THURSDAY, DECEMBER 10, 1908.

BIOLOGICAL RESEARCH ON THE LANCASHIRE COAST.

Report for 1907 *on the Lancashire Sea-Fisheries Laboratory at the University of Liverpool and the Sea-Fish Hatchery at Piel.* Drawn up by Prof. W. A. Herdman, F.R.S., assisted by Mr. Andrew Scott and Mr. James Johnstone. No. xvi. Pp. 406; with illustrations. (Liverpool, 1908.)

ABOUT half the bulk of this report is devoted to a monograph on the edible crab by Mr. Joseph Pearson. Excellent features of this work, which is illustrated with twelve plates and numerous diagrams in the text, are the methodical arrangement of the matter and the clearness and simplification of the descriptions. Hitherto, students who aspired to more than a general knowledge of the anatomy and development of the crab have had to search out and abstract for themselves the numerous original memoirs scattered in various scientific journals in different languages, a labour which only specialists care to undertake. It is, therefore, extremely useful to have all these researches carefully epitomised and brought together in one volume. Again, although the general features of the anatomy and development are fairly well known to readers of text-books, the average student knows very little about the habits of the crab, partly because the literature of this part of the subject is mainly of recent growth, and partly because the original memoirs dealing with it are contained in reports which have a somewhat limited circulation. Accordingly, much of the information contained in the section of this work which deals with "Bionomics," namely, such matters as the migrations, spawning habits, rate of growth, age and size at maturity, frequency of casting, "autotomy" and limb-regeneration, &c., will be new to those readers who have not consulted the more recent annual reports of the Fishery Board for Scotland and other journals. Altogether, Mr. Pearson's monograph maintains the high standard of excellence characteristic of the series of "L.M.B.C. memoirs" of which it is the latest number. This series of monographs can only be described as a boon both to general students and specialists.

A voluminous and important contribution to this report is given by Prof. Herdman, assisted by Mr. Andrew Scott, under the title of "An Intensive Study of the Plankton around the South End of the Isle of Man." The thorough nature of this investigation may be gathered when it is stated that the numbers of every species of organism obtained in more than 800 separate gatherings of plankton were carefully estimated—a vast labour in itself. More than 600 of these samples were collected within a very restricted area in the neighbourhood of Port Erin, simultaneous hauls being made with various kinds of pelagic nets both of the horizontal (tow-net) and vertical type, and these were worked in different depths of water. These samples were collected every week and almost every day during a full yearly period.

One feels justified in accepting with confidence conclusions which are based on observations the frequency of which in time and space is so great. On this secure basis Prof. Herdman discusses the seasonal changes in the abundance of plankton as a whole and of its various constituents, and arrives at important general conclusions regarding its vertical and horizontal distribution. Thus, it has been found, here as elsewhere, that diatoms reach their maximum development in April, and rise again to a second but less important and less constant maximum in autumn; dinoflagellates rise to a maximum later than the diatoms, and have also a sudden periodic increase in autumn; copepods attain their maximum in early summer after the diatoms have died down, and again in late autumn they follow the phytoplankton. The distribution of particular species is also exhaustively discussed and illustrated by means of frequency curves. Of more general interest is the evidence that the zone of most abundant life is not at the surface, but is generally a few fathoms below. This observation is of decided importance in connection with the depth at which certain plankton-feeding fishes such as the mackerel and herring swim. As regards the horizontal distribution, it is found that while some organisms have a very regular and uniform distribution over a considerable area, others are distributed very unevenly, including those which markedly tend to congregate in shoals.

"The horizontal distribution is consequently liable to be very variable and irregular, and although its characteristic constitution at different times of the year may be described, it is very doubtful whether any numerical estimate can be framed which will be applicable to wide areas."

This conclusion appears rather to discount the efforts of certain German naturalists to arrive at a census of pelagic organisms in whole seas on the basis of the numbers caught in hauls with specially designed quantitative apparatus.

Considerable light on the movements of plaice, and on the intensity with which the fishing for this species is carried on on the Lancashire and Welsh coasts, is thrown by the results of marking experiments reported on by Mr. James Johnstone and illustrated by means of two charts. These experiments bring to light a marked tendency on the part of small plaice to leave the estuaries and bays of this coast and move seawards in the summer months. The older fishes apparently leave the district for good. Some of these were found to have crossed the Irish Sea, while others had entered the Firth of Clyde. From 25 to 30 per cent. of the fishes liberated were returned by fishermen, but Mr. Johnstone has good reasons for believing that many more are re-captured than are returned. This represents a considerable intensity of fishing in the eastern part of the Irish Sea, and it is further interesting to note that by far the greatest numbers of marked plaice were recaught by first-class sailing trawlers. There is still, however, a good deal of obscurity as to the exact direction of the movements of the plaice in this district

at different stages of their lives. Further experiments with much larger batches of fishes will be required in order to provide material for the construction of a complete and convincing picture of these movements. In future experiments it would be desirable to determine the sex and maturity as well as the size of the fishes liberated, in order to discover whether there is any difference in the migrations of the two sexes, and to distinguish spawning migrations from feeding migrations.

From time to time, over a period of fifteen years, but, unfortunately, not with any regularity, experimental hauls have been made by the Lancashire authorities with shrimp-net, shank-net, and fish-trawl both on the Blackpool closed ground and in the Mersey estuary. The numbers of flat fishes and shrimps caught in these hauls form the basis of two short but valuable papers by Mr. Buchanan-Wollaston. The method adopted in this research is that of reducing the catches to the average number caught per hour in different months, quarters, and years, and then expressing the results in the form of frequency curves. The curves for the monthly data were too irregular to show any general tendency, but by taking the averages for certain combinations of months and for different years, and "smoothing" the curves thus produced, certain interesting features are brought to light. Thus it is clearly seen that on the Blackpool closed ground there has been a steady falling off in the catch per hour of plaice since 1892. No explanation is offered of this remarkable phenomenon, which, one supposes, must be due to the increased intensity of fishing on the offshore grounds. It is also shown that the "shank-net" is "superior to the shrimp-trawl in avoiding the capture of young fish, and this with no loss or even a small gain in the capture of shrimps."

In the Mersey estuary, plaice and soles reach their maximum abundance in late summer and autumn, but it is doubtful whether the data are sufficiently complete to justify the conclusion that soles attain their maximum in August and plaice in September. Finally, an examination of the (smoothed) curves showing the average catch per hour of plaice and soles on the Mersey banks shows some remarkable fluctuations, those of the two species being complementary, so that in those years when plaice were least abundant, soles attained their maximum. The importance of such researches as these from the point of view of the local fisheries scarcely requires to be emphasised.

In addition to these papers, Dr. H. Bassett contributes one on hydrographic observations, and Mr. Johnstone one on fish parasites.

As regards the work of the Piel hatchery, while it is questionable whether any demonstrably useful purpose is being served by annually "dumping" in the Irish Sea millions of newly-hatched fry of plaice and flounder, it seems not improbable that the holding of classes for fishermen is as effective in practice as it is excellent in theory.

It will thus be seen that the work which these two institutions are vigorously carrying on in the interests of marine biology in general, and the local fisheries in particular, is of a comprehensive and many-sided character. The expenses of this work appear to be met by funds derived from several distinct sources. For example, the cost of holding classes for fishermen at Piel is defrayed by a grant from the education committee of the Lancashire County Council, while Mr. Pearson's work on the crab was done and published, we are told, under the auspices of the Lancashire Sea Fisheries Committee, with the aid of grants from the Board of Agriculture and Fisheries, the University of Liverpool, and the Liverpool Marine Biology Committee. This appears to be a somewhat complicated arrangement, which perhaps, however, has the advantage of the safety which is popularly supposed to reside in numbers. It shows, at any rate, that marine biology in Lancashire does not lack friends. W. W.

LABORATORY ARTS.

Laboratory Arts. A Teacher's Handbook dealing with Materials and Tools used in the Construction, Adjustment, and Repair of Scientific Instruments. By Dr. George H. Woollatt. Pp. xii+192; with 119 diagrams. (London: Longmans, Green and Co., 1908.) Price 3*s*. 6*d*. net.

SKILL and wide knowledge in "laboratory arts" are much rarer attainments than the accumulation of ideas relating to abstract or even to mathematical physics, yet, without making comparisons, it is essential to the success of the experimentalist. If it were not for the fact that such skill and knowledge are not to be acquired by mere reading of a few books, it might be thought that the disproportion alluded to above might be the result of the still more marked disproportion between books of the text-book type dealing with the two branches of attainment. Actually, it is probably the cause, or partly so, and it may be also that the scarcity of books such as that now being noticed is due to a belief on the part of the few qualified to write them that, dealing as they do with a subject which directly is not an examination subject, there will be no great demand for them. Whatever the cause may be of the scarcity of books dealing with laboratory arts, they are actually invaluable, and from Faraday's chemical manipulation onwards they furnish the experimentalist with ideas as to how to accomplish his purpose.

Dealing as such books must do with all the properties of all materials and with the means peculiar to each whereby they may best be cut, distorted, attached, or protected, it is not possible for any one writer to be equally strong in all parts. A writer is certain to be specially strong in certain departments; let it be so; those who are or might be his fellow-writers of similar books will be quick to recognise these parts, and to benefit by them. Conversely, of course, no one book is likely to be quite satisfactory in dealing with every kind of operation where they are so diverse. Leaving now generalities and coming to the "Laboratory Arts" as presented by Mr. Woollatt, we find an admirable choice of material admirably presented. It must be understood that the teacher or the experimentalist probably is not and may not

even want to be accomplished in the art of using tools and producing results in the conventional way as performed in the way of trade by the professional. In the opinion of the writer of this notice, he ought not to want, for in that case he is certain to sacrifice his interest in the object for which he is preparing something to the preparation itself; he will change from the experimentalist to the amateur mechanic. He must, if he will retain his *rôle* as experimentalist, learn to be ruthless, and, if necessary, to do brutal things and defy every convention, so long as he attains his object. The author expresses this idea more neatly as follows :—

"The craftsman will doubtless find humour in some of the suggestions put forward herein, but it should be remembered that we are first of all teachers, and that we must use skill in craftiness in order to overcome our lack of the craftsman's skill. These are methods that will serve our purpose, and they are within our resources."

Was not the same idea expressed by the great Fresnel nearly a century ago in words such as these :—"If you cannot file with a saw or saw with a file you will be no good as an experimentalist"?

Wood-work, metal-work, and glass-work are the subjects of the first three divisions of the book, and these are supplemented by one called general, in which sixteen diverse subjects are treated, and these are followed by three appendices and an index. It would be tedious, and it would serve no useful purpose, to go through these chapters seriatim. It is sufficient to say that the descriptions are clear and are well illustrated, and that the book will be a valuable if not an invaluable addition to the working library of every physical laboratory. While commendation is justly earned by the author, there are a few points to which the writer would direct his attention in the hope that they may assist him in the preparation of the second edition.

In the section dealing with grinding and sharpening, the use of emery or carborundum wheels for grinding, or of artificial hones made of these materials for sharpening, is not suggested. The writer would urge that the natural stones have been superseded; he would be glad to know the experience of others with a slab of aluminium as a hone for the production of a fine edge. A solution of camphor in terpentine is, as is usual, recommended for use when drilling glass. The writer has always wondered what the camphor is for and if it makes any difference, for a recipe of this kind is and always will be faithfully repeated in book after book even when useless. Camphor dissolved in turpentine is used in making certain tailed stars for rockets. Did a firework-maker once lubricate a drill with the only turpentine he could find and thus start the use of camphor? Prof. Threlfall is most enlightening on the subject of drilling glass in his book on laboratory arts.

It is an omission to describe methods of cleaning mercury and ignore the existence of the vacuum still, which ought, in the writer's opinion, to be set up permanently in every physical laboratory. Similarly, it is an omission to describe a number of well-known cements and ignore the existence of that most useful addition to the resources of the experimentalist, viz. the much advertised cæmentium. The writer has used this material on all classes of substances, and he considers it one of the most useful in the laboratory. He would mention incidentally that it does not ruck up the end grain of soft wood, so that badly made patterns may be quickly smoothed over with it and interior angles filled in without producing a hedgehog back, as is the case with shellac varnish, and giving rise to the necessity for much glass-papering. Soldering is described as practised with the tinman's "bit." This, it is true, is often, especially with sheet work, exceedingly useful, but for nearly all the operations of the laboratory, especially when thicker work in brass is to be put together, the method known as sweating is preferred, and will be practised nine times while the bit is used once. The process of sweating is not described, nor is there given the very important direction to wash well and, if possible, to boil everything that has been soldered or sweated with chloride of zinc. Silver soldering is the cleanest and neatest form of brazing, and it is surprising that it is not more commonly practised. The author's description appears to the writer somewhat meagre. The essential to success being a uniform low red heat, the process is much more easily carried on in a fire bed or in a muffle than by a more fierce and local source of heat such as a blowpipe. Where this is used, every use that is possible should be made of reverberation from pieces of firebrick to maintain the heat uniform.

The author rather lets himself go when he gets to varnishing, staining, French polishing, and sand-papering. Information of the kind is very useful in its way, but if there is anything in which the student should not be encouraged it is on the "beautification" of his apparatus. Varnish or paint for preservation are well enough when there is necessity to preserve; as a rule, experimentalists' apparatus is made, used, and done with; it requires neither beautification nor preservation. The results obtained may be worth the latter.

We would, in concluding this notice, refer to two passages in the preface :—

"The ability to 'fix up' a piece of uncatalogued apparatus, by which a point under discussion may be proved, is worth the expenditure of time and trouble in its attainment, but until now no systematic attempt has been made in this direction, and it is only through the organisation of summer courses for science teachers in Ireland and Yorkshire that the prospect of success is held out."

And again :—

"The result must be a quickening of interest on the part of teachers able for the first time to construct their own special apparatus."

Has the author ever heard of the late Dr. Guthrie, who instituted this identical work at South Kensington, and sent out into the country hundreds of science teachers armed, it is true, with imperfect craftsmanship, but for all that able to "fix up" simple

apparatus with simple means? Dr. Guthrie's successors have not neglected the study of laboratory arts either, and anyone who has been connected with South Kensington must resent the suggestion that the desideratum here set forth is now capable of attainment for the first time. C. V. Boys.

MORAL EDUCATION.

(1) *Moral Instruction and Training in Schools.* Report of an International Inquiry. 2 vols. Edited by Prof. M. E. Sadler. Vol. i., pp. lviii+528; vol. ii., pp. xxviii+378. (London: Longmans, Green and Co., 1908.) Price 5*s.* net each.

(2) *Papers on Moral Education communicated to the First International Moral Education Congress.* (London: David Nutt, 1908.) Price 5*s.*

THE recent congress on moral education and the volumes which contain the results of the international inquiry upon the subject have rendered at least one great service to current educational thought. They have given us, on the one hand, a large amount of information on what is being done in various parts of the world in the matter of moral instruction and training, and, on the other hand, a series of valuable essays upon the various aspects of the problem as it presents itself to responsible persons, by means of which it is possible to examine some of the fundamental issues which are raised.

As Prof. Sadler frankly admits in his admirable preface to the committee's report, there is much variety of opinion expressed in its pages, and we may note at once that each of these many opinions is based upon experience. They furnish another illustration of the fact that successful experience is not always a safe guide in reaching scientific conclusions. Successful experience may even darken counsel! Witness the experience of those races who succeed in driving away the evil spirits who are attempting to destroy the light of the moon during an eclipse. In important matters of practice we are naturally eager to arrive at a guiding principle, and interest centres in the successes of this or that method. In our impatience to act, we do not wait to consider the failures, and we have no time to give to the wearisome analysis which aims at laying bare the elements that condition success and failure alike. Nevertheless, it remains a fact that, until this has been done, all procedure, even successful procedure, is little more than groping in the dark.

Such general agreement as is revealed in these volumes would perhaps be represented by a rather empty formula defining the aim of moral education, shall we say? to lead the individual to accept some principle which will give unity and meaning to his life. So soon as we step outside this or some similar statement, differences of a two-fold character are revealed. In the first place, we find them in the answers to the question, What is to be the nature of this unifying principle? "Service," says Mr. Gould; "the freedom of the inner life," says Prof. Foerster; whilst Dr. Penzig refuses teleological considerations any place in moral instruction, and others, again, would find the unifying principle in the conception of the active interest and supervision of a Divine Personality; and in the next place we find them when we inquire about the method to be followed in the effort to lead pupils to this principle. Here the differences are in part consequential upon the individual attitude to the previous question. It will make a world of difference, for example, whether the definitely religious point of view is accepted or not. But, leaving that particular difficulty aside, there remains the conflict between the advocates of the direct and systematic treatment of morals and those who favour indirect and incidental teaching. Both parties to the conflict admit the fundamental importance of training, of habit formation, but the former would have, in addition, definite lessons in the "oughts" of life, drawn from the consideration of concrete illustrations of virtuous and of foolish action, as told in story by the teacher. The point of view is precisely that of the teacher who wishes to establish a scientific law. The pupil is led to derive the law from the comparison of carefully chosen concrete examples. At a later stage various generalisations may be reviewed and compared with the view of arriving at a still more general principle, until finally the most widely embracing uniformities are conceived and formulated as "laws of nature."

This attitude towards the problem appears to rest on two assumptions. It seems to place moral law and physical law in the same category, and it seems to take for granted the child's capacity to analyse conduct and motive in the objective manner of some adults. It is not necessary to insist at length upon the difference between an ethical principle and a scientific generalisation. The ethical principle is a matter of personal adoption; it has a psychology and a meaning which differ fundamentally from the intellectual apprehension of a uniformity in the phenomenal world. There can be no analogy between the two such as would justify the statement that "the relation between indirect and direct moral instruction is the same as that between nature-study and science." The point is touched, though somewhat slightly, by M. Gabriel Séailles in a thoughtful paper read to the conference. Incidentally he also puts his finger upon the errors in psychology which not infrequently underlie the advocacy of the systematic treatment of the subject.

It is said, for example, that the children of poor districts are face to face with problems of gambling, intemperance, &c., and the school should come to their rescue by teaching them the wickedness of all these things that make up the daily life of their parents. As to the problems in the midst of which such children are said to find themselves, are the facts of their environment in any sense problems for the children? The lad who plays pitch and toss finds his problem in the effort to escape the vigilance of the policeman. A problem implies a contradiction felt in the actual experience of the individual. A contradiction between what the teacher says and the dominating facts of an out-of-school life will cause no more difficulty than the mathematical treatment of a space of four dimensions will affect my attitude to the facts

of my spatial environment. As M. Séailles puts it, the experience of the children of the poor may often be such that moral instruction will seem like fairy-tales, only not nearly so amusing. Where there is antagonism between life and the school, the handicap is heavily against the school, and we may doubt whether the weight of words will improve the chances of success.

What of the child in happier circumstances? Is not the teacher's moral analysis likely to be viewed as a rather futile attempt to find excuses for the obvious? Is there any more reason for the child why we should demonstrate the inherent evil in this or that course of conduct, or why we should trouble ourselves to urge the good upon him as superior to the evil, than that we should give him reasons for calling an orange yellow and not black?

The whole question of the attitude of the child to moral instruction has received relatively little scientific consideration. It is not easy to get at the facts. Mere reminiscence can never satisfactorily reveal them. We need some objective methods of inquiry such as have already been foreshadowed in the pedagogical experiments of Meumann and others. The development of purposefulness in action, the study of the working of contrariant ideas, the determination of types, the analysis of cases of moral degeneracy, may all in their turn help to raise the discussion of moral education to something more nearly approaching a scientific level.

The most striking cases of successful methods seem at present to come from the institutions engaged in the education of moral degenerates. The results of the reformatory and industrial school system offer striking testimony to the soundness of Prof. James's reply when asked what he would do to make education of greater ethical effect:—"Increase enormously the amount of manual training relatively to the book work." J. A. GREEN.

CLIMATE.

Climate, considered especially in Relation to Man. By Prof. Robert de Courcy Ward. Pp. xv+372. (London: John Murray, 1908.) Price 6*s.* net.

PROF. WARD explains in the preface to his book that its aim is "to coordinate and to set forth clearly and systematically the broader facts of climate in such a way that . . . the general reader, although not trained in 'the technicalities of the science,' may find it easy to appreciate them," while "the needs of the teacher and student have been kept constantly in mind." An introductory chapter, essentially a synopsis of the first six chapters of vol. i. of Hann's "Klimatologie," gives an outline of the climatic elements and of solar and physical climate. The classification of climates according to belts of latitude and the general distribution of land and sea is next dealt with, and to this section is added a brief account of some of the more elaborate subdivisions which have been proposed. Then follow sections on the characteristics of climate in the tropics, the temperate zones, and the polar zones; on the hygiene of the zones, and on the life of man in the zones; and a final chapter on changes of climate.

The basis of classification of climates actually adopted by the author, and employed in the second or applied section of his treatise, is thus primarily that of tropical, temperate, and polar zones, with boundaries defined by wind systems rather than by parallels of latitude or isothermal lines. Each zone is then subdivided according to the distribution of land and sea, giving as types marine, windward, and leeward coastal climates, interior climates, and, as a separate group, mountain climates. Experience has shown that, for general purposes, and particularly for elementary teaching, this method, in one form or another, is by far the most satisfactory, and it seems somewhat unfortunate that Prof. Ward does not state his own position more clearly and fully in his introductory chapters. The more elaborate methods, the description of which is here necessarily so condensed as to make difficult reading, are admittedly unsuitable for the purposes of the later sections of the book, and practically no use is made of them, but Prof. Ward deals with the method he himself employs in a couple of pages, and we are left in some uncertainty concerning his own views.

The descriptions given of the characteristics of the main climatic regions are admirable, and Prof. Ward has brought together an immense amount of illustrative matter which has hitherto been inaccessible to the ordinary reader. We could have wished, however, to see greater definiteness given to the normal position and extent of the major zones and their migrations by the insertion of a table similar to that given by Prof. Davis in his "Elementary Meteorology," showing the position of the equatorial belt and the trade wind belts at different seasons. Such a statement would, by the way, have made it easy to deal more adequately with the important question of the geographical and seasonal distribution of tropical cyclones. The distribution of monsoon regions seems also scarcely to receive the treatment it deserves; monsoon "belts" are discussed under the heading of tropical climates, the extension of monsoons in north-eastern Asia being merely referred to as an exception. The profound influence of the relief of the land in the production of monsoons and land and sea breezes is not emphasised, nor, in our opinion, is the importance of what may be termed "monsoonal influence" sufficiently recognised.

In the chapters describing the mode of life and occupations of mankind in different climates, Prof. Ward has again collected a wealth of illustration which affords extremely interesting reading, and will be of great value to the teacher. A good deal of matter, especially where the complex conditions of civilised life in the temperate zones are concerned, refers more to general geography than to climatology pure and simple, and considerable discussion might arise on the question of the precise significance of the climatic element in certain cases, but, on the whole, Prof. Ward avoids the dangerous pitfalls which beset this subject with great skill.

SCHOOL ARITHMETICS.

(1) *A School Arithmetic.* With Answers. By H. S. Hall and F. H. Stevens. Pp. xiii+475+xxxix. (London: Macmillan and Co., Ltd., 1908.) Price with answers, 4*s.* 6*d.*, without answers, 3*s.* 6*d.*

(2) *A Modern Arithmetic, with Graphic and Practical Exercises.* By H. Sydney Jones. Pp. xiv+598. (London: Macmillan and Co., Ltd., 1908.) Price, with or without answers, 4*s.* 6*d.*

(3) *Advanced Arithmetic and Elementary Algebra and Mensuration.* A Text-book for Secondary Schools and Students preparing for Public Examinations. By P. Goyen. Pp. xii+435. (London: Macmillan and Co., Ltd., 1908.) Price 3*s.* 6*d.*

(4) *Elementary Mensuration.* By W. M. Baker and A. A. Bourne. Pp. vi+144. (London: George Bell and Sons, 1908.) Price 1*s.* 6*d.*

(5) *Practical Arithmetic and Mensuration.* By Frank Castle. Pp. viii+249. (London: Macmillan and Co., Ltd., 1908.) Price 2*s.*

THE widespread attention that has been given during the last decade to the study of elementary mathematics has had a most salutary effect on the teaching of arithmetic, as is evidenced by the improved text-books that are now available and illustrated by the five books under review. The claims of science, the laboratory, and the workshop are coming to be adequately recognised, and commercial arithmetic is not allowed unduly to dominate the course. Moreover, some amount of experimental and quantitative work is done in connection with the subject, and associated more or less closely with decimal measurements, mensuration, approximate methods of computation, and perhaps with the use of tables of logarithms and even of sines and cosines. Again, algebraical notions and graphical processes are naturally and inevitably much in evidence. Altogether the treatment is on broader lines, the examples are drawn from a wider region, and are in much closer contact with common every-day experiences.

(1) The book by Messrs. Hall and Stevens fully realises the high expectations with which it has been awaited, and will immediately rank as one of the best text-books on the subject. Every modern development of value is embodied in its pages, and the whole is arranged with the thoroughness and skill which is always a feature of any work undertaken by the experienced authors. The book is divided into two parts, which may be obtained either separately or together, and with or without answers. The first part gives the fundamental principles and processes with which every youth should become familiar, very special attention being given to orderly arrangement of work and the cultivation of habits of rapid and accurate computation. The second part is somewhat more technical, and allows opportunity for discrimination according to the class of pupil. Where all is so good it is unnecessary to particularise. The explanations and proofs are always sufficient, clear, and concise; the well graduated examples are abundant, and range over a wide field of interest; the production of the book is a fine example of the printer's art; and from every point of view this arithmetic is of almost unrivalled excellence, and must soon be widely used in our schools.

(2) The title chosen by Mr. Jones for his book is most appropriate, for as regards originality of treatment and as leading the way in the reform this arithmetic is second to none, while at the same time the whole ground is covered in a thoroughly efficient manner. The author exhibits a charming faculty for selecting examples from new and unexplored sources, thereby adding greatly to the interest and diversity of the work. Variety is otherwise obtained by arranging the sets of exercises respectively as oral, mental, graphic, practical, general, revision exercises, and typical examination papers. The graphical and practical examples, comprising drawing, measuring, weighing, &c., using simple apparatus, are especially valuable, forming a systematic and most desirable course in quantitative experimental work. The chapter on logarithms includes the use of the slide-rule. The chapters on mensuration, statistics and averages, stocks, shares, and bills of exchange are particularly good. Teachers will find part i. of the book sufficient for the Oxford and Cambridge local and similar examinations in arithmetic, and this, with part ii., will meet all the requirements of other examinations such as those of the Army and the Civil Service. The general get-up of the book is most attractive. Teachers and students alike will welcome this notable arithmetic, and it should be extensively adopted.

(3) The author of this work is an inspector of schools in New Zealand, and its appearance is an indication that our colonies are in touch with modern developments in the teaching of elementary mathematics. The book proceeds on lines very similar to those just noticed; algebraical symbols are in continuous use from the start; the algebra extends to quadratic equations and the progressions, and the mensuration is carried as far as problems on the simpler geometrical solids. The subject is well presented and is quite up to date, and the student is provided with a large number of good and varied examples.

(4) The major portion of this book, including a chapter on contracted arithmetic, deals with the properties, construction, and mensuration of plane figures, with an application to surveying. The later chapters relate to the simple geometrical solids and the annulus. Proofs of the formulæ are given, though those for the surface and volume of an annulus are not altogether convincing. The general treatment is very elementary and simple; it does not include any mention of the prismoidal formulæ. Many sets of examples and revision papers are provided, the answers being collected at the end of the volume.

(5) The "Practical Arithmetic" by Mr. Castle is primarily intended for students of technical classes and evening schools, where, in making actual measurements in the laboratory, the pupil sees the necessity for and becomes acquainted with the more important arithmetical processes, including approximations and contracted methods. Thus theoretical study is subordinated to practical work, and the knowledge of principles is acquired largely

through the medium of the latter. Aids to computation, such as logarithms and the slide-rule, are introduced and largely employed in the later stages. Trigonometrical tables are also explained. The principal feature of the work is perhaps the excellent and extensive collection of practical exercises, in which the student has the advantage of the author's expert knowledge of the building and engineering trades and of his wide experience as a teacher. The subject is developed in the modern spirit, and the book will be very acceptable in many quarters.

GERMAN PHILOSOPHICAL TEXT-BOOKS.

Geschichte der Philosophie. By Karl Vorländer. I. Band, pp. xiv+361; II. Band, pp. viii+512. (Leipzig: Dürr'schen Buchhandlung, 1908.) Price 3.60 marks and 4.50 marks.

Grundlinien der Psychologie. By Dr. Stephan Witasek. Pp. viii+392. (Leipzig: Dürr'schen Buchhandlung, 1908.) Price 3 marks.

Die Entstehung der wirtschaftlichen Arbeit. By Dr. Ed. Hahn. Pp. iv+109. (Heidelberg: Carl Winters Universitäts-buchhandlung, 1908.) Price 2.50 marks.

PROF. VORLÄNDER'S "Geschichte der Philosophie" is an attempt to compress into two small volumes an account of the course of development of philosophy from the earliest times to the present day. When it is added that the work includes a short account of the life and writings of almost every writer of any importance at all in philosophy during the last five-and-twenty centuries, little hope will be felt of the success of the author in his attempt. It is therefore of the highest credit to Prof. Vorländer that he has achieved the seeming impossible, and produced a work which is both eminently readable and strictly accurate. He displays complete mastery of his subject throughout, and a fine sense of the distinction between the relevant and the irrelevant, the latter quality being possibly in part due to the fact that he is a prominent representative of the Neo-Kantian school, and excels in the application of the critical method. The same fact explains why so large a portion of the second volume is allotted to a treatment of the philosophy of Kant, at the expense chiefly of the description of Hegelianism which follows, and which cannot but be considered extremely inadequate by any school of philosophers. The last hundred pages of the book, on the philosophy of the present day (since 1840), make very interesting reading, and give much information not to be found outside the pages of "Ueberweg-Heinze"; but where so many names are mentioned, it is surely most surprising to find no reference whatever to William James and the pragmatic school, more particularly as the prodigious development of the science of psychology during the last few years and its significance for modern philosophy are distinctly emphasised.

Of late years text-books in psychology have been multiplying rapidly, but no external justification is needed for the publication of Dr. Stephan Witasek's manual. This book is admirably arranged, clearly written, and thoroughly up to date, and is probably the best and most complete *introductory* text-book of the science which we possess at the present day. In the earlier, more general, chapters the author argues out controversial points thoroughly, yet without profuseness; in the later ones, on "special" psychology, he gives the very latest results in the experimental study of the different forms of mental process. The discussion of the various possible theories of the relation of mind and brain is exceptionally well done. The arguments against psychophysical parallelism and its most recent form, panpsychism, are effectively put, and although the author admits that there are also serious objections to the interaction theory, it is very evident that his own sympathies are in this direction. The outcome of the discussion would seem to be, "Either interaction or a substantial soul," which, if quaint, is decidedly optimistic!

Dr. Hahn's book is a short anthropological essay on the origin of work possessing little more than an academical interest. WILLIAM BROWN.

OUR BOOK SHELF.

The Radio-active Substances. By W. Makower. Pp. xii+301. (London: Kegan Paul and Co., Ltd., 1908.) Price 5*s*.

THE author's aim in writing this volume is to present the chief phenomena and theories relating to radio-activity in a concise and simple form. The subject has been competently dealt with in an elementary manner in other works, but it is advancing rapidly, and the present work is intended to enable readers to keep pace with its development. All branches of the subject are treated in this book. Beginning with chapters on the nature of gaseous conductivity and on the methods of measurement employed, the author goes on to describe the discovery of the radio-active substances, the nature of the radiations they emit, the emanations, the active deposits from the emanations, and their successive transformations. In the concluding chapters the activity of substances in general and the mechanism of radio-active changes are briefly discussed.

The author has succeeded admirably in his aim of giving a very full and accurate summary of the chief facts and theories in a concise form, but perhaps the summary is too complete and condensed for general readers. The food supplied is sound and wholesome, but the general reader who has no knowledge of the subject to start with will find it difficult to absorb all the nourishment supplied to him in such condensed form. In some parts, notably when discussing the successive transformations of the radium atom, the author has successfully made use of simple analogies in presenting the results to his readers.

In the introduction the author is guilty of stating that the properties of radio-active substances have necessitated a "revision of many of our conceptions both in physics and chemistry." In no sense is this statement defensible, and occurring in a book intended in some measure for non-scientific readers, who are too prone to consider every new discovery as upsetting previous conceptions, it is likely to lead to the aggravation of an evil already sufficiently pronounced. It is due to the author, however, to point out at once that the above statement is an isolated one, and that the book as a whole conveys no such impression, showing as it does how the conceptions evolved from the study of radio-activity follow as a natural sequence

those ideas already existing in the minds of physicists before the discovery of the first of the radio-active substances.

In summarising work on points about which there is difference of opinion the author shows a commendable caution, and his verdict usually appeals to one as safe; perhaps an exception occurs where he states that the available evidence indicates that the activity of radium C can be altered by change of temperature.

The book constitutes a valuable addition to the literature of radio-activity, and can be recommended to those interested in that fascinating subject.

J. A. M.

The Psychology and Training of the Horse. By Count E. M. Cesaresco. Pp. xvi+334. (London: T. Fisher Unwin, 1906.) Price 10*s.* 6*d.* net.

In spite of its title, this book is no addition to our rapidly multiplying collection of works on animal psychology. It cannot be called scientific in the strictest sense. Modern psychological science endeavours so far as possible to found its conclusions on experimental treatment of its subject-matter, and in the case of the lower animals, where direct introspection is impossible and analogy unsafe, it refuses to accept conclusions not obtained in this way. But no records of experiments performed on the horse are to be found in Count Cesaresco's book. Description and anecdote there is in plenty, and that of the greatest interest, but all explanation is *a priori* and decidedly anthropomorphic. Psychological terms are used wherever possible to give precision to a description the main value of which is independent of such adventitious adornments. Not that the psychology is necessarily incorrect; on the contrary, it appears to have probability on its side, only it cannot lay claim to the title of strict science.

The practical knowledge displayed by the author is full and precise, and, doubtless, will alone suffice to commend the book to horse-lovers. Indeed, the earlier "psychological" chapters on the nature of the horse's mind form a description written merely *ad hoc*, prefatory to the main theme of the book, viz. the best methods that may be employed in the training of the horse for the service of man. These methods are based on the assumption that the horse learns by association of his actions with their pleasurable or painful effects, and by no higher process. No record is given of any attempt to justify this assumption experimentally. At times the book barely rises above platitude, and there is also much unnecessary repetition strewn up and down its pages. The absence of any of the elegances of style is doubtless to be accounted for by the fact that the author is writing in a language not his own. Despite these drawbacks, the book is quite readable, and thoroughly justifies its existence.

Elementary Botany. By Dr. E. Drabble. Pp. vi+234. (London: Edward Arnold, n.d.) Price 2*s.* 6*d.*

Biologie unserer einheimischen Phanerogamen. By M. Wagner. Pp. xii+190. (Leipzig and Berlin: B. G. Teubner, 1908.) Price 6 marks.

It would seem almost impossible to devise a new disposition of matter in an elementary text-book, but it must be allowed that Dr. Drabble has drafted a setting which differs in arrangement from the standard books of its kind. He begins with an explanation of physiological principles as a preparation for the interpretation of morphological structure, and touches on plant modifications and classification. The course outlined is very workable, and will certainly find favour with not a few teachers in schools. The text is characterised by accurate and logical exposition, combined with a sufficiency of illustration to make the points clear. Experiments for testing the physiological deductions are suggested. These might in several instances have been more fully detailed with advantage. The figures are not so creditable, and some are unnecessarily crude, such as the crocus corms and the fruits on p. 165, while Fig. 8 supplies an example of how not to set up the experiment. These are, however, slight defects when compared with the general excellence of the subject-matter.

The botanical volume, written by Dr. M. Wagner, is in no sense a text-book for use in schools, but provides a compendium of the various contrivances, mechanisms, and characteristics of flowering plants. Thus, in a chapter on light requirements, the author schedules a series of contrivances serving to intercept and absorb the light rays; then the various types of climbers are catalogued, and the methods of guarding against destruction of chlorophyll in the leaves are outlined. Under each heading a list of the plants showing the particular character is enumerated. The book is therefore intended primarily for reference, and, doubtless, teachers will be glad to add it to their library. The information is arranged under the general headings of nutrition and reproduction, and the chapters follow physiological, not ecological, conceptions. The author states in the preface that he has collated his facts from the works of Haberlandt, Kerner, Ludwig, and other writers. It would have added greatly to the value of the book if he had given references to the original sources.

The Deinhardt-Schlomann Series of Technical Dictionaries in Six Languages: German, English, French, Russian, Italian, Spanish. By Alfred Schlomann. Vol. iv. Internal Combustion Engines. Compiled by Karl Schikore. Pp. x+618; with about 1000 illustrations and numerous formulæ. (London: Archibald Constable and Co., Ltd., 1908.) Price 8*s.* net.

In noticing the first volume of this series of dictionaries in our issue for May 3, 1906 (vol. lxxiv., p. 6), descriptions of the objects of the series and the methods of treatment were given. The present volume deals with the following subjects among others:—gases and oils; the theory, construction, equipment and erection of internal combustion engines; materials and their economical use; complete plants; and general working and testing. The illustrations, though of necessity small, since the volume is of pocket size, are generally remarkably clear. The excellent alphabetical index with which the volume is provided makes reference easy and will greatly enhance the popularity of the dictionary among technical students and workers.

Highways and Byways in Surrey. By Eric Parker. With illustrations by Hugh Thomson. Pp. xix+452. (London: Macmillan and Co., Ltd., 1908.) Price 6*s.*

It is unnecessary to praise the charming series to which this book is the latest addition. Mr. Parker's volume will appeal in an especial manner to Londoners, who are within easy access of the delights of which he writes; and it may be hoped that the descriptions of Surrey's natural beauties and historic interests will encourage town dwellers to explore neighbouring counties for themselves. Mr. Parker has many useful hints to students of nature as to the favourite habitats of special plants and animals; and the sportsman, too, will find some guidance of the kind he desires. The sketches make it possible to appreciate the beauty of the highways and byways in Surrey without visiting them.

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.]*

Students' Physical Laboratories.

I AM truly sorry that the obituary notice published in NATURE two weeks ago should seem to Sir O. Lodge to minimise the work of Prof. Carey Foster and others. I feel sure that nobody can value Prof. Foster's work more than I do, but he had neither the money nor the other opportunities that Prof. Ayrton had in Japan. I admit a little overstrain in the statement that at the time when he created his Japanese laboratory "there were not half a dozen people in Great Britain who had experimented in electricity." I ought to have said that there were only a *few* workers in electricity. I had in my mind that before starting for Japan early in June, 1875, I had the curiosity to count the number of electrical papers published before the Royal Society, and now printed in vols. xxii. and xxiii. of the Proceedings. I had no knowledge of meetings after May 13, 1875, as I lived in Glasgow. At the forty-one consecutive meetings from December 11, 1873, to May 13, 1875, there were in all only five papers read having a bearing on electricity. These were two by Dr. Gore, one by Prof. Adams, one by Messrs. de la Rue, Hugo Müller and Spottiswoode, and one by Prof. Balfour Stewart. I was on my way to Japan when my own first published electrical investigation was described at the Royal Society on June 10, 1875.

I do not think that with a record like this it is worth while to cavil at my statement, for it is to be remembered that Royal Society papers, not electrical, were numerous. For example, at the meeting on June 18, 1874, there were twenty-eight papers, and on June 11 there were eight papers, and not one of these thirty-six papers had anything to do with electricity. I have not referred to a few papers during the year on terrestrial magnetism. It was with impressions due to this knowledge that I first saw the Japanese laboratory, and when I wrote the obituary notice my old feeling of overpowering admiration had come back.

In writing about Finsbury I ought perhaps to have expressed myself more clearly. Sir Oliver Lodge misunderstands me. Everybody knows that at King's and University Colleges, and at many other colleges, students were allowed to work in laboratories, and I can imagine that it was a great privilege to Sir Oliver to work under Carey Foster, whose record as a pioneer, as a teacher, and as a writer is so high that it is almost an impertinence in me to refer to it. Volunteer boys did excellent work in my own laboratory at Clifton College in 1871, just as Kelvin's students had worked much earlier in Glasgow; but I think I was right in saying that in all such cases the students were few in number, and that they were volunteers. My point was that *all* the students at Finsbury had much laboratory work, and they were made to think that laboratory work was much more educational than attendance at lectures. I still think that the reform effected at Finsbury was exceedingly great, and that it was of quite a new kind, for it was not only in the nature of the laboratory work, but in its combination with many other kinds of work, that the reform consisted. I cannot hope to carry Sir Oliver with me, for it is quite evident that he knows of Finsbury only at second or third hand. He seems to think that there were only evening classes. It is true that many of the evening students were of the artisan class; but the day classes were of much greater importance than the evening classes, and students of the ages of sixteen to eighteen coming from secondary schools will not fit into his description.

I am glad to think that Sir Oliver approves of that small part of the Finsbury work of which he has heard. No doubt much may be said for and against some of the Finsbury methods, but I do not care to continue a discussion founded on an obituary notice. I know of no obituary notice which might not be the subject of controversy.

JOHN PERRY.

December 5.

A Model Atom.

THE following attempt to construct a kinematics of an atom may prove of interest to readers of NATURE.

Let a sphere of a certain radius (depending on the given circumstances) be described round each charged particle as centre, and let the radii of these spheres be such that some of the spheres are in contact. The spheres may be called *spheres of interference*, and the points of contact *nodes*. The spheres associated with two oppositely charged particles may be supposed to touch internally, and those associated with two particles carrying similar charges may be supposed to touch externally.

A model atom may now be built up of spheres touching one another in this way. We shall suppose that there is one sphere surrounding all the others, which we shall call the atomic sphere. Within this sphere there may be other spheres which completely surround a number of others. Such groups will be called subatoms.

As the electrons within the atom move about we shall suppose that in general their spheres of interference adjust themselves so that the contacts are preserved; such a motion may be called a *steady motion*, and may be obtained by applying a continuous succession of conformal transformations to a given configuration of the spheres or set of spheres.

When an atom is in a normal state we shall suppose that the outer shell contains either a ring of electrons the spheres of interference of which touch one another in succession, and also touch two other spheres, one internally and the other externally, or a system of electrons at the corners of a polyhedron, the spheres being now arranged so that each one touches all its neighbours and two other spheres as before.

If the two extra spheres are kept fixed the electrons can move round an ellipse, so that the contacts of the spheres are preserved, the radius of a sphere being at any time proportional to the distance of its centre from the radical plane of the two fixed spheres (Steiner's porism). If now the mass to be associated with a given electron or sphere of interference belonging to the ring is inversely proportional to the square of the radius of the sphere, the total mass, kinetic energy, and position of the centre of mass will remain invariable so long as all the contacts are preserved.

When an atom is ionised we may suppose that there is one sphere missing from the ring if the charge be positive, and an extra sphere in contact with two spheres of the ring, but not belonging to the ring, if the charge be negative. If the number of degrees of freedom is calculated by allowing three for each electron and subtracting one for each contact or other geometrical condition, there will be a gain of one degree of freedom for each additional charge, whether it arises from the gain or loss of an electron.

We may suppose that a line spectrum is emitted when a given arrangement of nodes or geometrical conditions is preserved, and a continuous spectrum when the geometrical conditions are violated.

The group of infinitesimal conformal transformations seems the natural one for describing the kinematics of a system within a sphere; it may be built up from successive inversions with regard to spheres, just as the group of displacements of a rigid body may be built up from successive reflexions in different planes; it should be noticed, however, that an even number of inversions are required to produce an infinitesimal change.

An inversion does not alter the type of contact of two spheres when the centre of inversion is external to both, but when it lies in the space between two spheres the type of contact changes, and the spheres become external to one another. This may be regarded as a kinematical description of a radio-active process, for a subatom may be thus brought outside the atomic sphere by a continuous succession of changes. According to this view, an atom would break up whenever one of the centres of inversion happened to lie within the atomic sphere.

We suppose that in general the arrangement of spheres within the atom is not symmetrical; if, for instance, the atom forms part of a molecule, the field of force is not symmetrical, and there seems no reason why the arrangement of the electrons should be so.

In the type of motion which is consistent with a constant value of the energy the velocity of an electron belonging to the ring is directly proportional to the radius of its sphere of interference; this corresponds to a uniform motion in the symmetrical configuration, and may be derived from it by a conformal transformation. The assumptions made with regard to the mass of an electron and the interference of radiations at the nodes may be justified if the velocity of light within a sphere of interference is directly proportional to the radius.

The combination of a positive and negative ion may be pictured by supposing that the extra sphere belonging to the negative ion partly fits into the gap in the positive ion in such a way that it is in contact with two spheres belonging to the ring in the positive ion, and the atomic spheres of the two atoms are in contact. This would give three additional geometrical conditions. It should be noticed that the electrons would be nearer together close to the point of contact, so that the greater part of the mass would be concentrated round this point.

The connection between the number of degrees of freedom and valency is discussed in a paper which will appear shortly in the Memoirs of the Manchester Literary and Philosophical Society. HARRY BATEMAN.

The University, Manchester.

Silk-producing Insects of West Africa.

THE following observations in connection with the wild silk-producing insects of West Africa may be considered of interest. In parts of Nigeria (Ibadan, Ilorin, &c.) the cocoons of *Anaphe infracta*, Wlsm., and *A. venata*, Butler, are used for the production of a cloth termed "Sanyan," which is woven from yarn, spun from the boiled cocoon masses, mixed with native cotton yarns. In a state of nature the silk from the cocoons of both these species is brown or yellow-brown, and is of this colour when exposed for sale in the markets, but another kind of silk, which is brought to Ibadan from Bauchi and Bornu (in N. Nigeria), is pure white in colour, and is called "Gambari," or Haussa silk. This is only obtainable as boiled cocoon masses, and the dried remains of the worms found in them seem to indicate that they are allied to Anaphe. The collectors of this silk are said to gather the worms from the trees, on which they find them, when they are prepared to spin, and to confine them in calabashes.

Experimenting with live worms of *A. infracta*, received from S. Nigeria, I found that, by confining them in the dark, they produced pure white cocoons instead of brown, although the original larval cocoon was of the latter colour. It seems probable that the "Gambari" silk is white by reason of the confinement of the worms in calabashes, as no Anaphe or allied species is known to give a white cocoon naturally. A similar result has been obtained by Lepper in the case of *Attacus ricini* (the "Eri" silk-worm of India).

The pupæ of *A. infracta* and *A. venata* are eaten as a delicacy by the people of S. Nigeria. Both species seem almost omnivorous in the larva stage, but the first is said to feed, by preference, upon *Albizzia fastigiata* and a Sterculia sp.

A. Maloneyi and *A. subsordida*, the first of which has apparently a cocoon mass without an envelope, should, I think, be placed in another genus, by reason of the absence from their forewings of the lower radial vein (No. 5).

GERALD C. DUDGEON.

Imperial Institute, November 17.

Vitality of Leaves.

I HAVE in my possession a sprig of *Bryophyllum calycinum* which was cut off a plant in Jamaica six months ago, at the beginning of June. It has still attached to it three leaves, which are quite green, and at the edges of these there are minute new shoots projecting from the crenations. Only a fortnight ago a leaf plucked from it showed its vitality by giving rise to a new shoot when placed on some soil in a pot. This shoot is growing well under a glass in a warm room. During all these months this small sprig has been lying about in different rooms, without any supply of soil or moisture.

Could any of your botanical readers inform me if this degree of vitality, in a detached portion of a plant, is unusual? WALTER KIDD.

December 7.

The Exhibition of Fishes in Museums.

THERE are at least four museums in the United States in which collections of fishes are exhibited "in which the specimens are presented without the usual iron supports, with sufficient space around each fish and in natural colours" (NATURE, October 29, vol. lxxviii., p. 659). These institutions are the Field Museum of Natural History, Chicago; Museum of Comparative Zoology, Cambridge; American Museum of Natural History, New York, and Museum of the Brooklyn Institute.

Furthermore, the last-named museum has an attractive group of fishes of a coral reef amid their natural surroundings, and the Field Museum has two groups of fresh-water game fishes. F. A. LUCAS.

Museum of the Brooklyn Institute, Eastern Parkway, Brooklyn, N.Y.

An Electromagnetic Problem.

THE electromagnetic problem enunciated by Prof. Comstock in NATURE of November 19 admits of being solved without any reference to the corpuscular nature of electricity and without going beyond the basis of Maxwell's theory.

If σ be the surface density of the sphere, r its radius at any time, the value of the vector potential at a distance R is $\frac{4}{3}\pi\sigma\dot{r}r^3R^{-3}(x, y, z)$.

Making use of Maxwell's first expression for kinetic energy, $\frac{1}{2}(Fu-Gv+Hw)$, we get for the kinetic energy $\frac{1}{2}(4\pi\sigma r^2)^2\dot{r}^2r^{-1}$, from which the problem can be completed. To understand the question fully we must use the retarded formulæ for the potentials, Maxwell's expression being only the first terms of expansions in descending powers of C, the velocity of radiation. We get in this way more complicated values of the potentials, giving, however, no magnetic force and the original symmetrical electric force.

The question is interesting as supporting Macdonald's view as to the expression for the energy. It also seems to point out that in any æther theory the vector potential must be looked upon as something more than a mathematical abstraction. ARTHUR W. CONWAY.

Cosy Nook, 100 Leinster Road, Rathmines,
December 1.

Mercury Bubbles.

I HAVE often observed these bubbles when purifying mercury. They may be produced very easily by shaking mercury and any liquid in a wide stoppered test-tube, and then suddenly bringing the tube to rest, when the bubbles (of varying size) will be formed.

I have tried the following liquids:—water, alcohol, ether, acetone, ethyl acetate, acetoacetic ester, amyl nitrite, amyl alcohol, amyl acetate, carbon tetrachloride, benzene, toluene, xylene, gelatin, glycerin, formic acid, acetic acid, aniline, carbon bisulphide, toluidine, pyridine, ethyl iodide, methyl bromide, ethyl bromide, methyl iodide, dichloroethylene, ethylene dibromide, chloroform; it seems that the more volatile and less viscous the liquid, the smaller are the bubbles and the quicker do they burst.

PHILIP BLACKMAN.

Hackney Technical Institute, N.E.

IN view of the several letters about mercury bubbles which you have recently published, I beg to mention that molten steel is also capable of forming bubbles. If a bucket full of water be placed in a suitable position underneath and a little to the front of a Bessemer converter, then on removing the bucket after the completion of a blow it will be found to contain small spheres of steel ranging in size from a pin's head to that of peas, and even larger. These spheres are hollow, and some are perforated, and occasional ones are twins and triplets, sets of hollow spheres having plunged into the water at the instant they stuck together.

West Didsbury. C. E. STROMEYER.

THE ORGANISATION OF RURAL EDUCATION.

THE two publications of the Board of Education before us, "Suggestions on Rural Education" and "Memorandum giving an outline of the successive legislative and administrative conditions affecting the relation of the Board of Education to Agricultural Education in England and Wales," cast several sidelights on the very curious administrative situation which at present exists with regard to agricultural education in this country. As the memorandum explains, the first move in this direction was taken in 1888–9, when a sum of 5000*l.* was voted in aid of "agricultural and dairy schools," and the administration of this vote was handed over to the Board of Agriculture on its creation in 1890. Almost simultaneously the county councils became charged with provision of technical instruction, and were granted the so-called "whisky money" for its development. The outcome was the creation of a number of schools and colleges of agriculture, some departments of existing universities, others independent institutions maintained by a group or by a single county, supported in the main by county council funds, but also subsidised and inspected by the Board of Agriculture out of its grant of 5000*l.*, which has since grown to 11,550*l.* annually. The institutions thus subsidised by the Board of Agriculture were, however, all of the university or higher technical school type; other agricultural instruction in secondary or primary schools, or by means of evening classes or peripatetic teachers, was provided by the county councils on their own initiative, and not recognised officially by the Board of Agriculture.

The anomaly of thus cutting off part of the educational work of the country from the main stream of education soon attracted attention, and during Sir John Gorst's secretaryship a definite statement was made that the educational work of the Board of Agriculture would be transferred to the Board of Education. However, with Mr. Hanbury's arrival at the Board of Agriculture this idea was dropped, and the Board strengthened its educational staff, while, as may be seen from the report of the Committee on Agricultural Education which reported this year, it appears to desire or to contemplate an extension of its functions. Meantime, however, the Board of Education had been moving in the same direction; it remained the authority dealing with rural education in the primary and secondary schools, and by the appointment of two special inspectors it was evidently taking up the question seriously. This being the case, the manner in which the Board of Education was ignored, both in framing the Committee on Agricultural Education and in calling for evidence, is so remarkable that the recommendations of that committee cannot be regarded as of much weight, so obvious is it that they have given but little consideration to the wider questions involved.

The two documents before us may be taken to indicate that the Board of Education does not regard as settled the question of whether it shall not control the whole of rural education. But the two departments will no doubt be left to settle this in their own departmental way; it may not be amiss, perhaps, to consider the problem a little in the light of the interests of agriculture and education. Clearly the ideal state of affairs is that which prevails in Ireland, where the Board of Agriculture and of Technical Instruction is not divided, but administers the greater part of the money and sets the example to the county councils, instead of following their lead. As a result we have in Ireland, though the work is younger, a coherent system carried out with due regard to economy, which is educating the farmer and not gratifying the short-sighted opinions of local committees. Real work is being done for agriculture, as may be seen from the creation of the early potato industry, the way the flax problem is being attacked, the increased exports of butter, eggs and poultry. In fine, in Ireland there is a thinking head and a continuous policy; in England it is all go as you please, with plenty of good work, but with waste on one side and neglect on the other. The Board of Agriculture cannot exercise any control; even the colleges which it inspects defer but little to its opinion, because they are primarily concerned in satisfying their immediate paymasters, the county councils. As to the general policy of a county in rural education the Board of Agriculture can say nothing, nor is its opinion and advice ever sought in such matters. Probably the Board of Agriculture was right in keeping closely within its appointed function, but whether the result were necessary or not, the fact remains that in practice its opinion on agricultural education generally has never carried much weight, nor have the county councils obtained that help in dealing with rural education which they might have expected. The Board of Education, speaking with a knowledge of what can and cannot be done in teaching, might have saved the country from a good many experiments which were not only expensive failures in themselves, but which left behind a feeling of soreness and distaste for any further meddling with the education of the farmer.

It is too late now to dispossess the county councils of the very large measure of initiative and control over rural education which they obtained as a result of the Technical Instruction Act, but the situation was really vitally changed by the Education Act of 1902, which imposed on every council *the duty of considering all the educational needs of its own area.* Supposing any county is failing to carry out this duty (and there are several which make no provision whatever for agricultural education), it is the Board of Education which will have to apply pressure, for the Board of Agriculture has no title to interfere. Thus the Board of Agriculture is really in an *impasse* as regards that part of agricultural education which it has reserved for itself, the higher technical form; it can aid an established college, but it cannot exercise the least influence on the many counties which neither possess nor share in one of these colleges, nor can it do anything to fill up the blank spaces on the map showing its spheres of influence which it occasionally exhibits when agricultural education is under discussion.

While higher education in agriculture might thus most properly be handed over to the Board of Education, it would never do to allow the Board of Agriculture to lose all contact with the colleges, which should be all acting as intelligence departments, both collecting and diffusing information on its behalf. The Board of Agriculture has another function at present very imperfectly performed—that of being an advisory and investigating agency for the working farmer. Day by day the Board is addressed for information about crops, manures, injurious insects, diseased plants, and so forth; it possesses no scientific staff to deal with such matters; above all, it has no mechanism for investigation; when a new problem comes along some member of the staff either tries to look it up in a text-book or a correspondent is called upon for an opinion.

The way the Board of Agriculture has dealt with some of the diseases which have sprung up of late years would be ludicrous had they not turned out so tragic to some of the farmers concerned, and this has been purely the fault of a system which calls upon the

Board to advise and regulate, but yet gives it no means of obtaining knowledge. By some obscure departmental tradition research is supposed to be outside the scope of the Board of Agriculture—it spends something between 400*l.* and 500*l.* a year in assisting various investigations! But if the Board of Agriculture is to forward the industry of agriculture, its very first business is investigation and research; it must condescend to go to work in the way other countries and our own colonies aid their farmers, and it must have money to do the work with. Now to build up a proper intelligence department, the present grant of 11,000*l.* a year to the Board of Agriculture for educational purposes is none too much; let it be allowed to keep this money and retain its connection with the colleges by using it to promote investigation in them, building up in one a mycological department which would act as consultant for the board, in another an entomological department, and so forth. Meantime let the educational work of the colleges be put under the control of its proper authority, the Board of Education.

THE CHILDHOOD OF MAN.[1]

DR. L. FROBENIUS is a prolific writer on ethnological subjects, and we welcome a translation of a book which gives in popular language the results of his wide reading. The book deals with an extensive range of subjects, upon many of which very diverse views are held, and the English reader will be pleased to be able readily to grasp the point of view of a German ethnologist; but a book, in some cases, has to be judged by what is omitted as well as by what it actually contains.

In dealing with articles of personal adornment the author admits that the objects worn have usually another value than that of pure ornament; he refers to trophies and currency, but entirely omits the very widely spread wearing of "ornaments" for magical purposes. He makes some interesting observations on scarifications of various central African tribes, and alludes to the significance of these and other forms of skin decoration; but, unfortunately, he terms all such tattooing.

The making of shell money he regards as the most peculiar of the reasons for the origin of labour. He quotes R. Parkinson concerning the use and exchange value of the *dewarra*. Under the term of dress-language he refers to strings and belts of wampum, and to the notched and painted eagle feathers of some North American Indians. Also culled from American sources are his accounts of sign and gesture language, but no allusion is made to the gesture language of such peoples as the Australians, Papuans, Neapolitans, and many others. One of the best sections is that dealing with drums and drum language, which he believes has a very wide extension in Africa, and is "convinced that this peculiar drum-language is current throughout Central Africa east of the chain of lakes." He says (p. 86):—"It would appear to be most highly developed in the western parts of equatorial Africa, although scarcely less widespread in Oceania, that is, in the insular lands lying north-west and north-east of New Guinea. In New Pomerania [New Britain] itself the different villages communicate over wide areas by means of the drum-telegraph, which has also a very wide range in the Amazons valley and in Mexico. The North-west Americans, too, possess similar instruments." An interesting modification of the drum, according to him, is the apparatus that is fastened to a bow in Mangbattuland. He makes the interesting suggestion (p. 99) that "the drum is a hybrid sort of instrument, one part of which, the sounding-case, owes its origin to the pounding of corn; the other, the skin, to the measured beat in leather-dressing." The most valuable portion of his account of picture-writing is taken from Hoffman's (not "Hoffmann") contribution to Garrick Mallery's great monograph, to which he does not allude by name.

In the chapter on "skull-worship and head-hunting" he refers to the well-known fact that the preservation of skulls by some people is to ensure the assistance or protection of the spirit of the dead man, which in the next world becomes the servant of whoever captured his skull. Although he does not say so, scalp-collecting had probably a similar significance, as probably had the bunches of human hair which are inserted in some shields from Borneo and Celebes.

In dealing with fetishism he says (p. 184):—

"So long, for instance, as the owners of the ancestral images remember the names and the personalities of the dead represented by them, so long will the object retain the type identical in character, essentially the same. But when the memory dies out while the image remains, it will soon happen that the wooden figures will acquire the general significance of a sacred object without any personal value." "When . . . the negro sees any unusual object, he is at once taken with a certain feeling of anxiety, a certain perplexity, and he is ready to believe in a display of power in this object, which exceeds the usual, the commonplace, to the extent that the thing itself looks strange or weird. To put it clearly, the negro attributes a supernatural power to every fresh appearance, to any new object which in any way departs from the ordinary, the known, the intelligible. For him it is uncanny" (pp. 185–6).

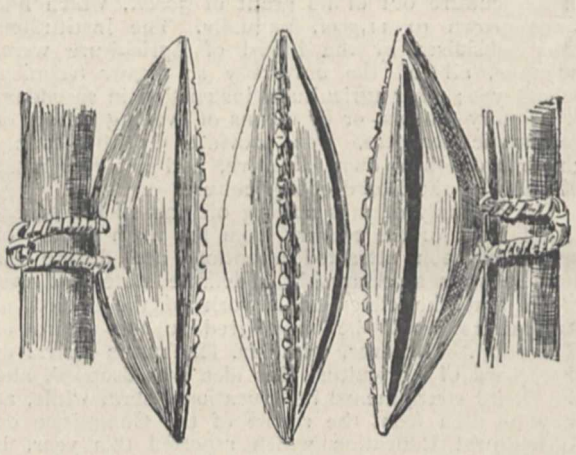

FIG. 1.—The little Signal-drum of the Madi bow. About half natura size. Three views. From "The Childhood of Man."

But the author does not pay sufficient attention to the fact that a fetish is credited with mysterious powers owing to its being the habitation, temporary or permanent, of a spiritual being, or as being the vehicle or means by which the spirit communicates with his worshippers. The chapter on secret societies and masks is of great interest; it deals mainly with West African conditions, but in the next chapter the author describes the *mide* of the Ojibways. The chapter on sacred animals is scarcely adequate, and totemism he regards, like Mr. Andrew Lang—of

[1] "The Childhood of Man: a Popular Account of the Lives, Customs and Thoughts of the Primitive Races." By Leo Frobenius, translated by A. H. Keane. Pp. 504; with 415 illustrations. (London: Seeley and Co., Ltd., 1909.) Price 16*s.* net.

whom no mention is made—as due to a system of naming.

A third of the book is taken up with the exposition of the solar god in mythology, and the author certainly gives examples of solar and other myths from different peoples, but he presses into this argument various folk-tales which do not seem to have any solar significance. It is true that certain incidents in some of these tales may be paralleled by incidents in folk-tales in other parts of the world which are recognisable as solar myths, for, to take one example, a fishing population is very likely to have in one of its tales the incident of a man being swallowed by a fish; and wherever this occurs the solar mythologists pick out this incident and regard it as a part of the "Jonah-solar myth," although the rest of the tale may have no bearing at all on solar mythology. This incident occurs in folk-tales from various places, and in the Torres Straits tale of Mutuk it is recorded that the hair of that individual fell off when he was in the shark's stomach. The same incident occurs in the North American tale, when Kaig, the Mink, was swallowed by a whale, the loss of hair in this case being due to the heat; in the tale as here given it is not evident that "the cause of the hair falling off is the heat of the sun" (p. 287). The same explanation is offered for the Mutuk incident; by such methods correspondences are readily arrived at, but this is not the place to discuss the modern recrudescence of astral-mythology in Germany.

The bird in symbolic art, according to Dr. Frobenius, bears the soul aloft through the air up to the sun. "But here is the solution of the whole problem; the soul of the dead man follows the sun." He considers that the tales of the cunning spider are survivals of mythological tales in which the spider is regarded as representing the sun. "In the form of rays the sun emits its sea of light; in the form of rays the spider, too, weaves its web. Thus the slender threads of the spider become solar rays and the sun becomes the spider which in artful ways ensnares the souls of mortals. The solar myth, however, became a nursery tale." There are two chapters on the origin of the world, the fall of the sky, the flood, and the theft of fire.

It will be seen that the book covers a broad field and contains much interesting matter, some of which is not easily accessible to the English-reading public; and, indeed, there seem to be some accounts not previously published, but the absence of references renders it difficult to be quite certain on these points, and is, indeed, a very serious blemish in the book. There is a large number of excellent figures and plates, but a great many of these are not explained, and appear to have no bearing on the text. Finally, the book is rather an exposition of the author's views than of those generally held by ethnologists.

A. C. HADDON.

FIG. 2.—The Juju Nkali Feast. From "The Childhood of Man."

ALBERT GAUDRY.

BIOLOGICAL and geological science mourns the loss of Prof. Albert Gaudry, who, full of years and honours, passed away at Paris on November 29. He was one of the most distinguished pioneers in the modern methods of studying extinct animals, and during the past half-century his brilliant expositions and suggestive writings have been among the most potent influences for the direction of palæontological research to profitable ends. In the case of his pupils and those who had the privilege of his personal acquaintance, the charm of his courtly manner and quiet enthusiasm strengthened these influences, and made him a revered master.

Jean Albert Gaudry was born at Saint-Germain-en-Laye on September 15, 1827, the son of a well-known

lawyer. He studied at Paris, where he eventually graduated as Doctor of Sciences. His earliest researches were mainly geological, relating to such subjects as the dolomitisation of limestone and the origin of flint; but in 1851 he wrote about the skeleton of some star-fishes, and his attainments were so varied that he attracted the notice of the French Minister of Agriculture and Commerce, who sent him in 1853 on a scientific mission to Syria, Egypt, Greece, and the Ionian Islands. Gaudry's official report appeared as a publication of the French Government in 1855, dealing with the geology, natural products, industries, and possible commercial development of the several countries visited; but his observations on the geology of Cyprus were so exhaustive that he reserved most of the details for a special memoir, which was issued seven years later by the Geological Society of France. When Cyprus became a British possession in 1878, Gaudry's important work was translated into English and re-published by the Intelligence Department of the War Office.

While travelling in Greece, Gaudry's attention was directed to a remarkable accumulation of fossil bones at Pikermi, between Athens and Marathon, which had been discovered and partially examined by the Bavarians. Collections of the bones had been sent to Munich, and described by Roth and Wagner in the *Abhandlungen* of the Bavarian Academy; but Gaudry realised that more exhaustive exploration would yield important results, and he induced the French Academy to provide him with means for the work in the season 1855–6. He made a large collection, which was sent to Paris and occupied his attention for the next four years; in 1860 he returned to Pikermi to obtain additional specimens that seemed to be required; and between the years 1862–7 he published his classic monograph, "Animaux fossiles et Géologie de l'Attique." This work dealt chiefly with the Upper Miocene (or Lower Pliocene) Mammalia, and was the first systematic attempt to arrange extinct animals of successive geological periods in linear series below their surviving representatives, to illustrate the probable direction of evolution of the several groups. Gaudry showed clearly that the mammals of Pikermi were links between those of earlier date and those of the present day; and he initiated a plan of detailed comparison, especially of the teeth and feet, which has been followed with great success during later years by those who have investigated the numerous extinct mammalian faunas of North America. He recognised that much additional information on the same subject could be obtained by comparing the Upper Miocene (or Lower Pliocene) mammalian skeletons from France itself with those of earlier geological periods already known from that country. In 1866 he accordingly made explorations at Mont Léberon, in Vaucluse, and seven years afterwards his earlier volumes were supplemented by that on the "Animaux fossiles du Mont Léberon."

Meantime Gaudry had joined the staff of the Paris Museum of Natural History, first as assistant (1853) and subsequently as professor of palæontology (1872). Here he came into contact with many workers, and took part in several other researches while his own special studies were in progress. He was particularly interested in Boucher de Perthes's discovery of flint implements with the bones of extinct Pleistocene mammals in the river-gravels of Abbeville; and when Prestwich and others confirmed this discovery in a communication to the Royal Society in 1859, Gaudry added his testimony in a paper read before the French Academy at the same time. The problems connected with early man continued to interest him to the end, and so recently as 1903 he wrote for *L'Anthropologie* an essay on the dentition and lower jaw of human skeletons from the Mentone caves, demonstrating their very primitive characters.

Gaudry's researches on the fossil mammals of Pikermi and Mont Léberon naturally led him to apply his methods of study to other groups; and he planned a great work which should sketch at least the broad outlines of the evolution of life as revealed by palæontology. It was entitled "Les Enchaînements du Monde animal dans les Temps géologiques," and appeared in three volumes between 1878 and 1890, with a supplementary volume, "Essai de Paléontologie philosophique," in 1896. This work is unique as a readable exposition of the science of palæontology, and its beautiful wood-cut illustrations of fossils have never been surpassed. While it was in course of preparation a continual series of original papers recorded the more technical results of the author's researches.

For fifty years Gaudry devoted unbounded energy to the perfection and arrangement of the collection of fossils at the Paris Museum, and when he retired in 1903 his colleagues and friends of every nationality subscribed towards a suitable tribute of admiration. A medal was struck in honour of the occasion. His withdrawal from official duties, however, did not affect his original researches, and until the beginning of his last illness in the summer of this year he was regularly occupied with the study of the remarkable extinct mammals of South America. He arrived independently at the conclusion, which is now very generally adopted, that the mammals of the southern continent evolved separately from those of the northern hemisphere, and remained in a comparatively backward condition.

The whole of Gaudry's published work is characterised by an almost poetic mode of expression; and while detailed descriptions of the fossils are rarely omitted, they are often dispersed among his illuminating comparisons in such a manner that his writings have sometimes been criticised as unsystematic or superficial. Gaudry's extensive travels, however, had made him acquainted to an unusual degree with the fossils of every land, and he realised the limitations of his science too thoroughly to make the dogmatic assertions concerning genealogies and relationships which are not infrequent in the works of some of his followers. In the existing state of knowledge, he was satisfied with broad outlines which could be used for guidance in future more detailed research.

Gaudry became a member of the Institute of France in 1882, and a foreign member of the Royal Society in 1895. Among foreign honours there was none he appreciated more highly than that of the Wollaston medal, awarded to him by the Geological Society of London in 1884. An excellent portrait of him appears in the *Geological Magazine* for February, 1903.

A. S. W.

NOTES.

DR. F. WALKER MOTT, F.R.S., has been elected Fullerian professor of physiology in the Royal Institution.

THE next meeting of the Australasian Association for the Advancement of Science is to be held in Brisbane in January, 1909.

THE annual meeting of the British Science Guild will be held on Friday, January 22, at the Mansion House, by permission of the Lord Mayor. Mr. Haldane, president of the Guild, will be one of the speakers.

IT is announced from Stockholm that the Nobel prize for physics has been awarded to Prof. G. Lippmann, and not to Prof. Planck, as was stated last week. Prof. Lippmann left Paris for Stockholm on December 4.

THE recently created Royal Society of South Africa has elected Sir David Gill, K.C.B., F.R.S., its first honorary fellow of the society, "in recognition of his great scientific attainments and of the great help and impetus he has given to scientific research in South Africa."

DR. W. E. HOYLE, director of the Manchester Museum and lecturer on morphology of Mollusca in the University of Manchester, has been appointed director of the National Museum of Wales. Dr. Hoyle will commence his duties not later than March 25 of next year.

AT the annual business meeting of the Scottish Meteorological Society, held at Edinburgh on December 1, Sir Arthur Mitchell, K.C.B., was elected president; Prof. A. Crum Brown, F.R.S., and Sir Archibald Buchan-Hepburn, of Smeaton-Hepburn, Bart., were elected vice-presidents.

DR. C. E. BEEVOR, whose death occurred on December 5 at fifty-four years of age, was Croonian lecturer at the Royal College of Physicians in 1903, Lettsomian lecturer at the Medical Society of London in 1907, and also president of the Neurological Society in the same year. Among his publications were scientific papers on the nervous system.

THE Bessemer gold medal of the Iron and Steel Institute has been awarded to M. A. Pourcel. The medal is awarded annually for services to metallurgy, and it is for M. Pourcel's investigations in the manufacture of ferro-manganese and for his work on the thermal reaction involved in the manufacture of iron and steel that he will receive it.

THE meeting of the Royal Geographical Society on December 14 will be a commemoration meeting of the jubilee of Speke's discovery of the Victoria Nyanza. Sir William Garstin will give an address on fifty years of Nile exploration and some of its results, and there will be an exhibition of portraits, Speke's original map of his discoveries, instruments, photographs, and other objects.

DR. AZEL AMES, whose death is reported from Danvers, Massachusetts, at the age of sixty-three, was at one time prominent among American writers on hygiene. He served as a lieutenant of engineers in the Civil War and as a surgeon in the Spanish War. He had also held various posts under the U.S. Government, in which his knowledge of sanitary affairs was of value.

ACCORDING to the Paris correspondent of the *Times*, an agreement has been signed between the authorities of the French Congo, the Pasteur Institute, and the Geographical Society, with the object of transforming the French mission for the study of sleeping sickness into a bacteriological institute at Brazzaville. The institute will be placed under the direction and control of the Pasteur Institute in order to ensure the permanence of the organisation.

THE Paris correspondent of the *Times* announces that Mr. J. Gordon Bennett has offered the Aéro Club de France, as a new international prize, a cup of the value of 500*l*., to be competed for next year in France under the auspices of the International Aëronautic Federation and of the French Society for the Encouragement of Aërial Locomotion. In addition, Mr. Gordon Bennett offers three sums of 1000*l*. each to be given to the winner of each of the first three annual competitions.

THE death is announced of Prof. E. G. von Rindfleisch, the eminent pathologist, at seventy-two years of age. Prof. Rindfleisch occupied in succession the chairs of pathology at Zürich and Bonn, and in 1874 he succeeded to the chair of pathological anatomy in the University of Würzburg, which had been occupied by the late Prof. Virchow. He devoted considerable attention to the causes and treatment of tuberculosis, and his publications included a manual of the doctrine of cellular pathology, a volume on the elements of pathology, and papers on the principle of life and on medical philosophy.

PROF. ALFRED LODGE desires to correct a part of the statement as to his remarks at the recent meeting on the correlation of the teaching of mathematics and science, reported in NATURE of December 3 (p. 144). What he suggested was that the science masters should each term furnish the mathematical masters with an epitome of the mathematical knowledge required by each division to enable the pupils to follow satisfactorily the science course of the following term, in much the same way as a mathematical preamble to each chapter or group of chapters of a scientific book would facilitate the understanding of these chapters.

MR. ALFRED COLSON, Millstone Lane, Leicester, who was one of the local secretaries for the meeting of the British Association held there in 1907, is preparing an album of extracts, reports, photographs, &c., for presentation to the library of the local Literary and Philosophical Society. He is anxious to obtain as many snapshots as possible of the visitors, and would be glad if photographers would send him negatives (which would be returned safely) or prints to illustrate the album. Photographs taken at the Loggia, the garden-party at Glenfield Frith, the Abbey Park, in the reception room, or at any of the excursions would be particularly acceptable. No doubt many photographers who were present at Leicester will assist Mr. Colson to secure this memento of a successful meeting.

IN the issue of NATURE for June 11, 1903 (vol. lxviii., p. 129) an article on Mr. W. A. Bentley's photographs of snow crystals was published, in which reproductions were included of some of his photomicrographs, taken from the annual summary for 1902 of the *Monthly Weather Review*. The annual summary for 1907 of the *Review* (vol. xxxv., No. 13), which has reached us, contains another admirable collection of photomicrographs of frost and ice crystals. There are thirty-one plates, which have upon them some 274 separate photographs. The plates are unaccompanied by any letterpress, but a description of the photomicrographs will probably be published later.

A SERIES of fire-tests of importance for the extinction of petrol fires with the aid of such simple means as cloths and sand was carried out by the British Fire Prevention Committee on December 2. Some twenty-four tests were undertaken at the committee's Regent's Park testing station. There was a large attendance of Home Office officials, as also officers from the Admiralty, War Office, London County Council, and other public departments. The tests were of a highly instructive character, and went to prove the efficiency of simple means for extinguishing petrol fires. An official illustrated report will be issued by the British Fire Prevention Committee in due course.

MR. A. SILVA WHITE, assistant secretary of the British Association, has resigned that office, which he has held with conspicuous success during the past four years. The announcement of his resignation will be received with regret by the sectional officers, who, perhaps more than members of the council, are able to appreciate the results of his organisation of the work of the association during

his period of office. The establishment of a Press Bureau is a particular instance of the advantages of combining in an organic system what had previously been left to individual action. At the meeting of the council on Friday last, the cordial thanks of the association were expressed for Mr. White's work, but it was resolved that the assistant secretary should not be a member of the council; and as this was the chief condition under which he would continue in office, his resignation was accepted.

MR. G. C. LLOYD has been appointed secretary of the Iron and Steel Institute in succession to the late Mr. Bennett H. Brough. Since 1904 Mr. Lloyd has been secretary of the Institution of Electrical Engineers, and he was previously assistant to Mr. Brough at the Iron and Steel Institute. We are glad to see that the council of the institute has decided to raise a fund to provide for the education of Mr. Brough's two children, and to give his widow a life annuity. A sum of about 5500*l.* is required; and it is a fine testimony to the high regard in which Mr. Brough's memory is held to know that subscriptions amounting to 2635*l.* were promised by members of the council before the appeal was issued to members of the institute by Sir Hugh Bell, the president. We are confident that the appeal will be responded to generously, not only by members of the institute, but also by numerous other admirers of Mr. Brough's work for pure and applied science. Subscriptions should be sent to the president, Iron and Steel Institute, 28 Victoria Street, London, S.W.

THE director of the Wistar Institute of Anatomy and Biology, Philadelphia, U.S.A., informs us that the anatomical journals published by the institute are to be sent regularly to NATURE. We shall be glad to notice from time to time any articles of outstanding importance and wide interest in these publications. The Wistar Institute, the only institution of its kind in the United States, is an endowed institution, maintaining a free museum of anatomy and a staff for the promotion of researches in this subject. It is rapidly becoming the central anatomical institute for research work in the United States, and its publications are distributed to all the principal laboratories of the world. As a central institute of anatomy it attempts to bring together data, specimens, and literature, and to interchange and distribute them to investigators in such a manner as to promote anatomy and aid those who are devoting their lives to the advancement of human knowledge. To the technical aspects of anatomy NATURE cannot devote much space, but an occasional note upon American progress in that science will be of interest to all biologists.

THE following are among the lecture arrangements at the Royal Institution before Easter:—Prof. W. Stirling, a Christmas course of six experimentally illustrated lectures on "The Wheel of Life," adapted to a juvenile auditory; Prof. Karl Pearson, two lectures on albinism in man; Prof. A. A. Macdonell, three lectures on the architectural and sculptural antiquities of India; Dr. F. Walker Mott, six lectures on the evolution of the brain as an organ of mind; Prof. J. O. Arnold, two lectures on mysteries of metals; Dr. Hans Gadow, three lectures on problems of geographical distribution in Mexico; Mr. A. D. Hall, two lectures on recent advances in agricultural science; Prof. G. H. Bryan, two lectures on aërial flight in theory and practice; and Sir J. J. Thomson, six lectures on properties of matter. The Friday evening meetings will commence on January 22, when Dr. Alfred Russel Wallace will deliver a discourse on the world of life: as visualised and interpreted by Darwinism. Succeeding discourses will probably be given by Sir Frederic Nathan, Prof. J. G. Frazer, Prof. H. A. Wilson, Sir Henry Cunynghame, the Earl of Berkeley, Mr. S. G. Brown, Mr. R. Threlfall, Mr. A. S. Eddington, and Sir J. J. Thomson.

TO-MORROW (December 11) a new wireless telegraphy station is to be opened at Bolt Head, near Kingsbridge, South Devon. The Postmaster-General is expected to be present. The station is about fifteen miles south-east of Plymouth, the Start being seven miles to the eastward, and Prawle Point, where Lloyd's station is fixed, between four and five miles. Bolt Head stands 350 feet above the sea-level, which is considerably higher than the Marconi station in Cornwall. The work was begun about six months ago, and is estimated to cost about 10,000*l.* We learn from the *Times* that an eight horse-power oil engine with dynamo and electrical appliances has been put down. The power is 110 volts, and there is large storage capacity for night work. The radio-telegraphic instruments are a combination of the Marconi and patents owned by the G.P.O., and one or two of Mr. Marconi's staff have assisted in laying down the plant. If the experiment is found satisfactory it is anticipated that the Government will provide other stations. It is stated that the station at Bolt Head will be open for public messages during the first week in January.

THE German Government has decided to send an expedition to the southern part of German East Africa to examine, and make a careful collection from, the remarkable deposit of Dinosaurian bones discovered last year by Prof. Eberhard Fraas in the Upper Cretaceous formation of Tendaguru, in the Lindi district. According to the report of Prof. Fraas, published last August (*Palaeontographica*, vol. lv., pp. 105–144, pls. viii.–xii.), the deposit resembles that of the famous Bone Cabin Quarry in Wyoming, from which the Americans have obtained so many remarkable gigantic reptiles. The huge bones lie weathered out on the surface of the ground, and can be followed by digging into the sandy marl and sandstone beneath them. Many of the bones are in their natural relative positions, showing that at least some parts of the skeletons were buried before their surrounding soft parts had decayed; and Prof. Fraas publishes a striking photograph of a nearly complete hind limb and foot before removal from the excavation in which it lay. All the specimens brought back by Prof. Fraas for the Royal Württemberg Museum in Stuttgart, where they are now mounted, belong to a large herbivorous Dinosaur which he names Gigantosaurus. They appear to represent an animal from 14 to 15 metres in length, closely related to the well-known Diplodocus and Morosaurus from Wyoming. The skull remains unknown, but both vertebræ and limbs are represented by numerous specimens. Further explorations will probably result in the discovery, not only of the missing parts of Gigantosaurus, but also of other reptiles which must have lived with it.

IN the death of Dr. E. T. Hamy, professor at the Muséum d'Histoire naturelle (1892), member of the Académie des Inscriptions et Belles-lettres (1890) and of the Académie de Médicine (1903), anthropologists have lost a learned colleague and France an illustrious savant. Jules Théodore Ernest Hamy was born at Boulogne-sur-Mer in 1842, and was always profoundly attached to his native district, as is testified by the eleven memoirs on its archæology published in the *Mémoirs de la Société academique de Boulogne-sur-Mer*, in the *Bulletin de la Société d'Anthropologie de Paris*, and in the *Revue d'Anthropologie*. He published his valuable pioneer work,

the "Précis de Paléontologie humaine," in 1870. In 1873 he was appointed "aide naturaliste" to De Quatrefages, then professor of anthropology at the museum, and in collaboration with him published the classical work "Crania ethnica" (1875–1882); of equal value is his great "Anthropologie du Mexique" (1884, 1890, 1891). His interest in American archæology and ethnography is evidenced by the "Decades Americanæ" (1883–1899). In 1880 he was appointed director of the Musée d'Ethnographie, then recently installed in the Trocadéro, which post he held for twenty-six years; but despite his incessant efforts, lack of funds prevented him from developing it according to his desires. In this connection he published the "Origines du Musée d'Ethnographie" (1890) and the "Galerie americane du Musée d'Ethnographie du Trocadéro" (1897). The geographical aspects of ethnology had an attraction for him, his most important contribution being the "Études historiques et géographiques" (1896). Most of his ethnographical essays were published in the *Revue d'Ethnographie et Anthropologie* (1882–9). Dr. Hamy possessed a great range of knowledge and sane judgment, and it is not only in France that his loss will be felt.

ALTHOUGH there is a slight increase in the list over that of the previous year, the council of the Ealing Scientific and Microscopical Society, in its report for 1907–8, urges the necessity for new members. Abstracts of the lectures delivered last session are included in the report.

FOUR out of the five papers in vol. ii., No. 3, of the Journal of the Federated Malay States Museums are devoted to the mammals of the district, Mr. O. Thomas describing new species from Tioman and Aor Islands, in the South China Sea, while Mr. Boden Kloss contributes lists of the species inhabiting the Malay Peninsula and neighbouring areas. It is sad to see such well-known names as *Macacus cynomolgus* and Galeopithecus respectively replaced by *Macaca fascicularis* and Galeopterus.

THE ovum of mammals forms the subject of two papers (each issued only in preliminary shape) in No. 6 of the Bulletin of the Royal Academy of Belgium. In the first of these Messrs. Winiwarter and Sainmont announce the discovery that, in the cat at any rate, the functional ova are developed during post-fœtal life, whereas it has hitherto been supposed that in all mammals this took place *in utero*, or during the very earliest stages of extra-uterine development. The second paper, by Dr. O. Vander Stricht, is devoted to the development of the ovum in bats, as represented by the noctule.

THE whole of the second number of the Annals of the Transvaal Museum is devoted to an account of the numerous species of ticks infesting South Africa. According to the author, Mr. C. W. Howard, entomologist to the Mozambique Government, these pests have hitherto been studied only in relation to the transmission of disease, so that little has been known with regard to specific characteristics and the variations (which are great) presented by the different species. These gaps in our knowledge are to a great extent filled by Mr. Howard's paper, although, as might be expected, much work still remains to be done.

FOR some time a discussion has been going on in the columns of the *Emu* with regard to the food of Australian cormorants and the harm these birds are alleged to inflict on the local fisheries. The discussion is continued in the October number of that journal, where it is emphatically affirmed that, instead of subsisting exclusively on fish (as is universally stated to be the case with all cormorants), these birds feed very largely upon crabs and shrimps, which themselves are harmful to fisheries on account of their partiality to fish-spawn. Moreover, instead of subsisting very largely on the introduced trout, as has been alleged, the local cormorants are stated to be much more fond of eels, which are of little importance as food-fish.

IN a notice of the badger in Norfolk, published in the November number of the *Zoologist*, Mr. A. H. Patterson gives a qualified assent to a theory suggested by Mr. T. Southwell, that the aboriginal stock was at one time totally exterminated, and the existing representatives of the species are the descendants of animals turned down in consequence of their usefulness in forming earths for foxes. If this be so, the practice of huntsmen in regard to badgers in Norfolk is different from that obtaining in certain other counties we could mention. It is satisfactory to learn that Norfolk badgers are now on the increase.

WE have been favoured by the author, Mr. R. B. Newton, with copies of two papers from the Proceedings of the Malacological Society, one on relics of coloration in fossil shells, and the other on fossil pearl-growths. The former is illustrated with a plate showing colour-pattern on shells from the Silurian upwards. The author mentions the theory that such patterns may be taken to indicate the comparatively shallow-water habitat of the shells in which it occurs, and the objections taken to the same, but fails to give his own opinion on the matter. Pearls or pearl-like growths are shown in the second paper to occur in fossil shells of the genera Volsella (Mytilidæ), Inoceramus (Aviculidæ), and Gryphæa (Ostræidæ), most of these being of Cretaceous age.

NEW discoveries of fossil fishes and arthropods in the Middle Coal-measures of Sparth, Rochdale, Lancashire, form the subject of a paper by Mr. W. A. Parker in vol. ix. of the Transactions of the Rochdale Literary and Philosophical Society. The fish-remains include scales of species of Ctenodus and *Strepsodus sauroides*, as well as a nodule enclosing a nearly entire specimen of a probably new member of the palæoniscid group. Of greater interest are the arthropod fossils, which include eight new species, namely, two of Eoscorpius, three members of the king-crab group referable to the genus Belinurus, a pedipalpate arachnid of the genus Geralinura, a member of the shrimp-like Pygocephalus, notable as being the only specimen exhibiting the whole dorsal surface, and a myriapod referable to Xylobius. Examples of previously known arthropods are likewise recorded.

AN issue (vol. iii., No. 4) of the botanical series of the *Philippine Journal of Science* is devoted to two sets of identifications of insular plants. The majority of the specimens described by Mr. C. B. Robinson, under the title "Alabastra Philippinensia, II.," are shrubs or trees collected by Mr. R. S. Williams. The euphorbiaceous genus Cleistanthus, supplying several new species, is specially summarised. The second paper, contributed by Mr. E. D. Merrill, contains the diagnoses of many new species and a new genus, Sagittipetalum, of the order Rhizophoraceæ, that grows in the dipterocarp forest. The species of Homalium, a genus furnishing important trees, are differentiated with the help of a key.

BULLETINS dealing with ground-nut and fig cultivation in southern India have been published by the Department of Agriculture, Madras. The notes by Mr. H. C. Sampson on ground-nut cultivation refer to the "Mauritius"

variety, that has replaced the native or "country" variety. In some districts quick-growing millets are planted as a catch-crop. Mr. C. K. Subba Rao is responsible for the pamphlet on fig cultivation. The red, loamy soil and temperate climate of Bangalore and Bellary provide conditions suitable for the fig tree. Artificial pollination, known as "caprification," is not practised, nor are the figs dried for market, owing, presumably, to the ready sale that exists for the fresh fruit

THE results of two years' experiments obtained on various estates and at the sugar experiment station, Jamaica, are reviewed by Mr. H. H. Cousins in his report recently published by the Board of Agriculture. A fact of considerable interest is the value of small dressings of lime on the sugar plantations. In accord with manurial experiments elsewhere, the application of a manure rich in nitrogenous matter is essential and profitable. With regard to new seedlings of value, the well-known variety B. 208 has proved to be eminently satisfactory for all districts, but even better results are expected from seedlings raised on the island within the last five years.

FROM Prof. Haberlandt's laboratory at Graz there has been issued another paper on the perception of light by plants, that is published in the *Sitzungsberichte der kaiserlichen Akademie der Wissenschaften*, Vienna (vol. cxvii., part ii.). The author, Dr. K. Gaulhofer, has studied the epidermal cells of the leaves of certain plants that take up a fixed light position, and suggests that an explanation may be found in the presence of pits or clefts in the cell walls acting as light distributors, in a similar manner to Prof. Haberlandt's "lichtsinnesorgane." The rays of light impinging on the edges of the pits are deflected, and consequently, underneath the pits, shadows are produced. Good instances of such pits occur in *Aporrhiza paniculata* and *Banisteria splendens*, while *Hyperbaena laurifolia* and *Abuta concolor* show well-marked clefts. The combination of pits and curved cell wall in *Cocculus laurifolius* will repay examination.

THE increasing use of artificial manures in South Australia—a sure sign of advance in agricultural methods—forms the subject of an interesting article in a recent issue of the *Journal of Agriculture of South Australia*. During the last ten years the total acreage under cereals has remained fairly constant, but the proportion receiving artificial manures has increased from 12 per cent. in 1898 to 68 per cent. during the present year. The steady and continuous nature of the increase is seen in the following table:—

	Total area under cereals, acres	Area receiving artificial manures, acres
1898	2,148,000	230,000
1900	2,298,000	500,000
1902	2,144,000	845,000
1904	2,154,000	1,170,000
1906	2,063,000	1,321,000
1908	2,154,000	1,456,000

Superphosphate is by far the commonest artificial manure used; at present it is imported, but as large quantities of mineral phosphates are known to occur in South Australia, there seems no reason why it should not be made on the spot.

MR. H. LING ROTH, honorary curator of the Bankfield Museum, Halifax, issues as one of his periodical Bulletins an interesting study of "Trading in Early Days." He suggests that the most primitive form of trading is to be found in the exchange of presents among certain members of savage tribes. He discusses the questions connected with silent trade, secret bargaining, early forms of transport and markets, the evolution of notation and currency, all illustrated by excellent photographs from the collections under his charge.

THE University of Philadelphia has undertaken a series of excavations in the Isthmus of Hierapetra, in Crete, the results of which for the year 1906, and so far as the site of Vasiliki is concerned, are described in the second volume of the Transactions by Mr. R. H. Seager. The remains extend over the second and third stages of the early and the first of the Middle Minoan periods. Though the ground has suffered much from denudation, some valuable discoveries have been made—a beehive tomb at Hagios Theodoros, believed to be the second of its kind belonging to the Bronze age that has been found in Crete; a series of houses, and much fine pottery. In connection with this last Mr. Seager makes the interesting statement that the mottled ware of the third Minoan period is of a type commonly in use at the present day in south India from Tuticorin to Madras, while that of the fourth period strikingly resembles the modern domestic ware of the Rajput States. The writer, in agreement with Profs. Ridgeway, Bosanquet, and others, regards as an early form of currency a number of curious axes, these weapons being obviously too small and weak to serve any industrial or military purpose.

DR. J. M. PERNTER has sent us the year-book of the Austrian Central Meteorological Office for 1906. The number of stations then included in the system was 409, of which forty-two ranked as observatories or stations of the first class, *e.g.* possessing self-recording instruments. The observations are arranged according to the class of station; some include hourly values, while at others tri-daily observations or simply mean results are given; several organisations, including the Hungarian, publish their observations separately. The Central Office takes part in the international monthly balloon ascents for the investigation of the upper air, and also issues weekly reports of earthquake phenomena observed at several of the principal observatories. An appendix contains valuable discussions (1) of thunderstorms and hail in Bohemia in 1905 and 1906, by Dr. F. Augustin, and (2) measurements of solar radiation at Vienna from March, 1904, to September, 1906, with Ångström's compensation pyrheliometer. The results are exhibited both statistically and graphically by Dr. R. Schneider, and show, *inter alia*, that the solar intensity on a perpendicular surface of 1 cm^2. attains its maximum of 740 gram calories *per diem* at the beginning of June, and its minimum of 245 calories *per diem* in December.

THOSE who have the designing of glass gauges and other glass apparatus to withstand high pressures will find a number of useful tables of breaking stresses of tubes subjected to internal pressure and of filaments subjected to tension in Communication No. 106 from the Physical Laboratory of Leyden, by Prof. Kamerlingh Onnes and Dr. Braak. Although the numbers in the tables differ considerably from each other in many cases, it seems that tubes break when the pressure inside makes the maximum tension in a direction perpendicular to the axis equal to about 5 kilograms per square millimetre, and that filaments in tension break at about 17 kilograms per square millimetre at ordinary temperatures, and at about 30 kilograms at the temperature of liquid air.

IN X-ray work it is necessary that the current through the tube shall be unidirectional. There are devices in existence by means of which the behaviour of the tube

can be tested. There are also devices by means of which the unidirectional character can be brought about, but these devices usually impair the performance of the tube. We have had the opportunity of examining an arrangement recently brought out by Messrs. F. R. Butt and Co., of 11 Denmark Street, W.C. The usual primary of the induction coil is surrounded by a subsidiary coil consisting of a single layer. This second coil can be short-circuited at any time, and it is so connected with a revolving break that it is short-circuited just prior to the make of the primary. The induced E.M.F. at the secondary terminals is thereby so far diminished that no discharge occurs there at the make. The subsidiary coil is immediately afterwards interrupted by the revolving break (and for greatest efficiency this interruption must occur when the current in the primary coil has a stationary value); the discharge at break of the primary circuit then takes place without being in any way reduced by the presence of the subsidiary coil. The result is a unidirectional current as perfect as could be desired. There are other details of the coils turned out by this firm which are of interest. In particular, the iron core, consisting of iron wires, is laid with these wires arranged in groups, which are insulated from one another with the object of thoroughly preventing the formation of Foucault-current circuits in the iron.

A SUPPLEMENTARY list of new apparatus for physical demonstrations, just issued by Messrs. Newton and Co., contains particulars of the nature and use of a number of important instruments. By arrangement with Mr. W. Duddell, F.R.S., Messrs. Newton are enabled to supply the complete apparatus for his well-known experiments with musical arcs. A universal optical bench and projection apparatus, designed by Mr. F. J. Cheshire, provide a means of demonstrating many important facts as to light and colour by projection. The same apparatus, with accessories, can be used to illustrate the optical properties of the human eye, and the principles of the telescope, microscope, and other optical instruments. Dr. R. S. Clay's apparatus for the production of waves and ripples in water and their projection upon a screen provides a particularly instructive means of illustrating interference effects. Lecture-table apparatus to demonstrate the properties of selenium and their application in the transmission of pictures by telegraphy is also described, together with other devices of interest to teachers and students of physics. The list should be seen by all who are contemplating the provision of new apparatus necessary for modern physical demonstration.

OUR ASTRONOMICAL COLUMN.

THE SPECTRUM OF COMET MOREHOUSE, 1908*c*.—In No. 21 of the *Comptes rendus* (November 23, p. 951) MM. Deslandres and Bosler publish some very interesting results derived from spectrograms of comet 1908*c*, taken with a slit spectrograph of 0·12 m. (4·7 inches) focal length, and a ratio of aperture to focal length of about 1 : 3.

On spectrograms obtained previously with a prismatic camera, MM. Deslandres and Bernard found that certain lines of unknown origin in the spectrum of this comet, as, also, in that of comet Daniel photographed last year, were double, and it was partly to determine the reality and nature of this doubling that the slit spectrograph was employed.

Two spectra were obtained, and they show that double lines really do exist at the approximate mean wave-lengths 470·00, 456·10, 453·10, 426·7, and 401·3. Moreover, the intervals between the components vary, approximately, with the wave-length, so that the ratio $\Delta\lambda/\lambda$ is practically constant.

Another remarkable feature, noted in the case of those radiations produced by the tail, is that the lines show different inclinations to the length of the spectrum, and it is suggested that this may be due to the fact that the particles of matter emitting the respective radiations were being acted on differentially by the solar repulsion; if this is the true explanation of the phenomenon, we have an experimental proof of the truth of Bredichin's theory.

In the longest lines, extending well into the tail, there is also a marked inflexion at some distance from the head, and the authors suggest that this phenomenon may be due to rotation of the tail.

Previous researches with the prismatic camera gave MM. Deslandres and Bernard no indications of polarisation in the components of these doublets; it therefore seems probable that the doubling is not a Zeeman effect. From the fact that the intervals separating the components appear to bear a constant ratio to the wave-length, it would seem rather to be a Doppler effect, but the researches must be carried much further ere any conclusion can be definitely accepted.

THE CHANGES IN THE TAIL OF COMET MOREHOUSE.—From No. 12 of the *Gazette astronomique* (November 30, p. 93) we learn that the photographs of Morehouse's comet, taken at the Juvisy Observatory, confirm the peculiar phenomena of the tail observed at Greenwich, Stonyhurst, and other observatories. Not only do they show the ebb and flow of activity, probably caused by the comet encountering masses of meteoritic matter of different densities, but they also afford proof that the conspicuous agglomerations in the tail suffered an acceleration in velocity as they receded further and further from the head.

DETERMINATION OF LONGITUDE BY WIRELESS TELEGRAPHY.—The *Comptes rendus* for November 2 (p. 819) contains a report, by M. Bouquet de la Grye, on behalf of the wireless telegraphy committee of the Académie des Sciences, dealing with the subject of the determination of longitude at sea by the aid of wireless telegraphy.

After reviewing the immense importance to navigators of this question, and the various methods by which longitudes have hitherto been determined, the report discusses the possibility of sending signals, at pre-advertised hours, from the summit of the Eiffel Tower. It is concluded that such signals could be sent, say, at midnight, when there would be least interference, and that ships in any part of the Atlantic, for example, could thereby receive their correct time necessary for the determination of longitude. A recommendation that the necessary experimental apparatus be erected on the Eiffel Tower as soon as possible was elicited from the Bureau des Longitudes, endorsed by the committee, and forwarded to the Ministers of War and Marine.

SPECTROSCOPIC BINARIES.—The November number of the *Astrophysical Journal* (vol. xxviii., No. 4) contains two papers by Mr. Plaskett, of the Dominion Observatory, Ottawa, dealing respectively with the orbits of the spectroscopic binaries ψ and ι Orionis.

For the former, the results show an abnormally large range of velocity, about 288 km., and a period of 2·52588 days; the apparent length of the semi-major axis of the orbit is 4,995,100 km.

The application of a least-squares solution to the data given previously for the orbit of ι Orionis has amended the orbit to some extent. The final elements give the ellipticity as $0{\cdot}7543 \pm 0{\cdot}0046$, the period as 29·136 days, and the apparent length of the semi-major axis as 28,907,000 km.

A RECENT OBSERVATION OF NOVA CYGNI.—From a plate exposed for two hours, Dr. Karl Bohlin estimates that Nova Cygni (No. 2), 1876, was of the fourteenth magnitude on October 22. From January 8, 1877, to March 24, 1882, the magnitude of this object sank from 6·7 to 14·0, and recent measures have given the following magnitudes:—Burnham, 1891·6, 13·5; Barnard, 1901·9, 15·6; Bohlin, 1908·8, 13·5. On the Dunecht scale of magnitudes Barnard's and Bohlin's results are between 15·0 and 14·3, and 14·0 respectively (*Astronomische Nachrichten*, No. 4286, p. 226, November 28).

SOME RECENT PUBLICATIONS OF GEOLOGICAL SURVEYS.

THE active Geological Survey of Great Britain has issued its "Summary of Progress for 1907" (1908, price 1*s*.), which is no mere departmental report, since it contains a number of original memoirs. One of these is by Dr. Flett, on the rocks styled mugearites, which may be described as dolerites rich in oligoclase and olivine, but poor in augite. These have now been found among the Carboniferous lavas of East Lothian and Midlothian, where they closely resemble Mr. Harker's original Cainozoic types from Skye. Two other memoirs deal usefully with new sections along English railways. Perhaps the most interesting feature of the general descriptions of the year's work is the insight given (p. 66, &c.) into the progress of the survey of Mull, from which much that is new may be expected.

The full memoir on "The Small Isles of Inverness-shire (Rum, Canna, Eigg, Muck, &c.)," by Messrs. Harker and Barrow, is now also published (1908, price 4*s*. 6*d*.). In chapter iii., the Mesozoic strata of Eigg and Muck are dealt with; Upper Cretaceous sandstone, 2 feet thick, has now been discovered in Eigg, resting on Oxfordian shales. Mr. Harker, following the lines of his masterly memoir on Skye, reports on the igneous series of Cainozoic age which forms the main mass of the islands. He lays much stress on the occurrence of intrusive sills, which have been regarded previously as lava-flows. Tuffs and gravels occur, and numerous true basaltic flows; but the author believes the famous mass of pitchstone that forms the Sgùrr of Eigg to be intrusive in the sills and lavas, and not a flow resting in an old valley-floor. This matter has already been discussed before the Geological Society of London. We have similarly heard already of the Cainozoic gneisses of Rum, produced by the intrusion of granite into eucrite (p. 105); but here we have a complete account of them, in which their similarity to some of the pre-Cambrian gneisses is pointed out. It is, of course, well known from field-observations by Callaway and others that some of our ancient banded gneisses have also arisen from an intermingling of acid and basic igneous rocks.

The southern part of the Derbyshire and Nottinghamshire coalfield is dealt with in a memoir explanatory of Sheet 125 (1908, price 3*s*.). The accompanying map (1*s*. 6*d*.) was drawn up in 1907, and includes the drifts, which here play no great part in the surface geology. The "solid" rocks range from Carboniferous Limestone up to Keuper marl, and almost all provide material of industrial value. Even the lead-mines in the north-west of the area show signs of revival. Messrs. Gibson and Wedd furnish an interesting sketch of the great variety of scenery to be met with in the country north of Derby. The term "Yoredale rocks" has been abandoned in this area (p. 8), but the typical "Pendleside series" has not as yet been traced. Numerous new observations are made on the coal-bearing strata, and the drifts are now described for the first time. In the north-east of the area, certain esker-like mounds (p. 165) are referred to the action of the Irish Sea glacier, which sent out a lobe thus far into the Midlands.

Mr. W. A. E. Ussher describes "The Geology of the Quantock Hills and of Taunton and Bridgwater" (1908, price 2*s*.) in a memoir accompanying Sheet 295 (1907, price 1*s*. 6*d*.). The map gives a picture of the great alluvial flat at Bridgwater, above which the Quantocks, formed of hard Devonian strata, rise boldly on the west. The occurrence of Carboniferous Limestone at Cannington Park, and of cherty Lower Culm-measures resting on Upper Devonian in the region to the south-west, gives rise to an interesting discussion (p. 33), in which it is urged that these two series are contemporaneous. Mr. H. B. Woodward adds a chapter on the Lower Lias near the Bristol Channel north of Williton.

The memoir on "The Geology of the Country around Oxford," by Messrs. Pocock, H. B. Woodward, and Lamplugh (1908, price 2*s*. 3*d*.), accompanies a specially arranged map with Oxford in the centre (1908, price 1*s*. 6*d*.). These publications are sure to have a rapid sale, and the colour-printed map, although it includes drifts, gives a very clear indication of the structure of the country. Mr. Lamplugh places the Shotover Sands (p. 66) as Wealden; on the east, near Great Milton, they are overlain by Gault, apparently without the intervention of marine Lower Greensand strata. This unconformity has been noticed elsewhere (p. 75) by Dr. A. M. Davies. The plateau-drift, a deposit older than the highest alluvial terraces of the streams, is correlated (p. 102) with the chalky boulder-clay of regions to the east. Might we not ask, in a memoir of such wide interest, for some of the photographic illustrations, connecting surface-features and geological structure, which are so liberally furnished by the survey for less accessible districts? Large parts of rural and industrial England still require adequate illustration. In this matter, colonial surveys are a bright example to us.

Photo.] [*A. G. Stenhouse.*

FIG. 1.—Cretaceous Sandstone resting on Oxfordian Strata, Laig Bay, Eigg.

In the concluding part of the *Jahrbuch der k.k. geologischen Reichsanstalt* for 1907, lvii. Band (1907), Dr. F. E. Suess describes (p. 793) the structure of the narrow Carboniferous basin of Rossitz, on the Bohemian and Moravian border. The Culm-measures and Devonian strata are unconformably overlain, and mostly concealed, by Upper Carboniferous and Permian beds, to many of which a desert origin is ascribed. Periodic floods swept down banks of pebbles, and some of the Carboniferous conglomerates are regarded as the remains of land-slides. The great intrusive masses of granite and diorite in the

Brunn area to the east must have been covered by the older sediments, since they yield no pebbles to the conglomerates, and their present proximity is due to faulting.

In the succeeding part (lviii. Band, 1 Heft, 1908) Herr P. S. Richarz describes (p. 1) the hills traversed by the Danube between Hainburg and Pozsóny (Pressburg), a region of the most romantic interest. His sections on pp. 31 and 32 recall the towers climbing up on both sides along the crags, and the narrow passage eastward into lands long subject to the Turk. Beneath the castles of Theben on the north and Hainburg on the south, Lias limestone rests on an old series of phyllites and schists. The crystalline character of the schists is attributed to the action of the intrusive granite of the Little Carpathians, and the alteration of the Lias points to a post-Jurassic age for this intrusion. The author does not wish to extend this conclusion to the Carpathians in general, since the granite of the High Tatra is known to be pre-Permian. He is a supporter of the potency of contact-metamorphism in producing types of rock previously attributed to dynamic action, and on p. 48 he connects the rock-sequence in the Hainburg area, through the Leitha range, with the Semmering region, where the metamorphosed Kossen beds recall the crystalline Lias of the Little Carpathians. Herr F. Broili (p. 49), in describing remains of the amphibian Sclerocephalus from the "Gaskohle" of Nürschan, in Bohemia, enters fully into the question of the age of this deposit, and concludes in favour of its being Upper Carboniferous rather than lowest Permian. Frič has previously treated it as Permian. Herr W. Hammer (p. 79) furnishes a detailed paper on the Ortler Group and the Ciavalatschkamm, which should appeal to climbers as well as to professed geologists. Divergent views have been held regarding the structure of this region, and the author was entrusted with the preparation of a detailed geological map, which will be published in 1909. His conclusions are opposed to those of Termier, who would introduce the principles of "Nappismus" to explain the folding of this part of the eastern Alps (p. 194).

In the *Verhandlungen* of the same institute, Dr. Franz Kossmat (Nos. 2 and 3, 1908, p. 69) describes the country on the Isonzo round Karfreit (Kobarid or Caporetto), a region rarely traversed by the modern traveller, though it lies on one of the highways to Trieste. An overthrust here brings Triassic dolomite above Flysch beds, which are probably of Cretaceous age. The Jurassic to Eocene floor of the basin of Flitsch, which is finely seen, surrounded by Triassic limestones, as one comes down from the Predil Pass, is regarded by the author as the nose of a synclinal pushed over into the Triassic area from the south-east. He has to resist the temptation of treating it as a "Fenster" in this region of conspicuous overthrusts. In Nos. 5 and 6, 1908, p. 111, Herr Wegner, of Breslau, adds considerably to our knowledge of the mammalian fauna of Oppeln, in Silesia. He points out that *Pliopithecus antiquus*, though represented only by teeth and jaws, is so widely spread in the Upper Miocene of Europe that it may be regarded as a characteristic fossil.

In No. 7, Herr Petrascheck (p. 140) describes the relation of the Sudetic mass to the adjacent part of the Carpathians, and supports the views of Suess, with some minor modifications. He thus urges that pre-Miocene folding had much to do with the present structure of the Sudetic area.

The late Mr. T. Barron's memoir on "The Topography and Geology of the District between Cairo and Suez" has been issued by the Survey Department of the Finance Ministry of Egypt (Cairo, 1907). It will be new to many who know the railway that runs close beside the Ismailia Canal to learn that traces of a direct and older line lie to the south of it, in more broken country, and near the historic post-road. The great macadamised road is now becoming lost in sand. The rocks described from this desert region are Cretaceous and Cainozoic. On p. 112 there is a striking passage, in support of Prof. Lapworth's view of the migration of earth-folds as advancing crust-waves; the author traces a trough into a wave-crest and then into a succeeding trough, as he surveys the history of his district from Eocene to Middle Miocene times. Practically the same succession is seen in the Paris basin, and we wish that Mr. Barron had been spared to state his views as to the further course of the wave that has controlled the deposits of Lower Egypt.

From the Geological Survey of India we have received Mr. Hayden's "Geology of Tsang and Ü in Central Tibet" (Memoirs, vol. xxxvi., part ii., 1907). The foliated biotite-granite of the Himalayas is continued into this region, and is undoubtedly intrusive in Jurassic rocks, which cover the greater part of the area. The Eocene marine beds do not contain nummulites, and may be older than the nummulitic stage of other areas (p. 56). The memoir includes photographic plates showing fine outcrops of strata on almost barren mountain sides. Part iii. of vol. xxxvi. of the Records of the same survey (1908, price 1 rupee) contains several palæontological papers, one of which, by Mr. Vredenburg, reviews the Cretaceous species of Orbitoides in India. Dr. Bleeck, of Munich (p. 164), describes the occurrence of corundum in metamorphic limestone in the Kachin Hills of Upper Burma. He urges that the crystalline limestone originated here, at any rate, by contact-alteration of a sediment, under conditions of pressure sufficient to produce corundum and to impart a foliation to the invading granite.

Photo.] [*W. Beattie and Co., Auckland.*

FIG. 2.—The Town of Coromandel, Auckland, situated on Recent Deposits at the foot of hills formed of pre-Jurassic sediments.

The Geological Commission of the Colony of the Cape of Good Hope, working under conditions of peculiar difficulty, has already issued in 1908 four large geological sheets of the map of the north-west area, including Mafeking, Vryburg, and Kimberley. These can be bought in London from Messrs. Wesley and Son, price 2*s.* 6*d.* each. The unconformity between the glacial Dwyka beds and the older rocks comes out well on Sheet 50, and in Sheet 42 we reach a district near Kimberley where the striated surfaces due to Permian ice are admirably seen in the field. The Twelfth Annual Report of the Commission, for 1907 (1908), by Dr. A. W. Rogers and Mr. Du Toit, describes much of the area of the maps with characteristic clearness. An interesting example of "pillow lava," a much discussed type of flow, is describec

on p. 66. The superficial deposits of the dry region include much calcareous tufa, and recent quartzites appear as we go westward into the genuine desert.

Prof. T. W. Edgeworth David has issued the first part of his description of "The Hunter River Coal Measures, New South Wales" (Mem. Geol. Survey, N.S.W., 1907, price 12*s.* 6*d.*). This memoir, forming a handsome quarto volume, explains the numerous coloured maps and sections that have been published under a separate cover. The plates will interest the practical miner as well as the geologist. The sedimentary rocks and typical fossils are here excellently illustrated. The limits of the Australian Permo-Carboniferous system are discussed (p. 311); glacial beds, 200 feet thick (p. 321), occur in the Lower Marine series, and ice-borne erratics have been dropped into the Upper Marine muds, which are indented by them (p. 197 and Plate xxiv.).

The New Zealand Geological Survey, in Bulletin No. 4 (1907), by Messrs. C. Fraser and J. H. Adams, describes the geology of the Coromandel subdivision, Auckland. This area includes the oldest goldfield in New Zealand, which is at present not particularly flourishing. The Hauraki mine, however, must have amply rewarded its original shareholders. The veins containing gold and silver, whether in the Jurassic and older sediments or in the Cainozoic andesites, are connected with the extrusion of the latter (p. 98). The bulletin is as finely illustrated as its predecessors, and many of the plates are of interest to petrographers, full attention being given to sedimentary as well as igneous rocks. The price of the volume, including four coloured maps in a pocket at the end, is 2*s.* 6*d.*, a sum that is in keeping with the liberality of colonial Governments in these matters.

Bulletin No. 5 (1908), by Mr. James Park, on the geology of the Cromwell subdivision, forms an equally handsome volume, and contains some interesting details as to the distribution of gold-bearing material by glacial action. No natural sorting out of the gold occurs in moraines, which thus are less satisfactory than ordinary pockets in alluvium.

The Annual Report of the Geological Survey of Canada for 1904 was issued in 1906, but did not reach us until the present year. Bound up with it are several separately paged papers, including reports by Mr. Keele and Mr. Camsell on rivers in Yukon, and by Dr. G. A. Young on Mount Yamaska, in Quebec. The Yamaska mass affords a study in igneous differentiation, with basic "yamaskite" in the centre, graduating outwards into "essexite," and then into "akerite," with nearly 60 per cent. of silica. The Summary Report of the same survey for 1906 appeared in 1907, and shows the wide range of the work, attention being especially directed to mineral resources and to the economic possibilities of new routes opened across the country. Mr. W. W. Leach's separately printed paper on the Telkwa River and vicinity, British Columbia (Geol. Surv. Canada, Ottawa, 1907), shows the pioneer work that falls to the geologist, side by side with the miner, in this great Dominion.

Since our last article on "Geological Work in the United States" (NATURE, vol. lxxviii., p. 282), we have received the annual report of the Geological Survey of New Jersey for 1907 (Trenton, 1908), and vol. vi. of the Maryland Geological Survey, dated 1906. The former is distributed for the cost of postage, and includes an interesting and surprisingly direct warning to would-be investors (p. 15) against speculators in the Portland cement industry. Mr. J. V. Lewis has written on the petrography of the Newark igneous rocks. His memoir (pp. 96–168 of the report), which is very fully illustrated, contains a description of certain inclusions of arkose in diabase (p. 134), which have assumed the composition and partly the structure of augite-granite. The green augite present has been probably derived from the igneous invader, but the defects of any chemical classification of rocks are emphasised more than ever when we learn that one of these altered masses should fall into the "dosodic subrang of the rang *alaskase*," and another into the "presodic subrang of the rang *dacase*." When Mr. Lewis shows us the origin of these rocks in the field, such nomenclature appears as a mere learned trifling. The basaltic lavas of the Watchung area are admirably described, and their zeolites are attributed to the action of "juvenile" waters during the cooling of the flows. The Maryland volume is, as usual, very handsome, but far too heavy for the hand. The whole physiography of the State is dealt with, and a general account of its geological structure follows. The first 251 pages, covering also the soils and meteorology, form, indeed, a popular and exact guide for any educated citizen. Mr. E. B. Mathews contributes a history of the origin of the counties of Maryland, occupying more than 150 of these weighty pages; we must presume that this, like the reports of the highway surveyors, finds its most fitting place within the green covers of this well-known geological series.

The Annual Report of the Iowa Geological Survey for 1906 (1907) deals extensively with Portland cement and with the rocks quarried for economic purposes in the State. The analyses and tests of sedimentary building-stones have a petrographic as well as an engineering value, since these types of rock are apt to be neglected.

G. A. J. C.

THREE VOLUMES ON NORTH SEA FISHERY INVESTIGATION.[1]

THE first of the volumes referred to below reports a meeting of the International Council named, held in London last year, and also contains accounts of numerous researches. Both parts possess features of, in some respects, unusual interest, to only a few of which reference can be made in the present brief notice. The meeting was memorable as the occasion of some remarks made by Earl Grey in the course of an address of welcome, which made it clear that the British Government intended to continue to support marine research in the interest of the fisheries, and looked favourably on international co-operation in the matter. Since the conference a committee has been appointed by the Treasury to inquire into the prosecution of such researches, has heard evidence, deliberated, and lately has made its recommendations, which include plans for the organisation of the work. There seems, therefore, every probability of British fishery research being placed on a permanent basis, and an opportunity has obviously occurred which, if wisely dealt with, may result in an important step in the application of biology to industry.

Another interesting announcement was that of Commander Drechsel, who stated that a convention had been arranged between Sweden and Denmark which would prevent the landing in these countries of undersized fish from the Kattegat, including its extra-territorial waters. This convention is said to be due to the results of research. The results in question appear to be embodied in the "Summary Report on the State of our Knowledge with Regard to Plaice and Plaice Fisheries," by Petersen, Garstang, and Kyle.

This summary, which is as able as it is concise, was prepared in response to a request of the Dutch and Danish Governments. It deals with very varied studies, and is backed by a formidable array of seventy-four tables. It recommends legislation against the landing of small plaice from the Kattegat, because these small fish are not fatally injured by the methods of fishing there employed, rarely leave the district, and increase in value with growth to an extent which amply compensates the fishery for their loss as small fish. The conditions in the North Sea are felt to be more complex, and for this area no legislation is recommended, though the report favours the transplantation of plaice to good feeding-grounds. An apparent discrepancy between the estimates of intensity of fishing and of its effects calls for mention. The intensity of fishing in the Kattegat is held to be greater than in the North Sea; yet while the evidence (described as "not large") points to a lowering of the average length of North Sea plaice, the weight per score of Kattegat plaice of above 25·6 cm. length is not declining (Table III.). If North Sea fishing kills off the large plaice more quickly than nature replaces them, *a fortiori* the largest Kattegat

1 (1) "Rapports et Procès verbaux des Reunions. Conseil permanent international pour l'Exploration de la Mer." Vol. vii. Pp. xxxviii+314.
(2) *Ibid.*, vol. viii. Pp. 125; plates 12.
(3) "Bulletins trimestriel des Résultats acquis pendant les Croisières périodiques." Année 1906-7. No. 3. Pp. 33–95; plates 9.

plaice should disappear. Of course it is theoretically possible that average length should decline without average weight, owing to the reduced competition for food attending a thinning of the population—though in that case the utility of a size-limit is not obvious—but in all probability the discrepancy is due to paucity of data in one or the other of the areas, and will disappear with the collection of more information. The point does, however, emphasise the importance of testing the adequacy of samples of fish used for statistical purposes, a matter which is dealt with in another paper of the volume on the Ymuiden plaice measurements.

The secretary concludes his official record of the conference with a reference to the reception of the council by the King, and with pleasant, if a little quaint, expressions of thanks to the institutions and gentlemen who constituted themselves hosts, and to the clubs which "opened their hospitable localities" to the members.

The second volume before us is devoted to the seals of northern Europe. The material used was collected by Hjort and Knipowitsch, and is of the most diverse character, ranging from zoological literature to the journals of sealing vessels. The intention in dealing with this data was to give accounts of the biology, economic value, and influence on fisheries of seals, and to arrive at conclusions on the question of their extermination. The first of these purposes is admirably carried out by Dr. Wollebæk in a paper well illustrated by charts and plates, the account of the distribution and migrations of the seals being especially interesting. The report is in two parts, a Norwegian and a Russian, and it is evident that the value attached to sealing by the Russians prevents their sympathising greatly with Norwegian projects for the extermination of these animals. The charges against the seals are that *Phoca vitulina* damages the salmon fisheries, which is generally admitted, and that *P. groenlandica*, *P. foetida*, and *P. vitulina* also damage the fishery for the cod which follow the "Lodde" (*Mallotus villosus*) to the coast of Finmark, in exceptional years causing its complete failure. The damage done by hordes of fish-eating seals in the exceptional "seal" years, such as 1902–3, must be very great; yet the report would undoubtedly have gained in value had more attention been paid to the admitted possibility that the exceptional conditions which brought the seals also drove off the fish. The hydrographic conditions of the years in question were so exceptional that they may well have determined the failure of the fisheries; yet they receive but brief recognition, and the resulting impression is somewhat that of a trial confined to speeches for the prosecution. One feels that, were the seals eliminated, the Lodde fishery would possibly still be liable to sudden failure.

The third publication under notice is one of a series issued at fairly regular intervals, and contains the detailed hydrographic and plankton observations made by the vessels employed in the international researches during the first quarter of 1907, together with illustrative charts and sections. The periodic preparation of these bulletins must be a severe tax on the time and energies of the workers, but the resulting records should be of great utility to those studying the North Sea and English Channel.

THE DAWN OF METEOROLOGY.[1]

METEOROLOGY as a science is young, but as a branch of knowledge very old, perhaps as old as mankind. Indeed, the beginnings of meteorology are to be found with the origin of human civilisation. In those remote times, man living as hunter or agriculturist mostly in the open air was more influenced by, and more depending on, the weather than we are ourselves at present, and he was therefore forced to watch atmospheric phenomena. He did so, of course, not in order to study the atmosphere and to discover its laws, but to derive immediate advantages for himself. He was anxious to learn how to protect his house against the inclemency of the weather, how to foresee the best atmospheric conditions for his undertakings, or how to find out the most favourable climatic situations for his fields.

The experience of the more intelligent men in this respect was handed down, and at the same time augmented, from generation to generation, and formed very early an essential element in the knowledge of the people.

It was the popular weather-wisdom which is still living nowadays, and will never die. This weather knowledge soon assumed the form of short proverbs, or rather absolute rules, because thus they were easily committed to memory.

It would, therefore, be wrong to imagine that the rich store of weather-lore found in the Bible, especially in the Book of Job, in the poems of Homer and Hesiod, that is, in writings of the eighth century B.C., originated then in Palestine or Greece. On the contrary, the familiarity of the people with the sayings and rules concerning the weather, revealed to us by these writings, shows clearly that they must be considered even then as a primeval stock of culture. Indeed, there is every reason to believe that the origin of a great deal even of the modern weather-lore can be traced to its Indo-Germanic source.

People attribute a good deal of prognostic signification to the so-called "twelve nights" (or "twelve days"), which formerly were counted from the beginning of the year, but later, under the influence of the Christian Church, from Christmas. People believe that the weather of these twelve nights (or days) corresponds with that of the twelve months of the following year—indeed, a rather simple forecast of long range if it were true! This superstition is met in the whole of European literature back to the fifteenth century, and still earlier in many MSS. Also the Venerable Bede mentions it; and the Byzantine-Greek work on agriculture, called "Geoponica," which was collected in the sixth century A.D., tells us that even Democritus, in the fifth century B.C., was familiar with it in pretty much the same form. On the other hand, we learn from the Sanskritists that the old Indian or Vedic texts reveal the same belief in the twelve nights as a symbol of the following twelve months. But this superstition not only spread westwards with the Indo-Germanic race, it migrated also eastwards to China, where on New Year's Day a custom is still in use which is based on the same Indo-Germanic conception.

Another superstition concerning the weather leads us to old Babylonia. Many European chapbooks of past centuries, and a little Swedish book, "Sibyllæ Prophetia," which is sold to-day at fairs, contain forecasts of the weather and fertility of the whole year deduced from the thunder heard in each of the twelve months. These *signa tonitrui* can be followed up in MSS. until the Middle Ages, and go back apparently to the rich literature of thunder-almanacs or brontologies, in the composition of which in the fourth and fifth centuries even Byzantine emperors have taken part. In a similar chapter of the already cited Greek book "Geoponica" this doctrine is attributed to Zoroaster. Though this may not be the real author, yet his name indicates its Oriental origin; and, indeed, I found in the works of the Assyriologists—Sayce at Oxford and Lénormant in Paris—some translations of cuneiform tablets proving the Chaldaic origin of this superstition concerning thunder.

The state of meteorology in the old Babylonian culture, namely, three to one thousand years B.C., shows quite another character than it did in those primeval times in which the weather proverbs originated.

After having been formed into the beginnings of a learned profession by the priests, the atmospheric phenomena were brought by them into connection with the constellations of the heavenly bodies, and a complete system of consequences and combinations was established which gave rise to the astro-meteorology. It even formed an integral part of the Assyric-Babylonian religion.

The meteorological observations of the Chaldeans were apparently of a quite selective nature, referring above all to optical phenomena, especially to the halos. They distinguished clearly the small halo of 22° diameter, called "tarbasu," from the greater one of 45°, called "supuru." Besides, they paid much attention to clouds, winds, storms, and thunder; but a good many of these observations served more for a general prophecy of good and bad things, or omens, than for the forecast of the weather.

[1] Abridged from a lecture delivered before the Royal Meteorological Society by Prof. G. Hellmann, and printed in the Quarterly Journal of the Society, October, 1908.

No meteorological theory has yet been discovered in the Babylonian tablets, of which, of course, only a small number has been preserved, and even a smaller number deciphered. But I was quite recently greatly surprised to find that the Babylonians had the windrose of eight rhumbs, and used already the names of the four cardinal points to denominate the intermediate directions; whereas it was until now generally supposed that we owe to Charles the Great, or perhaps to his learned monk Alcuin, who came from Yorkshire, this progress of the combination of the four principal winds to denote all others. That was indeed a great advance, for it is well known that in the Greek and Roman periods each wind had its peculiar name,

FIG. 1.—Fragment of Parapegma.

a practice still in use amongst the Italian mariners in the Mediterranean.

From the Babylonians to the Greeks is a far cry, but there is also great progress from a meteorological point of view. It seems that the Greeks were the first to make regular meteorological observations, some results of which are still preserved, and that their great capacity for pure science induced them to establish meteorological theories.

My first statement is not only proved by Theophrastus, who quotes several men in Asia Minor and Greece making meteorological observations, but also by the interesting fact that since the time of Meton, namely, since the fifth century B.C., in the so-called *parapegmata* (παραπήγματα), a kind of peg almanac fixed on public columns, the general data of the weather resulting from observations were exhibited. As these weather-almanacs differed from town to town, it clearly follows that they were based on individual observations made in each district.

Here is an example taken from the *parapegma* of Geminos, whose book, entitled "Introduction to the Phenomena," is of special value for this question :—

August 31.—The shoulders of Virgo are rising. The winds called ἐτησίαι cease to blow.

September 5.—Rising of Arcturus. South wind, rain, and thunder.

September 12.—The weather will likely change.

September 14.—Mostly fine weather for seven days, thereafter easterly winds.

Fig. 1 shows a fragment of such a *parapegma* found recently at Miletus, and now preserved in the museum at Berlin.

In the holes which can be seen in the marble stone little wooden pegs were put in order to fix the beginning of the year and the days, which gave rise to the name *parapegma*, derived from the Greek verb παραπηγνύναι = to fix into.

It is not surprising that in these *parapegmata* the observations of the wind prevail over all others, for they were of practical use to navigation and easily made. Also, the origin of the winds has always been a favourite subject of speculation among the Greek philosophers. In the epoch of Homer winds were still conceived as absolute beings like gods, whereas Anaximander of Ionia, who lived in the fifth century B.C., is the first to give a scientific definition of the wind, which is still valid. He says: ἄνεμον εἶναι ῥύσιν ἀέρος, the wind is a flowing of air.

It is therefore quite natural that the Greeks, even at this early period, used wind-vanes, which represent the older meteorological instrument, and a most interesting example of it is preserved in the "Tower of Winds" at Athens.

At the time of the construction of the tower, namely, in the first century B.C., a great many wind-vanes were already in use, for a contemporary Roman writer, Terentius Varro, tells us that in Roman villas they were constructed in such a manner as to show the direction of the vane on a windrose fixed to the ceiling of the room ("ut intus scire possis").

Soon after these earliest qualitative observations of the weather and direction of the wind we find the first quantitative ones, that is to say, the measurement of rain, in the first century A.D. It was made in Palestine, where the great influence of rainfall on the crops must have been fully appreciated at an early date, and the results of which observations are preserved in the Mishnah, a collection of Jewish religious books apart from the Bible. It seems to me most interesting to state that the amount of rainfall then considered as normal for a good crop corresponds pretty closely with that deduced from the modern observations made by Mr. Thomas Chaplin at Jerusalem, whence it can be inferred that the climate of Palestine has not changed.

Many of my audience will perhaps be astonished when I state that we are indebted also to antiquity for the first idea of a most important modern meteorological instrument. Most men of science are still of the opinion that antiquity achieved nothing concerning physical instruments and experiments; but the more we become acquainted with the scientific and technical literature of the Greeks and Romans, which at present is often the subject of study of philologists in preference to the classical authors, the more we learn their many positive results in this respect.

There are two physicists of special interest to us in this connection, namely, Philo of Byzantium, who lived in the third century B.C., and Hero of Alexandria, whose century is not yet settled, but who certainly lived after Philo and the great mathematician Archimedes, both being quoted

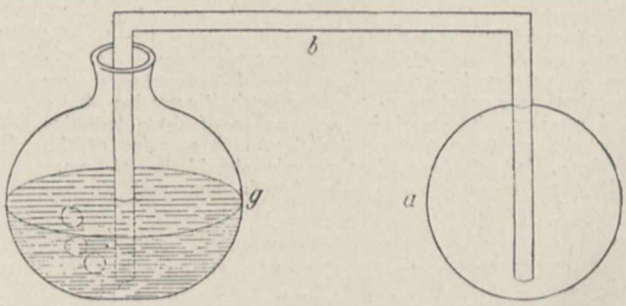

FIG. 2.

by him. In the writings of these two physicists we find the description of an apparatus which represents the primitive idea of the thermoscope.

Philo's description in his work "De ingeniis spiritualibus" (on pressure engines), the Greek original of which is lost, only an Arabian and a Latin translation being preserved, will be made intelligible by Fig. 2. He says :—

"One takes a leaden globe of moderate size, the inside of which is empty and roomy. It must neither be too thin that it cannot easily burst, nor too heavy, but quite dry so that the experiment may succeed. Through an aperture in the top is passed a bent siphon reaching nearly

to the bottom. The other end of this siphon is passed into a vessel filled with water, also reaching nearly to the bottom, so that water may the more easily flow out. *a* is the globe, *b* the siphon, and *g* the vessel. I assert, when the globe is placed in the sun and becomes warm some of the air enclosed in the tube will pass out. This will be seen, since the air flows out of the tube into the water, setting it in motion and producing air-bubbles, one after the other. If the globe is placed in the shadow or any other place where the sun does not penetrate, then the water will rise through the tube flowing into the globe. If the globe is again placed in the sun the water will return to the vessel, and *vice versâ*. . . . . The same effect is produced if one heats the globe with fire or pours hot water over it. . . ."

Somewhat more complicated is the similar apparatus of Hero, to which he gives the name λιβάς, or drip (Fig. 3).

Now it happened that this book of Hero on pneumatics, which must have been widely distributed already in MS., was translated in the eighteen years between 1575 and 1592 no less than twice into Latin and three times into Italian. It was studied by Galileo, Porta, and Drebbel, and gave, about the year 1600, to all three men the idea of constructing a thermoscope, and to the last one also the impulse of making an experiment on the origin of the winds. From this it appears there is an interesting

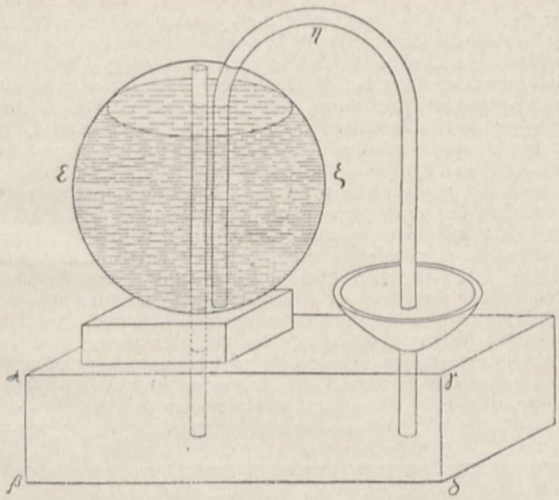

FIG. 3.

connection between the science of two remote periods with an interval of time of more than 1800 years!

As I said before, the Greeks were also the first to start theories of meteorological phenomena. Indeed, since the time of the oldest philosophical school, that of Ionia, there are few Greek philosophers who were not interested in some branch of meteorology. This covered a wider field of research then than at present, embracing, besides meteorology in the modern sense, also a good deal of physical geography and astronomy, especially shooting-stars, meteors, and comets. The favourite meteorological subjects of speculation and research seem to have been the origin of the winds, the theory of the rain, including the regular inundation of the Nile, and the rainbow. A good many cosmological speculations were also put forward by the meteorologists which often proved false, and, considered from a practical point of view, in all cases rather useless, whence in the period of Socrates meteorology itself came into disrepute.

But notwithstanding, meteorology made some real progress in time, and reached such perfection a century later that the system established by Aristotle remained for nearly two thousand years the standard text-book of our science. To be sure, considered from a modern point of view, Aristotle's meteorology was antiquated long ago, but if you imagine yourselves back in those old times you will agree with me that his treatise of meteorology—the earliest one existing—is an excellent piece of work, and well worthy of the greatest systematiser of all times.

I should go too far if I were to analyse here the merits and demerits of Aristotle's meteorology. It may be sufficient to say that his most distinguished successors, such as Theophrastus and Posidonius, have added but little to the perfection of his system, which, on the contrary, gave rise to innumerable commentaries and paraphrases. All text-books of meteorology issued on the Continent until the end of the seventeenth century are exclusively based on Aristotle, whereas, curiously enough, in England his influence was much less. If I except Duns Scotus, I do not know any British scholar who has written a commentary on the meteorology of Aristotle, and even this one has quite recently been disputed. It is true the number of treatises on meteorology published in Great Britain before 1700 is unusually small compared with that issued contemporaneously in Germany, Italy, and France, in Latin or the vernacular language. Englishmen seem always to have been more inclined to make actual observations of the weather than to theorise upon it and to write systematic treatises on meteorology.

Among the Romans meteorology made but little progress, like all other sciences of no immediate practical value. Pliny, Seneca, and Lucretius do not add any remarkable fact or theory to the knowledge of the Greeks, and probably the same can be said of the lost writings of Nigidius Figulus and Suetonius Tranquillus. From Virgil we learn some new weather-proverbs originating in Italy, and a writer on agriculture, Columella, who owned a large estate near Cadiz in Andalusia, has left behind a "Calendarium Rusticum," or rural calendar, with many interesting weather observations made in that district.

The extensive colonial possessions of the Romans were, of course, suitable for advancing the conceptions of climatological differences of the countries. As the great military expedition of Alexander the Great to inner Asia and India had brought to the Greeks the first knowledge of the monsoon winds, so the Romans were the first to point out the difference between the continental and maritime climate. Minucius Felix, a Christian writer from Africa, living in the second century A.D., says, concerning the climate of Great Britain, "Britannia sole deficitur, sed circumfluentis maris tepore recreatur," that is, freely translated, "Britain has little sunshine, but a mild climate on account of the warm sea-water flowing round it."

The barbarous state of Europe after the fall of the Western Empire was not adapted to the furthering of science, which was barely kept alive within the Christian Church. Yet the pursuit of meteorology never wholly ceased, for the Fathers of the Church, writing commentaries on the work of the seven days, the so-called Hexaëmeron, often took occasion, when dealing with the first day of the Mosaic Creation, to insert long elaborations on the atmosphere and its phenomena.

At the very beginning of the Middle Ages the great encyclopædists, such as Isidorus Hispalensis in Spain, the Venerable Bede in Great Britain, and Rabanus Maurus in Germany, were the first to devote more attention to meteorological questions, the interest in which must have been considerable in England, for in the tenth century an extract of Bede's writings, concerning astronomy and meteorology, was made for the uninitiated in the Anglo-Saxon language, which is perhaps the earliest treatise on science written in a popular form. It contains chapters on the winds, rain, hail, snow, and thunder.

A general revival of studies took place at the end of the twelfth century, when the writings of Aristotle, among which was his "Meteorology," came to the knowledge of the Western students by Latin translations made in Spain from the Arabian ones, not from the Greek originals. The imposing meteorological system of the great Stagirite again exercised a great influence on the writings of the scholars and on the teaching in the recently established universities, where, under the title "Meteora," regular courses and even exercises in meteorology were held. Albertus Magnus at Cologne wrote at this time his great meteorological works ("De Meteoris," libri iv., and "De Passionibus Aeris"), paraphrasing chiefly those of Aristotle, but adding also the opinions of other authorities

and his own remarks; and at the same time, or somewhat later, Vincent de Beauvais in France, Thomas de Cantimpré in Belgium, Ristoro d'Arezzo in Italy, Bartholomew Anglicus (or de Glanvilla) in England, incorporated the Aristotelian ideas in their encyclopædic works all bearing the general title "On the Nature of Things" ("De Natura Rerum").

But the firm and absolute adherence to the doctrines of the master, Aristotle, the denying of all that could not be found in his writings, rendered the scholastic meteorology so noxious to any real progress that it came into conflict with all new ideas. Notwithstanding, these forced their way by and by, and the beginnings of the modern experimental science are to be found just at that epoch when scholasticism had reached its highest point, namely, in the thirteenth century.

It is not yet definitely settled where the new experimental science took its origin—most likely contemporaneously in France and in England, where the two friends Pierre de Maricourt (Petrus Peregrinus) and Roger Bacon can be considered as the first great representatives of the new aims.

The former, a French nobleman and military engineer, is the author of the famous treatise on the magnet, and made many optical experiments like his English friend; and although both have not dealt with meteorology properly speaking—except the rainbow—yet their general influence must have been great on our science also. Roger Bacon's energetic opposing of the experiment to the argument—"argumentum non sufficit, sed experientia," he says in his "Opus Majus"—conduced naturally to the observing of atmospheric phenomena instead of only interpreting the writings of the ancients.

Thus the new aims advanced meteorological observations also, for which the ground was well prepared. As I have just shown, such observations were made in antiquity and never had wholly ceased, despite frequent and long interruptions. For the custom of the Roman historians to note in their annals the more important atmospheric phenomena, especially those necessitating sacrifices, was handed down to the chroniclers of the Middle Ages, whose chronicles became richer and richer in entries of the weather, until at the end of the thirteenth century these records are so replete with remarks on the weather that the character of the seasons could be traced back.

Now the time is ripe for more systematic observations, and we find at Oxford William Merle, a fellow of Merton College, to whom remains the distinction of being the first man in the Occidental world to keep a regular journal of the weather day by day. It embraces the years 1337 until 1344. The journal is preserved at the Bodleian Library. It is the earliest known journal of the weather, kept at Oxford and later at Driby in Lincolnshire, where William Merle was rector.

A close examination of the circumstances forces me to the conclusion that William Merle was induced to make regular observations by the desire to ascertain the correctness of the prognostics made by himself and his colleagues at Oxford, where meteorology, or, more properly speaking, astro-meteorology, had been flourishing since the time of Robert Grosseteste, the famous Bishop of Lincoln. Merle himself has left behind two MSS. on the forecasting of the weather, and his contemporaneous fellow of Merton College, John Eschendon (or Ashendon), whose name has been corrupted into Eschuid, completed in 1348 a voluminous treatise of astro-meteorology bearing the title "Summa judicialis de accidentibus mundi." It was printed at Venice in 1489, and served in the sixteenth century as a text-book at the University of Vienna. The work is usually quoted in meteorological literature under the abbreviated title "Summa Anglicana," and is now extremely rare.

When, eighteen years ago, the journal of William Merle was re-discovered, it seemed to stand all alone, since we had no knowledge of other observations made in England or abroad; but recently I have been able to find out a nearly continued sequence of series of such observations, and to prove that from the fourteenth to the middle of the seventeenth centuries, namely, until the invention of meteorological instruments, the weather was regularly observed in many places in Central and Western Europe.

I had noticed that some copies of the large astronomical work, published in 1499 by Justus Stoeffler and Jacob Pflaum at Tübingen, "Almanach nova plurimis annis venturis inservientia," containing ephemerides for the years 1499 to 1531, were full of meteorological entries written on the broad margins. This induced me to make systematic inquiry into copies of the work named containing such entries preserved in the great libraries of Germany, Austria, and Switzerland. The result of this inquiry was rather astonishing. No fewer than 123 different series of meteorological observations belonging to the fifteenth, sixteenth, and seventeenth centuries were found. Considering that this number of necessity represents but a small proportion, and concerns only some parts of Central Europe, we may safely presume that in the whole of Europe their number must have been far greater. Some of these early series of weather observations are even corresponding ones, made by agreement.

A fresh stimulus for observing came at the end of the fifteenth century from quite another direction. The great discoveries of new lands and seas considerably enlarged and widened old ideas and conceptions. Atmospheric phenomena never seen before came to the knowledge of man, and climates very different from those at home became known. Intelligent men were struck by such varieties, and we can clearly observe their effect on them in the writings of that epoch. Luis de Camões, the famous Portuguese poet, described in his epos, "Os Lusiadas," for the first time minutely the water-spouts often observed by him off the coast of Guinea and the storms in the South Indian Ocean, while from the logbook kept by Christopher Columbus during his first voyage we learn the deep impression he got from the difference of climate and weather in the Atlantic beyond the Azores compared with that eastwards of the islands. Such new observations advanced mostly the doctrine of the winds, which was now more fully expounded in Spanish and Portuguese works, until in the year 1622 Francis Bacon was the first to publish a special treatise dealing entirely with the winds.

But meanwhile experimental science, the growing up of which I have just alluded to, was so much developed that in the first half of the seventeenth century the principal meteorological instruments were invented. To Italy belongs the glory of being the native country of instrumental meteorology, the cradle of which stood at Florence. These inventions proved the first step in making meteorology a science, and now the shadows of the dawn are fast disappearing before the full light of the rising sun.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Certain friends of the Chancellor desire the establishment of some award to be associated with Lord Rayleigh's name, in order to commemorate the unanimous election of a scientific investigator to the office of Chancellor of the University. With this object they have deposited a sum of money at the bank, the interest of which may be used for the purpose of awarding from time to time a prize to be called the Rayleigh prize. It is proposed to adjudicate these prizes at the same time and by the same adjudicators as the Smith's prize.

The Walsingham medal for 1908 has been awarded to C. C. Dobell for his essay entitled (1) "Protista Parasitic in Frogs and Toads," (2) "Chromidia and the Binuclearity Hypotheses"; and a second Walsingham medal to G. R. Mines and D. Thoday. Mr. Mines's essay was entitled "The Spontaneous Movements of Amphibian Muscles in Saline Solutions," and Mr. Thoday's essay was entitled "Increase of Dry Weight as a Measure of Assimilation." Lord Walsingham has expressed his willingness to give, this year, a bronze replica of the medal to each of the candidates awarded the second medal. The medal is awarded for a monograph or essay giving evidence of original research on any botanical, geological, or zoological subject, zoology being understood to include animal morphology and physiology. Essays for the ensuing year are to be sent to the chairman of the special board for biology and geology (Prof. Langley, The Museums) not later than October 10, 1909.

Mr. W. E. Dixon has been appointed university lecturer in pharmacology.

The office of superintendent of the museum of zoology will be vacant on January 15, 1909, by the resignation of Dr. Harmer. The stipend at present attached to the office is 200*l.* per annum. Applications should be sent to the chairman of the special board for biology and geology (Prof. Langley, The Museums) on or before January 21, 1909.

LONDON.—Prof. A. Sedgwick, F.R.S., professor of zoology and comparative anatomy in the University of Cambridge, has accepted the professorship of zoology at the Imperial College of Science and Technology, South Kensington.

At a meeting on December 2 the Senate decided unanimously in favour of the appointment of a Royal Commission to consider the relations between the University and the Imperial College. It will be remembered that Mr. McKenna undertook to recommend the appointment of a Royal Commission if he received representations on the subject from the Senate of the University.

MR. LEWIS F. DAY will give an address at the Sir John Cass Technical Institute at the distribution of prizes and certificates on Wednesday, December 16. There will be an exhibition of students' work and apparatus in the laboratories, workshops, and other rooms.

MR. S. A. SAUNDER, secretary to the Royal Astronomical Society and a past-president of the British Astronomical Association, has been appointed to the Gresham lectureship on astronomy at Gresham College, London, rendered vacant by the resignation of the Rev. E. Ledger.

IT is officially announced that letters patent have passed the Great Seal of Ireland constituting and founding a university, having its seat in Dublin, under the name of the National University of Ireland, and a university, having its seat in Belfast, under the name of the Queen's University of Belfast.

SPEAKING at Abergavenny on December 4, Sir Edward Strachey, M.P., commented upon the recently issued report of the Departmental Committee which inquired into the provision of education in England and Wales for affording scientific and technical instruction in agriculture. Sir Edward Strachey asked, Why should there not be in this country a great State agricultural farm equipped with everything necessary for experiments and research and for the education of teachers in agriculture? There might well be in every county or group of counties an agricultural county farm subsidised by the State and, to a certain extent, from the rates. These farm institutions should be, he said, for assisting farmers and demonstrating the value of science applied to agriculture. There should be, too, a centre for experiments wherever local experiment is necessary, and for demonstration where desirable; but the best form of demonstration, he pointed out, is on various farms under different conditions of soils and climates. Sir Edward Strachey added that his suggestions were those of one who is a farmer, but that it is the duty of the President of the Board of Agriculture to formulate a scheme of national agricultural education somewhat on the Irish lines.

THE report of the departmental committee on agricultural education is under consideration in detail by a committee of the Farmers' Club. A memorandum dealing with its several provisions is being prepared, and the committee has expressed agreement with the views stated in the report in the following resolutions:—(1) That the funds at present available for agricultural education are wholly inadequate, and considerably increased funds should be provided, the main source of which must be the national Exchequer. Such funds should be employed by the Board of Agriculture, first, to aid existing and projected institutions in respect of their staff and general equipment, and, secondly, to aid local authorities in making provision for the agricultural work conducted by them. (2) That since complete cooperation between the Board of Agriculture and Education is essential, if the field of education is to be adequately covered and overlapping avoided the committee is of opinion that agricultural instruction, when provided by universities, university colleges, agricultural colleges, farm institutes, and winter schools, or by means of special classes or courses of lectures in agriculture and kindred subjects (*e.g.* dairying, horticulture), should be under the direction of the Board of Agriculture, while all instruction in agricultural subjects forming part of courses in primary, secondary, or such evening schools as are in definite continuation of the education given in primary schools, should be under the Board of Education.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 5.—"On the Generation of a Luminous Glow in an Exhausted Receiver moving near an Electrostatic Field, and the Action of a Magnetic Field on the Glow so produced, the Residual Gases being Oxygen, Hydrogen, Neon, and Air." Part iii. By F. J. **Jervis-Smith**, F.R.S.

A silica bulb, as used in the experiments described in Proc. Roy. Soc., A, vol. lxxxi., p. 214, was rotated in a magnetic and also in an electrostatic field, the residual gas being oxygen. The inductor was charged until the bulb glowed; then it was slowly discharged through damped thread, until the glow disappeared; on establishing the magnetic field the brilliant glow was restored. The magnetic effect was less marked when air was the residual gas. When glass was employed instead of silica the glow was greatly reduced. The glow effects in widely differing gases were compared. Sir William Ramsay kindly prepared for the author of the paper a bulb in which the residual gas was neon. The neon glow-bulb when treated exactly in the same way as the oxygen glow-bulb gave but little glow, of a reddish tint. The glow was but feebly affected by the magnetic field. A silica glow-bulb, residual gas air, was rotated, as in the previous experiments; the inductor was charged to 800 volts, and placed at such a distance from the bulb that it did not show any glow. On establishing a *magnetic field*, in which the bulb rotated, it *glowed brightly*.

When hydrogen was the residual gas, in a glass bulb the position of maximum glow was shifted through 90° from the position of maximum glow when oxygen was the residual gas.

The effect of a magnetic field on the generation of electricity was examined. A silica glow-bulb in contact with a camel-hair brush was rotated between the poles of an electromagnet. The pressure of the brush was so adjusted that no glow was visible; when the magnetic field was established the bulb glowed brightly, and ceased the instant the magnetic field was shut off. The experiment could be easily repeated with certainty.

In another experiment the brush, after being in contact with the bulb, was removed. The bulb glowed the instant the magnetic field was restored. The experiments illustrate the profound change which takes place in the behaviour of a moving static induction of electricity when the bulb in which it occurs is in a magnetic field, and show how the action of the magnetic field on the electric motion in the residual gas is modified by the nature of the gas employed.

Royal Microscopical Society, November 18.—Mr. Conrad Beck, vice-president, in the chair.—A new growing cell for critical observations under the highest powers: A. A. C. E. **Merlin.**—Studeria, a remarkable new genus of Alcyonarians: Prof. J. A. **Thomson.**—The present status of micrometry: Dr. M. D. **Ewell.**

Entomological Society, November 18.—Mr. H. Rowland-Brown, vice-president, in the chair.—Descriptions of micro-lepidoptera from Bolivia and Peru: E. **Meyrick.**

CAMBRIDGE.

Philosophical Society, November 23.—Prof. Sedgwick president, in the chair.—The relationship between human and bovine tuberculosis: Prof. **Woodhead.** The author gave an account of some observations on 127 cases of tuberculosis in children. He found that the disease seldom occurred in children who died under one year of age, only

four out of 100 affected with mesenteric tuberculosis coming into this category; between the ages of two and 5½ years, however, sixty-two such cases occurred. This led him to look to the milk of tuberculous cows as a source of infection, as children below the age of twelve months seldom receive much milk except that from the mother—especially amongst the poorer classes—whilst from one to 5½ years milk usually forms some part, at any rate, of a very mixed diet. He mentioned the work of other observers, who have come to the conclusion that bovine tuberculosis may be the source of infection of children, especially of the alimentary canal. There could, of course, be no doubt that there were two (or more) types of tuberculosis, marked differences of virulence, of growth, &c., being observed, but he was satisfied that these differences were not specific, and that sometime or other we should be able to find links connecting the extremes.—The transmission of *Trypanosoma lewisi* by fleas and lice: Prof. **Nuttall.** The author described experiments which demonstrated that *Ceratophyllus fasciatus* and *Haematopinus spinulosus* are capable of transmitting *Trypanosoma lewisi*. In one experiment three fleas, transferred from a diseased to a healthy rat, gave a positive result. On the other hand, thirty to sixty lice were required for the transmission of the trypanosome. No signs of any development of the trypanosomes were observed in the bodies of the lice.—The presence of anticoagulin in the salivary glands of *Argas persicus*: Prof. **Nuttall.** Experiments conducted with Mr. C. Strickland have shown that the salivary glands and intestine of *Argas persicus* contain an anticoagulin which is inactivated by exposure to a temperature of 80° C. for ten minutes. The organs of the tick do not contain hæmolysins.—The mode of action of specific substances: W. E. **Dixon** and P. **Hamill.** Evidence was brought to show that drugs having a specific action on a definite tissue do not bring about that effect by chemical combination with protoplasm or with a constituent of the living cell. It was concluded that the mode of action of Galenical drugs was different from that of the hormones.—The action of specific substances in toxæmia: W. E. **Dixon** and W. H. **Harvey.** In this paper it was shown that certain toxins, such as that of diphtheria, cause death by vasomotor failure. It was found that in animals affected with such a toxæmia death can be greatly delayed by the injection of normal saline solution. The action of drugs becomes progressively less according to the degree of toxæmia; those drugs which act on the central nervous system are the first to lose their effect, and those which act on muscle-fibre retain their characteristic effect longest.—Therapeutic inoculation for generalised bacterial infections: L. **Noon.** Opsonic observations show that rabbits and guinea-pigs, with an experimental peritonitis due to the B.-pseudotuberculosis, do not react to the infection for the first five days or more. An inoculation of killed bacilli under the skin of a normal rabbit produces a good opsonic reaction within forty-eight hours. A similar inoculation in a rabbit already diseased calls forth a still more prompt reaction.—The examination of living leucocytes *in vitro*: C. **Ponder.** The satisfactory examination of leucocytes attended with many difficulties. A method described and demonstrated, whereby, with the aid of a new form of blood chamber, the leucocytes are allowed to escape from a clot of fresh blood, and as they adhere to the surface of a glass slide the clot can be washed away; the leucocytes can be kept alive some time, and their movements and other physical properties observed.—The mode of growth of bacteria: Dr. **Graham-Smith.**—The radiation of various spectral lines of neon, helium, and sodium in a magnetic field: J. E. **Purvis.** Photographic observations were made with Prof. Liveing's 21-feet Rowland grating, and eye observations with an echelon spectroscope in the case of neon. The strengths of the magnetic fields varied from 24,000 to 26,100 units. The general results were:—(1) the measured shifts of the lines of neon towards the red end of the spectrum; (2) the values of the divided constituents of the neon lines compared with those of Lohmann; (3) the difficulty in distinguishing the various constituents of the neon lines in the more complex phenomena observed by Lohmann with an echelon spectroscope; (4) the values of the separated constituents of various neon lines, of those of the sodium lines 5896 and 5890, and of the helium line 5875·6 were compared with those of Lohmann, Runge and Paschen, and Rayleigh.—Note on migration constants of dilute solutions of hydrochloric acid: C. **Chittock.** Measurements have been made of the migration constants of aqueous solutions of hydrochloric acid of varying concentration, by a method similar to that which was employed by Whetham and Paine (Proc. Roy. Soc., vol. lxxxi., A, p. 58) for solutions of sulphuric acid, with the object of throwing light on the cause of the abnormally low conductivity of dilute solutions of acids. The experiments show a considerable increase in the migration constant as the concentration is diminished. The bearing of these results on the question of the conductivity of acid solutions is discussed.—The effect of pressure on the ionisation produced by Röntgen rays in different gases and vapours: J. A. **Crowther.** The effect of pressure on the ionisation produced by Röntgen rays in different gases and vapours has been investigated for the cases of air, carbon dioxide, ethyl chloride, ethyl bromide, and methyl iodide, for pressures varying from atmospheric down to 1 mm. of mercury. In all cases (except for ethyl bromide at the higher pressures, where the effect of the penetrating secondary radiation already investigated was appreciable), the ionisation-pressure curve was found to be sensibly a straight line, even at the lowest pressures reached, and with the electrodes only 5 mm. apart. There was not in any case any indication of the presence of a perceptible amount of soft secondary radiation from the gas, the ionisation being apparently due, in the main, to the direct action of the primary rays.—The variation of the relative ionisation produced by Röntgen rays in different gases with the hardness of the rays: J. A. **Crowther.** Values have been obtained for the relative ionisation produced by Röntgen rays in various gases and vapours compared with air, for varying degrees of hardness of the primary rays. The results give no evidence of any approximation to a density law even for the hardest rays employed. For hydrogen and ethyl bromide the relative ionisation increases with the hardness of the rays; carbon dioxide, methyl acetate, and methyl iodide show a decrease.—Waves in a stream of viscous liquid: W. J. **Harrison.**

DUBLIN.

Royal Dublin Society, November 24.—Prof. Sydney Young, F.R.S., in the chair.—A new British bird, *Locustella certhiola*, and two birds, *Emberiza pusilla* and *Acrocephalus streperus*, new to Ireland, all killed striking Rockabill Lighthouse: R. M. **Barrington.** The author read a short paper on these birds, stating that Pallas's grasshopper warbler (*L. certhiola*), an eastern Asiatic species, is new to the British Isles, and that this is the second record of its occurrence in Europe. The little bunting (*E. pusilla*) and the reed warbler (*A. streperus*) are both new to the Irish avifauna.—Vitality, and the transmission of water through the wood of plants: Prof. H. H. **Dixon.** In this paper a comparative method is described for investigating the *rôle* played by vitality in the transmission of water. The results indicate that no sensible force is exerted by the cells of the wood on the transpiration current. The author also described some experiments and observations going to show that the fading of leaves on killed branches is due to stoppage of the conducting tracts and poisoning of the leaf-cells. With reference to the cohesion theory of the ascent of sap, the author pointed out that Berthelot's experiment, demonstrating the tensile strength of water as at least equivalent to 50 atmospheres, was made with water saturated with air, and not, as usually stated, with water deprived of air.—The origin of the Dexter-Kerry breed of cattle: Prof. J. **Wilson.** The author showed that the prevalent theory (first published in 1845 by Prof. Low in his "Domesticated Animals") that Dexter cattle were originated by a land agent called Dexter is untenable. The author then traced the migration of cattle first from the Continent to Britain, and then from Britain to Ireland, and showed that there were four possible breeds by which the native black cattle of Ireland were crossed and by which the Dexter breed might have been produced, viz. the Longhorns, the Shorthorns, the Herefords, and the Devons; but the first three of these

four breeds are ruled out, probably by time and geographical position, and certainly by size and colour. Had the Dexter been produced by any of these breeds it would have been larger, and it would also have carried some of their colour markings. The Devons, or at any rate red English cattle from the south-western counties, are thus left as the only possible progenitors of the Dexter, and the Mendelian explanation of the variations occurring when Dexters are bred with Dexters and Kerries confirms this view.

Royal Irish Academy, November 9.—Mr. J Ribton Garstin, vice-president, in the chair.—The gravitation stress of the æther: Prof. F. **Purser.** The author has endeavoured to solve the problem, first started by Maxwell, of accounting for the electrostatic or gravitation field by strains and corresponding stresses in the dielectric, or æther. Maxwell left this problem in an unsatisfactory condition, assigning, indeed, a condition of stress, but leaving the necessary corresponding strains unsatisfied. Subsequently it was shown that these strains were impossible in the case of a homogeneous isotropic æther in the gravitation problem, and the same would hold in the electrical. The author endeavours to extend this impossibility to a general Greenian æolotropic æther. It appears, therefore, necessary to start, as in other elastic problems, not from the state of stress, but from a state of strain, arranging this so as to give suitable stress conditions. This method is adopted by the writer (1) in discussing the gravitation stress due to the gravitation of matter confined to a certain sphere. This is approximately the problem of the æther stress due to the earth, a problem discussed by Maxwell. The results arrived at agree with Maxwell in giving a uniform pressure at the surface of the sphere. While, however, this pressure is with him independent of the constants of the æther, in the solution at present offered this pressure depends on the ratio λ/μ for the æther. If, then, we suppose the æther very nearly incompressible, *i.e.* μ/λ very small, we shall attain a comparatively small pressure in place of the 4000 tons per square inch of Maxwell. (2) The case of electricity on the surface of conductors in an electrostatic field is then considered. The stress in the dielectric now obtained is in general quite different from Maxwell's, notably where the point in the dielectric considered is at a great distance from the conductors compared with their linear dimensions and mutual distances. It agrees, however, with the Maxwellian stress in the fundamental requisites of (*a*) yielding no stress on a dielectric cell not containing a nucleus of free electricity; (*b*) giving the requisite electromotive force when it does contain such nucleus; (*c*) giving the requisite normal stress at the surface of conductors.

PARIS.

Academy of Sciences. November 30.—M. Bouchard in the chair.—Characters of the upper layer of the gaseous atmosphere of the sun: M. **Deslandres.** The results of a further study of the calcium line K_3 under a high dispersion are given, and deductions made regarding the circulation of the upper portions of the sun's atmosphere.—The metamorphosis of hydrocyanic glucosides during germination: L. **Guignard.** The seeds of *Phaseolus lunatus* were allowed to germinate both in daylight and in the dark, and the amounts of hydrocyanic acid obtainable from the seeds and the seedlings measured. From the experimental results the conclusion is drawn that if hydrocyanic acid is formed during germination by the action of the enzyme on the phaseolunatin, it disappears as soon as it is formed, entering into new combinations.—The total sugar of the blood: R. **Lépine** and M. **Boulud.** The virtual sugar of the blood is obtained by treating the blood clot with hydrofluoric acid. This acid possesses the advantage of causing less secondary action than the acids generally used for hydrolysis.—The perpetual secretary announced the death of M. Fliche, correspondant for the section of rural economy.—Study of the photographs of the Morehouse comet, 1908*c*, obtained at the Observatory of Juvisy: MM. **Baldet** and **Quénisset.** Ninety-six photographs of this comet have been taken between September 17 and November 6, two of which are reproduced in the present paper.—Conjugate networks with equal invariants: M. **Tzitzéica.**—The cyclid of Lie: A. **Demoulin.**—A method of M. Darboux: Leopold **Fejer.**—A class of linear differential equations of infinite order: T. **Lalesco.**—The Brownian motion and Einstein's formula: M. **Chaudesaignes.** Making use of spherical grains of gutta of known diameter, Einstein's formula has been fully confirmed as regards the influence of the radius, the time, and the viscosity.—The chlorides and oxychlorides of thorium: Ed. **Chauvenet.** The anhydrous chloride, $ThCl_4$, is more readily formed by the action of phosgene upon the oxide ThO_2 at a red heat. The hydrated chloride, even in acid solution, is readily converted into an oxychloride.—The action of antimony trichloride upon cobalt and on its alloys with antimony: F. **Ducelliez.** The antimonide CoSb is the only compound formed in this reaction.—The combinations of silicon and uranium. Uranium bisilicide, Si_2Ur: Ed. **Defacqz.** This substance is prepared by firing a mixture of aluminium, sulphur, silica, and uranium oxide. The silicide Si_2Ur is analogous to the silicides of tungsten and molybdenum already described.—The composition of the colloidal hydroxyferric chlorides, studied by filtration through collodion membranes: L. **Michel.**—A method of producing ethylene hydrocarbons, starting with esters: Albert **Colson.** Ethyl benzoate is split up into benzoic acid and ethylene when heated in sealed tubes to 310° C. or higher temperatures. Other benzoic esters give the corresponding olefines under the same conditions, and the esters of fatty and mineral acids behave similarly.—The addition of hydrogen to triphenylmethane: tri*cyclo*hexylmethane: Marcel **Godchot.** The Sabatier and Senderens reaction applied to triphenylmethane gives tri*cyclo*hexylmethane, the physical and chemical properties of which are given.—Observations on a note of M. L. Paris on the reproduction of the blue coloration of the Oriental sapphire: A. **Verneuil.** It is contended that the method of M. Paris does not give the true Oriental sapphire, and that this gem has not yet been reproduced artificially.—Gabbro and the iron ore of Joubrechkine Kamen (north Ural): Louis **Duparc.**—The comparison of the effects of serums with complex mineral contents and with saline water on the phenomena of excretion and nutrition: C. **Fleig.**—Normal chlorotropism in Bernhardus: Romuald **Minkiewicz.**—Sudden disturbances of sight associated with cerebral trouble: Pierre **Bonnier.**—The identification of the imprint of a blood-stained hand on a sheet: V. **Balthazard.** Reproductions of the blood stain and of the ordinary imprint of the hand of the suspected murderer are given. In spite of the difficulties caused by the texture of the sheet, the two imprints can be completely identified.—*Leucocytozoon piroplasmoides*, from epizootic lymphangitis of the horse: A. **Thiroux** and A. **Teppaz.**—The therapeutic value of hordenine sulphate: J. **Sabrazès** and G. **Guérive.** An account of the results obtained in the application of this base to the treatment of infantile diarrhœa, intestinal tuberculosis, muco-enteritis, entero-colotis, typhoid fever, and dyspepsia.—The biology of the bradypods: A. **Menegaux.**—Contribution to the geological history of the Neckar and the Main: Gabriel **Eisenmenger** and Mlle. J. **Duprat.**—Recent excavations carried out in the valley of the Somme: M. **Commont.**—The distribution of the levels and facies of the meso-nummulitic in the Alps: Jean **Boussac.**—The discovery of *Elephas antiquus* at the island of Delos: L. **Cayeux.**—The density of sea-water at various points in the English Channel: A. **Letalle.**

NEW SOUTH WALES.

Linnean Society, October 28.—Mr. A. H. S. Lucas, president, in the chair.—Contribution to a further knowledge of Australian Oligochæta, part i.: E. J. **Goddard.** A new genus of fresh-water Oligochæta referable to the family Phreodrilidæ, represented by two species, is described. Individuals of both species are found associated with the large fresh-water crayfish, *Astacopsis serratus*, Shaw, one set dwelling among the eggs of the parasite, Temnocephala, the other set occurring in the grooves of the carapace. The conditions of habitat, the small number of known species, in conjunction with their geographical distribution, suggest that the Phreodrilidæ are the remnants of an old Antarctic stock, the modern representatives of which are now to be found under conditions

comparable with those of the stalked crinoids of the deep sea.—Some remarkable Australian Corduliinæ (Neuroptera: Odonata), with descriptions of new species: R. J. **Tillyard.** The paper deals with new or little-known Corduliinæ from northern Queensland. Three new genera are proposed:—Austrophya, allied to Cordulophya; Pseudocordulia, closely allied to Gomphomacromia; and Austrocordulia, allied to Syncordulia and the European Oxygastra. Five new species and the hitherto unknown male of the beautiful *Macromia tillyardi*, Martin, are described.—Notes on the geology of the north-west coast of Tasmania, from the River Tamar to Circular Head: T. **Stephens.** It seems probable that the basaltic sheets rising from the coast had their origin in fissure-eruptions along anticlinal axes, intervening folds being subsequently hollowed out by the erosion of rivers or by glaciers slowly moving northward along the lines of the present river valleys. With the exception of the fossils of the Tertiary beds near Table Cape, and the fossil wood from a breccia west of the River Leven, no evidence of any trace of organic remains in the rocks of the north-west coast has yet been placed on record.—Description of a new fruit-fly of the genus Dacus from New South Wales: D. W. **Coquillet.**

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 10.

ROYAL SOCIETY, at 4.30.—Reciprocal Innervation of Antagonistic Muscles. XIIth Note: Proprioceptive Reflexes. XIIIth Note: On the Antagonism between Reflex Inhibition and Reflex Excitation: Prof. C. S. Sherrington, F.R.S.—Electrolytes and Colloids. The Physical State of Gluten: Prof. T. B. Wood and W. B. Hardy, F.R.S.—On the Specific Heats of Air and CO_2 at Atmospheric Pressure by the Continuous Electric Method at 20° and 100° C.: W. F. G. Swann.—Potential Gradient in Glow Discharges from a Point to a Plane: J. W. Bispham.—The Extension of Cracks in an Isotropic Material: A. Mallock, F.R.S.—Results of Magnetic Observations at Stations on the Coasts of the British Isles, 1907: Commander L. Chetwynd, R.N.—The Rotation of the Electric Arc in a Radial Magnetic Field: J. Nicol.—On Anomalies in the Intensity in Diffracted Spectra: Dr. H. C. Pocklington, F.R.S.—The Isothermal Layer of the Atmosphere and Atmospheric Radiation: E. Gold.—A Comparison of the Radium Emanation Spectra obtained by Different Observers: T. Royds.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Output and Economy Limits of Dynamo Electric Machinery: J. C. Macfarlane and H. Burge.—*Probable Paper:* Commercial Electric Heating: J. Roberts.

ROYAL SOCIETY OF ARTS, at 4.30.—The Birds of India: Douglas Dewar.

MATHEMATICAL SOCIETY, at 5.30.—On the Propagation of Sound Waves Vertically in the Atmosphere: Prof. H. Lamb.—(1) On Sir William Rowan Hamilton's Fluctuating Functions; (2) On the Representation of a Function by Series of Bessel's Functions: Dr. E. W. Hobson.—Theory of Cauchy's Principal Values (Fourth Paper): G. H. Hardy.—Solution of a Problem of Mersenne's: Dr. T. Stuart.—Note on a Continued Fraction Equivalent to the Remainder after n Terms of Taylor's Series: Prof. L. J. Rogers.—Solid Angles and Potentials of Plane Discs: Balak Ram.—The Solution of the Homogeneous Linear Difference Equation of the Second Order: G. N. Watson.—On Differentials: Dr. W. H. Young.

FRIDAY, DECEMBER 11.

ROYAL ASTRONOMICAL SOCIETY, at 5.—An Improved Telescope Triple Object Glass: J. W. Gifford.—On the Determination of the Apparent Diameter of a Fixed Star: Major P. A. MacMahon.—Note on Spectral Class and Stellar Colour: Julia Bell.—Analysis of the Colours and Magnitudes of 3650 Stars between the North Pole and 25° South Declination: W. S. Franks.—A New "Cave Nebula" in Cepheus: Max Wolf.—On Some Points with Regard to the Light Fluctuations of Variable Stars: Karl Pearson.

PHYSICAL SOCIETY, at 7.—Exhibition of Electrical, Optical, and other Physical Apparatus.

MALACOLOGICAL SOCIETY, at 8.—On *Carelia pilsbryi*, n.sp.: E. R. Sykes.—The Radulæ of British Helicids, Pt. II.: Rev. E. W. Bowell.—New Species of Plectopylis: G. K. Gude.—A Preliminary List of Recent Middlesex Mollusca: J. E. Cowper and A. Loydell.—The Application of the Names Gomphina, Marcia, Hemitapes and Katelysia: A. J. Jukes-Browne.

MONDAY, DECEMBER 14.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Fifty Years of Nile Exploration and Some of its Results (The Jubilee of Speke's Discovery of the Victoria Nyanza): Sir William E. Garstin, G.C.M.G.

ROYAL SOCIETY OF ARTS, at 8.—Twenty Years' Progress in Explosives: Oscar Guttmann.

INSTITUTE OF ACTUARIES, at 5.—On a New Method of Constructing and of Graduating Mortality and other Tables: G. King.

TUESDAY, DECEMBER 15.

ZOOLOGICAL SOCIETY, at 8.30.—A Hunting-trip to Thian-Shan, illustrated by Lantern-slides: F. Gillett.—Some Notes on the Muscular and Visceral Anatomy of the Batrachian Genus Hemisus, with Notes on the Lymph Hearts of this and other Genera: F. E. Beddard.—Description of a New Species of Lacerta from Persia: G. A. Boulenger, F.R.S.—Remarks on Some Wart-hog Skulls in the British Museum: Dr. Einar Lönnberg.—On two Chinese Serow Skulls: R. Lydekker, F.R.S.—Warning Coloration in the Musteline Carnivora: R. I. Pocock.—On a New River-crab of the Genus Gecarcinucus, from New Guinea: Dr. W. T. Calman.—The Duke of Bedford's Exploration of Eastern Asia. XI., On Mammals from the Provinces of Shan-si and Shen-si, Northern China: Oldfield Thomas, F.R.S.

FARADAY SOCIETY, at 8.—The Redetermination of the Electrolytic Potentials of Silver and Thallium: Dr. F. J. Brislee.—The Heats of Combustion of Aluminium, Calcium, and Magnesium: F. E. Weston and H. R. Ellis.—The Formation of Graphite by the Interaction of Magnesium Powder and Carbonates: H. Russell Ellis.—Colloidal Barium Sulphate: Dr. E. Feilmann.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further Discussion*: The Rotherhithe Tunnel: E. H. Tabor.

ROYAL STATISTICAL SOCIETY, at 5.

WEDNESDAY, DECEMBER 16.

GEOLOGICAL SOCIETY, at 8.

ROYAL SOCIETY OF ARTS, at 8.—London Milk Supply from a Farmer's Point of View: Primrose McConnell.

ROYAL MICROSCOPICAL SOCIETY, at 8.—(1) A Workshop Microscope for the Examining of Opaque Objects; (2) A Simple Method of Illuminating Opaque Objects: J. E. Stead, F.R.S.—On Mounting Rotifers and Protista in Canada Balsam: Rev. E. Tozer.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Some Forms of Scientific Kites: E. S. Bruce.—(1) The Registering Balloon Ascents of July 27–August 1, 1908; (2) Balloon Observations at Ditcham, July 27–August 2, 1908: C. J. P. Cave.

THURSDAY, DECEMBER 17.

LINNEAN SOCIETY, at 8.—The Anomura of the Red Sea: W. Riddell.—Forms of Flowers in *Valeriana dioica*: R. P. Gregory.—Études sur les Cirrhipèdes du Cambridge Museum: Prof. A. Gruvel.—Rhynchota from the *Sealark* Expedition: W. L. Distant.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Electric Discharge and the Production of Nitric Acid: W. Cramp and B. Hoyle.

FRIDAY, DECEMBER 18.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Type-casting and Composing Machinery: L. A. Legros.

INSTITUTION OF CIVIL ENGINEERS, at 8.—High-power Water-turbines on Moderate Falls: R. Wolfenden.

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