin in that year. In the following year he entered the business of Messrs. Bass and Co. at Burton-on-Trent, where he ultimately became the head of the brewing and scientific staff, a post which he occupied up to the time of his death.

When O'Sullivan entered the brewing business the new ideas and discoveries of Pasteur with regard to fermentation were beginning to exercise a marked influence on brewing practice, and there seemed some danger of the new science of bacteriology occupying the field to the exclusion of chemistry. It is the special merit of O'Sullivan that, although very receptive of these new ideas, he clearly recognised that all the biological problems with which the brewer has to deal must ultimately be referred to the chemist, and he therefore set to work, in the first instance, to investigate the nature of starch and the mode in which it is transformed under the hydrolytic agencies of diastase and acids. In these researches O'Sullivan made use of the polarimeter, and by a combination of the optical method with that of cupric reduction he elaborated processes for a study of the gradual disintegration of the starch molecule which have been employed by all subsequent workers. In following the course of the action of diastase on starch, he conclusively proved that the sugar which is formed is not, as was then generally believed, glucose, but a well-defined crystallisable biose, maltose, and that the dextrins which are simultaneously formed consist of several bodies differing amongst themselves by certain well-marked properties. His researches on the influence of temperature on the reaction led to certain valuable practical applications, with which every student of brewing technology is now familiar. The results of O'Sullivan's work on starch were published in the Journal of the Chemical Society between 1872 and 1879, and constitute a series of memoirs which are justly regarded as classical.

O'Sullivan then turned his attention to the amylans and other carbohydrates of the cereals, and also extended his researches to the gums of the arabin series and to gum tragacanth. Throughout the middle and later period of his life he studied the action of the enzyme invertase on cane-sugar, and in a remarkable memoir published on this subject, in collaboration with Tompson, there is a vast amount of information which seems destined some day to assist in finding a rational explanation of the mechanics of enzyme action.

In 1884 the Chemical Society marked its appreciation of O'Sullivan's work by awarding him the Longstaff medal, and in the following year he was elected a Fellow of the Royal Society.

The varied life-work of O'Sullivan affords an excellent example of the brilliant results which can be attained by the close union of pure science and technology, and of the constant reaction of one on the other. Of all our industries there is not one, with the possible exception of agriculture, which is able to suggest so many problems in chemistry, physics, and biology as the ancient industry of brewing, and no one understood this better than the subject of this brief notice. Of his fine personal qualities and of the influence he had on the younger workers in a field which he made specially his own this is not the place to speak; suffice it to say that his generous, warm-hearted Celtic nature endeared him to a large circle of friends who are now mourning his loss.

NOTES.

THE council of the Royal Astronomical Society has awarded the gold medal of the society to Prof. E. W. Brown, F.R.S., professor of applied mathematics at Haverford College, Pennsylvania, U.S.A., for his researches in the lunar theory.

THE Göttingen Königliche Gesellschaft der Wissenschaften has elected the following foreign members:—Prof. H. A. Lorentz, Leyden; Prof. L. Luciani, Rome; Lord Rayleigh, Pres.R.S., and Prof. C. S. Sherrington, F.R.S.

THE council of the Royal Geographical Society has elected Mr. Roosevelt, President of the United States, an honorary member of the society. President Roosevelt has intimated his acceptance of this distinction.

PROF. E. L. NICHOLS, professor of physics in Cornell University, has been elected president of the American Association for the Advancement of Science for the meeting to be held next year at Chicago.

M. BOUQUET, director of technical instruction to the French Minister of Commerce, has been elected director of the Conservatoire national des Arts et Métiers for a period of eight years from January 1 last, in succession to M. Chandèze, who has retired.

WE learn from the *British Medical Journal* that the French Government has asked the Pasteur Institute to undertake an inquiry as to the distribution of malaria in various centres of colonisation in Tunis, especially the Béja, Mateur, and Goubellat regions, and as to the means of checking the prevalence of the disease.

THE Geological Society of London will this year award its medals and funds as follows:—Wollaston medal to Prof. W. J. Sollas, F.R.S.; Murchison medal to Mr. Alfred Harker, F.R.S.; Lyell medal to Dr. J. F. Whiteaves, of Ottawa; Wollaston fund to Dr. Arthur Vaughan; Murchison fund to Dr. Felix Oswald; Lyell fund to Mr. T. C. Cantrill and Mr. Thomas Sheppard; the Bigsby medal to Mr. A. W. Rogers, of the South African Museum, Cape Town.

NEW YORK UNIVERSITY has received a gift of about fifteen acres of land adjoining the south line of its grounds. The value of the property is, *Science* states, said to be between 40,000*l.* and 60,000*l.* From the same source we learn that Mr. Andrew Carnegie has given to the College of Physicians of Philadelphia 20,000*l.* toward the erection of its new building, on condition that a like sum be subscribed, of which 16,000*l.* has already been received.

WE announce with regret the death of the Very Rev. Robert H. Story, principal of Glasgow University, on January 13. For twenty-seven years Dr. Story was minister of the parish of Roseneath, and in 1886 he was appointed to the professorship of ecclesiastical history in the University of Glasgow. In 1898 he succeeded the Rev. Dr.

Caird as principal of the University. He was mainly instrumental in raising a special fund of nearly 100,000*l.* for improving Glasgow University.

A REUTER message from Samarkand reports that the eclipse of the sun on January 14 was observed from a point at the 1481 verst on the railway between the stations of Kuropatkino and Mijulnskaja. The first sign of the eclipse was noticed shortly after 9 a.m., and at 9.53 the period of total eclipse set in, lasting for two minutes. Throughout the time of observation snow was falling.

IN celebration of the twenty-first year of work, the president and council of the Biological Society of Liverpool have invited members of the society and their friends, along with some distinguished biologists from other towns, to a conversazione to be held on Friday, January 25, in the museum and laboratories of zoology in the University of Liverpool. The hon. sec. of the society is Mr. J. A. Clubb, Free Public Museums, Liverpool.

THE *Daily Chronicle* announces that a "zoo" for Yorkshire on an extensive scale has been definitely settled upon. A twenty-seven acres site near Roundhay Park, Leeds, has been selected. Herr Hagenbach, of Germany, is acting for the promoters of the scheme. An ostrich farm is to form a leading feature. A correspondent at Leeds informs us that the City Council, to whom Roundhay Park belongs, is not concerned with this project, which is a private venture for purposes of profit.

A SET of Watson magnetographs has been installed in the new magnetic house at Helwan Observatory, near Cairo, Egypt. The equipment comprises recorders for declination, horizontal intensity, and vertical intensity. The temperature coefficients of the intensity instruments are now being determined, and it is hoped that this work will be completed in February, and regular observations commenced.

THE rules of the aëroplane race, which is to take place on July 14, 1908, are published in the Paris *Matin* of January 14. All the machines which start, without distinction of name or of form, but of French make, will be admitted as competitors. Whatever may be the meteorological conditions on the date arranged, they will have to travel from the offices of the *Matin* in Paris to the office of the same journal in London within a maximum period of twenty-four hours, using only their own means of propulsion. The winner of the race will receive a prize of 250,000 francs (10,000*l.*).

EARTHQUAKE shocks were felt in the following places on January 10:—*Christiania.*—Two rather severe shocks of earthquake were felt at 1.30 a.m.; they were accompanied by rumbling sounds. The shocks were felt in towns on both sides of the Christiania Fjord. *Frederikstad.*—A slight shock was felt at 12.15 a.m., a more severe one at 1.30 a.m. *Gothenburg.*—Two severe shocks were felt in the district between Kornsjo and Mellerud at 1.30 a.m. A strong shock was also felt at Strömstad at the same time. *Arvika (Wermland).*—A violent shock occurred at 2.25 a.m. *Upsala.*—At 1.33 a.m. the Upsala seismograph recorded a slight shock which lasted twenty seconds. A despatch from Honolulu on January 10 states that the Mauna Loa volcano, Hawaii, is in active eruption.

A REUTER message from Kingston, Jamaica, announces that on January 14 the sixth agricultural conference, under the auspices of the Imperial Department of Agriculture, was opened there by Sir J. A. Swettenham, the Governor. Sir Daniel Morris delivered the presidential address, which reviewed the work accomplished by the department in developing tropical industries. The attendance at the opening meeting was large, those present including men of science and agriculturists from all parts of the West Indies.

A VIOLENT earthquake occurred at Kingston, Jamaica, at 3.30 on Monday afternoon, January 14, and caused great loss of life and property. No details of the disaster are known at the time of going to press, but it is reported that many houses and other buildings have been destroyed by the earthquake and the fires which started immediately after the shock. A Reuter message from New York states that cable communication with the Bermudas was broken on Monday night. The Commercial Cable Company's lines to the West Indies are also interrupted. The Hamburg-American Line Agency has received a message from Holland Bay, January 15 (5.38 p.m.), stating that a slight earthquake occurred there on Monday, but no damage was done. The seismograph at the offices of the U.S. Weather Bureau, Washington, recorded vibrations beginning at 3h. 38m. 23s. on Monday afternoon. Mr. Metcalf, Secretary for the U.S. Navy, has cabled to Rear-Admiral Evans, commanding the U.S. Fleet off Guantanamo, Cuba, directing him to investigate the extent of the Jamaica disaster and report to the Navy Department. A *Daily Mail* correspondent at Christiania reports that an earthquake was felt on Monday afternoon at Trondhjem and over the greater part of northern Norway. At some places the shock was severe enough to shake the houses.

MR. HALDANE, Secretary of State for War, has approved of the amalgamation of the Army Medical Advisory Board and the Army Hospital and Sanitary Committee. The reconstituted Army Medical Service Advisory Board is composed of the following members:—chairman, the Director-General, Army Medical Service; vice-chairman, the deputy Director-General, Army Medical Service. Members: Lieut.-Colonel D. Bruce, C.B., F.R.S. (as expert in tropical diseases); Colonel G. K. Scott Moncrieff, C.I.E., Assistant Director of Fortifications and Works; Lieut.-Colonel C. H. Melville (as expert in sanitation). Civilian members: Sir F. Treves, Bart., G.C.V.O., C.B.; Dr. J. Rose Bradford, F.R.S., professor of medicine, University College, London; Dr. Louis Parkes, consulting sanitary adviser to H.M. Office of Works; Dr. M. S. Pembrey, lecturer in physiology, Guy's Hospital; Sir Charles A. Cameron, C.B., professor of chemistry and hygiene, Royal College of Surgeons, Ireland. Representative of the India Office: Surgeon-General A. M. Branfoot, C.I.E. Secretary: Lieut.-Colonel C. H. Melville.

THE British Academy has received the sum of 10,000*l.* for the purpose of establishing a memorial to the late Mr. Leopold Schweich, of Paris. In accordance with the wishes of the donor, the endowment is to be called "The Leopold Schweich Fund," and is to be devoted to the furtherance of research in the archæology, art, history, languages, and literature of ancient civilisation, with reference to Biblical study. There are to be annually not fewer than three public lectures—"The Leopold Schweich Lectures"—to be delivered in London, and as the ordinary rule in the English language, dealing with some subject or subjects coming within the scope of these studies. The residue of the income of the fund, with all sums which may hereafter be added thereto by gift, bequest, or otherwise, is to be applied for the purposes of excavation, and for the publication of the results of original research in connection with one or more of the subjects named.

IT is with regret that we have seen the announcement of the death of Mr. T. R. Dallmeyer, who was for many years the managing director of the celebrated firm of J. H. Dallmeyer. He was the son of Mr. J. H. Dallmeyer, and grandson of Andrew Ross, and to a worthy degree carried on the work of these pioneer opticians. Mr. Dallmeyer designed several lenses and other photographic apparatus, but is best known as the inventor of the telephotographic lens. Although it was found not to be an absolute novelty, its introduction as a practical photographic instrument was due to him. He also worked out a modified combination for small cameras, the "Adon," which about doubles the linear measurement of the image without any loss of rapidity or need for focussing. In passing away at so early an age as forty-seven, the optical and photographic world loses one from whom they seemed to have good reason to hope for much further service.

THE metric system is to be adopted at the works of Kynoch (Ltd.). Mr. Arthur Chamberlain, chairman of the company, has made a statement explaining that it is intended to carry out the whole of the clerical work, relating to interior economy, in metric units. The clerical work relating to customers will only be shown in metric units so far as these measures are already in use with their customers carrying on business in countries that have already adopted the metric system. We learn from the *Times* that Mr. Chamberlain says the change will neither be expensive nor difficult. Weights expressed in British units will be translated into kilograms, and the cost into decimals of a pound sterling. This will be done by simple reference to a card of equivalents. Thereafter in all its processes through the works an article will remain as so many kilograms at a decimal of a pound sterling per kilo. In this way the cost of every article will be traced through all its processes in metric units and decimals of an English pound, but the selling price so arrived at will be changed into English currency. The total cost of the introduction of the new methods of calculation is estimated at ½ per cent. of a year's profits. The saving, on the other hand, on clerical labour will repay this in the first year. It will be seen that, so far from asking the clerks to learn anything fresh, they will only be invited to forget old troubles.

CARDIFF has given a lead to the rest of Wales by the establishment of a public observatory. Eleven years ago a suggestion was made in a local journal that a public telescope would be a most desirable acquisition. Following on this, Mr. Franklen Evans, J.P., a well-known local man of science, offered to the town his 12-inch reflector and sidereal clock, the offer being made through Mr. Arthur Mee, the then president of the Astronomical Society of Wales. Various difficulties stood in the way, and it was not until a couple of years ago that one of the councillors—Mr. J. A. Kidd—took the matter seriously in hand, and succeeded in rousing his colleagues to carry it through. In the meantime, the donor of the instrument had passed away. When, however, the council really moved, it made up for previous indifference. The telescope was put in thorough repair, and a suitable house built for it on Penylan Hill, which lies to the north-east of Cardiff, and is 250 feet above sea-level. In the final arrangements invaluable assistance was rendered by Mr. Albert Taylor, H.M.I.S., who resides at Cardiff, and has had great practical experience in the construction and use of telescopes. The observatory, which was formally opened by the Lord Mayor, is controlled by a committee of which Mr. Kidd is chairman, and consisting of city councillors and members of the Astronomical Society of Wales. The telescope is clock-driven, and an attendant has been instructed in its manipulation and use. An illustrated descriptive pamphlet has been prepared by Mr. Mee, and large numbers of people are visiting the observatory and viewing the heavens through the telescope.

STAPHILINID beetles, chiefly American, form the subject of part vi. of vol. xvi. of the Transactions of the St. Louis Academy of Science. The author, Mr. T. L. Casey, takes occasion to mention that throughout the work he employs the term "America" as equivalent to the United States.

LONGICORN beetles from Selangor and Perak, described by Mr. C. J. Gahan, of the British Museum, and a continuation of Mr. H. C. Robinson's synopsis of the birds of the Malay Peninsula, constitute the zoological contents of No. 4 of the first volume of the Journal of the Federated Malay States Museums.

IN the Proceedings of the U.S. National Museum (No. 1428, vol. xxxi., pp. 575–612) Mr. W. M. Lyon describes a collection of mammals from the small islands of Banka, Mendanao, and Billiton, lying between Sumatra and Borneo. Although many are described as new, nearly all are closely allied to well-known species, and none is of special interest.

PARTS ii. and iii. of vol. xxxvi. of Gegenbaur's *Morphologisches Jahrbuch* are entirely devoted to the comparative anatomy of the Primates, Mr. G. Ruge dealing with the characteristics of the liver throughout the order, while Dr. H. Bluntschli discusses the femoral artery in the lower catarrhine monkeys. Both papers are of a highly technical character, and of interest chiefly to specialists.

WE have received a copy of an illustrated "Handbook to the Perthshire Natural History Museum and Brief Guide to the Animals, Plants, and Rocks of the County." The Perthshire Museum, as is well known, sets an admirable example to other institutions of the same nature in devoting its attention to the local natural history, and in issuing this "Guide" (at the price of 3*d*.) it will afford valuable assistance to local observers and collectors.

IN the December (1906) issue of the *American Naturalist* Prof. H. F. Osborn completes his elaborate survey of the causes which have been most conducive to the extinction of the larger mammals. As the result of this survey it is concluded that such extinction cannot be attributed to any one general cause. Indeed, the chief induction which can be drawn from the investigation is that when the numbers of a species have been seriously reduced from some chief or original cause, various other destructive causes come into action, thus producing a cumulative effect which may lead to complete extinction. In fact, from weakening its hold upon life at one point, an animal species becomes subject to attack at many other points.

TO the January number of the *Naturalist* the Rev. O. P. Cambridge communicates a note on the power possessed by certain spiders of the family Salticidæ of changing the colour of the large pair of eyes on the forehead. Some time ago Mr. W. W. Strickland, of Singapore, announced the occurrence of this phenomenon in two species of Attis spiders from Java, stating that he believed such a change to be unknown in any other creature. Mr. Cambridge points out that Mr. Strickland's observations were long ago anticipated, in the case of other species, by the late Mr. J. Blackwall. The same issue contains a

tons of wax, and 49,600 tons of sulphate of ammonia. The coloured geological map and the sections accompanying the memoir are excellent, but the illustrations in the text are crude and roughly reproduced.

IN the *Electrician* of January 11 is an interesting article by Mr. G. W. Pickard on the measurement of received energy at wireless stations, reprinted from the *Electrical Review* of New York, which should appeal to all who are watching the development of wireless telegraphy. The method described by the author is both simple and useful, and does not require an elaborate arrangement of instruments. A telephonic mode of reception is employed, and the sound of a single spark at the sending station is reproduced in the telephone by the discharge of a local condenser through the same receiving circuits, the charging potential of the condenser being made equal in intensity by variation until this is accomplished. The periodicity of the condenser discharge is the same as that of the received energy. Then knowing the potential and capacity of the condenser, the energy can be deduced by a simple formula. An objection to the method is the difficulty in comparing successive sounds, which cannot be accomplished with any degree of accuracy. Also a slight change of spark-length at the sending station would seriously affect results, and therefore make comparisons of the sending station's performance from day to day almost impossible. The author mentions a method by which this may be partly overcome by the insertion of a key in the detector circuit, so as to secure the sending of a truly single spark. At the same time, the method described will be useful as a rough test in practical work, and should help towards the solution of a true formula for long-distance work.

WE have received from Mr. T. A. Vaughton, Sutton Coldfield, a communication entitled "'Growing' Alumina," which gives particulars of phenomena observed during the passage of electric sparks between a globule of mercury, acting as anode, contained in a drawn-out capillary tube placed vertically a few millimetres above an aluminium plate, which serves as kathode. While sparks are passing, a circular "crater" composed of nearly pure alumina in a light, feathery form grows round the sparking spot, and after a short time the quantity of the product formed is considerable. In appearance it resembles moss; when examined with a lens during its formation, filaments are seen to shoot along the surface of the aluminium in definite directions. If the sparking be stopped and the deposit removed, the formation of the moss again occurs without the current being necessary, and the process may be repeated several times in succession. In an atmosphere of hydrogen no alumina is formed, and in oxygen but little growth occurs. The alumina produced acts on a photographic plate even through celluloid. A contributor to whom we have submitted the communication informs us that the phenomena are probably due to the formation of aluminium amalgam owing to mercury being sprayed upon the plate by the sparks. It is decomposed by atmospheric moisture, giving alumina and mercury, which is free to repeat the process. Little action occurs in oxygen because of the need of a supply of water vapour. The photographic action occurs owing to the production of hydrogen peroxide, which will attack a photographic plate through celluloid; hydrogen peroxide is generally formed in similar oxidations.

THE Memoirs of the Liverpool School of Tropical Medicine, twenty-one of which have been published, are to be superseded by a periodical which is to be issued by the school under the title of *Annals of Tropical Medicine and Hygiene*. The annals will be edited by Prof. Ross, in collaboration with Drs. Stephens, Todd, Thomas and Breinl, Mr. Newstead, and Sir Rubert Boyce.

THE report on the scientific results of the voyage of the S.Y. *Scotia* is to be published in six quarto volumes by the Scottish Oceanographical Laboratory. The first volume will contain a narrative of the voyage and a summary of results, the second will deal with the physical results of the expedition, the third with botany, geology, and cartography, and vols. iv., v., and vi. with the numerous branches of zoology. The work will be fully illustrated with maps, plates, and photographs. Each volume will consist of several parts, which will be published separately when ready. Vol. ii. will be issued first, and will be ready immediately. It will consist of five parts, dealing respectively with meteorology, magnetism, bathymetry, physics of the ocean, and tides and waves. Orders, accompanied by a remittance for vol. ii., 42*s*., should be sent to the director, Scottish Oceanographical Laboratory, Surgeons' Hall, Edinburgh.

OUR ASTRONOMICAL COLUMN.

THE TEMPERATURE OF THE MOON.—In a paper appearing in the *Astrophysical Journal* (No. 5, vol. xxiv.), Mr. F. W. Very discusses Mr. Coblentz's recently-published conclusion that, from an investigation dealing with the reflection of heat radiations from various mineral substances, it may be deduced that the apparent temperature of the lunar surface is chiefly due to reflected solar radiations, and that the *actual* temperature may be about −225° C., in accordance with Langley's first conclusion. Mr. Very points out that his investigations of the radiations show that the larger part of them are not merely specularly reflected, but are radiated, the moon having first absorbed the heat from the solar radiations. Instead of −225° C., he suggests that the temperature of the lunar body may reach a maximum of about 100° C., the corrected lunar-radiation curve being similar to that appertaining to bodies not much below the temperature of boiling water.

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tons of wax, and 49,600 tons of sulphate of ammonia. The coloured geological map and the sections accompanying the memoir are excellent, but the illustrations in the text are crude and roughly reproduced.

IN the *Electrician* of January 11 is an interesting article by Mr. G. W. Pickard on the measurement of received energy at wireless stations, reprinted from the *Electrical Review* of New York, which should appeal to all who are watching the development of wireless telegraphy. The method described by the author is both simple and useful, and does not require an elaborate arrangement of instruments. A telephonic mode of reception is employed, and the sound of a single spark at the sending station is reproduced in the telephone by the discharge of a local condenser through the same receiving circuits, the charging potential of the condenser being made equal in intensity by variation until this is accomplished. The periodicity of the condenser discharge is the same as that of the received energy. Then knowing the potential and capacity of the condenser, the energy can be deduced by a simple formula. An objection to the method is the difficulty in comparing successive sounds, which cannot be accomplished with any degree of accuracy. Also a slight change of spark-length at the sending station would seriously affect results, and therefore make comparisons of the sending station's performance from day to day almost impossible. The author mentions a method by which this may be partly overcome by the insertion of a key in the detector circuit, so as to secure the sending of a truly single spark. At the same time, the method described will be useful as a rough test in practical work, and should help towards the solution of a true formula for long-distance work.

WE have received from Mr. T. A. Vaughton, Sutton Coldfield, a communication entitled "'Growing' Alumina," which gives particulars of phenomena observed during the passage of electric sparks between a globule of mercury, acting as anode, contained in a drawn-out capillary tube placed vertically a few millimetres above an aluminium plate, which serves as kathode. While sparks are passing, a circular "crater" composed of nearly pure alumina in a light, feathery form grows round the sparking spot, and after a short time the quantity of the product formed is considerable. In appearance it resembles moss; when examined with a lens during its formation, filaments are seen to shoot along the surface of the aluminium in definite directions. If the sparking be stopped and the deposit removed, the formation of the moss again occurs without the current being necessary, and the process may be repeated several times in succession. In an atmosphere of hydrogen no alumina is formed, and in oxygen but little growth occurs. The alumina produced acts on a photographic plate even through celluloid. A contributor to whom we have submitted the communication informs us that the phenomena are probably due to the formation of aluminium amalgam owing to mercury being sprayed upon the plate by the sparks. It is decomposed by atmospheric moisture, giving alumina and mercury, which is free to repeat the process. Little action occurs in oxygen because of the need of a supply of water vapour. The photographic action occurs owing to the production of hydrogen peroxide, which will attack a photographic plate through celluloid; hydrogen peroxide is generally formed in similar oxidations.

THE Memoirs of the Liverpool School of Tropical Medicine, twenty-one of which have been published, are to be superseded by a periodical which is to be issued by the school under the title of *Annals of Tropical Medicine and Hygiene*. The annals will be edited by Prof. Ross, in collaboration with Drs. Stephens, Todd, Thomas and Breinl, Mr. Newstead, and Sir Rubert Boyce.

THE report on the scientific results of the voyage of the S.Y. *Scotia* is to be published in six quarto volumes by the Scottish Oceanographical Laboratory. The first volume will contain a narrative of the voyage and a summary of results, the second will deal with the physical results of the expedition, the third with botany, geology, and cartography, and vols. iv., v., and vi. with the numerous branches of zoology. The work will be fully illustrated with maps, plates, and photographs. Each volume will consist of several parts, which will be published separately when ready. Vol. ii. will be issued first, and will be ready immediately. It will consist of five parts, dealing respectively with meteorology, magnetism, bathymetry, physics of the ocean, and tides and waves. Orders, accompanied by a remittance for vol. ii., 42*s*., should be sent to the director, Scottish Oceanographical Laboratory, Surgeons' Hall, Edinburgh.

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70° from the plane of the galaxy, the position of its densest part being R.A.=0h. 57·4m., dec.=+1° 20′ (1885).

This nebulosity is also remarkable in appearance; around the densest region there extends a quantity of nebulous matter of varying intensity showing small clouds of increased intensity at several points. Further out the intensity becomes so feeble that it is impossible to define its limits, and Prof. Wolf expects that a longer exposure than the four hours which he gave may materially extend the nebulosity seen on the plate. Three B.D. stars are involved in the cloud, which extends about 40′ in declination and 30′ in R.A. When examined under the microscope the brighter parts of the image are filled with numerous minute spots and short trails, and Prof. Wolf thinks it possible that the cloud may consist of a multitudinous congregation of very small planetary nebulæ which a more powerful instrument may be able to resolve. The present plates were taken with the 16-inch Bruce telescope (*Monthly Notices*, November, 1906).

PERIODICAL COMET DUE TO RETURN IN 1907.—Only one periodical comet is due to return during the current year, that discovered by Giacobini at Nice on December 20, 1900. As observed then it was very faint, and showed only a small nebulous disc, without any tail. As its period is about seven years, according to the elements calculated by Prof. Kreutz, and as it passed through perihelion about December 3, 1900, it is not likely to be rediscovered until nearly the end of the present year (the *Observatory*, No. 379).

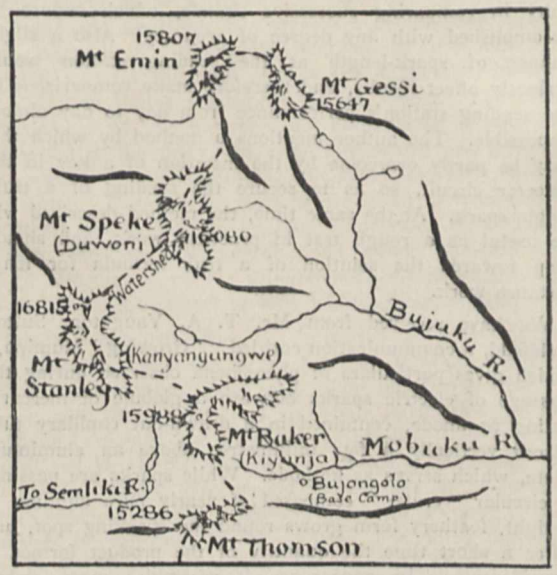
ORBITS OF THREE DOUBLE STARS.—The results of an investigation, by Prof. Doberck, of the orbits of ζ Cancri, ω Leonis, and H139 (Σ 3062), are published in Nos. 4144–5 of the *Astronomische Nachrichten*. The author gives a set of elements for the orbit of each system, and compares all the available observations with the calculated places; from a discussion of the whole he gives the probable error of the annual means of each observer's measures. According to the final elements, the respective periods of these three systems are approximately 60, 116·7, and 105·5 years.

THE DUKE OF THE ABRUZZI'S ASCENTS IN THE RUWENZORI RANGE.

AT a crowded meeting of the Royal Geographical Society, held at the Queen's Hall on January 12, and honoured by the presence of the King and the Prince of Wales, the Duke of the Abruzzi gave an interesting account of his recent exploration of the snowy summits of the Ruwenzori range. It will be remembered that many attempts on these peaks have been made within the past few years, but that, owing rather to the climatic character of the range and its distance from an accessible base than to special difficulties from a mountaineer's point of view, all the Duke's predecessors had failed to reach its culminating point. Profiting by the experience of these, the Duke was able to avoid the causes of their failure, his expedition being provided with all that forethought could suggest in the way of equipment, while he was also fortunate in securing trustworthy information as to the times of year at which the climatic conditions were likely to be most favourable.

The Duke was accompanied by two Alpine guides and two porters, all from Courmayeur, as well as by experts entrusted with research in various scientific departments, including Major Cagni, his trusty companion on his previous expeditions, and Signor Sella, well known for his unique experience in mountain photography. Apart from the mountaineering interest of the expedition, there was much to be done before the topography or morphology of the range could be at all thoroughly understood. Captain Behrens, of the Anglo-German Boundary Commission, had, by triangulation, fixed the altitude of the highest summit within very narrow limits, and shown that it was much under the 20,000 feet attributed to it by some travellers. He had also fixed with considerable accuracy the position of the double culminating peak, recognised as the Kanyangungwe of Stuhlmann, but the number and relative positions of the several *massifs* were still matters of uncertainty.

It is unnecessary to refer to the first part of the Duke's address, dealing with the journey from the coast and final organisation of the expedition. The route adopted (after much deliberation) for the approach to the snows was that from the east by the Mobuko valley, followed by Moore, Johnston, Grauer, and others. During the toilsome march up this the Duke saw reason to doubt its being the best, and he subsequently found that the Bujuko, a northern branch, or even the main head-stream, of the Mobuko, possessed some advantages. After the usual difficulties had been overcome, the snows were at last reached, and a view of all the peaks obtained from a ridge running east from Kiyanja. To the north, four distinct snowy mountains, separated by well-marked depressions, were in view, the nearest and most westerly being crowned by two pairs of peaks, the loftiest of which were at once recognised as those seen from Butiti both by Freshfield and the Duke, while evidently quite distinct from the Duwoni of Johnston. This had already been suspected by Mr. Freshfield after receiving the account of Mr. Wollaston's ascents. After ascending to the summit of Kiyanja it was decided to make a circuit to the south of this mountain, and after descending into a valley belonging to the



Rough Sketch of the Ruwenzori Peaks.

Semliki system, to strike north for the saddle between the two highest peaks. During the descent of this valley a striking sunset view over the great Congo forest was obtained, and the Duke's description was well reinforced by one of Signor Sella's striking photographs. The ascent was successfully accomplished by the Duke and the guides on June 18, the chief difficulty arising from the mists and from an overhanging cornice, which required great care to negotiate. A peculiar feature was the presence of huge "ice-stalactites," which supported the cornice. The twin peaks received the names of the Queens of Italy and England. Between June 22 and July 10 the Duke ascended all the main peaks, while his coadjutors prosecuted their own several tasks, Major Cagni completing an excellent map, while Signor Sella pursued his photographic labours, of the admirable results of which the audience had many specimens.

To the individual *massifs* and peaks the Duke has given the names of distinguished explorers of the region and of Royal personages, although it may be doubted by some whether the native names which have already found their way into Ruwenzori literature are not more in harmony with the romantic aloofness of the range than any exotic appellations, however otherwise suitable. Even though not strictly belonging to the summits, the native

names might as legitimately be transferred to the latter as many of the names in use in the Alps and elsewhere. An interesting point brought out is the fact that all the snowy *massifs* lie on the main water-parting of the range. As regards its geology, the theory of a volcanic origin may be absolutely excluded, there being only one spot in the whole upper region at which even local traces of basaltic veins were seen. The evolution of the range may be ascribed to (1) an upheaval *en masse* of a portion of the Archæan floor of Central Africa; (2) to a highly accentuated anticlinal uplift, ellipsoid in form, with strata more or less tilted in the central group; (3) the presence in this of a series of rocks (amphibolites, diorites, &c.) far more resistant than the gneisses and mica-schists of the outer ranges. Evident traces were seen of the enormous development of glaciers in the Ice age, while at present they are of the second order only, on the upper slopes and in the larger ravines. They are all, at the present moment, in retreat. The snow-line seems to be at about 14,400 feet. Among other results of the expedition, various new species of birds, molluscs, insects, crustacea, &c., were collected, though the fauna of the upper region was naturally poor.

The Duke showed a praiseworthy caution in identifying the range with the "Mountains of the Moon," in spite of the obvious allurements of the notion, to which so many of his predecessors have succumbed.

At the conclusion of the address the King, in a short speech, expressed the thanks of the assembly to the Duke, whom he congratulated upon his successful expeditions in tropical and polar regions.

METEOROLOGY IN PERU.[1]

IN 1892 Prof. W. H. Pickering and others of the staff of the Arequipa Observatory were trying to establish meteorological stations in Peru, a region which up to the present has not been very well represented in meteorological observations. The meteorological station at Mollendo had been discontinued during 1890 and 1891, but observations were resumed there and at Arequipa during the early part of 1892, and in March a station was established at La Joya, a town midway between these two places.

In December, 1891, Messrs. Douglas and Goodair made a journey of inspection past the Chachani Ravine, behind Arequipa, and ascended the main Chachani summit to an altitude of 18,000 feet, being satisfied that the ascent could be completed. In January, 1892, Prof. Pickering established a station at the Chachani Ravine at an altitude of 16,650 feet. An attempt was made in December to start a station on the main summit, but when Prof. Pickering and Mr. Goodair reached a height of 18,800 feet the Indians who were carrying the instruments and baggage deserted, and the attempt failed. The Chachani Ravine station was visited about once a month during 1892, and discontinued in 1893.

In October, 1893, a station was erected on the summit of the Misti Volcano, and in December another lower down on the eastern flank, the altitudes being 19,200 feet and 15,600 feet respectively. In 1895 observations were also taken at an altitude of 13,300 feet.

These stations constituted a chain from the sea coast over the western Cordilleras, and in order to continue this chain across the Andes, Prof. Solon I. Bailey, in July, 1894, started a station at Cuzco, in the valley between the western and eastern Cordilleras. The instruments were established in the yard of a brewery, and one of the employees commenced observations in July.

The Meteorological Station at the Chachani Ravine (16,650 feet).

After an unsuccessful attempt to secure a station to the east of Cuzco, Prof. Bailey went on northward, using mules and encountering many difficulties on the way. Very often the shelters and instruments had to be carried by hand under the low branches of trees and overhanging rocks, which would otherwise have struck them from the backs of the mules. At Santa Ana Prof. Bailey met one of the estate owners, who willingly agreed to make the observations in his own grounds, and did so for more than a year.

The various stations were all fitted with Richard barographs and thermographs, standard and maximum and minimum thermometers, &c. Observations were also made of rainfall, clouds, winds, and of occasional phenomena.

At Mollendo, La Joya, and Cuzco observations were made at 8 a.m., 2 p.m., and 8 p.m. each day, but at Santa Ana only at 8.0 a.m. At the mountain stations observations were made only at intervals of about ten days by various members of the Arequipa staff.

In the volume under notice only eye observations have been discussed, the automatic records being left for a future volume. So also are all the Arequipa records.

An examination of the thermometer records shows that the annual range of mean temperature at the lower stations is small, being largest at Mollendo on the coast,

[1] "Annals of the Astronomical Observatory of Harvard College." Vol. xxxix., part ii., Peruvian Meteorology, 1892–5. By Prof. Solon I. Bailey.

where the range is from 59°·9 F., in August, to 71°·6 F., in February, only 11°·7 F., whilst at Cuzco the range is only 6°·1 F.

At Mollendo and La Joya, both west of the mountains, the south and east winds predominate very largely, whilst at Cuzco and Santa Ana there is no marked preponderance of wind from any particular quarter.

During the period April, 1892, to December, 1895, the total rainfall at Mollendo was 2·65 inches, the mean annual rainfall being 0·66 inch. At La Joya, which is in the middle of the desert of Islay, no measurable rain fell during the whole period, that is, never did more than one two-hundredth of an inch fall on any one day. On the average there are eight days per year on which some rain falls. The annual rainfall at Cuzco is 38·58 inches, and the rainfall for the year July, 1894, to June, 1895, at Santa Ana was 51·71 inches.

All the observations made by eye are given in full, and are well summarised. The dated remarks which accompany the tables prove very interesting reading, especially those referring to the high stations, and show well the difficulties encountered in making observations at these altitudes, exposed to wind and cold, and apparently also to robbers, for on September 6, 1894, it is recorded that at the Misti summit station the doors of the hut and shelter were found open, and that the barograph, thermometers, and tools had been stolen!

As an appendix an account is given of the moving sand dunes of the desert of Islay. Scattered over this desert are thousands of these crescent-shaped dunes. They are all of one form, and have always the same orientation, with the convex side to the south winds and the cusps pointing north and north-west.

Prof. Bailey measured one of these dunes near La Joya in 1894. The points were 160 feet apart, and the length round the convex side was 477 feet. Its maximum width was more than 100 feet, and the weight was estimated as more than 8000 tons.

Between March, 1892, and March, 1894, it had travelled 125 feet, and by March, 1896, a further 120 feet. From that date until January, 1901, monthly measures were taken, and in the five years it travelled 294 feet at an average rate of more than 5 feet per month. A comparison of the record of movement and the record of strong south winds shows that these winds are the sole cause of the northerly movement of these sand dunes. W. M.

THE ASSOCIATION OF ECONOMIC BIOLOGISTS.

ON Wednesday, January 9, the annual meeting of the Association of Economic Biologists opened at Cambridge, and continued until Friday, January 11. The conferences were held by kind permission of the medical staff in the pathological department of the University, and the laboratories in this department and also the zoological laboratory were thrown open for the occasion, and members also had the opportunity of visiting the botanical department.

Mr. A. E. Shipley, F.R.S., was elected president of the association for 1907 in the place of the retiring president, Mr. F. V. Theobald, who with Sir Patrick Manson, K.C.M.G., and Prof. W. Somerville, will act as vice-presidents for the year.

In his presidential address Mr. Shipley dealt with the subject of sea fisheries. He gave an interesting account of this important subject, and dwelt on the necessity of constant investigation. No less than 27,000 vessels are engaged in this industry, employing 90,000 men, fishing from British ports, the capital invested being estimated at 11,000,000*l*. He referred to the partial failure of the herring fishery last summer, and to the numerous inquiries that had been held concerning such matters, recounting no less than seventeen in the last seventy years.

The president is of opinion that time is not yet ripe for deep-sea fishing legislation, on account of our knowledge still being so deficient that it does not yet form a sound basis for law making. The North Sea fisheries are those upon which our energies must be mainly expended. Fishermen and experts have long held that the grounds are being depleted, and the latest report of the Board of Agriculture and Fisheries bears out these statements.

Mr. Shipley then mentioned various experiments that had been carried out in Norway and on the Dogger Bank. Some interesting figures regarding fish reproduction were quoted, showing their enormous sexual powers; for instance, the turbot produced annually 8½ million eggs and the cod 4½ million.

The chief possible causes of impoverishment were summed up as follows:—(1) the accumulated stocks of the Dogger and Iceland grounds had been fished out; (2) any given area of sea could support but a limited quantity of produce; and (3) the excessive destruction of young fish. In spite of the grave nature of the North Sea problem, it is satisfactory to learn that the condition of the fishing industry generally was never more prosperous than at the present time. It is hoped that sufficient funds will be forthcoming to continue the excellent scientific work in this subject that has already been done.

Prof. Nuttall's paper on red-water fever and allied diseases was full of interesting matter. After explaining the results of his investigations into the life-history of the Piroplasmæ he dealt with the various diseases caused by them, dwelling particularly on the results of his experiments on canine piroplasmosis. In connection with this paper Prof. Nuttall and Mr. Warburton had prepared a most interesting exhibition of ticks, and the parasites they convey.

The first day's proceedings finished with a paper by Mr. R. H. Biffen on his well-known work on cereal breeding.

The first paper on Thursday was one by Mr. F. V. Theobald on some new hemipterous fruit pests. Illustrated by lantern-slides, the life-history and damage caused by leaf-hoppers (Typhlocybidæ) were fully entered into. There had been no complaint of these insects by fruit-growers until last year, when some species occurred in such numbers that they even stopped picking. Besides mentioning results obtained in the treatment of these pests, Mr. Theobald discussed the parasites which affect the Typhlocybidæ, amongst the most interesting being some small Proctotrupids which cause "parasitic castration," one genus, Aphelopus, having occurred during the past year in such numbers that the opinion was expressed that the "hoppers" must have been nearly stamped out in places.

A long paper followed on the American gooseberry mildew, by Mr. Salmon, who explained its life-history and the great damage it does, and dwelt upon the necessity of immediate steps being taken to stamp it out and prevent importation. The paper caused some discussion, in which Profs. Middleton, Percival, and Fisher joined.

The secretary (Mr. Collinge) then gave a short and concise description of his successful extermination of the black-currant gall mite by means of sulphur and lime. Dr. MacDougall read a paper on parthenogenesis in the pine sawfly, and then gave an account of an extremely interesting piece of work on the length of life of *Calandra granaria*. At the afternoon sitting Mr. Freeman dealt with the geographical distribution of rubber plants, and incidentally stated that the output last year was 70,000 tons, valued at 30,000,000*l*. Of this, 63 per cent. came from tropical America and 34 per cent. from tropical Africa, the remainder from Asia, the output of cultivated rubber being only 1½ per cent. to 2 per cent. of the world's output.

Mr. E. R. Burdon then read a paper on the spruce-gall and larch-blight diseases caused by Chermes, and traced the connection between the two aphides and their migrations.

The day's proceedings terminated with a paper by Mr. F. V. Theobald on the insect pests of the British East Africa Protectorate, giving an account of the chief insect pests received from the Imperial Department of Agriculture. The most interesting is the diamond-back moth, which is thought to have been introduced into Africa, but which Mr. Theobald believes to be indigenous, in which Prof. Carpenter entirely agreed.

The final sitting was held on Friday morning, January 11, when papers were read by Mr. T. Strangeways, on a description of an infectious disease occurring in hares; by Mr. E. G. Fearnsides, on the blood changes in man caused by the presence of metazoan parasites, and their aid in diagnosis; and the use of an economic museum in the teaching of geography, by Mr. W. G. Freeman. Some valuable observations were brought out in Mr. Fearnside's paper on the changes observed in the blood in parasitic attacks and the production of toxins by the parasites. Mr. Warburton exhibited an apparatus for extracting small mites, &c., from moss, invented by Prof. Berlese, who contributed a paper on the olive-fruit fly and its treatment.

The next annual meeting will take place at Edinburgh in Easter, 1908; a meeting was also arranged for July in London.

Mr. Walter Collinge, of Birmingham University, is still continuing the secretaryship.

THE PUBLIC SCHOOL SCIENCE MASTERS' ASSOCIATION.

THE annual meeting of the Public School Science Masters' Association was held on Saturday, January 12, at the University of London, the president, the Rev. and Hon. E. Lyttelton, headmaster of Eton, being in the chair.

The president, in his address on the place of science and of literature in a general education, prefaced his remarks with the opinion that a classical headmaster had one great advantage when criticising a science lesson in that his total ignorance of the subject placed him in the position of the most backward of pupils, and enabled him to ascertain exactly when the lesson was successful in producing the required impression on the mind of the learner. In the discussion of educational matters there were the dangers of cloudiness from ignorance and of dogmatism which afforded no contribution to the discussion. Science was calculated to diminish these two dangers. By science he meant experimental study, and not the form of class demonstration sometimes, in the old days, combined with lax discipline, the object apparently being to provide a sort of agreeable change in the regular work of the schoolboy.

As now understood, general education meant that given to boys up to the age of sixteen, and the arguments following were in favour of science being taken seriously before that age. It would be conceded that science aroused more interest, at least in its initial stages, than was the case with any other subject, save religion, but it was a question whether this interest did not fall off later when more brain work was required. This was so with classics. The practical question, however, was not whether science interested the boy more than did the classics, but whether science and literature should go on together. The boys who were apparent failures at classics might be found successful later in science. Huxley had said that in science young minds were brought into contact with facts. It was not so very different in the case of literature. The advantages claimed for science in educational effects, training in inductive and deductive methods, and freedom from following mere authority, were shared by most other subjects when these were taught by modern methods. These newer methods were certainly due to the influence of science teaching.

The advantages of experimental science might be said to consist in the constant application to reason, truth, the senses of touch and sight, the virtue of patience, and accuracy. Science brought the pupil into association with the great army of discoverers, and illuminated daily life with its stimulating powers, leading to the exercise of the precious faculties of imagination and wonder. The president pleaded for training leading to ambidexterity, and referred to the healthful mental effect afforded by exercise of both sides of the brain, pointing out that many school games were lacking in this respect. The results of scientific and of literary teaching both depended upon the enthusiasm of the teacher, but this was especially true of the latter. One advantage of literature was that it brought the learner more into contact with human affairs generally, and although some of the faculties touched were the same as in the case of science, there were others not so influenced. They were not called upon to decide between two subjects. There was room for both; teachers of science and of classics should be co-workers. Literary teachers should be able to save the science masters the labour of teaching the art of making notes in correct style. The classical failures should be rescued by science. The classical teacher called to the science teacher for help with new devices to touch the imagination and awaken hope—for something to haunt, startle, or waylay the young minds; to make them feel the joy of learning.

Sir Oliver Lodge said that to eliminate the heat retained rather than generated by cloudiness of thought and fog of dogmatism, it was necessary to admit the clear and bracing atmosphere of science. He agreed that ambidexterity was to be encouraged. There were three kinds of boys, the docile, the eager, and the unwilling, each of whom required different treatment. But it was necessary to consider the average boy. The quantitative side of science should not be overdone. In that respect subjects differed; in the study of heat, quantitative work was desirable in the earliest stages, but in electricity he thought it better at first to allow an acquaintance with phenomena, proceeding later to measurement. The teacher should excite interest, rouse curiosity, feed only the hungry, and not stuff with information *apropos* of nothing. Sir Oliver suggested that astronomy and physiology might be taken in schools, and that astronomy should be treated in a manner not too technical, but rather on biographical lines. One should begin at both ends of a subject, but in different ways, for science was both inductive and deductive, and this method of learning would use both qualities. He advocated the pupil's going "behind the scenes"; he should read examination answers, perhaps set examination papers. In learning a language a boy was apt to consider he was dealing with chaos, so many forms of words occurring, *e.g.* changes in stem of verbs, for which he could see no reason. Were the boy set to construct a language, he would see the necessity for and realise the meaning of tenses and cases. Boys should be encouraged to read the classics of science, and then they would get to appreciate the spirit of scientific investigation, which should be carried into all their studies. Books should be used in order to learn how to acquire knowledge at first hand; problems should be thought out before information was gratuitously supplied. A literary education was possibly best on the psychical side, but it did not give a knowledge of the material universe, and no educated person should be deprived of this.

Prof. Tilden thought the system of classical and scientific sides in schools was insufficient. There were, for instance, artistic minds which did not respond to either of these divisions. The president, replying to Mr. J. Talbot (Harrow), said he agreed that science should have a liberal allowance of time in the curriculum, something quite different from simply two hours per week, and in reply to the Rev. A. L. Cortie, S.J. (Stonyhurst), he advocated commencing the subject at, say, six or seven years of age. Mr. Thwaites (Wyggeston Schools, Leicester) gave the results of some inquiries he had made of the chief public schools. In general, about 60 per cent. of the boys take science, and of these about 95 per cent. are in the general courses. The average number in classes was 21·5 for the general and 14 for special courses. The former were allowed, on the average, four hours per week for two subjects, and the latter twelve hours. In twenty-three schools there was one science master for every seventy-six boys. He considered it was now time for the schools to agree upon the subject-matter of their science courses.

Mr. F. R. Leyland-Wilson (Charterhouse) read a paper on the best method of introducing the atomic theory in science.

An exhibition of apparatus by members and manufacturers was held at the close of the meeting.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. EVAN SPICER, chairman of the London County Council, will distribute the prizes and certificates at the annual conversazione of the Northampton Institute, Clerkenwell, E.C., on Friday, January 25.

THE annual general meeting and dinner of the Central Technical College Old Students' Association will be held at the Trocadero Restaurant, Piccadilly Circus, W., on Saturday, February 23. Applications for tickets should be sent to Mr. R. J. Caldwell, 40 Salehurst Road, Crofton Park, London, S.E.

THE department of archæology of the University of Pennsylvania has received a gift of 8000*l.* from Mr. Eckley Brinton Coxe, jun. The donor has specified that of the gift 1720*l.* a year shall be paid for five years to the new curator of the department of Egyptology, Dr. D. Randall MacIver, who is now in Egypt, where he has been instructed to begin excavations.

MR. SIDNEY WELLS, principal of the Battersea Polytechnic, and a member of the consultative committee of the Board of Education, has been appointed Director-General of the Department of Agriculture and Technical Education for Egypt. This department has been created in order to develop, organise, and control technical education in Egypt generally. It will be concerned with all the Government educational institutions of every kind, and also with the non-Government technical institutions.

A PRIVATE donation has enabled the Meteorological Committee to invite applications for an appointment as reader in dynamical meteorology. The readership will be of the annual value of 350*l.*, and will be tenable for three years at any British university that may be approved for the purpose and affords the required facilities. The duty of the reader will be primarily to promote the science of meteorology by mathematical investigation, and he will be expected to give annually a short course of about twelve lectures. Further details may be obtained from the Director of the Meteorological Office, 63 Victoria Street, London, S.W.

THE annual report of the council of University College, London, has just been issued. The number of students in the college for the session 1905–6 was 1396; of these, 134 were post-graduate and research students. The report contains particulars of the benefactions received during the year, which include valuable grants from the Drapers' Company, from the Chadwick trustees, and the sum of 2500*l.* collected by the Jewish Historical Society for the maintenance of the Mocatta library. The report also contains a summary of the research work done during the past session; the lists of the publications by professors, assistant teachers, and senior students occupy fourteen pages. The steps that have been taken for the union of the college and the University of London are summarised in the report. On January 1 of the present year the college ceased to be a school of the University, and became incorporated with it, thus realising the aims of those who in 1826 founded it. It is the first college to be thus incorporated with the University, and it is understood that its example will be followed by King's College. Important additions have been made during the past year to the departments of physics and chemistry, and a plan has been worked out for the rearrangement of many of the college departments. This will be possible when the new buildings for the school of advanced medical studies, now in course of erection by the generosity of Sir Donald Currie, and the new buildings of University College School at Hampstead, are completed.

SOCIETIES AND ACADEMIES.

LONDON.

Mathematical Society, January 10.—Prof. W. Burnside, president, in the chair.—An exhibition of models of four-dimensional figures was made by Mrs. A. **Stott**. The models are sections by three-dimensional flat spaces of the six regular hypersolids of a flat space of four dimensions. The sections are in general polyhedra; and corresponding faces of different polyhedra, forming a series of sections of the same regular hypersolid, are coloured identically in order to show the relations between the different sections. Other models show the grouping about a point of the regular hypersolids which have the space-filling property.—The uniform convergence of Fourier's series: Dr. E. W. **Hobson**. The coefficients of the Fourier's series determined by an assigned function are defined by integrals, which may be determinate when the extended definition of integration introduced by Lebesgue is used, although they have no meaning when integration is interpreted in accordance with Riemann's definition. It is shown in the paper that whenever the coefficients of the Fourier's series, determined by a function $f(x)$ in the interval $\pi > x > -\pi$, are, in this sense, determinate, and the function $f(x)$ is continuous throughout a sub-interval included in this interval, and this function is of limited total fluctuation in the whole interval, the Fourier's series so determined converges uniformly in the sub-interval.—Hyper-even numbers and Fermat's numbers: Lieut.-Colonel A. **Cunningham**. The hyper-even numbers are formed in sequence as 2^n, 2^{2^n}, $2^{2^{2^n}}$, and so on. Fermat's numbers are of the form $2^{2^n}+1$. The numbers ξ which are such that $2^\xi \equiv 1 \pmod{m}$ are the *Haupt-exponents* of 2 for the modulus m. The paper is occupied with tracing the relations which connect together the residues of successive hyper-even numbers, the uneven factors of the *Haupt-exponents*, and the Fermat's numbers.—Riemann's hypergeometric function: Dr. E. W. **Barnes**. It is shown how the differential equation of the hypergeometric series, and likewise that of Riemann's function, can be solved respectively by means of certain contour integrals, and how the known solutions can all be obtained by deforming the contour. The relations between the various forms of solution, which hold in the neighbourhoods of the singular points, can be traced very simply by means of the general formulæ. The method is applied to obtain asymptotic approximations to zonal harmonics in the case where the index increases indefinitely.—Partial differential equations of the second order, having integral systems free from partial quadratures: Prof. A. R. **Forsyth**. The integral systems discussed are those in which three variables x, y, z are expressed in terms of two parameters u, v, an arbitrary function of u, an arbitrary function of v, and differential coefficients of these two functions. The object of the paper is to determine the forms of the differential equations which possess integrals of the type in question, and to construct the integrals of such equations.—The singular points of certain classes of functions of several variables: G. H. **Hardy**. The theory of the singularities of functions of one variable, defined by Taylor's series, may be said to be tolerably complete, but in the case of functions of several variables little advance has been made. The purpose of this paper is, by the consideration of a few of the simplest cases, to make a beginning with the problem of classifying types of power series in two or more variables according to the nature of their singularities.—The singularities of functions defined by Taylor's series: G. H. **Hardy**.—Asymptotic approximation to integral functions of zero order: J. E. **Littlewood**.—The reducibility of covariants of binary quantics of infinite order: P. W. **Wood**.—The forms of the stream lines due to the motion of an ellipsoid in infinite fluid, frictionless or viscous: Dr. T. **Stuart**.

Geological Society, December 19, 1906.—Sir Archibald Geikie, Sec.R.S., president, in the chair.—The post-Cretaceous stratigraphy of southern Nigeria: J. **Parkinson**. In this paper, which is a first attempt to outline the sequence of the later deposits of southern Nigeria (now including the colony of Lagos), a series of beds is described from four localities—three from the western side of the Niger, and one around Calabar near the Kameruns frontier. The alluvium of the river-beds and the lower terraces are referred to, and the succeeding sediments grouped under three heads.—The geology of the Oban Hills (southern Nigeria): J. **Parkinson**. The country described in this paper comprises some 1800 square miles of the Eastern Province of southern Nigeria, adjacent to

the Kameruns frontier. The rocks are crystalline, principally gneisses and schists, with later granites, pegmatites, and basaltic dykes, surrounded on the north, west, and south by Cretaceous sediments. For purposes of description the series is divided under nine headings, according to locality and petrographical character; and it is concluded that, neglecting the basaltic dykes, two broad groups may be distinguished—the one characterised by the presence, the other by the absence, of foliation. In the former the foliation tends to be lost, giving a passage between types which petrographically are acid orthogneisses and granites.—The crystalline rocks of the Kukuruku Hills (Central Province of southern Nigeria): J. **Parkinson.** In this paper a short account is given of the crystalline rocks found in the Central Province of southern Nigeria, between the station of Ifon (north of Benin City) and the northern Nigerian frontier. The rocks fall under two heads:—(*a*) a group of gneisses, and (*b*) a group of schists.

Royal Microscopical Society, December 19, 1906.—Dr. D. H. Scott, F.R.S., president, in the chair.—Microscopic study of strain in metals: F. **Rogers.** The author described the nature of the fatigue of steels which is brought about by submitting them to alternating stresses of a certain magnitude. The nature of the effects in the ferrite of steels is different from that in soft iron, and the effects in pearlite depend upon the type of pearlite. An important difference exists between steels as rolled, or annealed below about 750° C., and steels annealed at higher temperatures, *i.e.* more or less overheated. In the former, the outcrops of surfaces upon which slip has repeatedly occurred are very numerous, short and crooked, and the surface parallel to the direction of stress becomes ruffled. In the latter type, the outcrops are fewer, less crooked, and longer, and the surface is practically unruffled. A relation is found to exist between the ruffling and the Lüders's lines which are found upon statically-strained pieces, and this leads to the theory that specimens of the "normal" group endure fatigue better than "overheated" specimens, because the permanent and injurious microscopic strains are more minutely subdivided and uniformly distributed in the former than in the latter. There is a stage in the life of a piece of steel enduring fatigue, after which, though it is far short of final rupture, annealing is futile, if not actually harmful. Pieces in this stage if heated to 250° C. or higher, and then fatigued to rupture, show heat-tint marks on the ultimate fracture, which map out the portion of fracture which was sufficiently open at the time of heating for air to enter.

PARIS.

Academy of Sciences, January 7.—M. A. Chauveau in the chair.—The distillation of alloys of silver and copper, silver and tin, and silver and lead: Henri **Moissan** and Tosio **Watanabe.** Alloys of the above-named metals were heated under comparable conditions in the electric furnace, the current being maintained at 500 amperes at 110 volts. The original alloy was analysed, and also the ingot remaining in the graphite crucible after the heating. It was found that the metal most easily volatilised was lead, followed by silver, copper, and tin, tin having the highest boiling point of the four. The results are in general agreement with the experiments of Krafft on the distillation of small quantities of metals in a kathode vacuum.—The results of the micrometric measurements made during the eclipse of August 30, 1905, at Roquetas and at Saint Genis Laval: Jean **Merlin.** The value adopted by Newcomb for the constant of lunar parallax is not appreciably in error, and a better value cannot be deduced from the above observations. A certain number of the relative positions of the sun and moon given in the *Connaissance des Temps* require correction.—A theorem of Heine and a theorem of Borel: A. **Schœnflies.**—Turbines with a flexible axis: L. **Lecornu.** In high-speed impact turbines of the Laval type there are certain advantages connected with the use of a flexible axis. The present paper is concerned with the effects of this flexible axis upon the movements of the centre of gravity of the system, taking into account the small variations of the angular velocity of the turbine disc.—The theory of the magnetic properties of iron beyond the temperature of transformation: Pierre **Weiss.**—The measurement of the radio-chromometric degree by the electrostatic voltmeter in the utilisation of the Röntgen rays in medicine: J. **Bergonié.** The voltage of the Crookes's tubes being measured by an electrostatic voltmeter indicating up to 60,000 volts, it was found that whatever the intensity of the current traversing the tube, if the voltage measured by the voltmeter was kept constant, the rays emitted by the tube are always sensibly of the same radio-chromometric degree. For increased voltages of the tube the rays become more penetrating, the variable intensities of current passing through the tube being without effect. Finally, for tubes of different patterns, unequally used, and carrying different intensities of current, provided that the voltages are kept equal the radio-chromometric degree of each is the same.—The ultra-violet phosphorescent spectrum of fluorspar. The variations of the phosphorescent spectrum of the same element in the same diluent: G. **Urbain** and C. **Scal.** The phosphorescence spectrum of an element cannot be considered as constant, but depends on the proportions in which it is present in the diluting medium.—The chlorination of organic compounds in the presence of thallous chloride: V. **Thomas.** The results obtained by the substitution of chloride of thallium for ferric chloride as a catalytic agent in chlorination are not essentially different in the two cases, complex mixtures being found.—The alkaline reduction of *p*- and *m*-nitrobenzophenone: P. **Carré.** The complete reduction with zinc dust and caustic soda is not possible without affecting the ketonic group; the mixture of azo- and azoxybenzophenone resulting from this reduction furnished *p*-hydrazobenzophenone on treatment with ammonium hydrosulphide.—The use of polarised light for the detection under the microscope of starches composed of rice and maize in wheat flour: G. **Gastine.** An improvement of a method proposed in an earlier paper.—Fluorine in mineral waters: P. **Carles.** The author has improved his method for the detection of traces of fluorine in mineral waters, and gives approximate determinations of the amounts present in ninety-three waters of different origin.—Artificial growths: Stéphane **Leduc.** An account of the influence of the medium in which the artificial cells are produced.—The influence of temperature and the hygrometric state of the surrounding atmosphere on the preservation of eggs: M. **de Loverdo.** The most favourable conditions for the preservation of eggs are a temperature kept exactly at −1° C., and a hygrometric state as near as possible to 78 per cent. saturated.—The annelids collected by the French Antarctic Expedition: Ch. **Gravier.**—The origin of the centrosome: J. **Kunstler.**—The regulation of the nycthemeral cycle of temperature and its inversion in the aged: Ed. **Toulouse** and H. **Piéron.**—The Cretaceous strata of the eastern Atlas in Morocco: W. **Kilian** and Louis **Gentil.**—The value of the magnetic elements at the Val-Joyeux Observatory on January 1: Th. **Moureaux.**

NEW SOUTH WALES.

Royal Society, November 7, 1906.—Prof. T. P. Anderson Stuart, president, in the chair.—Notes on some native tribes of Australia: R. H. **Mathews.** The author reproduced some information he had collected during many years past among the aborigines of different portions of the continent respecting their sociology, laws relating to food, methods of avenging deaths, and so on. He also briefly touched upon their language, and some curious beliefs held by the natives concerning metempsychosis, or reincarnation of souls.—Note on the Silurian and Devonian rocks occurring to the west of the Canoblas Mountains, near Orange, New South Wales: C. A. **Süssmilch.** The area referred to comprises a large portion of the parish of Barton and a small portion of the parish of Bowan, county of Ashburnam, and is about fifteen miles south-west from Orange.

CAPE TOWN.

South African Philosophical Society, November 28, 1906.—Dr. J. C. Beattie, president, in the chair.—Notes on the morphology and biology of *Hydnora africana*, Thunb.: Dr. **Marloth.** The genus Hydnora comprises several species (about seven), which are confined to the African continent. They are all parasites which grow on

the roots of different shrubs and trees. The species which forms the subject of this paper, viz. *Hydnora africana*, uses the common milkbush of the karroo and karroid regions of the interior, viz. *Euphorbia mauritanica*, as its host. It is in the structure of the flower that the author has observed some organ which has hitherto escaped the attention of botanists. Each of the three segments of the perianth bears a large snow-white body on its inner side, while the remainder of the inner surface of the flower is of a bright flesh colour. These three white bodies are not mentioned in any existing description of Hydnora.—Examination of the validity of an approximate solution of a certain velocity equation: Prof. A. **Brown.** The question here considered is the part played by the initial value of y (λ) in the solution of the equation

$$\frac{dy}{dt} = a_1 y + a_2 y^2 + a_3 y + - - - ..$$

It is commonly assumed that, for a small initial value of y, the method of successive approximation is applicable, the proviso being sometimes made that the value of y, so obtained, be also small. This assumption is shown in the paper to be not necessarily correct, or in certain cases to lead to a rapid approximation when correct.—List of Natal plants: J. Medley **Wood.**

DIARY OF SOCIETIES.

THURSDAY, JANUARY 17.

ROYAL SOCIETY, at 4.30.—The Natural and Induced Resistance of Mice to the Growth of Cancer: Dr. E. F. Bashford, J. A. Murray, and Dr. W. Cramer.—On the Pathology of the Dropsy produced by Obstruction of the Superior and Inferior Venæ Cavæ and the Portal Vein: Preliminary Communication: Dr. C. Bolton.—Observations on the Life-history of *Adelea ovata*, Aimé Schneider; with a Note on a New Gregarine from the Gut of *Lithobius forficatus*: C. C. Dobell.

CHEMICAL SOCIETY, at 8.30.—The Relation between Absorption Spectra and Optical Rotatory Power, Part i., The Effect of Unsaturation and Stereo-isomerism: A. W. Stewart.—Organic Derivatives of Silicon, Part ii., The Synthesis of Di-ethyl, Propyl Benzyl Silicol, its Sulphonation, and the Resolution of the Sulphonic Derivatives into Optically Active Compounds: F. S. Kipping.—The Association of Phenols in the Liquid Condition: J. T. Hewitt and T. F. Winmill.—A New Mercuric Oxychloride: J. T. Hewitt.—Aromatic Selenonium Bases: S. Smiles and T. P. Hilditch.—The Relation of Colour and Fluorescence to Constitution: A. G. Green.—The Constitution of Silver Nitrite, a Correction: E. Divers.—Preparation of Chromyl Chloride: F. D. Law and F. M. Perkin.—Tetraketopiperazine: A. T. de Moulpied and A. Rule.

ROYAL INSTITUTION, at 3.—Recent Advances in the Exploration of the Atmosphere: Dr. W. N. Shaw, F.R.S.

LINNEAN SOCIETY, at 8.—*Platanthera chlorantha*, Custor, var. *tricalcarata*: W. Botting Hemsley, F.R.S.—Acanthacea of Insular Malaya: the late Mr. C. B. Clarke, F.R.S.—A Freshwater Isopod from Calcutta: Rev. T. R. R. Stebbing, F.R.S.

INSTITUTION OF MINING AND METALLURGY, at 8.—Some Sampling Results: E. H. Garthwaite.—The Assay of Silver Bullion by Volhard's Method: E. A. Smith.—Water Skip with Automatic Discharge: W. R. Francis.—Breaking Piece for a Swinging-Jaw Rockbreaker: G. E. Brown.—A Visit to the De Beers Consolidated Diamond Mines: E. P. Rathbone.

FRIDAY, JANUARY 18.

ROYAL INSTITUTION, at 9.—Fifty Years of Explosives: Sir Andrew Noble, Bart., K.C.B., F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Adjourned Discussion on Lighting of Railway Premises, Indoor and Outdoor: H. Fowler.—Eighth Report to the Alloys Research Committee: On the Properties of the Alloys of Aluminium and Copper: Prof. H. C. H. Carpenter and C. A. Edwards.

MONDAY, JANUARY 21.

VICTORIA INSTITUTE, at 4.30.—The Scriptural Idea of Miracles: Rev. Canon Girdlestone.

TUESDAY, JANUARY 22.

ROYAL INSTITUTION, at 3.—The Sculpture of Aegina in Relation to Recent Discovery: Prof. Percy Gardner.

ANTHROPOLOGICAL INSTITUTE, at 8.30.—Annual General Meeting.—Presidential Address: The Burial Mounds and Dolmens of the Early Emperors of Japan: Prof. W. Gowland.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Internal-Combustion Engines for Marine Purposes: J. T. Milton.

WEDNESDAY, JANUARY 23.

SOCIETY OF ARTS, at 8.—The Isthmus of Panama: Philippe Bunau-Varilla.

ENTOMOLOGICAL SOCIETY, at 8.—Annual Meeting.

GEOLOGICAL SOCIETY, at 8.—The Geology of the Zambezi Basin around the Batoka Gorge (Rhodesia): G. W. Lamplugh, F.R.S. With Petrographical Notes by H. H. Thomas.

THURSDAY, JANUARY 24.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Experiments on the Dark Space in Vacuum Tubes: Sir William Crookes, F.R.S.—On a New Iron Carbonyl, and on the Action of Light and of Heat on the Iron Carbonyls: Sir James Dewar, F.R.S., and Dr. H. O. Jones.—Note on the Application of Van der Waals's Equation to Solutions: The Earl of Berkeley.—On the Presence of Europium in Stars: J. Lunt.

ROYAL INSTITUTION, at 3.—Recent Advances in the Exploration of the Atmosphere: Dr. W. N. Shaw, F.R.S.

SOCIETY OF ARTS, at 4.30.—The Bhils of Western India: Captain E. Barnes.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Investigations on Light Standards and the Present Condition of the High-Voltage Glow Lamp: C. C. Paterson.

FRIDAY, JANUARY 25.

ROYAL INSTITUTION, at 9.

PHYSICAL SOCIETY, at 5.—The Strength and Behaviour of Brittle Materials under Combined Stress: W. A. Scoble.—A Spectrophotometer: F. Twyman.—Photographs of Electric Sparks: K. J. Tarrant.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Alternating-Current Commutator Motors: C. A. Ablett.

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