THURSDAY, JUNE 14, 1906.

THE RESPIRATORY SYSTEM OF VERTEBRATES.

Lehrbuch der vergleichenden mikroskopischen Anatomie der Wirbeltiere. Edited by Dr. Albert Oppel. Part v., Parietal Organ. By Dr. F. K. Studnička. Pp. vi+254. Price 8 marks. Part vi., Atmungsapparat. By Dr. Albert Oppel. Pp. x+824. (Jena: Gustav Fischer, 1905.) Price 24 marks.

IF any interruption should overtake the present rapid growth of scientific knowledge it will not be in the acquisition of new facts that the breakdown will occur, but in the systematisation of facts already acquired by present and past generations of workers. The task of systematisation, so necessary for further progress, is in the hands of the writers of text-books, but, unfortunately, the fate which presides over that world wherein men of science live and move has ordained that the financial success of a text-book is in inverse proportion to its scientific value. The general student can command with ease both author and publisher, but the specialists, for whom a text-book is a first necessity, find it almost impossible to obtain either author or publisher. It is the good fortune of those specialists who are actively investigating the finer structure of the vertebrate body to find that, thanks to the untiring industry of Prof. Oppel and the enterprise of Herr Gustav Fischer, the text-book they so much needed has now been provided for them. In bringing to a conclusion the sixth part or volume of this great task, Prof. Oppel modestly consoles himself with the hope that the work, to which he has devoted twelve years of his life without reward or fee, may prove of use to others. It is in no niggardly spirit that we in England must acknowledge the service he has rendered us.

Within the sixth volume Prof. Oppel has compressed the results of two centuries of inquiry into the minute structure of the breathing organs of vertebrate animals. The facts are drawn from more than 900 separate publications as well as from his own researches, and deal with the respiratory system of more than 500 species of vertebrate animals. A close examination of the great mass of evidence which has been thus brought together leaves one convinced that, however unlike they may seem, the gill of the fish and the lung of the mammal serve not only the same functional purpose, but are, indeed, but modifications of the self-same organ. It is now clear that in the evolution of the vertebrates there has been no development of a completely new organ of respiration. By a process which we understand but imperfectly at present, the same organ has been modified to serve the same purpose in fishes, amphibians, reptiles, birds, and mammals. The embryological investigations into the origin of the lungs of the frog by Goette, of the fowl by Kastschenko, of the human embryo by Fol, and the later researches of Weber and Buvignier, leave no room to doubt the truth of that generalisation.

Perhaps no two structures have engaged the speculative fancy of naturalists so much as the swim-bladder of fishes and the air-sacs of birds. As to the first, it cannot be said that the great number of observations which Prof. Oppel has succeeded in massing in his pages takes us perceptibly nearer a conception of the true nature and origin of the swim-bladder and its relationship to the vertebrate lung than were the naturalists of fifty years ago. A theory which regards it simply as a hydrostatic organ for permitting a fish to accommodate itself to any depth of water gives only a very incomplete explanation of its presence and structure. On the other hand, the nature of the air-sacs of birds is now almost completely understood. When the facts grouped together by Prof. Oppel are considered it becomes evident that in the vertebrate lung, be it of a frog, of a lizard, of a bird, or of a mammal, there are three distinct parts which differ in structure and in function. In no vertebrate form have these three parts become so highly specialised and distinctly separated as in birds. The three parts are:—(1) a vascular membrane covered by peculiar epithelium and puckered so as to form alveoli (the respiratory part); (2) an elastic chamber or series of chambers, capable of being enlarged and diminished on inspiration and expiration (the bellows part); (3) a series of non-collapsible tubes for conveying the air to and from the air chambers (the conducting part). In the avian lung the bellows part has become completely separated from the respiratory portion, and forms the air-sacs. Intermediate stages in the process of separation are to be seen in the lungs of reptiles. In the mammalian lung the bellows part is broken up into a series of small chambers throughout the whole organ, which form what we in England have been in the habit of calling infundibula, but which, in the more elaborate terminology of Dr. W. S. Miller, are now demarcated into vestibule, atrium, and air-sac.

The progress of our knowledge of the minute structure of the mammalian lung has been peculiarly slow. In part this has been due to the elaborate nomenclature employed. The same term has been used to designate totally different parts, and the same part has been called by several different names. Prof. Oppel has done us a great service in coordinating the terminology used by different investigators. It is clear from the manner in which Prof. Oppel discusses the question as to the nature of the epithelial covering of the gills that he finds it difficult to break away from the tradition which has come down to us from the older embryologists—that there is a profound morphological distinction between the ectodermal and endodermal layers of the embryo. From the minute manner in which he relates the matter it is evident that he quite enjoyed the prolonged scholastic discussion which was first raised by Aeby—as to whether the branching of the bronchial tree was by a process of dichotomy or monopody.

The fifth volume, which deals with our knowledge of the pineal body, and the pineal eye or parietal organ, was entrusted by Prof. Oppel to the safe hands of Dr. F. K. Studnička. That authority has not only coordinated the results contained in some three hundred papers dealing with this structure, but has added much new and valuable work of his own.

The study of structure by itself and for itself is a most unprofitable occupation, and Prof. Oppel, by including a free reference to function and development, has not only added greatly to the interest, but also to the value of these two volumes.

A. K.

A TEXT-BOOK OF GENETICS.

Vorlesungen uber Deszendenztheorien mit besonderer Berücksichtigung der Botanischen Seite der Frage gehalten an der Reichsuniversität zu Leiden. By Dr. J. P. Lotsy. Erster Teil. Pp. xii+384. (Jena: Gustav Fischer, 1906.) Price 8 marks.

AS the moment is favourable, may it be suggested that the branch of science the rapid growth of which forms the occasion of Prof. Lotsy's book should now receive a distinctive name? Studies in "Experimental Evolution" or in the "Theory of Descent," strike a wrong note; for, theory apart, the physiology of heredity and variation is a definite branch of science, and if we knew nothing of evolution that science would still exist. To avoid further periphrasis, then, let us say genetics.

Prof. Lotsy's lectures are a welcome contribution to genetics. They are expository and critical rather than creative, but there is plenty of room for such a work. Since it must be admitted that to most of us facts appeal "first when we see them painted," such a presentation as this book provides should attract many who would find little to detain them in original records.

There are twenty lectures in this first part, and a second part is promised. After a philosophical introduction, which must be left to the judgment of those versed in such matters, the author proceeds to a careful discussion of the evidence for direct adaptation. Though no Lamarckian in the usual sense, he has a high respect for Lamarck's penetration and breadth of view. In this revindication of a great name, naturalists of the younger generation who have studied Lamarck's writings at first hand will probably sympathise with Prof. Lotsy. In a limited sense the modification produced by environment—biaiometamorphosis, as Prof. Lotsy calls it—is important. No botanist doubts that the forms of plants can be profoundly changed by the conditions to which they are exposed. The normal or habitual form in which we know a species is only one of these modifications. Consequently each experimental proof of the dependence of form on environment has a direct bearing on the genesis of type. But the question of *purposeful* or adaptative modification is quite distinct, and of any transmission of purposeful modification in descent there is no evidence.

The section of the book which gives it its chief value is that in which an account is provided of the new developments in genetics, especially Mendelian analysis and the experiments of de Vries. The consequences of Mendelian segregation are described with great clearness, and are illustrated by some excellent diagrams, of which one (p. 101) is striking and novel. The members of the various generations are shown in a perspective view, drawn approximately to scale, in a way which should do something to remove the supposed obscurity of these phenomena. Both the description of the facts and the critical discussion of the bearing of Mendel's discovery on the earlier or Galtonian method of calculating inheritance are especially lucid and to the point.

The weaker features of this section are such as are almost inevitable in attempts to confine a rapidly growing study within text-book limits. The relative importance of the various elements is continually changing. For example, though due stress is laid on Tschermak's fine series of cases illustrating the influence of hidden factors, or cryptomeres, Cuénot's useful exposition of the part played by double factors in the case of mice seems to have been left out. Having regard to the remarkable developments which have followed, this omission is unlucky. In the same connection it is a matter of special regret to myself that the revised and simplified account of the "walnut" combs in fowls did not reach Prof. Lotsy in time to prevent a reproduction of my former and erroneous idea in his text-book.

By all who are working at genetics the discussion of de Vries' mutations will be read with interest. Till now those remarkable observations have been regarded either with indiscriminate enthusiasm, or with still more unreasoning suspicion. But on those who know that the mutations of Œnothera are not errors of observation, and hesitate to accept them as the single key to the final mysteries of evolution, the question begins to press: What *are* those mutations? Upon this point the teaching of genetic research is clear. Before we can form a definite view as to the nature of any given mutation we must know its gametic relations to the type from which it sprang, and to the sister-mutations. So far, these relations, as expressed by the ratios in which the forms appear, seem to be almost always irregular in the Œnothera cases. Experience, however, has shown that such irregularities, as in the case of Miss Saunders' *Matthiola*, may conceal an underlying regularity which fuller analysis can reveal. For instance, we know that various individuals of a form A may give respectively an F_2 ratio 9A : 7B; or 3A : 1B; or all A; or 27A, 9C, 28B, and so on, and the causation or meaning of these several ratios is clear. May not such complexities be the source of the confusion which apparently besets the Œnothera cases? That is the opinion to which Prof. Lotsy inclines, and the position is for the most part unassailable as yet. All that can be positively asserted is that these mutations are forms arising discontinuously, and that their distinctions are exactly comparable with those that often appear to characterise species. But now that we understand what a medley of phenomena is included in the term "specific

difference " it becomes necessary to go further and to ascertain which phenomenon is exemplified in each case. That genetic analysis can alone answer that question everyone now perceives. De Vries' own discussion of his results contains manifest traces of an attempt to incorporate the Mendelian ideas into earlier and pre-Mendelian conceptions, and the result is not always harmonious or convincing. We look to de Vries and the many observers who are now at work on Œnothera to bring the various possibilities to a strict test, case by case, and so complete what has been begun with such astonishing success.

Meanwhile, however, it must be conceded that there are serious difficulties in the way of a purely Mendelian account of the Œnotheras—more perhaps than Prof. Lotsy indicates. Of these one of the most formidable is the behaviour of the form *nanella*, for which other cases afford no parallel. There are, further, the objections de Vries himself has urged in the passages contributed to Moll's exposition of his work—particularly, that no indication of a hybrid origin of his original stock is forthcoming. Again, though the sterile pollen grains are suspicious, I may mention that in a collection of wild Œnotheras (? species) made near Baltimore, I found none which had not some bad pollen grains. Were all these hybrids? it may well be asked. If so, hybrids of what? Our Rubi hybridise freely, but, as Focke showed, there are pure forms with perfect pollen, and hybrid forms with an admixture of bad grains. This test should be made in America on a large scale, to discover whether any Œnothera is " pure " by that criterion.

But again, we know that the production of analytical varieties by a hybrid, and the production of novel forms by a mutating species, must be exceedingly similar and perhaps indistinguishable phenomena. Hybridisation cannot be regarded as the sole source of analytical variation—witness the case of *Primula sinensis* and the sweet pea, where analytical variation is rife, though no hybridisation has taken place. The interrelationship of the two sets of occurrences is still obscure; but by experimental breeding it can in great measure be elucidated, and in the course of that inquiry the meaning of mutation will probably be discovered.

Only salient features of the book have been mentioned; many others must be passed over. *Capsella* has provided (p. 180), as might be expected, good examples of the constancy of *petites espèces*. Time brings revenges, and we must hope that Jordan would have felt satisfaction in the recognition now accorded to his once discredited work, though, by the perversity of things, that work is used to complete and support those views he most detested. Strange, too, would it seem to his opponents to see Jordan's micro-species received as a valuable element in the general doctrine of mutability!

In several minor points the book is open to criticism. The Artemia-Branchipus story should not be repeated even incidentally without words of caution. The pictures even in these half-tone days are below the mark, and such pictures as those of peloric Linaria make one long for decent woodcuts again. The figure of the Norwich canary would surprise the fanciers of that city, and it suggests that the crest is a Norwich character. Lastly there is a profusion of most distracting misprints. W. BATESON.

TEXT-BOOKS OF PHYSICS.

(1) *Müller-Pouillets Lehrbuch der Physik und Meteorologie*. Edited by Leopold Pfaundler. Tenth edition. First vol. (in two parts). Pp. xiv+801. Illustrations. (Brunswick: F. Vieweg und Sohn, 1905 and 1906.) Price 7 marks and 3 marks 50.

(2) *Cours de Physique de l'École Polytechnique*. By J. Jamin. Troisième supplément. Radiations, Électricité, Ionisation. E. Bouty. Pp. vi+420. (Paris: Gauthier-Villars, 1906.) Price 8 francs.

(3) *Lehrbuch der Physik*. By H. A. Lorentz. Translated into German by G. Siebert. Erster Band. Pp. vi+482. (Leipzig: Johann A. Barth, 1906.) Price 8 marks.

(1) THE preparation of this tenth edition of a well-known text-book has been undertaken by Dr. Pfaundler, in succession to Dr. Wild, whose death occurred soon after the publishers had put the revision in hand. For the present instalment on mechanics and acoustics Dr. Pfaundler is responsible; but for other parts of the four volumes in which the work will be completed the co-operation has been secured of Dr. Lummer (optics and heat), Dr. Kaufmann (magnetism and electricity), Prof. J. M. Pernter (meteorology), Dr. Nippoldt (terrestrial magnetism), Dr. Drucker (physical chemistry), and Dr. Wassmuth (heat conductivity and thermodynamics).

It is intended to maintain the characteristics of the book as being essentially non-mathematical. This plan, of course, very much restricts the treatment of most of the problems dealt with, and in many cases prevents any proof being given of formulæ which are discussed. There is room, however, for a text-book of this kind, as is amply testified by the success of the previous editions. In spite of the limitation in the treatment, the author has succeeded in giving a very comprehensive account of his subject. He is very clear, and takes special pains to be so in cases where difficulties are commonly met with. For example, in connection with *mass* and *weight* he is very precise. The kilogram is a mass, and not a weight; one can only say *it has a weight*, and can call this the kilogram-weight. In stating this he is in agreement with the International Committee of Weights and Measures (Paris, 1901), whose decisions may be considered as representing the common-sense of the scientific world.

The intention is to bring out the remaining volumes quickly. It is expressly hoped that owing to the large number of collaborators, the treatise may be completed before the first volume is out of date.

(2) The second of the volumes under notice is the third supplement to the treatise on physics, commonly known as " Jamin et Bouty." The subject-matters embraced are radiations, électricité, ionisation. It is

more than six years since the second supplement appeared, and in the interval the study of the kathode stream, the phenomena of radio-activity, and in general of everything concerned with the propagation of electricity in gases has given rise to a new conception of electrical conductivity, and of the ultimate constitution of what were once called the "electrical fluids." The faith of scientific men in the non-transmutability of matter has been shaken; even the notion of material mass tends to be absorbed in that of electromagnetic inertia.

This is the state of things as set forth in the preface to this supplement; no surprise need be felt, then, at its large size compared with that of the preceding numbers. The portion dealing with radiations includes amongst other things an account of recent work on the energy of a block body, the pressure of radiation, the laws of dispersion (normal and anomalous), remainder rays, and N-rays. In regard to the last-named subject, we have no wish to be dogmatic; there is certainly some evidence that M. Blondlot has been experimenting with objective, and not entirely with subjective, phenomena, and if this is so, experiments should not cease until the *exact* nature of these phenomena has been established. But when M. Bouty devotes nearly two pages to this subject, and does not even hint that there is doubt, amounting to disbelief, in the minds of most of the leading physicists of the world in regard to this matter, we think that he is hardly doing justice to it.

In electricity, leading sections deal with wireless telegraphy, polyphase currents, the ionic theory, and the work of Nernst. Under the head of ionisation are taken the phenomena of ionisation in gases and radio-activity. The volume concludes with some miscellaneous practical applications of electricity.

Any who are familiar with the main treatise and the previous appendices will know that M. Bouty is a master of lucid exposition; there is no need to commend this volume to them. Those who are desirous of learning, in brief but clear summary, the present state of knowledge in regard to the above supremely important subjects may be recommended to read this appendix.

(3) The third of the above books is the first volume of a course of elementary physics based on lectures delivered to classes consisting largely of medical students. As the reader is assumed to be attending experimental lectures and, if possible, performing experimental work himself in a laboratory, small space is given here to descriptions of experiments and of methods of observation.

The subjects dealt with are mechanics, and the properties of bodies in the solid, liquid, and gaseous states. The sixth chapter consists of thermodynamical considerations in respect to gases. This chapter is undoubtedly very lucid, but we think that its proper place is later on—after calorimetry. The mathematics employed is simple, and the treatment very clear. The name of the author is, of course, a sufficient guarantee of the nature of the book. We look forward to seeing the German translation of the remainder.

REDUCTION OF GEODETIC MEASURES.

The Adjustment of Observations by the Method of Least Squares, with Applications to Geodetic Work. By T. W. Wright, with the cooperation of J. F. Hayford. Second edition. (New York: D. Van Nostrand Co.; London: A. Constable and Co., Ltd., 1906.) Price 3 dollars net, or 12*s.* 6*d.* net.

THIS is a book which in its original form grew out of the experience and requirements of the U.S. Coast and Geodetic Survey. As points of novelty or difficulty arose in the course of the work and were solved by the staff, Mr. Wright collected the decisions and the methods as guides for the treatment of similar cases in the future. The systematic arrangement of these cases, and the discussion of the principles which furnished the solution, provided a mass of materia which has been of great service to the department An opportunity has now arisen for the revision o. this work, and in the belief that the information would be of advantage in many operations connected with scientific engineering, the original author, in collaboration with Mr. J. F. Hayford, chief of the computing division and inspector of geodetic work, has given to this material the form of a treatise.

The book is eminently practical. The authors do not enter into the question whether the principle of least squares suggests the best or the only method for deriving from a mass of imperfect data a result that will command general confidence. They recognise the fact that the method has secured an impregnable place in all inquiries to which it is applicable, and proceed at once to discuss the law of error on the ordinary Gauss-Chauvenet lines. The subject necessarily does not lend itself to any novelty of treatment. The value of the earlier chapters at least lies in the fact that the authors place before us the results of a wide and profound experience. Everywhere they keep in sight the practical treatment, insisting on the importance of arithmetical checks and processes of abbreviation. In this connection one is glad to see Doolittle's system of solution set out in a complete scheme, as well as other processes which have a practical application.

The question of the rejection of discordant observations will always occasion a computer some anxiety The authors have evidently suffered, and the practical rule given here may not be generally accepted, but is valuable as showing, presumably, what is the practice in the U.S. Geodetic Survey. The authors advise that no observation should be retained for which the residual exceeds five times the probable error of a single observation, and that all observations the residuals of which exceed three and a half times the probable error of a single observation should be examined, and rejected, if any of the conditions under which the observation was made were such as to produce any lack of confidence. The conviction is also expressed that an observer's best observations are poorer than he believes them to be, and his poorest better. As a consequence of this the range of weights that observers attach to their observations is too large.

Actual geodetic measures necessarily introduce the

problem of conditioned observations, in which no set of values can be assumed to satisfy approximately the observation equations which does not exactly satisfy some *a priori* conditions. This problem may not necessitate any fresh method of treatment, but the applications are somewhat unusual, and, again, it is of very great importance to know what is done in actual practice. The authors have given us a valuable treatise, prepared with care, and generally free from errors. There is some confusion in the numbering of the figures after p. 193, but this, if annoying, is of less importance than any error in the formulæ.

W. E. P.

OUR BOOK SHELF.

Modern Milling Machines. By Joseph G. Horner. Pp. ix+304. (London: Crosby Lockwood and Son, 1906.) 12*s.* 6*d.* net.

A MODERN machine shop in any large works would be very incomplete indeed without a full complement of milling machines. The proportion of this class of machinery very largely depends upon the class of work dealt with. For instance, in a sewing-machine, cycle, or motor-car factory the milling machine would predominate, being in many specialised forms, each machine designed for some particular function. On the other hand, in a general engineering establishment any milling machines installed would be of the universal type, and capable of dealing with many different operations, such as the universal machines made by Brown and Sharpe, of U.S.A., and many others.

It is only during recent years that milling machinery has come prominently to the front, principally due to the fact that designers of such machines have grasped the fact that they must be made of ample weight with large bearing and wearing surfaces, so as to ensure steady running without spring of the machine and consequent vibration. Another very important consideration is the possibility of obtaining suitable material for the cutters used. The cost of making a milling cutter is infinitely more than the value of the cast steel used. It is evident, therefore, that when once completed the cutter should have a long life. This desideratum has been rendered possible by the introduction of high-speed tool steel, the results obtained being of a most satisfactory nature, particularly those from the "Air-hardened" steel manufactured by Edgar Allen and Co., of Sheffield. The cost of the material, therefore, is a secondary consideration.

In the volume under notice the author describes very fully many different types of machines, and probably one of the best chapters is that dealing with the design and manufacture of the cutters. The power required very largely depends on the design of cutter used, other things being equal; to use a cutter in any degree dull is also poor economy.

Another valuable assistant to the milling machine and its cutters is the introduction of special cutter grinding machines, which, I believe, emanated from the Brown and Sharpe Manufacturing Company. Many of these machines are described and illustrated, the author having gone very fully into the subject. This is as it should be, since a good cutter is of the utmost importance in milling work.

Chapter xi. is too short, though very interesting; it deals with the subject of feeds and speeds. On these constant worries of a machine-shop manager our author has much to say, and sensible advice to give, and we cordially agree with him where he points out how easy it is to get wonderful results by means of a sharp tool running for short periods by comparison with work done under ordinary shop conditions. Such work, as a rule, does not pay.

We can recommend this volume to all interested in machine-shop practice. The machines dealt with are of the latest type, and much useful information will be found scattered through its pages.

N. J. L.

Lectures on the Method of Science. Edited by T. B. Strong, Dean of Christ Church. Pp. viii+249. (Oxford: Clarendon Press, 1906.) Price 7*s.* 6*d.* net.

THESE lectures formed part of a course on scientific method delivered at the University Extension summer meeting at Oxford last August. The discourses are intended to illustrate the forms taken by scientific method in various departments of research. Prof. Case deals with scientific method as a mental operation; Prof. Francis Gotch, F.R.S., treats of various aspects of the method; Prof. C. S. Sherrington, F.R.S., describes the scope and method of physiology; the lecture by the late Prof. Weldon discusses inheritance in animals and plants; Dr. W. McDougall explains the psychophysical method; Dr. A. H. Fison applies the method to the question of double stars, Sir Richard Temple to the evolution of currency and coinage, Prof. W. M. Flinders Petrie, F.R.S., to archæological evidence, and the Rev. Dr. Strong to history.

From the nature of the case, the arguments are such as to appeal to persons of general culture rather than to specialists. If Oxford were as energetic in the prosecution of scientific research as she is in popularising knowledge by means of extension lectures, men of science would probably be disposed to think her activities better and more suitably directed. The omission of an index can never be justified in the case of a scientific book, but that a work devoted to scientific method should be deficient in this respect is an irony which cannot be overlooked.

The Secrets of Dog-Feeding. By "Great Dane." Pp. ix+58. (Southampton: Toogood and Sons, 1906.)

THE mere fact that this little work has reached its second edition within less than a year of the date of its first appearance may be taken as a sufficient guarantee that it has obtained the verdict of approval from dog-owners, and is therefore a success. The author is of opinion that the nature of the food is a matter of prime importance in the case of valuable, highly-bred dogs, and one which too often receives but insufficient attention on the part of their masters. While advocating a mixed diet, he deprecates the use of green vegetables, which has of late years come much into fashion among many dog-owners; and he adds that to a dog which has been kept largely upon farinaceous food the change to a meat diet in later years will often produce highly satisfactory results. The constituents of nearly all the foods referred to are given, so that readers can judge for themselves as to their nutritious value.

R. L.

In My Garden. A Little Summer Book for Nature Lovers. Pp. 72. (Wellingborough: The Lavender Press; London: Philip and Tacey, Ltd., 1906.) Price 1*s.* net.

THIS dainty little memorandum book, with its blank pages for notes on experiments in gardening and other observations of natural objects, will please all students of country life. The well-selected quotations and the hints on table decoration should appeal to a wide circle of readers.

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.]*

Inheritance of an Abnormality.

A CASE of the heredity of an abnormality of the hand may be of interest to some of your readers.

A father and a mother with normal hands had a family of three sons and seven daughters. The eldest son had an abnormality of each hand, the second and third fingers being apparently jointed to the same bone, and the third daughter has a different abnormality, both hands being affected. The accompanying skiagram, kindly taken for me by Mr. J. J. Blake, of Onslow Road, Richmond, will

FIG. 1.—Abnormal hand of third daughter.

show the character of this abnormality. All the remaining children had normal hands.

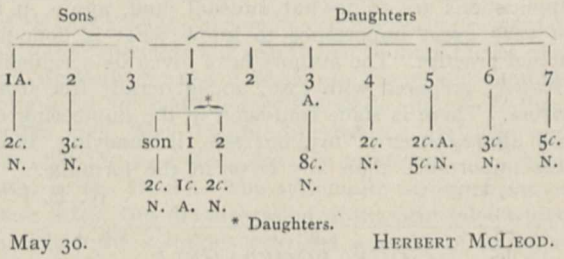
The eldest son had two children without abnormalities, and the second son three children that were normal. The eldest daughter had one son and two daughters normal; the son has two normal children, the first daughter one child abnormal, and the second daughter two children normal.

Returning to the third daughter with the abnormal hands, all her eight children are normal; the fourth daughter has two normal children; the fifth daughter has two children abnormal and five normal; the sixth has three normal, and the seventh five normal children.

There is no tradition of abnormalities in any of the relations of the father or mother. It may be mentioned that the husbands of the eldest and fifth daughters, some of whose descendants are abnormal, are first cousins (not first cousins of their wives).

The following scheme may make the relationship more clear (N signifies normal; A, abnormal; and *c*, children):—

Father and Mother, both N.



May 30. HERBERT MCLEOD.

Thermometer Scales.

A DECIDED disadvantage of the centigrade scale in meteorology is the use of negative numbers for temperatures below freezing point. In taking out means of months where negative numbers occur the labour is doubled, and other additional sources of error have to be avoided.

The Fahrenheit scale is not so liable to this trouble, but there are other objections to its use. Both of these scales might be superseded by a scale starting from absolute zero, on which the temperature of melting ice is 350°. Such a scale is compared in the following table:—

	°C.	°F.	°Positive
Absolute zero	−273 ...	−459 ...	0
Mercury melts	− 39 ...	− 38 ...	300
Ice melts	+ 0 ...	+ 32 ...	350
Very hot weather ...	+ 39 ...	+102 ...	400
Water boils	+100 ...	+212 ...	478

The great advantage of this positive scale in meteorology is that temperatures, except the most unusual, fall between 300° and 400°, so that temperature columns might be headed "300° plus." On this scale water, under a pressure of 31·3 inches, boils at 480°, so that the most important temperatures in physics are easy to remember.

R. T. A. INNES.

Government Observatory, Johannesburg, May 12.

Solar and Lunar Halos.

AN interesting halo round the sun was seen a few miles from here, on Dartmoor, from 7.30 p.m. to sunset on June 7. The halo consisted of a double circle, the inner one having an angular radius of about fifteen to twenty degrees, with concentrations of light at the top and at the right extremity—the bottom of the ring was below the horizon, and the left extremity hidden by clouds—and a concentrated ray from the sun to the top of the circle. The outer circle was double the diameter of the inner one, and much fainter. A similar halo round the moon (with the exception of the outer circle) was observed the same evening. ROWLAND A. EARP.

The Laboratory, Buckfastleigh, Devon, June 12.

THE ROYAL SOCIETY OF EDINBURGH AND THE GOVERNMENT.

THE great deputation on behalf of the Royal Society of Edinburgh, which waited on the Secretary for Scotland at the Scottish Office in Parliament Square in Edinburgh on June 1, stated a strong case in favour of more liberal treatment of the society by the Government. As one speaker expressed it, they were met there on Scottish soil, indeed at the very heart of the ancient metropolis of the kingdom of Scotland, to confer with their own Secretary of State, and to urge the claim of a society

which has been identified with scientific progress in Scotland during the nineteenth century to remain in its old home, and receive some small assistance in producing its Transactions and Proceedings. It must be admitted that this appeal met with only a very disappointing response.

The Royal Society was the heir and successor of a previous society which was established in 1731, and therefore has been practically contemporary with the great scientific illumination which had its beginning in Newton's "Principia." After an existence of about half a century the society was established, in 1826, in the Royal Institution on the Mound in Princes Street, the building in the form of a classic Greek temple, which with the unfinished national monument on the Calton Hill—the Edinburgh Parthenon—and some other public buildings on classic models, affords the outward and visible part of the claim of Edinburgh to be called the Modern Athens. Of the real distinction of the city, its eminence in the arts, science, and letters, the Royal Society has undoubtedly contributed a very considerable part. Never a scientific society only in the purely technical sense of the present day, and never imposing any arbitrary restriction on its fellowship, it has had on its roll and among its presidents and office bearers all the authors, jurists, philosophers, mathematicians, and physical investigators whom Scotland has produced during the eventful period of the society's existence.

Though, like others that might be cited, the Royal Society of Edinburgh has been from time to time perhaps a little too closely identified with the city in which it has had its headquarters, it has always been a national institution. Its library, which is rich in scientific periodicals, has been consulted by men from all parts of Scotland, and its rooms have been a rallying place for Scottish workers, especially in later years for the younger generation of biologists, mathematicians, and physicists. It was never more active than at present, and is in danger of being ruined by its very success, for the problem of providing for the expense of the publication of the many excellent memoirs which have been received of late for its Transactions has seriously embarrassed the council. This point should be carefully borne in mind in considering the reply of the Scottish Secretary to the deputation. The demand made was not merely that the society should not be dispossessed of its rooms without full compensation (though this was the immediate reason for the deputation), but that it should be treated with regard to publications in a small degree at least as the Royal Society of London and the Royal Irish Academy are treated.

As was explained in our last week's issue, the proposal of the Government is to provide the Royal Scottish Academy with a separate house in which, like the Royal Academy at Burlington House, it may annually exhibit its pictures and sculpture to the general public, and—incidentally, of course—to the patrons of Art. Hitherto this Academy has shared the rooms provided for artistic purposes in the National Gallery building also on the Mound; and competent judges, even within the Academy itself, have deemed the provision sufficient. Some of their chief men have even dared to suggest that what was wanted was not so much an extension of space as an elevation of the standard of selection! Nevertheless, the bitter cry of the artists for some time has been for a house of their own; and this the Government has now determined to provide, not by erecting a suitable new building from public funds, but by the cheaper method of evicting the Royal Society of Edinburgh from the rooms which were arranged for it in a building erected mainly for its accommodation. When the decision was announced to the Royal Society it was accompanied by a statement of the willingness of the Government to do something to "help" the Society in the difficulty thus created for it by no fault of its own. Though Mr. Sinclair has now gone a good deal further, and admitted that the Government will be under an obligation to do something substantial, he still merely speaks of "help," and urges the Society to trust to the "liberal spirit" in which the Government is sure to view its necessities!

Now this is all very well, but, as Mr. Sinclair knows, it is not exactly business. The Government of the day has always been lavish of assurances of its high consideration to the men of science who have applied to it in the past, whether for the Royal Society of Edinburgh, the Ben Nevis Observatory, or anything else, but for science in Scotland at least it has consistently refused to do anything whatever beyond continuing the small dole it has hitherto given. The society is not justified, therefore, in being too trustful. It is being dispossessed, and its claim for compensation should either be recognised by a clause in the Bill now before Parliament or acknowledged by being made the subject of a definite pledge by the responsible Minister.

Another assurance asked for by the society and no less essential remains to be given. Time is needed in which to find the best possible premises, to fit them up, remove the library, and arrange for the meetings, without interruption of the society's work. At present the council has only a legal right to two years' notice, and a definite promise that this much too narrow limit of time will not be insisted on is most important. As it is, the insistence of the Scottish Secretary on the necessity for promptitude of decision and action by the society is ominous.

With regard to the promise of "help" towards the erection, or provision otherwise, of new rooms, it is to be observed that the society has no funds to contribute to the erection or purchase of a building. Every penny left after providing for a very modest budget of ordinary expenses goes to the publication of scientific papers. The dole of 300*l.* made by Government is actually paid back to the Board of Manufactures as rent for the rooms in the Royal Institution. For publications the Royal Society of Edinburgh receives nothing; the Royal Society of London receives 1000*l.* per annum for publications; the corresponding body in Ireland—the Royal Irish Academy—lives in its own house, which was given it by the Government, and enjoys a grant of 1500*l.* a year. [Moreover, the houses in London and Dublin are maintained by the Board of Works, which means a further yearly contribution not made to the Edinburgh society.] The request of the deputation that some small annual grant should be made for publications was ignored in the Secretary's answer. That answer, it is to be observed, was written out beforehand, and read as soon as Prof. Chrystal had summed up for the Society, so that even the usual form of taking the representations made into consideration was omitted. In fact, except as regards the admission of the claim of the society to some compensation for disturbance, the statements and claims of the deputation went the way of most representations made to Scottish Secretaries, whether at home at Parliament Square or on the alien soil of Dover House.

The British Science Guild has not been established too soon. The Government and Mr. Sinclair may have as generous intentions as the friends of the artists in the Edinburgh Press urge the Royal Society to believe—and we may say that nobody doubts that the intentions of both are good—but it will be the duty of the council to obtain the necessary guarantees for the continued usefulness, if not for the existence, of the society. If necessary the British Science Guild will no doubt lend its powerful aid.

ARCHÆOLOGY IN THE ISLE OF MAN.[1]

THESE notes form a useful handbook to the geology and antiquities of the Isle of Man, and those responsible for persuading the authors to reprint and amplify their scattered notices have conferred a benefit on the public. Although the little volume runs to little more than 100 pages, it includes a good survey of both branches of the subject, and emphasises the interest of the island in the two aspects of its remoteness in some respects from its neighbours and as a meeting place of the arts of the Celt and the Northman. The evidences of man's presence in the island naturally begin with the Neolithic period, the climatic conditions of the Pleistocene age effectually preventing him from reaching so far north; but from Neolithic times onwards the story of the island can be traced by its archæology. Flint appears only to exist in the form of nodules washed from the Boulder-clay, and the "factories" of flint implements are always on actual deposits of Boulder-clay. Some of the implements figured are, as the authors admit, of very rude make, as well as of very curious types (Fig. 4).

It is perhaps hardly surprising that signs of dwellings are not found near these Neolithic "floors" or factories. Stone-age man, here as elsewhere, chose his dwelling for reasons of security or shelter from the weather rather than from the proximity of a good store of flint nodules. Dwellings in the form of hut circles have, however, been found in fair numbers, and though it is by no means improbable that they date from Neolithic times, the authors are justly cautious in dogmatising on their age. No type of exploration is more difficult than that presented by the ordinary hut circle, and often the principal evidence is that of analogy. Such remains, moreover, share with stone circles the danger of having been disturbed by treasure seekers, with the result that stratigraphical deductions cease to be of value. It cannot be too often insisted upon that the class of exploration that produces the fewest objects of intrinsic value, viz. those of prehistoric times, should be excavated with most care and attention to detail. The reason is a simple one. The elucidation of the problems of early man depends solely upon such explorations, for no other documents can possibly exist to help in the solution of the puzzle. In later historic times the helps to knowledge are endless. Both Mr. Kermode and Dr. Herdman clearly recognise the importance of careful work, but, like most students of the earlier periods, they will doubtless admit the need of this warning to the unwary or careless explorer.

Apart from the interest to those who study the Manks antiquities as part of the general archæological scheme, this little book can scarcely fail to have a good effect in the island itself. It is to be hoped that all the relics that may come to light in future will be deposited in Castle Rushen, where they will be available for comparison and study. It is sad to read of such things going astray when a little tact or trouble might have preserved them.

[1] "Illustrated Notes on Manks Antiquities." By P. M. C. Kermode and W. A. Herdman. Pp. 108. (Liverpool: Tinling and Co., Ltd., 1904.)

The Bronze age in the Isle of Man was evidently a time of considerable communication with the mainland. The types of urns, as well as the fact that all the stone axes are of foreign material, show that trade must have been fairly brisk. The urn shown in Fig. 23 is, for instance, nearly related to the Scottish urns of the same time. This fact has, of course, an important bearing on the relative date of this and other periods when such communication existed. If the same types of funeral furniture are found here as on the mainland, it not only shows intercommunication, but also, as a necessary consequence, proves the contemporary existence of the same burial customs in the two places. Thus although it may well be that the remoteness of the island prevented its inhabitants from being quite as advanced as the continental dwellers, yet the difference in time can only have been slight. The authors seem to lay rather more stress than the facts justify upon the retarding effect of the inaccessibility of the island. It is probable that the civilisation was relatively further behind the rest of England during the eighteenth century, for instance, than it was in the Bronze age. The similarity of stone implements in parts of the world widely separated is not always easy to explain, though the similarity of need has a good deal to do with it. But an elaborated and more complex object, such as an ornamented pottery vase, can scarcely be reproduced in all its details without some relations between the two makers. Commonplace though such an observation may be, it is very necessary to bear such facts in mind in discussing an island civilisation like that of the Isle of Man, or even of Britain.

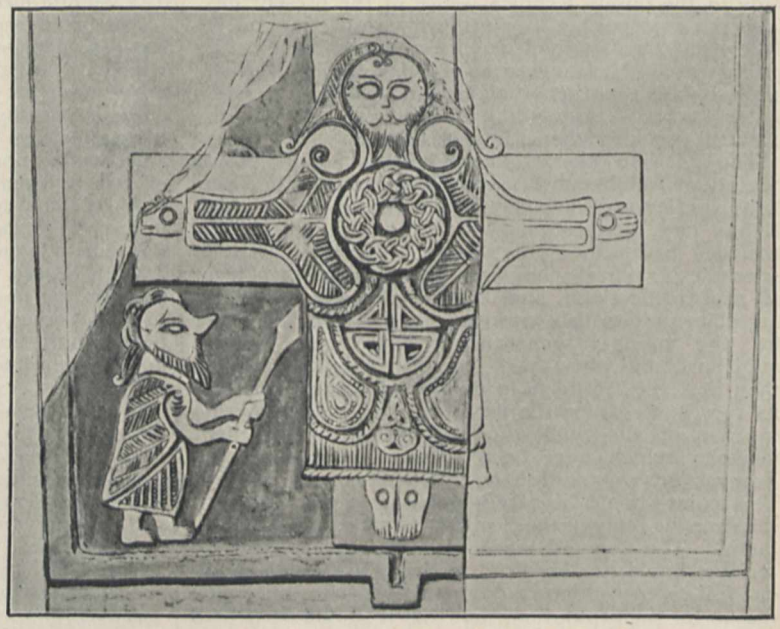


FIG. 1.—Cross from Calf of Man. From "Illustrated Notes on Manks Antiquities."

The most characteristic, and in some respects the most interesting, antiquities of the island are the Scandinavian and Celtic carved stones of Christian times. It is very useful to note how the Northmen appreciated the delightful complicated designs of their Celtic forerunners. The respective shares of Scandinavian and Celt in the motives of these curious monuments, and even in the finest Celtic manuscripts, have never been adequately elucidated. The genius

of the two races in the treatment of ornament differed so widely that in some pages of the "Book of Kells," for example, the two can be separated as easily as if they were of different colours. It is odd to find that Mr. Kermode describes the interesting crucifixion shown on p. 72 and here reproduced as "an example of pure Byzantine art." To our eyes it is nearly pure Celtic, and has no relation, artistically, to any Byzantine crucifixion we have ever seen. The statements, however, throughout the "Notes" are in general accurate and restrained, and there is an entire absence of the wild local enthusiasm so often found in books of this particular character. The "Notes" may be commended as likely to be of great use to anyone visiting the island or studying its antiquities.

MOLLUSCAN MORPHOLOGY.[1]

THIS fifth volume of the important "Treatise," edited by Prof. Ray Lankester, deals with the Mollusca, and is the work of the one biologist capable of doing this group most justice, namely, Dr. Paul Pelseneer. Like its predecessors in the series it treats of the subject almost exclusively from the morphological standpoint, just such a sufficiency of systematic matter being added as to justify the title, while it is, of course, very far from being, and indeed does not pretend to be, a manual on the phylum.

Some delay has occurred in its appearance, owing to the need of translation and revision for the press, which has been carried out by Dr. Gilbert Bourne.

FIG. 1.—*Stenogyra mamillata*, left side view, with four embryos in the oviduct. *em*, embryo. From "A Treatise on Zoology."

The work itself is an expansion of Dr. Pelseneer's similar contribution to Blanchard's "Traité de Zoologie." The translation is remarkably well done, and save in some of the opening sentences it is hard to realise that it was not written in English. Not but that there are small slips such as "biannual" for "biennial." The revision, we suspect, has largely consisted in the importation of new terms, so dearly beloved of a certain school of biologists, that do not altogether make for clearness, and are foreign to the lucid style customary in the author's other writings. The opening paragraph on the "general description and external characters" of the Mollusca (p. 3) is a case in point. While the statement (p. 20), "It has been shown that in the Cephalopoda hyperpolygyny is the rule, and in certain Atlantæ and American Unionidæ, hyperpolyandry," inspires the not hypercritical comment that, without hyperbole, it is hypertechnical. Certainly a glossary will be indispensable to the work.

One is glad to observe that that mythical monster, the "Archi-" or "Schematic Mollusc" has dwindled to a shadow of its former self, and now survives solely in a diagrammatic figure as a "scheme of a primitive mollusc" (Fig. 19). For, as Verril pointed out in 1896 (*Amer. Journ. Sci.*, series iv., vol. ii., pp. 91–92), the primitive mollusc is rather to be sought in the early larval stages, such as the Veliger form. Even now one is tempted to think that the "primitive" has been introduced by the translator, since the author in his previous work, to which reference has already been made, simply labels his figure "Schème d'un Mollusque," which is rather a different thing.

Dr. Pelseneer's explanation of the torsion of the gastropod body evidently now meets with Prof. Lankester's approval, for it is the only one advanced and is reinforced by an additional diagram.

A good deal more attention is paid, and rightly, to the shell than in the author's previous writings, and it is interesting to see Sharp's theory of the progressive disappearance of the anterior adductor muscle in certain successive forms of Lamellibranchs (which was first illustrated by specimens in the Index Hall of the Natural History Museum) made the subject of illustration, though in the text this disappearance is made the cause, instead of the consequence, of the alteration of the body-axis.

One or two other points need further attention. Allusion might advantageously have been made to the origination of the gill in Cyclas, Teredo, and Scioberetia by perforation of a continuous membrane: also to the discovery by Dall that Philobrya passes through a glochidium stage, which is therefore not confined to the Unionidæ.

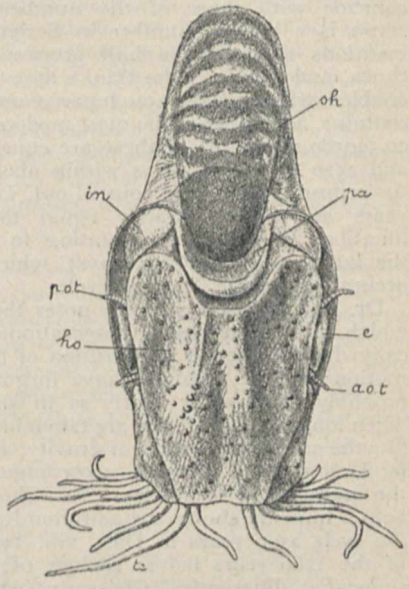


FIG. 2.—*Nautilus macromphalus* creeping on a horizontal surface, anterior view. *a*, *e*, *t*, anterior ophthalmic tentacle; *e*, eye; *ho*, hood; *in*, infundibulum; *pa*, nuchal part of the mantle; *p*, *o*, *t*, posterior ophthalmic tentacle; *sh*, shell. (After Willey.) From "A Treatise on Zoology."

The systematic portion is open to much criticism. It does not differ materially from that given in Dr. Pelseneer's previous works, though there is, so to speak, some shuffling of the cards. It is a great pity, however, that the nomenclature has not been brought up-to-date. This would have prevented such an error as recording *Zonites* as British.

The majority of the illustrations, which are all clear and well printed, are diagrammatic, or elucidate structural features, while of the few pictorial ones most are those used by Owen, without acknowledgment of their source, in his article on Mollusca in the eighth edition of the *Encyclopædia Britannica*. The greater number of these are now, very properly, attributed to their rightful authors, but of those still labelled "From Lankester after Owen" it has escaped observation that Nos. 71, 134, and 136 are after Adams, No. 158 after Philippi, and Nos. 66 and 135 are from S. P. Woodward's "Manual," while the well-known figure of *Sepia officinalis* (No. 299) is from Férussac and D'Orbigny's "Histoire."

The index would have been more useful had references to the genera cited elsewhere than in the systematic parts been included.

All these are, however, minor points, and the fact remains that malacologists now possess one of the best-written treatises yet produced in the English language on the morphology of the Mollusca.

(B V)[2].

[1] "A Treatise on Zoology." Edited by Dr. E. Ray Lankester, F.R.S. Part v., Mollusca, by Dr. Paul Pelseneer. Pp. 305: 301 text illustrations. (London: A. and C. Black, 1906.) Price 15*s.* net.

CYCLES IN CHRONOLOGY.[1]

THAT the 1260 years understood to be expressed by the "time, times, and a half" (taking "time" to indicate a prophetic year of 360 days each) of Dan. xii. 7, and repeated in Rev. xii. 6 and in Rev. xi. 2 and xiii. 5 under its equivalent term "forty and two months" (taking a month as thirty days), was in fact an astronomical cycle, was first suggested by Loys de Chéseaux in a work published at Paris in 1754, three years after the author's death. But it did not meet with much attention in England until a small work on the subject was published by Mr. W. Cuninghame in 1834, and it was subsequently more fully explained by Mr. H. Grattan Guinness in his "Approaching End of the Age," which appeared in 1878.

Dr. Bell Dawson however, in a pamphlet now before us, goes into the matter much more elaborately, using the most recent knowledge of the lengths of the solar and lunar years (by lunar year he means twelve lunar synodic months or lunations), and finds a remarkable correspondence between multiples of these which coincide with those of the number in Daniel. As seven is a perfect number in Scripture, and Daniel mentions three and a half prophetic years ("time, times, and a half"), he thinks that the 1260 must be doubled, which makes 2520 lunar years. Now a lunation contains, according to the most modern determinations, 29·530589 days; 504 of these are equal to 178,601 days and 2520 to 893,005 days within about four minutes. An eclipse-cycle is also pointed out, *i.e.*, that 649 solar years are almost exactly equal to 8028 (223 × 36) lunations (the former amounting to 237042·1853, and the latter to 237042·0355 days), which is much more accurate than the Metonic cycle.

Dr. Bell Dawson carefully notes the different values which have been found (observationally and theoretically) for the secular acceleration of the moon's mean motion; but he seems to have forgotten that though probably constant or nearly so in amount, its effect, when long periods of time are taken into account, varies like the accelerating force of gravity, as was pointed out by Halley, its discoverer, according to the square of the number of centuries. As Chéseaux had done before him, he shows the astronomical significance of the cycle 2300 years in Dan. viii. 14, as well as that of the 1260 years before spoken of; but he treats it somewhat differently. Chéseaux (whose scheme, we may mention, is explained in the second volume of Mr. Chambers's "Handbook of Astronomy") took the difference between 1260 and 2300 (*i.e.* 1040) years, and showed that 1040 solar years form a period almost exactly equal to 12,863 lunations, the former amounting to 379851·8839 and the latter to 379851·9624 days. But Dr. Bell Dawson takes them as lunar years (or periods of twelve lunations) and shows that 1780 (the mean between 2300 and 1260) lunar years is almost precisely equal to 1727 solar years, each exceeding 630773 days by only 0·27 and 0·37 respectively, and therefore differing from each other by only 0·10 of a day in that time or about 0·006 in a century. It does not appear that any reference is made to the 1290 and 1335 days of Dan. xii. 11 and 12. No attempt is made to discuss the *terminus à quo* (or therefore *ad quem*) of Daniel's periods, being beyond the scope of the paper before us, which treats only of the numbers themselves and their accordance with astronomical epochs.

Dr. Bell Dawson inserts a reflection on the inferior accuracy of the Roman calendar arrangements to those of the Chaldeans and other Oriental nations. It is probable, however, that when Julius Cæsar reformed the calendar he decreed that each fourth year should be an intercalary year, not because he was not aware that the actual length of the year was somewhat less than 365¼ days (a question which had been discussed by Sosigenes, who assisted him), but because he thought it would be a convenient rule and sufficient for all practical purposes. In this a distinguished astronomer of our own day (Prof. Newcomb) agrees with him; and indeed the chief object of the introduction of the Gregorian calendar was to bring back the date of the vernal equinox to that which it had at the epoch of the Council of Nicæa. W. T. L.

[1] "Solar and Lunar Cycles implied in the Prophetic Numbers in the Book of Daniel." By Dr. W. Bell Dawson. Pp. 20. (From the Transactions of the Royal Society of Canada, vol. xi., Section 3.)

PREVENTABLE DISEASE AND MILITARY STRENGTH.

IN a letter to the *Times* (June 6), Mr. St. John Brodrick directs attention to the serious diminution in the military strength of an army, not to say the terrible loss of life, which ensues in campaigns from diseases which are largely preventable. It is a truism, well recognised by medical men, that the soldier has much more to fear from the ravages of disease than from the bullets of the enemy. Mr. Brodrick points out that

> "In South Africa the deaths per 1000 were 69 from disease and 42 from wounds, but the admissions to hospital were 746 per 1000 from disease and 34 from wounds. In other words, about 450,000 were passed through the hospitals for disease during the war, and 14,800 deaths occurred, while the admissions for injuries in action were only 22,000."

Dysentery and enteric fever are the great scourges of an army in the field, and, as was pointed out in an article in NATURE (lxxii., p. 431), are largely preventable. That this is the case is proved by the records of the Russo-Japanese War, in which the Japanese had a total of some 221,000 killed and wounded and 236,000 cases of sickness, a ratio very different from that which obtained in our own army in the Boer War. The Japanese have realised to the full the importance of hygienic measures in the field; sanitary corps went on ahead of the main army and chose the camping grounds, supervised the water supplies, and exercised a rigid sanitary control in all matters, with the above result.

Mr. Brodrick suggests one simple remedy:—

> "Why should not the admirable body of Army Medical officers who have made sanitary conditions a study educate combatant officers in the elements of military hygiene? Every cadet at Sandhurst or Woolwich should be examined on passing out in a problem which he should grasp as easily as tactics or strategy, since upon it the fighting strength by which he is to win his battles depends. A captain before promotion to major might be encouraged to get a special certificate which would excuse him from all such training at the Staff College."

Sir Frederick Treves, in a letter to the *Times*, cordially supports this suggestion, and goes further, advocating that a like knowledge of a more elementary character should be possessed by the private soldier.

In addition it may be added that the formation of a sanitary corps seems desirable to aid the medical staff, to guard and control the water supplies, and the like. At present the Army Medical officer is powerless to enforce sanitary measures; although responsible, he can give no orders, and can only act through a commanding officer, often junior to himself, who has no technical knowledge. Moreover, through the Esher Committee, the Director-General, who formerly had direct access to the Secretary of State and had a seat on the Army Council, has been

deprived of those privileges, the Adjutant-General at present being practically head of the Medical Department. Now that a former Secretary for War has directed public attention to the matter, it is to be hoped that those in authority will recognise that medical science is a vital part of military strength, a dictum which has for years been preached by the medical profession.

NOTES.

AT the meeting of the council of the Royal Astronomical Society, held on Friday last, June 8, the following resolution was unanimously agreed to:—"That the council learn with deep concern of the danger threatened to the Royal Observatory, Greenwich, from the erection of a large electric generating station near the observatory; and desire to represent to the Admiralty at the earliest opportunity their conviction of the paramount importance of maintaining the integrity and efficiency of Greenwich Observatory, which has been adopted as the reference point for the whole world." It was further resolved that a copy of this resolution be forwarded to the First Lord of the Admiralty.

MR. HALDANE, M.P., Secretary of State for War, will open the electrical laboratory of the National Physical Laboratory on Monday, June 25, at 2.45 p.m.

AT the twenty-fifth annual meeting of the Royal Society of Canada, recently held at Ottawa, Dr. William Saunders, the director of the Dominion Government's system of experimental farms, was elected president for the ensuing year, with Dr. S. E. Dawson vice-president.

INVITATIONS have been issued by the Institution of Electrical Engineers for a conversazione at the Natural History Museum on Tuesday, June 26, to meet the visiting delegates from kindred institutions.

PROF. K. BIRKELAND, of Christiania, the inventor of the only successful commercial process for obtaining nitric acid by the direct oxidation of atmospheric nitrogen, will read a paper before the Faraday Society about June 26 entitled "Oxidation of Atmospheric Nitrogen by Means of the Electric Arc."

MUCH interest was aroused in India some time ago in the attempt to introduce the permanganate treatment of snake-bite. In the Central Provinces a large number of Sir Lauder Brunton's lancets were distributed last October for use by vaccinators and selected landholders. Several cases of successful treatment have been reported to Government, but unfortunately, says the *Pioneer Mail*, none of the reports gives sufficient detail to prove that the bites were really those of poisonous snakes, and it is therefore not possible to form any conclusions as to the value of the treatment.

A PARTY of Birkbeck College zoological students spent Whitsuntide at West Mersea, near Colchester, collecting marine specimens. Owing to the low temperature of the surface waters the tow-netting expeditions were not very productive, but many and varied forms of life were brought up by the trawl and the dredge.

THE annual conversazione of the Royal Geographical Society will be held at the Natural History Museum tomorrow evening, June 15.

A TELEGRAM from Reggio di Calabria states that fairly strong earthquake shocks were felt there on June 10 at 2.30 a.m. and 9.45 a.m. At Monteleone, Calabria, two strong shocks were felt at 2.45 a.m.

PROF. W. F. KOHLRAUSCH, of Hanover, will be the president of the Verband deutscher Electrotechniker for 1906–8.

DR. BERNHARD MOHR, of London, recently presented to the museum of the German Chemical Society 100 letters written by the famous Liebig to Dr. Mohr's father, the late Prof. Friedrich Mohr, of Bonn, during the years 1834 to 1869.

DR. STUTZER, assistant in the geological institute of the Freiburg (Saxony) Mining School, has been awarded a grant of 2000 marks by the committee of the Carnegie fund to enable him to continue his investigations on iron deposits in Lapland.

PROF. LUDWIG BOLTZMANN, the well-known professor of theoretical physics in the University of Vienna, has been awarded the prize of the Peter Wilhelm Müller fund of Frankfurt a.M. The award consists of an appropriately worded gold medal and 9000 marks, and is made to the most brilliant workers in pure science.

AT the seventy-eighth meeting of the Deutscher Naturforscher und Aerzte, which will be held this year on September 16–22 in Stuttgart, there will be an exhibition of scientific and medical appliances and subjects as in previous years. The König Karls Hall of the Königlicher Landesgewerbemuseum has been set apart for the purpose. All announcements and communications may be addressed to the president of the exhibition committee, Dr. Lampert, Archivstrasse 3, Stuttgart, from whom further particulars may be obtained.

PROF. WALTER NERNST, professor of physical chemistry in Berlin, has declined the opportunity of proceeding to Leipzig as the successor of Prof. Ostwald, whose resignation will take place on September 30. Prof. Nernst was formerly a privatdocent at Leipzig from 1889 to 1891, when he accepted a professorship in Göttingen University. According to the *Physikalische Zeitschrift*, Prof. Ostwald's successor is to be Dr. K. Haussermann, professor of technological chemistry and director of the applied chemistry laboratory of the Technical High School, Stuttgart.

A SPECIAL meeting was held in the Great Hall of the University of Athens on May 20 to celebrate the fortieth anniversary of Dr. A. C. Christomanos's appointment as professor of chemistry in the University. A large audience, including the Greek Minister of Education, the University professors and students, and many of the general public, was present. Dr. A. C. Dambergis, the professor of pharmaceutical chemistry, referring to the great work which Prof. Christomanos has done in the forty years, asserted that the greatest has been the pioneer work in the introduction of scientific chemistry into Greece with the provision for laboratory work in chemistry and the other sciences, and more particularly in organising so successfully the large chemical department of the University with its laboratory accommodation for 130 students. Prof. Christomanos was the recipient of numerous honours, including several from foreign countries.

DR. RUDOLF KNIETSCH, the director of the Badische Anilin- und Soda-Fabrik, died on May 28 at the early age of fifty-two. From the *éloge* dedicated to Dr. Knietsch's memory by the Badische Anilin- und Soda-Fabrik, we learn that Dr. Knietsch was born in 1854 in Oppeln, in Schlesien. From 1876–1880 he studied at the Technical High School in Berlin, and graduated in 1881 at Jena University. He was for a short time an assistant in Dr. Emil Jacobsen's private laboratory, and in 1882 entered the Farbenfabrik von Bindschedler und Busch in Basle,

where he worked at the nitration of dichlorobenzaldehyde and the preparation of chloroindigo. In 1884 he joined the Anilin- und Soda-Fabrik. He founded in 1888 the industry of liquid chlorine, and devoted himself with zeal to the task of modifying the Winkler process of preparing sulphuric anhydride. Knietsch read an important communication on the results of this work before the German Chemical Society in 1901. For the solution of the problem of the commercial preparation of synthetic indigo Dr. Knietsch proved himself to be the right man in the right place. In company with a number of earnest colleagues he worked out and developed the present manufacturing processes for the preparation of the materials necessary for the synthesis of indigo and other dyes. Always broad-minded, he was ready at any time to replace existing plant and methods by improvements. In 1904 Knietsch was placed at the head of the firm. The Verein deutscher Chemiker, at the annual general meeting in Mannheim in 1904, awarded the Liebig gold medal to Dr. Knietsch, and at the opening of the new Technological Mechanical Institute of the Dresden Technical High School in 1905 the honorary degree of Dr. Ing. was conferred on him.

THE weekly weather report issued by the Meteorological Office for the period ending June 9 shows that the present month has opened with typical summer weather. The major portion of the United Kingdom was entirely rainless, the only rains reported occurring in parts of Scotland and Ireland, and amounting only to few hundredths of an inch. Bright sunshine was for the most part greatly in excess of the average, 80 per cent. of the possible duration occurring in the Channel Islands and 71 per cent. in the south of England. The temperature averages were generally rather low, and in the south of England the sheltered thermometer at night fell below the freezing point.

WE learn from the Journal of the Society of Arts that what can be done by sanitation to stamp out malaria is shown by Mr. Consul Morgan in his reference (No. 3565, Annual Series) to the work of the Italian Red Cross Society during late years to stamp out malaria in the Roman Campagna. The first attempt was made in 1900, when the returns showed that not less than 31 per cent. of the inhabitants of the "Agro Romano" had been fever-stricken. In 1901 the figure was returned at 26 per cent., 20 per cent. in 1902, 11 per cent. in 1903, 10 per cent. in 1904, and 5·1 per cent. during last year. These results were obtained by strict sanitary measures, use of wire nets so as to prevent access of mosquitoes to cottages, and free distribution of quinine among the peasantry.

THE annual dinner of the London section of the Society of Dyers and Colourists was held on May 23, when a representative company was presided over by Sir Thomas Wardle, president of the society. In proposing the toast of the London section of the society, the president expressed his astonishment at the beautiful work being done in the dyeing industry in Italy, and how much pure chemistry is being made use of in that work. London, he continued, is taking an interest in chemical development, and he suggested that the Dyers' Company might associate itself in some way with such a body as the Society of Dyers. Sir Thomas Wardle concluded his address by appealing to the younger men to take advantage of the splendid scientific training now available, and to induce others to do the same, for by such methods many of our lost industries would be won back. Responding to the toast of the "Allied Industries," Dr. J. C. Cain said no doubt to some extent our patent laws, the lack of cheap alcohol, and other causes have had a certain amount of influence in the downfall of the English aniline dye industry, but in his opinion the only real cause has been the lack of a man of commanding genius, like Perkin or Nicholson, who could discover a colour, make it, and sell it. Prof. R. Meldola, F.R.S., in proposing "The Visitors," remarked that we have lost tone in our supremacy in this branch of manufacture, but the blame is not on the shoulders of the dyers, who have always been on the *qui vive* to utilise new discoveries. It was the English and Scotch dyers who first took up chemical dyes and encouraged the manufacturers to proceed. Mr. F. Robinson proposed "The Chairman," and directed attention to the fact that present-day results and modern methods could never have been attained but for the research chemists and their work. At one time dyeing was more an art than a science; now our chemists have made it practically a science. The old dyestuffs such as indigo and madder are gradually and surely disappearing, and are being supplanted by synthetic products. The English dyeing and colouring industry is moving with the times, and will eventually hold its own against all rivals.

WE have received a copy of No. 12 of the fifteenth volume of the *Zeitschrift für Oologie und Ornithologie*, said to be the only serial in the world specially devoted to the interest of the egg-collector. The present part contains notes on the eggs of two African birds previously unknown to collectors, general observations and suggestions on subjects intimately connected with oology, and descriptions of certain eggs from Turkestan.

IN the report for the year 1905, the committee of the Albany Museum, while referring with satisfaction to the general progress of that institution and the present state of the collections, directs attention to the congested state of the buildings, and the urgent need for more space and for additional funds, if the work is to be carried on in an effective manner. The appointments of Profs. Duerden and Schwarz to the zoological section are stated to have been followed by most satisfactory results.

IT has been stated by those who have investigated the subject in the selachian group that fishes lack lymphatic vessels other than those of the visceral system, the superficial and deep-seated vessels of the heart and trunk being regarded as veins, and their sinuses as venous sinuses. However this may be in the case of sharks, Mr. W. F. Allen, in a paper on the lymphatics of the loricate fish Scorpænichthys, published in the Proceedings of the Washington Academy (vol. viii., pp. 41–90), shows that it is not so in the case of the group to which the latter belongs. On the contrary, Scorpænichthys has as fully developed a lymphatic system as any vertebrate, so that it may be said that in general wherever connective tissue exists there lymphatics will be found.

THE February and March issues of the Proceedings of the Philadelphia Academy contain a paper by Mr. J. A. G. Rehn on tropical American grasshoppers of the group Acridinæ, with descriptions of several new forms, and likewise the commencement of one by Dr. R. Smith on the phylogeny of the races of a species of gastropod of the Eocene genus Volutilithes. In the case of the genus Fulgar, it has been supposed that certain Miocene forms represented the ancestral stock of the living American species. According to the author this is not so, the fossil forms being decadent senile offshoots from the original line, which appear, however, to be dominant. A very similar

state of affairs is shown to exist in the case of Volutilithes, with the important exception that the main ancestral line is the one which is dominant.

THE Ostracoda of the San Diego region (No. 1), the California shore-anemone, *Bunodactis xanthogramma*, and sexual dimorphism in the hydroid polyps of the genus Aglaophenia, form the subjects of articles nine, ten, and eleven of Contributions from the San Diego Marine Laboratory issued in vol. iii. of the Zoological Publications of the University of California. In the article on dimorphism (by Mr. H. B. Torrey and Miss Martin) it is shown that in the genus mentioned, not only are the gonophores dimorphic, but an analogous dissimilarity also obtains in the jointed plumose structures known as corbulæ, of which numerous examples are figured. The plate intended to illustrate Mr. Torrey's paper on the sea-anemone was destroyed in the San Francisco fire, but a new one will be supplied later.

THE April issue of *Spolia Zeylanica* is of more than usual interest. It opens with a translation of an article by Dr. F. Doflein, of Munich, entitled "Termite Truffles," being the description of certain remarkably nodular masses of fungus cultivated in their nests by white ants in Ceylon. The hillocks of these termites were found by the author to contain a number of large chambers, each approximately the size of a cocoanut, and each containing one or more large friable masses, looking somewhat like small bath-sponges. These cakes were occupied by thousands of termites, ensconced in the cells and connecting passages. The framework of each was beset with numerous white nodules of the size of pins' heads, which proved to be fungus-growths. These nodules are eaten by the larvæ of the workers and soldiers and by the sexual forms at all ages, the adult soldiers and workers having, however, other food. That the funguses are introduced and cultivated by the termites seems undoubted. In the same publication Dr. A. Willey records a singular instance of symbiosis in a crab, originally described from Mauritius under the name of *Melia tessellata*. When first described its habit of holding sea-anemones in its two front claws was not noticed, but although this was observed later on in Mauritius, it has been generally overlooked. According to Dr. Willey's account and figure, the crab holds in each claw a small white anemone, which it presents, with the tentacles fully expanded, to every intruder, in "true boxing attitude." The ground-colour of the crab is whitish with a rosy flush on the front of the shell, which has also a pattern of black lines. "Probably both crab and actinians benefit by the association, the actinians enjoying increased mobility, and the crab sheltering and defending itself with the living gloves with which it is provided." In the author's opinion, the stinging threads of the anemone are the active means of defence and offence.

A LEAFLET, No. 16, published by the Department of Agriculture in British East Africa, contains the reports on various samples of cotton grown at Golbanti and Malindi. The cotton was produced from Egyptian Afifi seed, except for one sample of Sea Island and one of American upland. The soils on which the crops were grown were a heavy alluvium or a lighter red soil, the latter yielding much better results, owing probably to its requiring less cultivation. The values, except for the Sea Island, ranged between fivepence and sixpence per pound. There is a striking difference between the yield from Egyptian seed on the red soil and the other crops obtained.

THE green colour of plants is such an ever-present reality that the explanation is apt to be overlooked. The absorption spectra of chlorophyll and the curves of absorption and assimilation do not directly furnish a solution, and it is only from the consideration of these, together with the effects produced by the absorption and dispersion of light rays in the atmosphere, that a satisfactory explanation is obtained. The subject is ably discussed by Prof. E. Stahl in *Naturwissenschaftliche Wochenschrift* for May 6, where he points out that the two pigments contained in chlorophyll are suited to the sun's rays as modified by reflection, the colours being complementary to those of the chlorophyll-absorbing rays that predominate in diffused light, and that certain rays, *e.g.* the ultra-red, are excluded wholly or in part owing to the danger of too great absorption in direct sunlight.

THE fungus *Phycomyces nitens* is well adapted to physiological investigation owing to the rapidity of its growth and its sensibility to stimuli. Proceeding out of investigations by Elfving wherein curvature of the sporangiophores was attributed to physiological action through space, Prof. L. Errera was led to experiment on the curvatures caused by the presence of various substances such as rough and polished metals, porcelain, glass, deliquescent salts, marble, mica, &c. The results so obtained, and the notes relative to them, had been sufficiently fully drafted before Prof. Errera's death to allow of publication, and they appear in *Recueil de l'Institut botanique*, Brussels, vol. vi., 1905. It was found that Phycomyces curves towards bodies that absorb moisture and away from those that give off vapour. Thus the sporophores curve towards an unpolished rod of iron, but not towards a piece that is perfectly polished. A number of photographs accompany the paper, of which one of the most striking is reproduced. A dry, porous pot is suspended over the Phycomyces growing on bread in a moist atmosphere. The pot absorbs moisture, and the sporophores have curved right over the surface of the pot, some of them ultimately turning upwards owing to the stimulus of gravity.

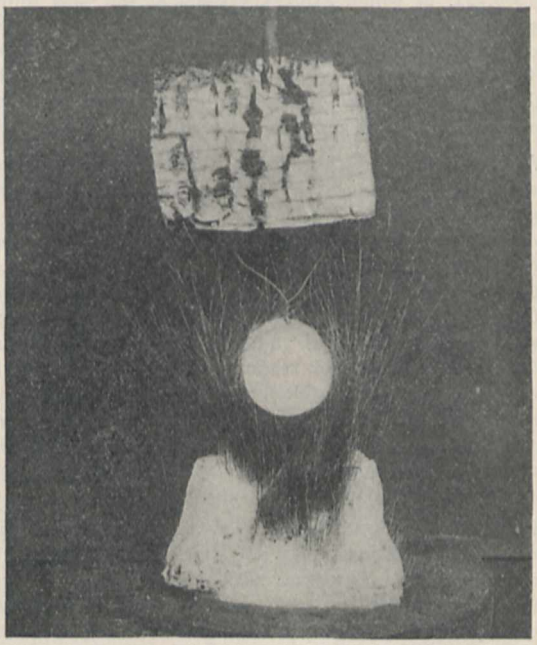


FIG. 1.—*Phycomyces nitens* stimulated to grow towards and over the surface of a porous pot.

THE report for 1905 of the Botanical Exchange Club of the British Isles, prepared by Mr. J. W. White, has been received. Besides being the official organ for the publication of notes by the collectors or special authorities on the correct determination of the plants, the report provides a record of new or rare species with the localities in which they have been found. The new records include *Caltha radicans* for Perthshire, *Ulex Gallii*, var. *humilis*, for Cornwall, the aliens *Hibiscus Trionum* and *Bromus unolioides* collected in Salop, *Lotus tenuis* from near Cardiff, and *Epipactis atrorubens* from Banff. The specific determination of the large-flowered Œnothera so plentiful on the Lancashire coast having been questioned, Mr. C. Bailey sent specimens to Dr. O. Focke, of Bremen, who considers that it is probably a form of the famous variable *Œnothera Lamarckiana*.

THE Home Office has issued for 1905 statistics of the persons employed, output, and accidents at mines and quarries in the United Kingdom, arranged according to the inspection districts. The total number of persons employed was 887,524, of whom 858,373 worked at the 3252 mines under the Coal Mines Act and 29,151 at the 688 mines under the Metalliferous Mines Act. At the quarries under the Quarries Act there were 94,819 persons employed. The death-rate from accidents was 1·49 per 1000 persons employed for coal miners and 2·49 per 1000 for metal miners.

WE have received the two latest additions to the valuable series of bulletins issued by the Peruvian Corps of Mining Engineers. In *Boletin* No. 30 Mr. Carlos E. Velarde gives a detailed account of the means adopted to obviate accidents in the mines of the Cerro de Pasco. *Boletin* No. 31 is a monograph on the mineral resources of the province of Cajamarca, by Mr. F. Malaga Santolalla. The work covers eighty-three pages, and is well illustrated and furnished with maps and sections. The coalfields of the province are of considerable importance, bituminous coal being worked at Yanacancha and anthracite at Punre. Descriptions are also given of mines of silver-lead ores, of copper, antimony, and sulphur. In fact, the province is one of exceptional mineral wealth.

MESSRS. SWAN SONNENSCHEIN AND CO., LTD., have published a second edition of Mr. C. H. Hinton's book on the fourth dimension. The first edition was reviewed in the issue of NATURE for July 21, 1904 (vol. lxx., p. 269), and it is only necessary to say that the new edition differs chiefly by the addition of a new chapter of twenty-three pages on a language of space. The new chapter is also published separately.

OUR ASTRONOMICAL COLUMN.

PHOTOGRAPHING THE CORONA WITHOUT A TOTAL ECLIPSE.—A communication from MM. Millochau and Stefanik referring to a recent note in these columns (May 31, p. 112) on their proposed method of photographing the corona without a total eclipse of the sun points out that the meaning of part of their note in the *Comptes rendus* was misinterpreted.

The successful experiments at Meudon dealt with the feasibility of photographing the line at λ 5303 with a *spectrograph*; and others, performed since their communication to the academy was published, have clearly affirmed the possibility of observing the green coronal line when the atmosphere is sufficiently pure and suitable screens are employed. It is this study of the *spectrum* of the corona that they hope to complete on the summit of Mont Blanc.

OBSERVATIONS OF NOVA GEMINORUM.—The results of some interesting observations of Nova Geminorum, which were made by Prof. Barnard between the date of the Nova's discovery (March, 1903) and February 27, 1906, appear in No. 6, vol. lxvi., of the Monthly Notices (R.A.S.).

At the time of discovery the magnitude of the Nova was 8·0, but it steadily decreased until at the present time the object is but very little brighter than the fifteenth-magnitude star which slightly precedes it.

The observations made in order to discover any possible difference of focus between the Nova and the surrounding stars indicated no such difference at first, but on September 21, 1903, it was found that the focus for the Nova was 0·29 inch further from the object-glass than that of a tenth-magnitude preceding white star. In connection with these observations a curious feature was noted on March 30, 1903. The Nova appeared to have two distinct foci, both of which gave sharp images. The one image was of about 8·5 magnitude, of reddish-yellow colour, and at the ordinary stellar focus, whilst the second was of the tenth magnitude, about 0·39 inch further out, and of a beautiful crimson colour. On April 6 the crimson image was still present, though not so strong or definite, and on April 27 it had entirely disappeared. This image was probably due to the strong Hα line in the spectrum of the Nova.

Measures of the distances between the Nova and the surrounding comparison stars, of which Prof. Barnard gives a chart, indicate a decrease of distance between one of the latter and the Nova. From this it would appear that the Nova is in motion, but that cannot be stated as a fact until further measures have been made. The measures of the position of the Nova gave no indication of a parallax.

PERSONAL EQUATION IN PHOTOMETRIC OBSERVATIONS.—In No. 4089 of the *Astronomische Nachrichten* Prof. Ceraski directs attention to the fact that in recording the results of observations made with the Zöllner photometer it very often happens that no mention is made of the relative positions of the real and the artificial stars during the observation, and asks that this should always be carefully recorded by the observer.

There is often an effective personal equation introduced into the results, depending upon whether the real star is to the right or to the left of the artificial star when the observation is made, and as this equation varies with the instrument employed and the magnitude of the variable star at the moment of observation, it becomes important that the conditions should be carefully recorded and the resulting corrections applied when the final values are computed.

COMET 1906*b* (KOPFF).—In No. 4087 of the *Astronomische Nachrichten* Herr M. Ebell publishes a newly derived set of elements and an ephemeris for comet 1906*b*. The following are the elements:—

$$T = 1905 \text{ Oct. } 18{\cdot}6620 \text{ (Berlin M.T.)}$$
$$\left.\begin{aligned} \infty &= 158^\circ\ 42'\ 11''{\cdot}4 \\ \Omega &= 342^\circ\ 13'\ 35''{\cdot}1 \\ i &= 4^\circ\ 14'\ 32''{\cdot}4 \end{aligned}\right\} 1906{\cdot}0$$
$$\log q = 0{\cdot}522130$$

The ephemeris shows that the comet has just passed from the constellation Leo, wherein it was discovered on March 13, into Virgo, and is situated about one-third of the distance between υ Leonis and β Virginis, reckoning from the former.

A note in the *Observatory* (No. 371) points out that the perihelion distance of this comet is greater than any previously recorded, with the exception of that of the comet of 1729. Prof. Wolf has found an image of the comet on a plate secured on January 14, 1905, more than a year before the discovery, an event which is unique in the history of cometary observations. At that time the magnitude of the object was about 0·4 that at the time of discovery, and approximately equal to the present magnitude.

OBSERVATIONS OF VARIABLE STARS.—Twenty-two newly discovered variable stars in Carina are announced in Circular No. 115 of the Harvard College Observatory. The variability of these stars was discovered by Miss Leavitt from the examination of six plates taken with the Bruce telescope, the total number of variables discovered from these plates being now thirty-nine. The star H 1232 is found to

be an Algol variable, and a number of the observations made near minima, together with an ephemeris for May, June, and July, are given in the circular.

A plan proposed by Prof. Bailey for the construction of a variable star Durchmusterung, in which the cooperation of amateur and other astronomers is sought, is described in No. 116 of the same publications.

The results of a number of variable-star observations made by Mr. S. D. Townley at the Lick Observatory during the summer of 1902 are published in No. 95 of the Lick Observatory Bulletins. Most of the stars observed were taken from the "Catalogue of Stars recognised as Variable since the Appearance of Chandler's Third Catalogue," which appeared in the *Astronomical Journal* (vol. xxii.) in 1902.

VISIT OF REPRESENTATIVES OF FRENCH UNIVERSITY EDUCATION.

THE French visitors have come and gone. To describe in detail the events of a crowded programme would be impossible. We can here only give a brief sketch. From the first meeting on Whit Monday, at the informal dinner given at the Empress Rooms of the Royal Palace Hotel, it was obvious that the *entente* between the French savants and their English hosts was sincere and cordial, and that it was of much older standing than the political agreement. The Vice-Chancellor, Sir Edward Busk, speaking in French, struck the right note at the outset, and Sir Walter Palmer, the chairman of the reception committee, and Mr. P. J. Hartog, the academic registrar of the university (who acted with Mr. W. K. Hill as secretary), both former students of the Sorbonne, welcomed, in the French guests, old teachers and fellow-students.

To the toast of "Our Guests," proposed by Sir Walter Palmer, responses were made by M. Bayet (for the Ministry of Public Instruction), M. Boutroux (for the Faculty of Letters of Paris), M. Lippmann (for the Faculty of Sciences of Paris), M. Chavannes (for the Collège de France), M. Thamin and M. Angellier (for the French provincial universities), M. Morel (for the Société des Professeurs de Langues vivantes), and M. Gautier (for the Guilde Internationale), several of whom, including MM. Lippmann and Angellier, spoke in excellent English.

On the following morning the official proceedings began with a reception by Lord Fitzmaurice and Mr. Lough, Parliamentary Secretary of the Board of Education, in the large room of the Foreign Office, followed by luncheon for 300 guests in the East Gallery of the University.

The gallery, which is nearly 200 feet long, was decorated with French and English bunting, and with red, blue, and white flowers; and the French robes of crimson silk (science) and yellow silk (arts), with the ermine-barred *epitoga*, the scarlet gowns and many-coloured hoods of the Englishmen, and the light summer dresses of the ladies, formed a gorgeous display. It was a surprise to the Frenchmen, who had been somewhat loth to don academic costume, very rarely worn in France, and only on solemn official occasions, to discover its value in a pageant. One of the most distinguished of them prophesied that the English fashion would before long be followed in France.

Official distinction was given to the reception by the presence of M. Cambon, the French Ambassador, who responded to the toast of the President of the French Republic; and the connection of the University with London was emphasised by the toast "Welcome to London" proposed by Mr. Evan Spicer, chairman of the London County Council, and responded to by M. E. Hovelaque, the French Inspector-General, who has of late years transformed the teaching of English in French schools, and who spoke with an ease and distinction that Englishmen might well envy. After lunch came addresses in the Great Hall to an audience of about 1800 persons. The Vice-Chancellor gave a brief but interesting sketch of the relation between the University of Paris and the older English universities; M. Liard, the Vice-Rector of the University of Paris, gave an account of the great and fruitful reforms in French secondary and university education, on which, as Sir Edward Busk justly said, he has for many years exerted "a commanding and beneficent influence"; Sir Arthur Rücker, principal of the University, showed how the ideal of Adam Smith of free and competitive teaching, and the ideal of Dr. Johnson of an endowed and privileged university were united in the University of London with its external and internal sides, and he amused his audience greatly by pointing out that while the test of "residence" at the Inns of Court was eating, and at Oxford and Cambridge was sleeping, that test in London had been divorced *a mensâ et thoro*; Prof. Sadler, as past-president of the Modern Languages Association, a number of the French guests of which were entertained by the University, gave an interesting and suggestive sketch of French influences on English education. After the addresses tea was served in the new, and still unfinished, chemical and physical laboratories of the Royal College of Science, over which the visitors were conducted by Sir Arthur Rücker, Prof. Tilden, Prof. Callendar, and the staff of the college. In the evening the guests were invited to meet fellow-specialists informally at parties given by Sir Edward Busk (modern languages and literature), Prof. and Mrs. E. A. Gardner (classics, archæology, and philosophy), Sir William and Lady Ramsay (mathematics and physical sciences), Mr. Mackinder (history and geography), and Dr. Waller, Dr. Farmer, Dr. Halliburton, and Dr. Starling (biological sciences).

On Wednesday morning, June 6, and afternoon, the County Council took charge of the visitors; they were driven in thirty-five carriages, headed by two mounted policemen, from the Royal Palace Hotel to Westminster, where they inspected the Abbey and school, then to the excellent Camberwell School of Arts and Crafts and the Oliver Goldsmith School, and so to Belair, the beautiful park of Mr. Evan Spicer, where lunch was served in an open marquee. The guests returned *viâ* Dulwich College and Picture Gallery, and drove through the Dulwich Common Park, now maintained by the County Council, in which there is a magnificent show of rhododendrons and azaleas. In the evening private dinners were given by the Vice-Chancellor and Lady Busk, the Principal and Lady Rücker, Dr. and Mrs. Bradford, Sir William Collins, M.P., Dr. Headlam, principal of King's College, Mrs. J. R. Green, Sir Philip Magnus, M.P., and Lady Magnus, Dr. and Mrs. T. L. Mears, Sir Walter and Lady Palmer, Dr. and Mrs. Pye-Smith, and the principal, professors, and lecturers of University College.

The evening concluded with a brilliant and crowded reception at the French Embassy.

On Thursday morning, June 7, a series of eight addresses was given in the Great Hall of the University of a singularly varied and interesting character, in which it may fairly be said that the English speakers, Prof. Gardner, Dean of the Faculty of Arts, who spoke in Latin, Dr. Waller, Dean of the Faculty of Sciences, and Sir William Ramsay, who spoke in French, did not fall short of the high literary level characteristic of French eloquence. M. Croiset and M. Appell, the Deans of the Faculties of Arts and Sciences of Paris, M. Léger, professor at the Collège de France, M. Benoist, Rector of Montpellier, and M. Morel, vice-president of the Société des Professeurs de Langues vivantes, gave addresses on which it is impossible to comment adequately. It is understood that they will be published later, when we hope to have occasion to describe them.

On the afternoon of Thursday, June 7, the French guests journeyed by special train to Windsor, where they were introduced by Lord Rosebery, Chancellor of the University, and by the Vice-Chancellor, to the King and Queen, and were afterwards entertained at tea in the Castle; and in the evening the proceedings, so far as London was concerned, concluded with a brilliant conversazione at the University.

On June 8 half the guests of the University and of the Modern Language Association were entertained at Oxford and half at Cambridge. The majority left London on Saturday and Sunday, June 9 and 10.

In these festivities there has been much brilliancy, much pomp and circumstance. But behind the show there has been real and solid work accomplished or begun. Lessons are learnt better from men than from books, and the lessons to be derived from French education, to which (with the Army) France has devoted the best part of her energies since 1871, have been sadly neglected by England. We have still to learn that solid secondary education is a

necessary preliminary to fruitful university education; that it is possible to combine literary and scientific training; that both in secondary and in higher teaching, if the teachers are to stimulate individuality in their pupils, they must be given time and opportunity to cultivate and develop their own; that examinations may be used to test the power of taking general views, as well as of remembering an infinity of details; and many other things, which France can teach us. But apart from intellectual profit, there is a moral profit in a meeting of this kind. Blessed are the peace-makers; and the discovery of unsuspected and deep human sympathies between workers in the same intellectual fields, between men and women whose business it is to train up the young minds of their own people, makes for the peace of Europe.

ECONOMIC ENTOMOLOGY.[1]

(1) SINCE 1867 the State entomologists of Illinois have constantly issued very able reports on noxious and beneficial insects. The first were by Walsh and Le Baron; the last twelve have been by Prof. Forbes, the writer of the present work. In 1894 he issued the first part of "A Monograph of Insect Injuries to Corn." This extended to some 170 pages, with fifteen plates, and dealt only with those insects that attack the planted seed and the roots of corn of various kinds. This dealt mainly with wire-worm, white-grubs or chafer larvæ, ants, aphis, their natural enemies and means of prevention. The second part that has just appeared is very much better than that issued nearly twelve years ago. It treats of the insect injuries to those parts of the corn plant above ground, including stalk, leaves, and ear.

A very excellent plan we do not remember having seen before is adopted in the text, namely, that of grouping the insects under the following three headings:—(1) the more important pests; (2) the less important pests; and (3) the unimportant species.

In dealing with the first it is pleasing to note that the insects are dealt with in a strictly practical manner. Such reports as these can well be made to serve a double purpose if properly drawn up as this one is, namely, as a reference book for practical men and also for those who are studying the subject from a student's point of view. The coloured plates, of which there are eight, include the army-worm, corn bill-bugs, the chinch bug, the corn-worm, white-grub, the seed-corn maggot, and other well-known corn pests. The plates are good, and show in some cases, not merely the perfect insect, but the whole life-history and the damage produced on the growing plant.

Among the more interesting sections we find a good account of the damage caused by the chinch bug (*Blissus leucopterus*, Say) and the means of preventing it, of the army-worm (*Leucania unipunctata*, Haw.), and of the corn-leaf louse (*Aphis maidis*, Fitch). In regard to the latter some interesting new observations are recorded, although nothing very definite has been arrived at in regard to the life-history of this corn pest. The author (p. 133) refers to "the failure of all attempts to find or produce a bisexual generation or an alternative food plant of *Aphis maidis* or to learn how and where it passes the winter."

Some interesting notes are given on several species of Crambus, called popularly in the States "sod web-worms" or "root web-worms" (Figs. 1 and 2). Although we have many species of Crambus in Europe, no very material damage has been recorded. In America we learn that "not infrequently these 'web-worms' become so abundant as to cause brown and deadened spots in a lawn or meadow, sometimes, indeed, deadening the turf as thoroughly as white-grubs or cut-worms can do." Corn seems to be very heavily injured and even completely destroyed over considerable areas in early spring. This is an attack we must be prepared for in many localities in this country when grass land is broken up, an unlikely proceeding, however, at the present day with the low price of corn. Probably a good deal of damage is done here now, but has been attributed to other causes. The figures given by Forbes are thus reproduced to give an idea of the larval stage, during which the damage is done.

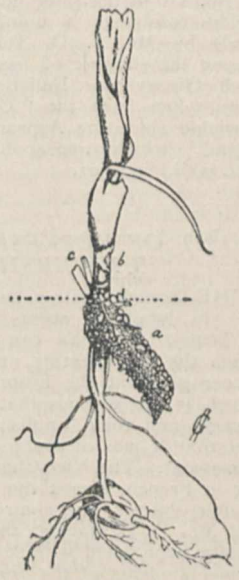


FIG. 1.—The Sod Web-worm (Crambus) web (*a*) containing larva, at base of young corn plant; *b*, *c*, injuries to leaf and stem.

In this country, again, we have not observed any injurious Syrphidæ or hover flies, but we find recorded by Forbes (p. 162) that *Mesogramma politum*, Say, feed, not on Aphides, but on the pollen and juices of corn and cotton (Ashmead). The whole work is full of interesting and sound material alike to the practical man and student. One point we notice; the corn-worm or cotton-worm is still called *Heliothis armiger*, Hübner, instead of *Heliothis obsoleta*, Fabricius, which antedates it.

A key to the discussion of insect injuries to corn is given which will prove very useful to those studying the subject in America, and even elsewhere, for where species differ genera often agree in various parts of the world. A very complete bibliography and a copious index complete the work, which is useful to us in many regions other than America.

(2) This work contains a good deal of useful information and a lot of what appear scrappy notes, which will, however, serve a useful purpose later on. The great difficulty of working at such a subject as the one Mr. Stebbing is engaged upon can only be estimated by those who have attempted the like.

The economic entomologist is often too apt to jump at specific and even generic determinations, or is loth to publish his observations unless the scientific name can be given. Some groups of insects are almost impossible to name specifically, and many others should only be treated by specialists, who have not always time or inclination to deal with the material sent them.

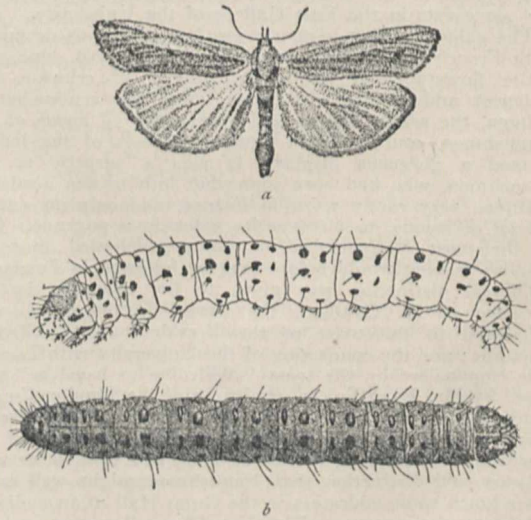


FIG. 2.—The Common Sod Web-worm (*Crambus trisectus*): *a*, adult slightly enlarged; *b*, back and side views of larva (much enlarged).

[1] (1) "A Monograph of the Insect Injuries to Indian Corn." Part i. By S. A. Forbes. Twenty-third Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois. Pp. 273+xxxiii; 238 Figures and 8 Coloured Plates. (Chicago, 1905.)

(2) "Departmental Notes on the Insects that affect Forestry." By E. P. Stebbing, F.L.S., F.Z.S., F.E.S. No. 3, with Preface and Index to vol. i. Pp. 335-469+8 plates. (Calcutta: Government Printing Office, 1906.) Price 2s.

Nevertheless, it is very necessary that we should record the bionomics of arthropods of economic importance, even though we have to leave to some future date the scientific nomenclature, which in many cases is quite as diverse as the sometimes derided popular one! It is thus pleasing to find in this work valuable information recorded without waiting for even the definite generic status of the pest in question.

From p. 379 to p. 385 is detailed in a most able manner the life-history and workings of a cerambycid beetle, probably a Stromatium, which attacks the sandal-wood tree.

This "borer" is well known to be one of the most assiduous pests in the sandal-wood area of North Coimbatore, and yet Mr. Stebbing tells us that he is as yet unable to obtain any beetles and that he is not even sure of its generic position. So much is recorded, however, that one has only to find and name the beetle and fill in a few details and the account is complete. The sandal-wood borer will remain the same to the Indian forester, who is indebted to Mr. Stebbing for that work of special value, its life-history, whatever technical name it appears under later on. Other forest enemies are recorded in similar manner; sometimes the genus is doubtful, sometimes the species.

The most interesting part of this work deals with the bamboo beetle or shot-borer (*Dinoderus minutus*, Fabricius). This and allied species are often very destructive to bamboos.

It is shown that this species is the chief pest to bamboos in Calcutta and in the hotter, damper parts of the country, apparently taking the place of the *pilifrons* in Upper India.

In the account of this pest we find recorded some real practical work with regard to protecting bamboos from the ravages of this insect. The conclusions arrived at show that soaking the rods for five days in water, then drying them and soaking them for forty-eight hours in common Rangoon oil, is the best method of treatment. Other interesting wood-borers are also dealt with, including a goat-moth (*Duomitus leuconotus*, Walker) found in Calcutta, Sikhim, and Ceylon, which attacks the Cassia trees just as our goat-moth attacks the ash and oak; and there is also a very full account of the Casuarina bark-eating caterpillar (*Arbela tetraonis*, Moore), a widespread pest in Casuarina plantations, where it often does much damage.

An unusual, yet useful, diversion we note in this report is that at the end of each subject are mentioned the "points in the life-history requiring further investigation."

The plates are for the most part rather crude, but serve their purpose. The photogravure of bamboos tunnelled into by the bamboo-borer is, however, an exception. A great foundation is being prepared in such a work as this; it is only a foundation, but, judging from what we have seen of this and others, it is one upon which we need not be afraid to continue building. FRED. V. THEOBALD.

THE SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES.

THE eleventh annual congress of the South-Eastern Union of Scientific Societies was held at Eastbourne on June 6–9 at the invitation of the local natural history society. On Wednesday evening, June 6, the retiring president, Prof. Flinders Petrie, opened the proceedings and gave up his chair to Dr. Francis Darwin, who delivered the presidential address. The title of the latter was "Periodicity," and in it Dr. Darwin pointed out that one of the most striking features of living things is their periodic or rhythmic character. Life itself may be described as a rhythm made up of alternate destruction and reconstruction. Protoplasm—"the physical basis of life"—is alternately falling to pieces by a degradation into simpler compounds and rebuilding itself from the food materials supplied.

In the address simpler instances were mentioned, such as are seen in the process of reproduction, for instance in the case of a plant, which produces a seed that gives rise to another plant, and so on. Again, allusion was made to the seasonal appearance and disappearance of the leaves of deciduous trees. Attention was turned to the time limits between the earliest and latest unfolding of the leaves in various trees and to the attempts which have been made by phænologists to explain these periodic phenomena as being strictly regulated by temperature.

In the end, however, Dr. Darwin was able to show that the plant is really master of the situation, and not the temperature, for among other things buds in ordinary circumstances will not develop at the end of summer, and at this time it is much milder than in the spring, when they begin to unfold and grow into shoots. The plant is, in fact, guided by internal rather than external conditions, for the bud has to go through certain invisible changes during its winter's rest before it is ready for its normal growth, and these invisible changes are part of the plant's automatic rhythmic capacity which enables it to be independent, to a large extent, of external changes. The same arguments were found to apply to the daily movements of plants. Increase of temperature may cause flowers to open in the morning, but it has no effect at night. Again, leaves that show sleep movements by falling at evening from a horizontal position to one which is, roughly speaking, vertical, will, even if kept in the dark, return to their original station in the morning. At nightfall the sleep movements again occur, though as the plant becomes more and more unhealthy owing to the absence of light they are gradually lessened. Dr. Darwin described a very interesting case of habit in a sleeping plant, namely, the scarlet runner, which he recently demonstrated. Like other plants, the one in question adapts itself to one-sided illumination by placing its leaves obliquely so that they are at right-angles to the line of illumination, and get the full advantage of the light. If a scarlet runner which has assumed this oblique position is allowed to go to sleep at night as usual, and is then placed in a dark cupboard, it will in the morning assume the diurnal position as already mentioned in the case of other sleeping plants. Most remarkably, however, it does not return to its normal day position, that is, with horizontal leaves, but takes up the oblique position already described. This looks like a reminiscence of its former position, and is interesting psychologically since it might almost be described as an instance of a plant taking advantage of its individual experience.

Another experiment showing how a periodic movement had been induced, and pointing to a kind of memory on the part of a plant, was described by Dr. Darwin, who finally touched upon circumnutation, which he looked upon as the raw material out of which movement in response to stimuli has been developed.

During the congress several papers were read which showed, not only that the neighbourhood of Eastbourne is very rich in plants, birds, and insects, but that there are many keen naturalists in the county of Sussex. For instance, Mr. J. H. A. Jenner dealt generally with nature near Eastbourne, a communication by the late Dr. Whitney and Miss Milner treated upon the flora of the Eastbourne district, while Mr. Ruskin Butterfield compared the birds of Sussex with the list for Great Britain, showing that from the county in question there is a greater number of birds recorded than from any other.

On Thursday evening, June 7, Dr. Jonathan Hutchinson gave a powerful discourse on the educational value of museums. He emphasised the need for large and inexpensive buildings, and showed the great importance of museums now that it has been recognised that things, and not words, must be studied if the memory is to be of any real use. He dwelt on a graphic method of teaching history adopted in Haslemere Educational Museum, which he founded, and also alluded at length to the moral effect of proper education.

Two papers dealt with geology, namely, that on sea erosion and coast defence, by Mr. E. A. Martin, and the geology of the Upper Ravensbourne Valley, with notes on the flora, by Mr. W. H. Griffin. The former contribution summed up the present situation, and was particularly suggestive, while the latter showed how much useful work a naturalist can do who devotes his time ungrudgingly to a particular district.

At the reception given by the Mayor of Eastbourne, Mr. Edward J. Bedford gave a most successful lecturette on bird architecture. The photographic lantern-slides which

illustrated it were particularly good, which, seeing that Mr. Bedford began his work in this direction so long ago as 1890, is not, perhaps, to be wondered at.

The last lecture, on Saturday morning, June 9, to which the teachers of the district were invited, was given by Mr. Wilfred Mark Webb, on nature-study. As two years ago Mr. Webb presented a formal paper to the union, he contented himself, after a few brief remarks, with showing by means of lantern-slides what directions the pursuit in question has taken or might take.

A number of interesting specimens were brought together to form the usual congress museum under the direction of Mr. E. W. Swanton, and the photographic surveys of Surrey, Kent, and Sussex contributed a selection of photographs.

The business done included the election of Prof. Silvanus Thompson as president for 1907, and the acceptance of an invitation to visit Woolwich for the twelfth congress in that year. Dr. Abbott, the founder of the union, its first secretary and late treasurer, was added to the list of vice-presidents, of whom besides Dr. Hutchinson, Mr. F. Merrifield, Mr. F. W. Rudler, the Rev. T. R. R. Stebbing, Dr. Treutler, and Mr. W. Whitaker attended the congress.

The perfect weather made the four excursions to Mickleham Priory and elsewhere a complete success, and a pleasing feature of the meeting was the votes of thanks to local secretaries, Mr. J. J. Hollway and Mr. Sparks, and their coadjutors, as well as that to the general secretary, the Rev. R. Ashington Bullen, which was emphasised by the whole company rising in their seats.

THE SURFACE TRAJECTORIES OF MOVING AIR.[1]

THE Meteorological Office has just published the results of an investigation into the movements of the air during storms and periods of barometric depression affecting the North Atlantic and western Europe. The authors deal, not so much with the discussion of theories about cyclones as with the results of direct observations on the direction and force of the winds as recorded at as many stations and as often as possible. Apart from ships' logs, the records from about 200 stations have been utilised.

The attempt has been made to trace the path of any body of air from the point where it descended from the upper regions of the atmosphere along the surface of the earth to the place where it ascended again, and the method used is briefly as follows:—Using hourly observations whenever possible, arrows have been drawn on a map through the position of the recording station showing the direction of the wind, and the length of the arrow is equal to the distance which the recorded velocity suggests as being the journey of the air during the half-hour preceding and the half-hour following the time of observation. By this method the trajectories are made up step by step through station after station as the hourly maps are made up. Anemometer records are consulted to decide where the velocity of the wind has been sufficiently constant to carry the trajectory properly from one hour to the next.

In the discussion of certain circular storms and barometric depressions which have passed over the British Isles, and which have been selected as typical examples, 162 trajectories were examined, and also the changes in the meteorological conditions along them. Naturally many of these trajectories do not represent the full course of the particular current considered, only the beginning, the middle or the end coming within the region under observation.

These trajectories have been divided into five classes. Class i.—Final-stage trajectories terminating generally, but not always, near the centre or the trough of the depression. These are marked by diminishing pressure, increasing velocity, and falling temperature. These currents end under cloudy skies and with rainfall. In some cases the end is caused by the meeting with a cross-current. The conclusion is that this air has fed the ascending current, and that the rain has been caused by the expansion and consequent cooling. These trajectories are always from almost due south, and show very little curvature.

Class ii.—Initial-stage trajectories, commencing in regions of fairly still air which may be quite near to the centre of the depression. The meteorological conditions and changes which characterise this class are the reverse of those for class i., even to this extent, that they flow from low pressure to high. There are many cases of this class shown; too many to suggest a mistake.

Class iii.—Looped trajectories generally cross the track of the depression twice, once in front of the storm and once behind, and may be taken as a continuation of classes i. and ii.

Class iv.—Spiral trajectories generally represent cold currents blowing from the east or north round the west of the centre of the depression to replace the southerly currents of class i.

Class v. has three subsections:—(*a*) trajectories from a point in front of the trough; (*b*) from a point in the rear; and (*c*) in the line of the trough. The meteorological conditions accompanying (*a*) and (*b*) are similar to those for classes i. and ii. Trajectories in the line of the trough are remarkable for the strength of the wind and for the small and irregular changes of pressure. The accompanying weather is generally cloudy, but without rain.

The trajectories over the Atlantic are obtained from observations made between August, 1882, and September, 1883, and, as only daily records are used, the investigation is on a much coarser scale. Moreover, they are more open to criticism, for there may be many changes in the meteorological elements in twenty-four hours. Some of the trajectories traced are remarkable for their length; for example, between December 23 and 30, 1882, one is traced from West Africa to North Russia, and another from Florida to the British Isles, and between November 13 and 17 one is followed from Hudson's Bay to the Adriatic.

In seeking to locate the positions of ascending and descending currents and the connection between these and the distribution of rainfall, it has been taken as proved that an ascending current of air is necessary for the production of measurable rainfall, and we are reminded that it is not necessary or usual for these ascending or descending currents to be vertical. They are generally very oblique. The approximate positions of ascending currents are located by noting the convergence of air to such places, divergence denoting descension.

Convergence may be produced by the trajectories being directed towards one point, or by air overtaking air which is preceding it in the same direction, or by the wind blowing towards a persistent cross-current. These are obvious and typical cases.

If two sets of isochronous points or trajectories be joined by lines, then the ratios of the enclosed areas will indicate convergence or divergence according to whether the second area is smaller or larger than the first.

The greater convergence takes place almost always in front of the centre of the depression, and this agrees with the area of greatest rainfall. As, however, the rain is generally brought by southerly winds, the rainy district is somewhat to the north of the area of convergence, the current evidently having continued its onward course whilst rising.

Some of the general conclusions deduced during the investigation may be given:—

(1) In the front portion of travelling storms there is air moving from high pressure to low and to lower temperature and rainfall, while in the rear, even quite close to the centre, there is movement from low pressure to high and towards improving weather conditions.

(2) Fast-travelling storms receive air from the right hand (south) of the path in front of the storm, and lose an equivalent amount from the rear at the same side. Slow-travelling storms receive air from the south direct to

[1] "The Life-history of Surface Air-currents; a Study of the Surface Trajectories of Moving Air." By Dr. W. N. Shaw, F.R.S., and R. G. K. Lempfert. (London: Published by the Authority of the Meteorological Committee, Wyman and Sons, Ltd.) Price 7*s*. 6*d*.

the centre, whilst air from the north flows round the rear.

(3) Southerly winds are generally short-lived as surface currents. Other currents last longer. They may persist until they reach the trade winds, or they may turn and join the depression from the south, or may disappear in some depression over the Atlantic.

(4) The central areas of well-marked anticyclones have not shown themselves to be the usual birthplace of descending currents. These generally originate in the "col" or shoulder of an anticyclone, or the areas of comparatively low pressure between two anticyclonic or two cyclonic areas. Only very rarely has a trajectory been traced back to the centre of an anticyclone.

(5) Surface observations have not indicated the conditions which mark out the track of a barometric minimum.

The publication contains some twenty-six valuable plates of weather charts with the trajectories plotted, and accompanied by full notes and selected observations along the trajectories. The trajectories have also been drawn having regard to the centre of the storm as a fixed point. There are also some mathematical notes by Mr. G. T. Bennett with reference to looped trajectories and the calculation of dilatation of areas in travelling storms.

W. M.

NEW ARCTIC EXPEDITIONS.

THE present season promises to be one of unusual importance in the annals of Arctic exploration, both in the way of scientific investigation of specific problems such as those stated in the paper by Sir Clements Markham published in the January number of the *Geographical Journal*, and in what may be more correctly described as "attacks on the Pole."

According to a note in the current number of the *Geographical Journal*, Mr. A. H. Harrison's expedition reached Herschel Island, near the mouth of the Mackenzie, in February last, where Mr. Harrison found Lieut. Hansen and the members of the *Gjöa* expedition. Writing on March 1, Mr. Harrison expressed the intention of making his way during April to Bailie Island, and thence to Banks Land, where he proposes to spend next winter.

The general scheme of the expedition—now formally designated the "Anglo-American" Polar Expedition—undertaken by Mr. Elnar Mikkelsen and Mr. Leffingwell, has already been outlined in these columns (January 25, vol. lxxiii., p. 302). Since his arrival in the United States the American Geographical Society has voted Mr. Mikkelsen a sum of 3000 dollars, the largest grant ever given to an explorer by the society, and the council of the Royal Geographical Society has made a second grant of 100*l*. Mr. Mikkelsen has purchased a schooner of 66 tons burden, which he has named the *Duchess of Bedford*, and has now been able to elaborate his plans in considerable detail on the lines already announced (see the *Times*, April 21, and the *Geographical Journal*, vol. xxvii., p. 507). The programme is an extensive and extremely hazardous one, but if even a part of it is successfully carried out scientific results of great value will certainly be obtained.

The Danish or "Danmark" expedition, for which funds amounting to about 250,000 kr. have been raised by means of a Government grant and private subscriptions, will leave Copenhagen on July 1 under the leadership of Mr. L. Mylius-Erichsen, and make its way so far north as possible along the east coast of Greenland. There a landing will be effected, and the party will proceed along the east coast, wintering *en route*, to the most northerly point of Greenland, which is, in the leader's opinion, the most favourable place from which to make an attempt to reach the Pole. A sledge expedition will set out for the Pole from here, and return in time to winter on the ship the second year. In March, 1908, Mylius-Erichsen, accompanied by one of his staff and two Greenlanders, hopes to set out on the second part of his journey, and realise the daring plan of traversing the inland ice of Greenland on the broadest portion of the continent. The crossing is to be effected partly by motor-car, partly by dog sledges, and partly on ski, and is expected to occupy about two months and a half.

Mr. Walter Wellman has formed a project for reaching the North Pole by means of an airship. The vessel is to start from a base in Spitsbergen, and it is estimated that the return voyage of 1200 miles may be accomplished in from five to fifteen days. This expedition is being financed by Mr. Victor Lawson, chief proprietor of the *Chicago-Record Herald*, and a very full description of the airship—which is of a quite novel type—is given by Mr. Wellman in the April number of the *National Geographic Magazine*. The contract for construction was given to M. Louis Godard, of St. Ouen. According to a Reuter correspondent in the *Times* of June 5, the ship will leave Paris for Spitsbergen in a few days.

A CATALOGUE OF FOSSIL INVERTEBRATES.[1]

THIS catalogue of fossil invertebrates, compiled by Mr. Charles Schuchert, assisted by Messrs. W. H. Dall, T. W. Stanton, and R. S. Bassler, is arranged alphabetically, and gives the catalogue number of the department registers, the name of the species as written in the work cited, the kind of type (for instance, holotype, cotype), the formation, locality, author, and place of publication, with remarks on the present name if different from the one cited, or a cross reference when the same species appears in the list under more than one name. Remarks, together with sources of such, are added in brackets where necessary.

The list itself is preceded by an admirably clear and carefully written introduction by Mr. C. Schuchert, dealing mainly with type terms. Use is made of the contributions of Schuchert, Buckman, Cossmann, Oldfield Thomas, Bather, and others to the discussion of the terminology of type specimens, thus furnishing a valuable and concise summary of definitions, the understanding of which is necessary for the proper appreciation of the catalogue. In addition to terms already in use are others which are introduced here for the first time, and consequently call for brief notice. Primary types or proterotypes are divided into holotypes, cotypes (or syntypes), paratypes, lectotypes, and chirotypes, the last two terms being new. The term "chirotype" is proposed for "the material upon which a published manuscript name is based." In cases "where the original diagnosis is without illustrations or is accompanied by figures based on two or more specimens, the first subsequent author is at liberty to select from these cotypes a type for the old species, adhering, as far as can be ascertained, to the intention of the original author." Such a type specimen is designated a "lectotype." Supplementary types are divided into plesiotypes, neotypes, and heautotypes. "Heautotype" is a new term proposed by Buckman for "a specimen figured by an author as an illustration of his own already founded species, such not being a proterotype." Typical specimens are divided into "topotypes," "metatypes," "homœotypes," and "ideotypes" (new). The term "ideotype" is used by Buckman for specimens which come from places other than the original locality, and named by an author of a species after publication. The term "protograph" (suggested by Buckman for the original figure or figures illustrating a holotype) and "synthetograph" (a drawing which is a composite figure based upon several specimens of the new species) are also introduced here for the first time. For any artificial specimen moulded directly from a primary type Schuchert proposes the term "plastotype." For types of genera or genotypes the word "geno" is prefixed to the primary type terms, thus giving the corresponding terms "genoholotype," "genosyntype," and "genolectotype."

We cannot but feel grateful to Mr. Schuchert for his clear correlation of type terms. Although distinctly opposed to a multiplicity of terms in itself, we feel certain that such as are introduced in this volume justify their usage in the interest of scientific method. I. T.

[1] Smithsonian Institution: Bulletin of the United States National Museum; Catalogue of Fossils, Minerals, Rocks, &c., Merrill. Part i., Fossil Invertebrates. Pp. 704.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Dr. William Somerville has been elected to the Sibthorpian professorship of rural economy.

The following have been nominated to examine in the final honour schools:—in physics, Mr. W. C. D. Whetham; in chemistry, Prof. Arthur Smithells; in physiology, Mr. W. M. Bayliss.

An examination for a geographical scholarship of the value of 60*l.* will be held on October 11. Candidates, who must have taken honours in one of the final schools of the University, should send in their names to the reader in Geography, Old Ashmolean Building, Oxford, by October 1.

An appointment to the Oxford biological scholarship at Naples will be made next Michaelmas term. Candidates should send their names to the professor of comparative anatomy, the professor of physiology, or the professor of botany, by October 15.

CAMBRIDGE.—Dr. Nuttall, F.R.S., has been appointed reader in hygiene; Dr. L. Humphry has been re-appointed university lecturer in medicine, and assessor to the regius professor of physic.

The degree of LL.D. *honoris causa* will, on June 16, be conferred on His Excellency Paul Cambon, G.C.V.O., the French Ambassador.

A prize of 50*l.* from the Gordon-Wigan fund will be awarded in next Easter term for a research in chemistry to be carried out in Cambridge by a member of the University under the standing of Master of Arts.

A course of lectures and demonstrations in crystallography will be given during the long vacation by Mr. Hutchinson, beginning on July 7.

In the Mathematical Tripos, part i., two candidates are bracketed as senior wranglers, namely, Mr. A. T. Rajan and Mr. C. J. T. Sewell, both of Trinity. There are thirty-three wranglers. In part ii. all seven candidates are placed in the first class.

The diploma in agriculture has been awarded to six candidates, who have passed both parts of the examination.

The certificate of research has been awarded to two advanced students, Mr. P. Phillips and Mr. E. F. Burton, both of Emmanuel College, for researches in experimental physics.

Prof. Sims Woodhead will represent the University at the dedication of the new buildings of the Harvard Medical School on September 25 and 26.

The inaugural address of the local lectures summer meeting will be given by the Hon. Whitelaw Reid, American Ambassador, on August 2.

MR. HALDANE, M.P., Secretary of State for War, has consented to distribute the prizes at the London Hospital Medical College on Friday, July 13.

PROF. LECOMTE has been appointed professor of the botany of the phanerogams in the Paris Museum of Natural History, and Dr. Trouessart professor of zoology.

HERR ADOLF HALLICHS, managing director of the Friedrich Wilhelms metallurgical works, Mülheim, has been appointed a professor of the Technical High School at Aachen.

DR. R. SCHENCK, privatdocent for chemistry in the chemical institute of Marburg University, has been chosen for the professorship of physical chemistry in the Technical High School in Aachen.

DR. FRANZ ARTHUR SCHULZE, privatdocent and senior assistant in the physics institute in Danzig, has been appointed professor of physics in the Technical High School as successor to Prof. Zenneck, now in Brunswick.

MR. J. D. DALY, of the Department of Agriculture and Technical Instruction, Ireland, has been appointed secretary of the Royal Commission upon Trinity College, Dublin, and the University of Dublin.

DR. OTTO DIELS, senior assistant in the chemical institute of the University of Berlin, whose brilliant discovery of carbon suboxide was only recently made known, has been granted the title of professor. Dr. Karl Neuberg, assistant in the pathological institute of the same University, has also received the same honour.

AT the meeting of the Glasgow University Court on June 7 a letter of resignation was received from Prof. McKendrick, the professor of physiology. Prof. McKendrick has held the chair of physiology for thirty years, and has decided to retire at this time in order that his successor may have a considerable share in the equipment, and an opportunity of arranging the details of apparatus, both for teaching and research, of the physiological laboratories, which have been designed according to specifications supplied by Prof. McKendrick, and are now approaching completion.

IT is announced in *Science* that Yale University has received an anonymous gift of 1000*l.* to the forestry school, the income of which is to be used for the publication of works on forestry by graduates and members of the faculty.

THE council of the University of Paris has definitely approved of the scheme for the extension of the University. This will include, according to the *Lancet*, the construction of an institute of chemistry covering an area of 9000 square metres. Here will be established the various departments of chemistry belonging to the faculty of science and the department of applied chemistry which, since its creation, have been provisionally installed in some sheds. The cost of this will be 3,000,000 francs, which will be divided between the City of Paris and the State. The extension scheme also includes the acquisition by the University, in view of future necessities, of a plot of land of 14,000 square metres. Towards the cost of this land the University will pay 1,900,000 francs and the city 700,000 francs, to which will be added the donation from the Prince of Monaco. On a portion of this area will be erected the Institute of Oceanography, founded by the Prince of Monaco.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 15.—"On the Specific Heat of, Heat Flow from, and other Phenomena of the Working Fluid in the Cylinder of the Internal Combustion Engine." By Dugald **Clerk**. Communicated by the Hon. C. A. Parsons, C.B., F.R.S.

This paper describes experiments made with a gas-engine of sixty brake horse-power, devised to obtain data necessary for a more complete theory of the internal combustion motor, and also to discriminate between the effects of continued combustion in a gaseous explosion, and specific heat change, at temperatures between 200° C. and 1500° C. The new method of experiment consists in alternately compressing and expanding the highly heated gases within the engine cylinder while cooling proceeds, and observing by the indicator the successive pressure falls and compression and expansion curves from revolution to revolution.

From some two hundred indicator cards taken under varying conditions have been calculated:—(1) a curve of apparent specific heat of the gaseous contents at constant volume between 200° C. and 1500° C.; (2) curves of heat loss to the enclosing walls; and (3) distribution of heat in the working cycle calculated from diagrams only. The apparent specific heat at constant volume is proved to increase from 22 foot-pounds per cubic foot at 200° C. to 27·4 foot-pounds at 1500° C., and an examination of expansion curves and specific heat determinations made at different engine speeds and jacket temperatures shows that combustion is proceeding, and accounts for a part of the apparent increase of specific heat. Tables I. and II. show the apparent instantaneous specific heats and the mean specific heats in foot-pounds per cubic foot of working fluid at 0° C. and 760 mm.

TABLE I.—*Table of Apparent Specific Heats (Instantaneous) in foot-pounds per cubic foot of Working Fluid at* 0° C. *and* 760 mm.

Temperature ° C.	Specific heat at constant volume ft.-lbs.	Temperature ° C.	Specific heat at constant volume ft.-lbs.
0	19·6	800	26·2
100	20·9	900	26·6
200	22·0	1000	26·8
300	23·0	1100	27·0
400	23·9	1200	27·2
500	24·8	1300	27·3
600	25·2	1400	27·35
700	25·7	1500	27·45

TABLE II.—*Table of Mean Apparent Specific Heats in foot-pounds per cubic foot of Working Fluid at* 0° C. *and* 760 mm.

Temperature ° C.	Specific heat at constant volume ft.-lbs.	Temperature ° C.	Specific heat at constant volume ft.-lbs.
0—100	20·3	0—900	23·9
0—200	20·9	0—1000	24·1
0—300	21·4	0—1100	24·4
0—400	21·9	0—1200	24·6
0—500	22·4	0—1300	24·8
0—600	22·8	0—1400	25·0
0—700	23·2	0—1500	25·2
0—800	23·6		

The curves of heat loss show that for equal temperature differences heat loss per unit surface exposed increases with density, and values are given of the heat losses for various temperatures. From these curves mean temperatures of the cylinder walls have been calculated, and shown to vary at full load from 190° C. for the whole stroke to 400° C. for the three-tenths stroke.

Calculations are made of heat distribution in the working cycle of the fluid which show that the total heat present in the form of combustible gas can be accurately calculated from the indicator diagram alone, by means of the new data obtained in the investigation.

It is pointed out that with a sufficiently sensitive indicating instrument the rate of continued combustion can be determined, and the true change of specific heat obtained from experiments made by the new method. The determination of the specific heat of gases heated by high compressions, such as one and a half tons to the square inch, is suggested, to avoid the complications introduced by combustion. It is shown that in these experiments the rate of loss of a mass of flame at 1000° C. to the comparatively cold walls of the cylinder was less than the rate of addition of heat by work performed by the piston, so that the flame temperature in the first compression rose from 1000° C. to about 1300° C., that is, compression in 0·25 second enabled a mass of flame to be handled in such a manner as to obtain accurate results. In these experiments, with maximum pressures of four hundred pounds per square inch, nearly twenty-eight tons total pressure was applied from 120 to 160 times per minute.

Mallard and Le Chatelier's experiments are discussed, and it is shown that no curve of specific heat can be deduced from their observations. It is pointed out that the curve of apparent change of specific heat of certain gases from 0° C. to 1500° C. has been here determined experimentally for the first time. The gases forming the working fluid consist mainly of carbonic acid, steam, nitrogen, and oxygen. The composition and all other details are given in the paper.

Anthropological Institute, May 22.—Prof. W. Gowland, president, in the chair.—(1) A series of slides of stone monuments found in Assam; (2) a paper on the "genna" (tabu) among the tribes of Assam: T. C. **Hodson.** The tabus are of two kinds, general or communal, as contrasted with private or individual tabus. Communal tabus are observed by the whole village, which consists of several exogamous subdivisions, and are automatic, in the sense that they are of regular occurrence or necessarily follow the occurrence of some event. These regular tabus are mostly connected with the crops, and are frequently times of great license. The village is made genna before the crop is sown, at the harvest-home, and sometimes on the appearance of the first blade of the crop. When the village is genna everyone must stay in until the tabu is over, and it sometimes lasts as long as ten days, and no one who is outside is allowed to come in. The village is also genna when a rain-making ceremony is necessary, and, in fact, any magical ceremony for the good of the whole community is necessarily accompanied by a general genna. Gennas are also occasioned by natural phenomena, such as earthquakes, eclipses, &c., and when the annual ceremony of laying the ghosts of those who have died within the year is held. Individual gennas are necessary at all important events in life, such as childbirth or marriage, and are as inevitable as crop gennas. They are also extended to certain foods, especially in the case of the head man of the village, and are also necessary when any person wishes to erect a monolith, usually for self-glorification. Such an individual is genna from the moment he takes the first steps towards erecting a monolith until the stone is finally in position. Slides of these monuments were shown by Mr. Hodson earlier in the evening. Gennas are also occasioned by the birth or death of any animal within the house, and warriors before and after a raid are subject to them.

Geological Society, May 23.—Mr. R. S. Herries, vice-president, in the chair.—The importance of Halimeda as a reef-forming organism, with a description of the Halimeda-Limestones of the New Hebrides: F. **Chapman** and D. **Mawson.** Calcareous algæ, nullipores, Lithothamnion, &c., have been frequently referred to as forming important contributions to the rock of coral-reefs. The material obtained in the great boring, the lagoon borings, and lagoon dredging at Funafuti has yielded a considerable quantity of Halimeda, and Dr. Guppy has described a Halimeda-Limestone in the Solomon Islands. Evidence such as this shows that the important deposits of calcareous plant-remains forming at the present day can scarcely be paralleled by any deposit formed in past geological times except, possibly, the limestones of the Alpine Trias, which owe their origin to the thallophytes Diplopora and Gyroporella. Among other Halimeda-Limestones mentioned by the authors are those of Christmas Island, Fiji and Tonga, and the New Hebrides.—Notes on the genera Omospira, Lophospira, and Turritoma, with descriptions of new species: Miss Jane **Donald.** The new species described in the paper belong to three genera, characterised by the possession of a band on all the whorls formed by the gradual filling up during growth of a sinus, and not a slit, in the outer lip.—Lantern-slide views illustrating the late eruption of Vesuvius and its effects: Prof. H. J. **Johnston-Lavis.** Nearly all the photographs were taken by the exhibitor, who explained the different phenomena portrayed. He considered this eruption to resemble mostly that of 1822, although the present crater was larger, attaining 1500 feet both north-by-south and east-by-west; it was probably 500 feet to 600 feet deep at least. The remarkable character about this eruption was the large amount of fragmentary material ejected, especially in a north-easterly direction, crushing in the roofs of the buildings in the towns of Ottajano, San Giuseppe, and Terzigno. At the first-named locality the depth attained was nearly 0·75 metre, made up as follows:—0·04 m. grey dust, 0·49 m. reddish lapilli, chiefly "supplementary ejecta," 0·20 m. black vesicular scoria, chiefly the "essential ejecta." The material which fell at the observatory and Naples had much the same arrangement, but was, of course, less, and practically only sand and dust. Near the base of the cone the ejecta attain to blocks several tons in weight; and it may be estimated that, at the north-eastern toe of the great cone, in some places, the débris must be 60 feet thick. It is to be seen as much as 30 feet in thickness in the new ravines that have been formed. After careful study, Prof. Johnston-Lavis had come to the conclusion that the remarkably uniform and deep scoring of the cone by very regular "barrancos" was due to the sliding and avalanche-like effect of the rapidly accumulating fragmentary material on the steep slopes, and not due to water-action. The volcano seems to have opened at four, if not five, different places on the south-western, southern, and south-

eastern sides, giving rise to at least three important streams of lava. Another rift, to the north-north-east of the cone, emitted lava that forms an apron on that side of the mountain, and must, of course, have been formed early in the eruption, that is, before April 7 to 8. The ejected blocks are chiefly old lavas and scoria, partly re-cooked and metamorphosed, with their cavities filled by tachylytic juice from the fluid magma of the neighbouring chimney. The cavities are also often lined by sublimations of augite, hornblende, leucite, microsommite, hæmatite, halite, and a well-crystallised, yellow, deliquescent mineral which proves to be a new chloride of manganese and potash for which a new mineral name is proposed. A few fragments of limestone, and the various mineral aggregates derived by metamorphism from it, are met with, but they are chiefly re-ejected old ejected blocks. A light green spongy tachylyte is also frequent. The "essential ejecta," either as scoria or lava, does not show any marked difference from the usual products of Vesuvius in such eruptions during the last three centuries. Although much damage has been done, great areas of rugged lava-surfaces that would have required centuries to render cultivable are now available for the growth of woods, vines, and herbaceous plants.

Physical Society, May 25.—Dr. C. Chree, F.R.S., vice-president, in the chair.—Colour phenomena in photometry: J. S. **Dow.** The author has found that to compare lights of different colours is chiefly a matter of practice. The central portion of the retina is more sensitive to red, and less sensitive to green, than the surrounding portion. When an attempt to photometer lights of different colour is made, differences are found as the distance of the eye from the photometer-screen is altered, and different results are obtained with different photometers. Differences of 5 per cent. can easily be obtained. The Purkinje phenomenon, generally regarded as a cause of uncertainty in ordinary work, only becomes noticeable at small illuminations and with large fields of view. Experiments are described to show that flicker photometers seem to be affected by colour-phenomena, but to a smaller extent than ordinary ones. Whether flicker or an ordinary photometer is adopted, it is necessary to specify the size of the field, the distance of the eye, and the order of illumination used in order to get consistent results.—Automatic arc-lamp: H. **Tomlinson** and G. T. **Johnston.** A simple form of automatic arc-lamp. A vertical brass tube supported by a wooden framework carries the upper carbon, which can be raised or lowered by hand and clamped in any position in the tube. The lower carbon fits into a hollow brass tube, and into the lower part of the tube is fitted an iron plunger. The plunger is surrounded by a solenoid, consisting of a layer of No. 14 copper wire, the internal diameter of the solenoid being slightly greater than the diameter of the plunger. The plunger dips into a box of mercury, and is made to float upright by means of a brass collar and by the rounded ends of three nails forming an equilateral triangle. The current enters the upper carbon through the brass cylinder, passes through the lower carbon into the mercury, and then through the solenoid. To "strike the arc" the lower carbon is raised to touch the upper one, and the plunger is then permitted to sink into the mercury until the suction of the solenoid balances the buoyancy of the mercury.—The theory of moving coil and other kinds of ballistic galvanometers: Prof. H. A. **Wilson.** The exact formulæ giving the quantity of electricity passed through various types of ballistic galvanometers in common use are obtained. The various types require different formulæ, all of which reduce to the same formula when the angle of deflection is small. In the case of a moving-coil galvanometer with rectangular coil, iron core, and pole-pieces arranged so as to give a radial magnetic field, the formulæ take a simple form.—Bifilar galvanometer free from zero creep: A. **Campbell.** For measuring direct currents and voltages of ordinary range moving-coil galvanometers are convenient. The usual instruments are affected by gradual displacement of zero when a deflection is maintained for some time. This difficulty is got over by replacing the torsional suspension by a bifilar system with two wires so far apart that the gravity control swamps that due to the torsion of the wires. The wires are more than 1 cm. apart, and the sensitivity with 40 ohms resistance is 400 mm. at 1 metre for 0·001 ampere. The full deflection may be maintained for hours without causing a zero creep of 1 part in 2000. To attain good damping a powerful magnet is used.

Zoological Society, May 29.—Mr. Frederick Gillett, vice-president, in the chair.—Mammals collected by Mr. C. H. B. Grant in the Zoutpansberg district of the Transvaal, and presented to the National Museum by Mr. C. D. Rudd: H. **Schwann** and O. **Thomas.** The collection was obtained at two localities—Klein Letaba at 1000′ altitude and Woodbush at 4500′—and so gave a good general idea of the fauna of the region. In all it consisted of about 250 specimens belonging to fifty-one species and subspecies, of which several were described as new. In addition, the old genus Macroscelides was broken up into three, the new name Elephantulus being given to the group of which *M. rupestris* was the type, and Nasilio to that typified by *M. brachyrhynchus*.—The vascular system of Heloderma, with notes on that of the monitors and crocodiles: F. E. **Beddard.**—The external characters of an unborn fœtus of a giraffe (*Giraffa camelopardalis antiquorum* ♂ × *G. c. wardi* ♀): F. E. **Beddard.**—The South African diaptosaurian reptile Howesia: Dr. R. **Broom.**

DUBLIN.

Royal Irish Academy, May 14.—Dr. F. A. Tarleton, president, in the chair.—Some applications of Bessel's functions to physics: Prof. F. **Purser.** In this paper the author applies (1) the Besselian forms $K_0(nr)$ sin, cos $n2$ and $J_0(mr)$ (sin h, cos h $m2$), where $K_0(nr)=J_0(<nr)$, to the solution of problems of electric potential, viz. the finite Leyden jar and equal circular disks fronting one another at different potential, the theory of the condenser formed by a circular disk midway between two large circular plates, and of the guard-ring electrometer. (2) The same functions are applied to some problems in fluid motion. (3) Certain problems in the theory of the elastic equilibrium of a right circular cylinder are discussed by the use of the Besselian forms

$$J_1(mr)\left(\frac{x}{r},\frac{y}{r}\right)\left(\sin h,\ \cos h,\ m2\right),$$

$$K_1(nr)\left(\frac{x}{r},\frac{y}{r}\right)\left(\sin,\ \cos nr\right)$$

where

$$J_1(x)=-\frac{d}{dx}J_0(x),\ K_1(x)=\frac{d}{dx}(K_0(x).$$

(4) Lastly, the functions $J_0(mr)$, $J_1(mr)$ are applied to some problems of vortical motion of fluids under the influence of viscosity.—A map showing the relative distribution of various types of rock on the sea-floor off the west of Ireland, based on materials dredged by the Fishery Survey of the Department of Agriculture for Ireland: Prof. **Cole.** It is proposed to publish further details in the report of that survey, but meanwhile it is believed that the stones show the actual local distribution of rocks on sunken land, and are not the result of casual drift. The Porcupine Bank undoubtedly consists of a mass of olivine-gabbro, while a Carboniferous area west of co. Galway indicates that Connemara may have risen as an island in the Carboniferous sea.

Royal Dublin Society, May 15.—Prof. J. A. McClelland in the chair.—Injurious insects and other animals observed in Ireland during 1905: Prof. G. H. **Carpenter.** In addition to records of several well-known farm and orchard insects, the paper contains an account of the rare "cauliflower" disease of the strawberry, due to the small nematode worm *Aphelenchus fragariae*, J. R. Bos, observed in county Wicklow.—A possible connection between the recent disturbances at Vesuvius and San Francisco: Rev. H. V. **Gill.** This paper contained an account of some experiments with rotating bodies, and an application of the principles involved to certain seismic phenomena. A hollow tee-totum weighted at one point will not spin about its axis of symmetry, but if it contain matter capable of shifting its position, it will automatically tend to steady itself, owing to the symmetrical distribution of the movable matter round its circumference. For example, if three

steel balls of equal size be dropped into a smooth, hollow tee-totum they will take up equidistant positions round the edge. These results suggest the possibility of seismic disturbances being related in some such way. The above principles were applied to the disturbances which characterised the month of April—Vesuvius, April 8; Formosa, April 14; San Francisco, April 18. The possibility of this explanation being correct is supported by observed facts in connection with displacement of the poles associated with great earthquakes, and also by the positions of the localities referred to.

PARIS.

Academy of Sciences, May 28.—M. H. Poincaré in the chair.—Remarks on work recently carried out at the Observatory of Besançon: M. **Lœwy.**—Centres of gravity of spiraloid systems: Haton **de la Goupillière.**—An expedition in an aërostat, projected for the exploration of the North Pole: J. **Janssen.** An account of an expedition projected by Mr. Walter Wellman, and supported by the Geographical Society of Washington.—Addition to the note on the use of low temperatures in chemical analyses: MM. **d'Arsonval** and **Bordas.** In the majority of cases the vacuum obtainable by an ordinary pump is sufficient. In certain cases, however, the authors have found it advantageous to use either a mercury pump, or charcoal and liquid air, according to Dewar's method.—Magnetic observations at Tananarivo: Éd. Él. **Colin.** Three tables are given showing the results of the absolute measurements of the declination, inclination, and the horizontal component at the Observatory of Tananarivo, taken weekly from May, 1905, to April, 1906.—M. Charles Trépied was elected a correspondant in the section of astronomy in the place of M. Perrotin.—The properties which correspond to monogeneity for functions of a hypercomplex variable: Léon **Autonne.**—A particular class of Θ-functions: Henry **Bourget.**—The resistance of electrolytes for high-frequency currents: André **Broca** and S. **Turchini.** The authors showed a year ago that the theory of Lord Kelvin relating to the resistance of cylindrical conductors for currents of high frequency leads, in the case of metals, to results presenting systematic differences from those obtained experimentally. In the experiments in the present paper the conductor is an electrolyte. The resistance was first measured for a low-frequency current (42), and this assumed to be the same as with a continuous current. The resistance of the same solution was then measured with high-frequency currents (190,000 to 3,000,000). For very dilute acid or sulphate of copper solution the ratio of the two resistances thus measured was unity, but for solutions of higher conductivity the heating is less with a high-frequency current than with a low-frequency current, contrary to the result predicted by theory.—X-ray tubes with an automatic regulator: G. **Berlemont.**—The variations in the state of amorphous carbon under the influence of temperature and under the action of oscillations of temperature: O. **Manville.** Amorphous carbon, heated in a current of oxygen, commences at a definite temperature to give carbon dioxide, and at another, higher, temperature, carbon monoxide. These temperatures are a function of the temperature to which the carbon has been previously heated.—The acid phosphites of primary cyclic amines: P. **Lemoult.** The acid phosphites of aniline, *o*-toluidine, and *m*-xylidine are described, together with an advantageous method for preparing them.—The absolute atomic weight of terbium: G. D. **Hinrichs.** If the atomic weights of oxygen, sulphur, and hydrogen used in the determination of the atomic weight of thorium from the analytical figures be taken as the round numbers 16, 32, 1, then the atomic weight of thorium becomes also the round number 159, instead of the 159·22 deduced by M. Urbain.—A contribution to the study of pure ferrotungstens: Em. **Vigouroux.** Using the aluminothermal method, tungsten steels can be obtained containing 46·25 per cent. of tungsten; these, when extracted with dilute hydrochloric acid, yield the whole of the free iron, leaving a substance containing 68·7 per cent. of tungsten, a figure corresponding to Fe_3W_2.—Combinations of mercuric iodide and free methylamine: Maurice **François.**—Some hydro-anthracene derivatives: Marcel **Godchot.** A description of the mode of preparation and properties of octahydro-anthranol and its phenylurethane, β-anthracene hexahydride, γ-anthracene tetrahydride and its dibromo-derivative.—The rapidity of absorption of odours by milk: F. **Bordas** and M. **Toutplain.** In an atmosphere containing only 1/100,000 of formaldehyde a few minutes' exposure is sufficient for the milk to show clearly the reaction of the aldehyde. The fresher the milk the more rapidly the absorption appears to take place.—A qualitative reaction of phosphorus: M. **Maurichеau-Beaupré.** The reaction is based on the depolishing of glass by the action of a flame containing small amounts of phosphorous compounds.—A new method for the microscopical analysis of flour and the determination of rice starch in wheat flour: G. **Gastine.** The flour is treated with certain colouring materials in solution, the whole slowly dried on the slide, and mounted in Canada balsam. The differential staining of the hilum is the basis of the method.—Oxydising catalysers and the generalisation of flameless combustion: C. **Matignon** and R. **Trannoy.**—Autocatalysis and the decomposition of a photochemical system: Béla **Szilard.** Details are given of the action of light on a solution of triiodomethane in chloroform.—The study of heterogeneous equilibria under varying pressures: E. **Briner.** The increased pressures are obtained by the use of a cylinder of compressed carbon dioxide, whilst the constancy of temperature during the reaction is ensured by a vapour jacket. A diagram of the apparatus used is given.—The nearly total transformation of the dextrins arising from the saccharification of starch into maltose: A. **Fernbach** and J. **Wolff.** The rate of production of maltose from the dextrins is much slower than the conversion of the starch into the dextrins, so that it is incorrect to assume that the reaction is finished when the liquid no longer gives the iodide of starch reaction. It is proved experimentally that if there exists a dextrin not transformable into maltose, it can represent only a minute fraction of the original starch.—The principles of gutta-percha obtained from *Palaquium Treubi*: E. **Jungfleisch** and H. **Leroux.** From the crude gutta from the leaves of this plant a new substance has been isolated, to which the provisional name of paltreubin is given. It appears to be a mixture of two isomeric alcohols of the formula $C_{30}H_{49}.OH$, the acetates of which were prepared.—The spores of a Streptothrix: MM. **Brocq-Rousseu** and **Piettre.** Under certain conditions of cultivation the spores could be obtained in such abundance that they could be analysed. The analyses given are stated to be the first published on the spores of the lower fungi.—An invasion of algæ (*Colpomenia sinuosa*) on the oysters of the Vannes River: M. **Fabre-Domergue.**—The evolution of some crustacean gregarians: L. **Léger** and O. **Dubosq.**—Researches on the relations between emotional states and infection: M. **Vaschide.** It is known that the leucocytes play an important part in the pathological processes of infection, the state of infection being especially connected with an increase in the proportion of leucocytes with polymorphic nuclei. The author has found that certain profound emotions are followed by an increase in the polynuclear leucocytes. The author cites well-known facts in pathology in support of his results.—Experimental infection by *Trypanosoma brucei*. The destruction of the parasite in the spleen: A. **Rodet** and G. **Vallet.** Experiments on dogs and rats show that in infection by this trypanosome the spleen and the other lymphoid organs are foci for intense destruction of the parasites. The spleen is endowed with an energetic trypanolytic power, and this organ evidently plays an important part in the defence of the body against infection.—The pathogenic importance of bronchial adenopathy: Gabriel **Arthaud.**—The frequency and the probable etiological *rôle* of *Uncinaria americana* in beri-beri: F. **Noc.**—The contradiction of glacial erosion: Jean **Brunhes.**—The degree of mineralisation of subterranean waters: F. **Dienert.**

NEW SOUTH WALES.

Linnean Society, April 25.—Mr. C. Hedley in the chair.—The geology of the volcanic area of the East Moreton and Wide Bay districts, Queensland: H. I. **Jensen.** The district investigated lies between the Pacific Ocean and Moreton Bay on the east, and the beds of the Mary and Stanley Rivers on the west; and between Cooran on the north and North Pine on the south. It is important

from a geological point of view on account of the variety of igneous rocks to be found within its borders. The author shows that the low-lying district east of the Blackall and D'Aguilar Ranges, which is composed essentially of Trias-Jura sandstones belonging to the Ipswich Coal-measures and Tertiary alluvials, has been subject to oscillatory movements of elevation and depression in late Tertiary times. At present elevation is going on, as evidenced by raised beaches at Point Arkwright and elsewhere along the coast. The D'Aguilar Range north of Woodford is made up of Trias-Jura sandstone, but to the south of this point it consists of highly interesting plutonic and metamorphic rocks belonging in part to the Gympie beds, in part to much older formations. The country to the west of the D'Aguilar Range forms a peneplain with an average elevation of 500 feet. The Blackall Range is shown to consist of basalt capping rhyolites and rhyolitic tuffs, and Trias-Jura sandstones. The Maroochy district was a centre of great volcanic activity, rhyolites, andesites, dacites and basalts, as well as extensive areas of tuff and breccia, being here found.—The botany of Howell (Bora Creek), N.S.W.: a tin-granite flora: J. H. **Maiden.** Howell is situated nineteen miles to the south-east of Inverell. The tin-granite area under consideration extends in a two- or three-mile radius from the township. It lies on the western New England slope, at an elevation of about 2500 feet, and is included in E.9, New England County, of the botanical map to be found in the society's Proceedings for 1901 (p. 766). A list of the plants found so far, about 150 species referable to forty-two natural orders, is given. The locality is especially rich in Acacias, *A. neriifolia* perhaps being most abundant.

DIARY OF SOCIETIES.

THURSDAY, JUNE 14.

ROYAL SOCIETY, at 4.30.—The Experimental Analysis of the Growth of Cancer: Dr. E. F. Bashford, J. A. Murray, and W. H. Bowen.—On the Electrical and Photographic Phenomena manifested by certain Substances that are commonly supposed to be Ætiologically Associated with Carcinoma: Dr. W. S. Lazarus-Barlow.—The Bone Marrow; a Cytological Study forming an Introduction to the Normal and Pathological Histology of the Tissue: Dr. W. E. Carnegie Dickson.—On the Relation of the Liver Cells to the Blood Vessels and Lymphatics: Dr. P. T. Herring and Dr. S. Simpson.—Studies on Enzyme Action, Lipase, II.: Prof. H. E. Armstrong, F.R.S., and Dr. E. Ormerod.—Studies of the Processes operative in Solutions, I., The Sucroclastic Action of Acids as Influenced by Salts and Non-electrolytes: R. J. Caldwell.—The Origin of Osmotic Effects: Prof. H. E. Armstrong, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—Exhibition of Models of Space-filling Solids: W. Bailey.—The Algebra of Apolar Linear Complexes: Dr. H. F. Baker.—Supplementary Note on the Representation of Certain Asymptotic Series as Convergent Continued Fractions: Prof. L. J. Rogers.—On Certain Special Types of Convertible Matrices: J. Brill.

INSTITUTION OF MINING ENGINEERS, at 11 a.m.—Address by the President.—The Commercial Possibilities of Electric Winding for Main Shafts and Auxiliary Work: W. C. Mountain.—Electrically-driven Air-compressors, combined with the working of the Ingersoll-Sergeant Heading-machines, and the subsequent working of the Busty Seam: A. Thompson.—Practical Problems of Machine-mining: Sam Mavor.—The Strength of Brazed Joints in Steel Wires: Prof. Henry Louis.—Bye-product Coke and the Huessener Bye-product Coke Ovens: J. A. Roelofsen.—Considerations on Deep Mining: George Farmer.

SOCIETY OF PUBLIC ANALYSTS, at 8.—An Examination of the Method of Milk Analysis used at the Government Laboratory in connection with Samples referred under the Sale of Food and Drugs Acts: H. D. Richmond and E. H. Miller.—On the Examination of Linseed, Olive and other Oils: R. T. Thomson and H. Dunlop.—On the Composition and Valuation of Oils used for Gas-making Purposes: R. Ross and J. P. Leather.—Note on Fractional Distillation by Steam Vapour: H. Hardy and B. Richens.—A New Method for the Estimation of Tartaric Acid: A. C. Chapman and P. Whitteridge.

FRIDAY, JUNE 15.

INSTITUTION OF MINING ENGINEERS, at 10.30 a.m.—Rescue Apparatus and the Experience made therewith at the Courrières Collieries by the German Rescue Party: G. A. Meyer.—A New Apparatus for Rescue-work in Mines: W. E. Garforth.—A Rateau Exhaust-steam-driven Three-phase Haulage Plant: William Maurice.—Development of Placer Gold-mining in the Klondike District, Canada: J. B. Tyrrell.—Mining Education: Prof. J. W. Gregory.—The Capacity-current and its Effect on Leakage Indications on Three-phase Electrical Power-service: Sydney F. Walker.—Petroleum Occurrences in the Orange River Colony: A. R. Sawyer.

NATIONAL ASSOCIATION FOR THE PROMOTION OF TECHNICAL AND SECONDARY EDUCATION, at 3.—Annual General Meeting.

MONDAY, JUNE 18.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—A Fifth Journey in Persia: Major P. Molesworth Sykes, C.M.G.

TUESDAY, JUNE 19.

ZOOLOGICAL SOCIETY, at 8.30.—The Nudibranchs of South India and Ceylon: Sir Charles Eliot, K.C.M.G.—Description of a New Species of Zebra: The Hon. Walter Rothschild.—On the Entomostracan Fauna of the New Zealand Lakes: Dr. G. Stewardson Brady, F.R.S.—Note on some Crustacea from the Freshwater Lakes of New Zealand: Dr. Charles Chilton.—A Classification of the Selachian Fishes: C. Tate Regan.

ROYAL STATISTICAL SOCIETY, at 5.—The Generalised Law of Error, or Law of Great Numbers: Prof. F. Y. Edgeworth.

WEDNESDAY, JUNE 20.

ROYAL MICROSCOPICAL SOCIETY, at 8.—On the Structure of some Carboniferous Ferns: Dr. D. H. Scott, F.R.S.

ROYAL METEOROLOGICAL SOCIETY, at 4.30.—The Development and Progress of the Thunder Squall of February 8, 1906: R. G. K. Lempfert.—The Mean Prevalence of Thunderstorms in Various Parts of the British Islands during twenty-five Years, 1881–1905: F. J. Brodie.—Note on a Typical Squall at Oxshott, May 25, 1906: W. H. Dines, F.R.S.

THURSDAY, JUNE 21.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Transition from the Liquid to the Solid State and the Foam-structure of Matter: Prof. G. Quincke, For.Mem.R.S.—Experimental Evidence of Ionic Migration in the Natural Diffusion of Acids and Salts: R. G. Durrant.—Ionic Velocities in Gases at Different Temperatures: P. Phillips.—The Action of Radium and Certain Other Salts on Gelatin: W. A. Douglas Rudge.—On the Electric Inductive Capacities of Dry Paper and of Solid Cellulose: A. Campbell.

CHEMICAL SOCIETY, at 8.30.—The Cleve Memorial Lecture: Prof. T. E. Thorpe.—The Constituents of the Essential Oil from the Fruit of *Pittosporum undulatum*: F. B. Power and F. Tutin.—Mobility of Substituents in Derivatives of β-Naphthol: J. T. Hewitt and H. V. Mitchell.

LINNEAN SOCIETY, at 8.—On the Botany of Southern Rhodesia: Miss L. S. Gibbs.—On the Authentic Portraits of Linnæus (lantern slides): W. Carruthers, F.R.S.—Plantæ novæ Daweanæ in Uganda lectæ: Dr. Otto Stapf.—On the Genitalia of Diptera: W. Wesché.

FRIDAY, JUNE 22.

PHYSICAL SOCIETY, at 5.—The Effect of Radium in Facilitating the Visible Electric Discharge *in vacuo*: A. A. Campbell Swinton.—A Comparison between the Peltier Effect and other Reversible Heat Effects: A. O. Allen.—The Effect of the Electric Spark on the Actinity of Metals: T. A. Vaughton.—Dielectric Strength of Thin Liquid Films: Dr. P. E. Shaw.—The Effect of Electrical Oscillations on Iron in a Magnetic Field: Dr. W. H. Eccles.

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