THURSDAY, NOVEMBER 23, 1911.

HUMAN GEOGRAPHY.

Influences of Geographic Environment. On the Basis of Ratzel's System of Anthropo-Geography. By Ellen C. Semple. Pp. xvii+683. (New York: Henry Holt and Co.; London: Constable and Co., Ltd., 1911.) Price 4.00 dollars net.

THE influence of geology on that part of geography which deals especially with the forms of the earth's surface, and of mathematics on the measurement and representation of that surface, have given a definiteness and precision to the inorganic side of the subject which are less evident in the geographical study of man and of his relations to the region in which he dwells. In German the work of Ratzel has long furnished a basis for the scientific development of this part of the subject, and though his "Anthropologie" is rather a collection of brilliant essays than a logical and even treatment of this vast subject, its influence on subsequent workers has been far-reaching. In English such treatment of the subject in a scientific manner on a like scale has not been attempted, and the organic side of geography has been delayed in its scientific development here by its absence. Miss Semple's volume is therefore particularly valuable, especially as it is not simply a restatement of the principles embodied in Ratzel's work but comprises such amplification of some portions and abridgment of others as were necessary to make a more even presentation of the subject; at the same time as much evidence as possible of typical peoples of all races and all stages of cultural development living under similar geographical conditions has been incorporated.

A short account of geographical factors and influences serves as an introduction to the subject, in which the continuous operation of geographical conditions on man is shown, and their importance in the history of peoples is emphasised. These influences are classified into the physical effects of environment; the psychical effects, which are bound up in many physiological modifications, and help to differentiate peoples and races in point of temperament; the economic and social effects; and, lastly, the influence of the features of the earth's surface in directing the movements and the ultimate distribution of mankind. From this general statement of the scope of the subject illustrated by numerous instances from the history of peoples of all stages of development we pass to the results of environment as seen in general location; here the relations of a society or state to the land come first, since in geography a human group is not conceivable apart from the land on which it dwells.

Such considerations lead naturally to the more definite treatment of the geographical significance of environment in the bearings of geographical location, the influence of geographical area on its inhabitants, and the various types of geographical boundaries which exist. The examples which support and illustrate the treatment of these subjects are drawn from primitive races, semi-civilised peoples, and the civilised nations, from the races of the past as well as of the present, so as to show the importance of taking into account the stage of culture and world-relations when drawing deductions from the facts of geographical environment. The aspects of specific location are next discussed, and the part played by seas and oceans, rivers and lakes, by continents and islands, plains and deserts, mountain barriers and their passes is explained as influencing the distribution, development, and movement of the peoples inhabiting them. The people of the coast, island races, and mountain tribes are thus investigated in order to show the effects which have been produced on them by their environment.

In this way and with the aid of a full bibliography at the end of each chapter a very large amount of information relating to the influence of the earth's surface on its population has been collected and presented in a very convenient form. Definitions and systematic classification have been avoided intentionally from the conviction that the subject is being but gradually evolved, and has not yet reached a stage at which such can be usefully introduced, but some provisional efforts in this direction would have assisted the geographer who avails himself of the mass of material here provided and the original works to which he is referred. Precise description and quantitative treatment by recognised scientific method is much needed in this branch of geography, and Miss Semple has placed English-speaking geographers under a deep obligation by her scholarly treatment of the influences of geographical environment. It is for them now to carry forward the investigation into specific instances in order to determine the value of the different factors involved in each case, so that human geography may be as precise and definite in its methods and its results as the physical branch of the subject. To this end accurate and well-designed maps are of great assistance in representing the distribution of data, and we must regret that most of those in the present work are not satisfactory; the drawing is coarse and the scale is indicated by the lines of latitude and longitude only. Printed on suitable paper line blocks give excellent results, and looking at those which illustrate German text-books on this and other subjects, it is to be desired that they should be employed here to better advantage.

THE AMERICAN AND COUNTRY LIFE.

The Country-life Movement in the United States. By Prof. L. H. Bailey. Pp. xi+220. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1911.) Price 5*s.* 6*d.* net.

TO the untravelled Englishman, who still looks upon money-making and hustling as the natural habit of the American, the steady outflow of books from the United States dealing with the country and with country life comes as a great surprise. But those who have had the privilege of meeting the American in real life know that he, too, like the Englishman, has an inborn love of the country, which has not been killed off even by a couple of generations of town life, and is now asserting itself more than at any time in our previous history. Indeed, this

conscious love of country life so often (and sometimes so mawkishly) expressed, is perhaps one of the most significant of modern characteristics.

Two factors play a highly important part in the movement: the purely personal factor, a desire on the part of the individual to get away from the artificiality of the city into the green fields and the woods, and the social factor, a realisation that only by making the most of our natural resources and getting the greatest possible produce out of the land can the community be established on a sound basis. We may thus roughly divide the literature of the subject under two main headings. Several of Prof. Bailey's books deal with the second aspect of the problem; in the present he takes a complete survey of the whole field.

The country-life movement, he states, is the working out of the desire to make rural civilisation as effective and satisfying as any other civilisation. It is thus to be an end in itself, and not merely a way of raising more food, or of absorbing city undesirables, or increasing the price of land, although all these things may happen as secondary consequences. The Commission on Country Life appointed by President Roosevelt in 1908 was the first organised expression of the movement in the States, and it found that agriculture is not commercially as profitable as it is entitled to be, and that the social conditions of the open country are far short of their possibilities. Three great campaigns were recommended: a survey of rural resources; the organising of a nationalised extension work; and the inauguration of a general campaign of rural progress. All are, in Prof. Bailey's view, equally necessary; every rural community needs to have a programme of its own carefully worked out, and this programme should rest on a physical valuation. It is high time that this work was put in hand; much of the necessary information has been collected by the agricultural colleges, and in general men are available for carrying out these great constructive plans once they are evolved.

But some very clear thinking must first be done, and a good deal of confusion must be brushed away. Especially must we avoid one very common error—the idea that suburbanism and gardening constitute country life. It is to the development of the village, not as the suburb of a great city, but as the place where the inhabitants actually earn their livelihood, that Prof. Bailey looks for future progress. As a first step farming has to be made more profitable by eliminating non-effective charges (the middleman, according to Prof. Bailey, secures over 50 per cent. of the proceeds in some cases), and more power, political, social, and commercial, must be given to the village. Further, the village and city must not compete. "We can never again be a rural people. We want the cities to grow." But it is also necessary to impress upon the cities the fact that they stand to gain by having an efficient village society, a new social order evolved in the open country, to which every farmer must contribute his share. Whilst the tendency of the city is to make eight-hour men and clock watchers, this new society must aim higher, for its business is the struggle with nature and the conquest of the earth. E. J. R.

ELEMENTARY METEOROLOGY.

Weather Science: an Elementary Introduction to Meteorology. By F. W. Henkel. Pp. 335. (London: T. Fisher Unwin, 1911.) Price 6*s.* net.

IN elementary text-books of meteorology it is the custom to begin with a description of the action of common instruments like the barometer and thermometer, and of common facts like the apparent motions of the sun, and to continue the theoretical development as far as elementary mechanics and thermodynamics. Exigencies of space prevent a complete exposition, and it is found necessary to omit explanations at some stages. Unfortunately, authors almost invariably choose the later stages for the omissions; there they give merely the bald statement of facts, with little or no explanation. It would seem desirable to omit certain introductory matters which can be found in all elementary text-books on physiography or physics, and to reserve the space for a fuller treatment of the special problems of the atmosphere. In the book before us, the author describes in detail the apparent motions of the sun, but assumes that his readers understand the term "latent heat," and gives no explanation of the effect of change of pressure on moist air.

Nevertheless, Mr. Henkel has produced an interesting and readable book. He has quoted freely from authorities such as Abercromby, Scott, Waldo, Maury, and Inwards, and has, in some cases, added paragraphs and chapters giving a description of more recent work. The additions are not all as complete as could be desired, and they usually appear to be culled from isolated books and papers, producing a somewhat fragmentary result in places. Thus, a reference is made to Simpson's new theory of thunderstorms as it appeared briefly in NATURE, but other new theories are not mentioned.

Perhaps the most serious criticism that would occur to a reader is the almost complete absence of diagrams, and more especially of charts and maps. The book is by no means free from illustrations, but they are almost entirely reserved for instruments and cloud forms, the latter being particularly good. We doubt whether a reader new to the subject would understand clearly the verbal descriptions of the distribution of mean pressure, air and sea temperatures, and ocean currents; and the explanations of Buys Ballot's Law and of the types of pressure distribution are incomplete without illustrative examples.

The author has allowed himself to build up a complete story under the general heading of each chapter, irrespective of whether a part of the story appears elsewhere in another connection. Thus, Buys Ballot's law is stated no less than three times in three different chapters. The reiteration of the fundamental law of dynamical meteorology has its advantages, but other repeated statements are open to question. Among these is one affirming that rain in mountainous districts is due to the cooling effect of the summits on the warm moist air passing over them. Meteorologists are not yet agreed as to whether a mountain peak is in general cooler than the surrounding air, but even allowing a considerable temperature difference,

the dynamical cooling due to the forced ascent of the air and consequent reduction of its pressure is a more effective rain-producing agent.

We have noted a few misprints and mis-statements, but in general the principles as stated are sound. The book is well printed on good paper, and there is a useful index; but the binding of the copy that we have has already given way. R. C.

A GARDEN OF HERBS.

The Herb-Garden. By Frances A. Bardswell. Pp. viii+173+plates. (London: A. and C. Black, 1911.) Price 7*s.* 6*d.* net.

ONE of the most delightful charms of old English gardening must have been due to the numerous sweet-smelling and aromatic herbs that were commonly cultivated around the homesteads. The very earliest records of gardening were supplied us by the ancient herbalists who cultivated their simples for medicinal purposes or for the pretty sentiments and conceits that legend had associated with them, but there is sufficient evidence that the herbalists took pleasure in their plants for the further reason that many of them possessed the qualities of beauty and fragrance. As we read Gerarde and Parkinson or Culpepper, we seem to breathe the atmosphere of the herbalist's garden, laden as it was with the delightful perfumes of lavender, balm, rosemary, southernwood, and many other plants the names of which are scarcely known to modern gardeners, much less their distinctive qualities.

The comparative neglect of the herbs which fire the enthusiasm of the author may be traced to a feeling allied to contempt, directly due to the fact that modern medical science has exposed the fallacious character of the beliefs formerly entertained in respect to their healing qualities. The contempt was natural enough, although unscientific and illogical, as is the case with most things which are merely the results of reaction. We are only just beginning to realise that, even when it is admitted that the garden simples are not "heal-alls," yet they have a wonderful interest for those who care to study them and admit them to their gardens.

At this point Miss Bardswell's book comes to show how we may make the most of the herbs from the point of view of the decorative gardener. It convinces the reader that many of the species have claims which should entitle them to every consideration—fragrance, romance, and economic value in the kitchen, still-room, and nursery. The pictures by the Hon. Florence Amherst and Miss Forrest are a pretty feature of the volume, and they greatly assist the author in presenting her case, for they show that, if but few of the sweet herbs possess such brilliant flowers as, for example, the bergamot, nevertheless many of them are sufficiently decorative to provide charming subjects for the artist's brush. And what about their cultivation? The author gives all the information necessary for any novice who wishes to engage in their culture. There are directions for planting, propagation, harvesting, and drying, with other details. We have known many cases where herbs were given a prominent place in the garden, and every care expended on their cultivation, but they were not utilised indoors, as they might be, because there appeared to be a lack of knowledge as to the time proper for cutting them and the care they require until they are perfectly dry.

The first things to consider in the formation of a herb garden are what site to choose and what style to make the beds. The author has something to say on these matters, but she is not inclined to be rigid in her recommendations. Beyond insisting upon the necessity for sunshine, she does not lay down rules as to the form of beds, she pleads for the cultivation of the herbs and is content if they are planted in beds or in ordinary flower borders, remarking that one of the best collections of herbs she has seen was grown in a kitchen garden. For ourselves, the interest we have in the plants is partly for their fragrance but equally for the sentiment that belongs to them in the legends. Consequently we admire them most when they overlay the confined borders of the narrow and oblong beds in the old English garden, with paved paths on which the thyme and other low-growing species find homes in the soil between the flags, the whole surrounded with venerable walls supporting old-fashioned climbers, including the fragrant myrtle, honeysuckle, and other species reminiscent of a long-past age. Such a garden we saw quite recently in North Wales, where the lavender bushes were three feet high and as much through.

PHYSICAL CHEMISTRY FOR THE GEOLOGIST.

Vorlesungen über die chemische Gleichgewichtslehre und ihre Anwendung auf die Probleme der Mineralogie, Petrographie, und Geologie. By Prof. R. Marc. Pp. vi+212. (Jena: Gustav Fischer, 1911.) Price 5 marks.

IN this little volume Prof. Marc gives the substance of a course of lectures delivered at the University of Jena, dealing, as the title announces, with the theory of chemical equilibrium in its application to mineralogical and geological problems. We gather from the preface that these lectures were addressed to students not previously acquainted with the modern developments of physical chemistry. It is to be presumed that the material has undergone considerable condensation for the purpose of publication, for a student in this situation must read very closely if he is to obtain the full benefit of the book before us. He will be aided by the simplicity of the general plan, and by the author's clear method of presentation, while the numerous well-chosen references will enable him to pursue farther any particular part of the subject.

The first lecture treats of the general conception of chemical equilibrium, and the second introduces the reader to the law of mass action and the phase rule. The next two lectures deal with the conditions of equilibrium in systems of one component, the illustrations being drawn so far as possible from cases which are of importance to the geologist. Thus the dependence of melting-point on pressure is considered with special reference to the case of ice. Polymorphism

in the mineral kingdom is discussed, and a list of examples given, which might be considerably enlarged. Three lectures are devoted to two-component systems, introducing the subjects of solution and solid solution, and discussing the crystallisation of silicate-magmas of ideal binary composition. Next we come in due order to three-component systems, which are treated less fully than might be expected. The author makes a bold attempt to construct a diagram for the system silica-lime-magnesia by combining data drawn from various sources. He does not allude, except in a passing reference, to Schreinemaker's work. The important case of an aqueous solution containing several components receives due notice, and the results of van 't Hoff's researches on the crystallisation of marine salts are given at some length. A lecture on surface energy in its application to geological phenomena contains much interesting matter. Joly's work on sedimentation is not cited, but there is an account of Schade's curious researches on the oolitic structure. In the final lecture, dealing with cosmology and vulcanology, the author has permitted himself some latitude of speculation, and some of his remarks are at least open to debate.

The book will serve as a very useful guide to chemical geology. Its information is in general well up to date, though a few exceptions may be found; for instance, Shepherd and Rankin showed two years ago that the high-temperature form of silica is not tridymite but cristobalite. A. H.

FEEBLE-MINDED CHILDREN.

(1) *The Feeble-minded: a Guide to Study and Practice.* By Dr. E. B. Sherlock. With an introductory note by Sir H. B. Donkin. Pp. xx+327. (London: Macmillan and Co., Ltd., 1911.) Price 8*s.* 6*d.* net.

(2) *Feeble-mindedness in Children of School Age.* By Dr. C. P. Lapage. With an appendix on Treatment and Training by Mary Dendy. Pp. xiv+359. (Manchester: University Press, 1911.) Price 5*s.* net.

THESE two books are in a sense complementary of one another, the former being a work which might easily be of interest to the general reader, and will certainly be a useful help to those who are engaged in the care of the feeble-minded, while the latter is essentially a scientific book in which idiocy and imbecility are treated from a more academic point of view. Both works take full advantage of the information obtained by the Royal Commission on the Care and Control of the Feeble-minded, which was appointed in 1904 and concluded its work in 1909.

(1) Dr. Sherlock's book has seventy pages devoted to a brief account of the nature of mind and its physical basis. The two chapters, though brief, give a very good working foundation for the study of mental deficiency. Then follow another sixty-four pages on the nature of the "feeble mind" and its physical basis, including discussions and illustrations of such conditions as microgyria, porencephaly, irregularity of the convolutions, &c. There is also a description of changes in the dura mater, skull cap and scalp and of the various deformities commonly known as the physical stigmata of degeneration.

The chapter on "Causation" is excellent and, *inter alia*, compresses into a short space all the chief views which have been held in modern times as to the nature of heredity.

Dr. Sherlock introduces a new classification of the varieties of idiocy which coincides for the most part with former classifications, but there are some new words which display his known tendency to eschew consonants from his neologisms. The "ateleiotic forms" are the "minds in miniature" without abnormal development of any one faculty, such as occurs in some idiots. The hypertrophic sclerosis of Bourneville receives the new name "epiloia" which includes the author's cases formerly comprised by his term "anoia." All the paralytic cases are grouped together under the name of "plegic forms" and there is a separate group of "residual forms" in which are included presumably all the rarest forms of idiocy. The author does not make any separate group for epileptic idiots inasmuch as he regards the occurrence of fits as accidental to all varieties of idiocy and insufficient to warrant a separate clinical group, however convenient for practical purposes.

The work concludes with a very clear chapter on the handling of the feeble-minded, the way in which they may be placed under care, legal relationships, mental and physical examination, mental and physical training, craftsmasters, craftsmistresses, &c.

(2) Dr. Lapage's book, so far as practical relationship of the feeble-minded is concerned, is based upon experience at the Sandlebridge Colony for the Feeble-minded, and there is an appendix by Miss Mary Dendy, honorary secretary of the Lancashire and Cheshire Society for the Permanent Care of the Feeble-minded, on the treatment and training of these patients.

Her chapter, in common with the rest of the book, is very well arranged under the headings of admissions, food, dress, dormitories, bath-rooms and lavatories, wardrobes, dining- and day-rooms, kitchen utensils, school, work, games, hospital and sick-rooms.

Naturally the treatment of the subject by Dr. Lapage falls under similar headings to those of Dr. Sherlock. There are chapters on the statistics of the subject, on the physical and mental characteristics of the patients, diagnosis and prognosis, &c.

Four chapters are devoted to the condition of the brain in feeble-mindedness and on its causation by inherited and acquired factors.

To the general practitioner an appendix giving a list of institutions for the mentally defective, including asylums, homes, colonies, and schools, will be found exceedingly useful, seeing that mental deficiency is so very common, and the provision for patients suffering therefrom so small and so little known. There is a very good chapter on the defects of speech.

From both the above books we learn that feeble-mindedness is an incurable condition and that the only hope for such patients lies in institution care. The patients can be trained to become useful in handiwork and capable of earning their own living,

but they are incapable of competition in the outside world, and require constant and skilled supervision. There is a large amount of accommodation for these patients, but, as already said, it is too small for the numbers to be found in this country. Those in charge of institutions for the feeble-minded will find a great deal of help in their management and treatment in the book by Dr. Lapage, and they will find considerable interest added to their work if they study these patients in a scientific spirit on the lines laid down by Dr. Sherlock.

ELEMENTARY MATHEMATICS.

(1) *A First Book of Geometry.* By J. V. H. Coates. Pp. xi+142. (London: Macmillan and Co., Ltd., 1911.) Price 1*s.* 6*d.*

(2) *A School Algebra.* Part ii. By H. S. Hall. Pp. vi+301–450+xxxix–l. (London: Macmillan and Co., Ltd., 1911.) Price 1*s.* 6*d.*

(3) *Theoretical Geometry for Beginners.* By C. H. Allcock. Revised and rearranged. Part i., pp. xii+125. Parts ii.–iv., pp. xii+204. (London: Macmillan and Co., Ltd., 1911.) Price, part i., 1*s.* 6*d.*; parts ii.–iv., 2*s.* 6*d.*

(4) *A New Trigonometry for Schools and Colleges.* By the Rev. J. B. Lock and J. M. Child. Pp. xii+488. (London: Macmillan and Co., Ltd., 1911.) Price 6*s.*

(5) *Solid Geometry.* By C. Godfrey, M.V.O., and A. W. Siddons. Pp. ix+109. (Cambridge University Press, 1911.) Price 1*s.* 6*d.*

(6) *Engineering Descriptive Geometry: a Treatise on Descriptive Geometry as the Basis of Mechanical Drawing, explaining Geometrically the Operations Customary in the Draughting Room.* By Commander F. W. Bartlett and Prof. T. W. Johnson. Pp. vii+159. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1910.)

(7) *Trigonometría Esférica.* By Prof. C. Wargny. Pp. 219. (Valparaiso: Talleres Tipograficos de la Armada, 1909.) Price 6 dollars.

(1) THE object of this small text-book is to give the reader a sound appreciation of the fundamental ideas of geometry, rather than a systematic knowledge of its theorems. Without doubt this is the best way of approaching the subject. As soon as an intelligent grasp is acquired of such concepts as angles, parallelism, areas, &c., it is a simple matter to take a theoretical course; but without this preliminary stage, not only is progress very slow, but the work is in itself of little educational value. Part i., which occupies one-quarter of the book, is entirely practical; part ii. contains a selection of the important theorems of Euclid, I., III., with a large quantity of numerical exercises; it is, in our opinion, unfortunate that few riders have been inserted.

(2) The second part of this book carries the reader up to the binomial theorem. A change from the customary order has been made by taking a first course of progressions immediately after quadratics. As is to be expected of so well known an author, the quality of the workmanship is excellent throughout. The explanations in the text are clear and concise, and the examples have evidently been selected with great care.

(3) In spite of the title of this book, which is a revised form of an older edition, practically no work on experimental geometry has been included. After an introduction of twelve pages on definitions, axioms, postulates, &c., the reader is at once immersed in the theoretical work. The course of theorems given agrees fairly closely with the Cambridge schedule, with a few additions. Each proposition or group of propositions is followed by a number of riders, of which only a few are numerical. We are unable to find any very novel or distinctive features in this text-book.

(4) This volume is designed for the use of candidates for scholarships at the universities, and is intended to form an introduction to the more advanced parts of Dr. Hobson's standard work on the subject. Although it assumes no previous knowledge of trigonometry, the earlier portions are scarcely sufficiently full for the novice in view of the modern idea of taking the subject at a very early stage in the school course. For introductory purposes, some such book as Mercer's "Trigonometry for Beginners" is more useful. But after this preliminary stage is covered, it is well for the student to revise this work once more in such a form as is provided by this text-book. Practical applications are fully treated, and there is an abundance of numerical and graphical work. One important change has been made in the sequence of subjects. The applications to the geometry of the triangle and quadrilateral have been deferred to the closing chapters, thus avoiding any break in the presentation of the purely analytical work. The sections on geometry are far fuller than usual, and indeed contain more than the ordinary boy is likely to require or be able to digest. This is, however, a matter for each individual teacher. We are glad to find a full treatment of the geometrical interpretation of imaginary quantities; the interest which the student takes in this kind of work and the stimulus it applies to his mind more than justify the expenditure of time involved. The general theory of infinite series and products is regarded as beyond the scope of the book, but sufficient is said to justify the validity of the use of those particular series and products met with in the course of the work. Hints for the solution of the more difficult questions are included among the answers.

(5) In spite of recent geometrical reforms, the attention paid to three-dimensional geometry is still, to say the least, inadequate. Time does not allow of a course on the lines of Euclid XI., nor would this be particularly beneficial. What is required is an informal study of the ideas and practical applications of solid geometry; and this is supplied in an excellent and brief form by the work before us. The authors have had a great deal of experience in this direction, and it is not therefore surprising that this small book should seem so admirably adapted to the purpose for which it is intended. It falls into three sections: (1) a discussion of the main properties of lines and planes; (2) the properties and mensuration of the principal solids; (3) the elements of practical solid geometry. The examples are chiefly numerical, but a sufficient

number of riders has been included to test the student's grasp of the theory.

(6) The treatment in this volume is practical rather than mathematical, and is designed for the use of those taking a course in mechanical drawing. Elementary in character, it provides a thorough introductory account of the subject. The first chapter considers in great detail the nature and meaning of orthographic projection, using three planes of reference. Next an account is given of the projection of a straight line and the method of obtaining the true length of a line in space. After this follow successively the treatment of the intersection of planes, curved lines, and surfaces, and the traces of lines and planes with various applications, and the book closes with a description of isometric projection. The excellence of the diagrams is a feature which calls for special remark. The explanations are clearly put, and the work is so arranged that no special mathematical ability is required.

(7) The absence of spherical trigonometry from the ordinary school syllabus is both surprising and unfortunate in view of the practical applications which may be made; nor can this omission be excused on the score of difficulty, since the analysis is scarcely more difficult than that of the corresponding work in plane trigonometry. The explanation, of course, lies in the fact that it is at present excluded from the schedule for university scholarships. The book before us contains in a rather unduly elaborate form the kind of course which might be incorporated in a school programme. After a preliminary discussion on spherical triangles, the methods for solving right-angled triangles are first explained, and then the general case of oblique-angled triangles is considered. Great care is taken to explain the best way of arranging the work in numerical examples. The concluding chapters of the book give applications to geometry, astronomy, and navigation. Theory is throughout subordinated to practice, and those who require a comprehensive working knowledge of the methods of this subject cannot do better than read through this book.

OUR BOOK SHELF.

L'Évolution de l'Électrochimie. By Prof. W. Ostwald. Translated by E. Philippi. Pp. 266. (Nouvelle Collection scientifique: directeur, Émile Borel.) (Paris: Félix Alcan, 1912.) Price 3.50 francs.

THE evolution of electrochemistry affords probably one of the most interesting chapters in the history of the progress of chemical knowledge. Since the birth of this branch of chemistry may be regarded as dating from the discovery of so-called voltaic electricity, the period covered by its history is limited to a little more than a century. The comparative shortness of this period has certain obvious advantages, and the many discoveries of fundamental importance made by investigators in the field of electrochemistry, as well as the development of theoretical knowledge relating to the nature of and connection between electrical and chemical energy afford particularly attractive material for an historical study.

The account presented by Prof. Ostwald, who may be legitimately regarded as the greatest authority on the subject, is admirable in every way, and a more fascinating description of the development of a branch of science cannot well be imagined. The subject-matter and mode of treatment is indicated sufficiently by the titles of the sections into which the text is divided, viz.: (1) introduction; (2) prehistory; (3) Galvani and Volta; (4) Ritter and Davy; (5) from Faraday and Daniell to Hittorf and Kohlrausch; (6) electromotive forces; (7) the beginning of technical electrochemistry; (8) van 't Hoff and Arrhenius; (9) the ionists; (10) modern electrochemical industry; (11) the electron. In this final chapter a very brief but well-written account is given of the results attained in the investigation of the conductivity and the ionisation of gases, which results have given so much impetus to the development of the electron theory.

Much of the material collected and condensed in this little volume is to be found in Ostwald's compendious treatise on "Elektrochemie," published in 1896. This book, largely on account of its size, is comparatively little known amongst students of physical chemistry, and the appearance of a smaller work is therefore in itself an event of some importance.

The Life and Love of the Insect. By J. H. Fabre. Translated by A. T. de Mattos. Pp. x+262. (London: A. and C. Black, 1911.) Price 5*s.* net.

SEVERAL translators have already drawn from the abundant well of Fabre's entomological studies, and the volume before us is a pleasant addition. We like the grateful tribute to the veteran which the preface pays, and the quotation from Maeterlinck in regard to this "Insects' Homer," "who is one of the most profound and inventive scholars and also one of the purest writers, and, I was going to add, one of the finest poets of the century that is just past."

The book tells us of the sacred scarabee supremely inspired by the instinct of maternity to wonderful industry and not less wonderful art; of the Spanish Copris which kneads a large loaf and divides it into pills, one for each egg; of the common dung-beetles (Geotrupes), who belong to the public health service, and are often deservedly decorated; of *Minotaurus typhaeus*, a black beetle of the sheep's pasturage, who burrows and bakes, and even makes sausages; of the ringed Calicurgus, which first stings its captured spider in the mouth, paralysing the poison fangs, and then, safe from being bitten, drives in its poisoned needle with perfect precision at the thinnest part of the spider's cuticle between the fourth pair of legs; of the leaf-rolling Rhynchites, which spends the whole day in making an inch-long cigar with eggs between the layers of the scroll; and of the mother of the Halictus bee family, who becomes in her old age the portress of the establishment, shutting the door with her bald head when strangers arrive, opening it by drawing aside when any member of the household appears on the scene. And so the stories run, full of dramatic situations and romantic interest. We know not which to admire the more, Fabre's style or his eyes. The translator has given us a fine rendering, which reads like the original.

(1) *Aids to Bacteriology.* By C. G. Moor and Wm. Partridge. Second edition. Pp. viii+240. (London: Baillière, Tindall, and Cox, 1911.) Price 3*s.* 6*d.* net. Paper, 3*s.*

(2) *Aids to Pathology.* By Dr. H. Campbell. Second edition. Pp. viii+228. (London: Baillière, Tindall, and Cox, 1911.) Price 3*s.* 6*d.* net.

THESE two little books contain a large amount of information in a small space. Neither professes to be more than an outline of the subject of which it treats, but both seem to be successful in their aim—that of acting as epitomes for the student and practitioner.

(1) The bacteriology treats of bacteriological methods, pathogenic bacteriology, and bacteriology as applied in hygiene in the examination of water, milk, foods, disinfectants, &c. A few slips need correcting—*e.g.* the statement that an antibody consists of two parts (p. 19)—and the Wassermann reaction needs amplifying somewhat; otherwise there is little to criticise, and some portions of the book are particularly good, *e.g.* the section on disinfectants.

(2) The pathology suffers somewhat from the attempt to include everything in so small a book—*e.g.* diseases of the teeth and parasitic worms—and other more important and fundamental processes are in consequence too briefly discussed. Fatty infiltration and degeneration are treated as though they are quite distinct. It is stated that active immunity is conferred by the injection of an anti-serum, whereas it is correctly stated a couple of lines later that this procedure confers a passive immunity. The diagrams indicating the interaction that occurs in the Wassermann reaction should render this subject clear.

R. T. H.

Senior Chemistry. By Dr. G. H. Bailey and H. W. Bausor. Pp. viii+509. Price 4*s.* 6*d.*
Senior Magnetism and Electricity. By Drs. R. H. Jude and J. Satterly. Pp. viii+446. Price 5*s.*
Senior Heat. By Drs. R. W. Stewart and J. Satterly. Pp. viii+300. Price 3*s.*
(London: W. B. Clive, University Tutorial Press, Ltd., 1911.)

ALL these books are based upon previous volumes issued by the same publishers. The first is an adaptation apparently of Dr. Bailey's "Chemistry for Matriculation," which was reviewed in our issue of May 11, 1911 (vol. lxxxvi., p. 345); the second of Dr. Jude's "Matriculation Magnetism and Electricity," noticed in these columns on June 23, 1910 (vol. lxxxiii., p. 485), and the third of the late Dr. Stewart's book on heat, noticed at the same time as the volume on magnetism and electricity referred to.

It would seem that the present volumes cover those parts of the respective subjects included in the syllabuses for candidates presenting themselves at the Senior Local Examinations conducted by the University of Cambridge.

Fifty Useful Metric Equivalent Tables. (London: The Central Translations Institute, n.d.) Price 6*d.* net.

PROVISION is made in these tables for the range of equivalents likely to arise in commercial dealings between this country and others using the metric system. The calculations are based upon figures supplied by the Board of Trade. The price equivalents deal with feet, yards, square feet, square yards, cubic feet, gallons, pounds avoirdupois, hundredweights, and forty cubic feet measurements—which are useful for checking freight charges. The prices are calculated at the rate of exchange of 25.22 francs to the £.

A Handbook of Physics and Chemistry. By H. E. Corbin and A. M. Stewart. Pp. viii+519. Fourth edition. (London: J. and A. Churchill, 1911.) Price 7*s.* 6*d.* net.

THE first edition of this book was reviewed in NATURE of January 4, 1900 (vol. lxi., p. 221). It will suffice to say that in its present form the volume covers the extended syllabus of work required for the first examination of the Conjoint Examining Board of the Royal Colleges of Physicians and Surgeons. Additional articles have been introduced in the present edition on hydrostatics, the polarisation of light, and Röntgen rays.

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.]*

Electricity and Vegetation.

WITHOUT pretending to answer the question raised by Mr. Benham at the conclusion of his letter on p. 41 of NATURE of November 9, and without prejudging the results of recent experience on electrification of crops as reported on by Dr. Priestley and other impartial investigators, I would remind him and your readers generally that it is unsafe to attach a positive conclusion to a negative result obtained by supposed electrification of a wire network over a field, unless there is reasonable guarantee that such network was really kept positively electrified during considerable periods.

For instance, it has been attempted in the past, and it is still tempting, to supply electricity to a network by means of elevated spikes, arranged so as to utilise the gradient of potential naturally existing in the atmosphere. But think what singularly perfect insulation would be required to enable electricity slowly supplied in this way to accumulate until a fizzing point was reached. The attainment of such potential over a large area would in this climate be quite impracticable except when a thundercloud was passing overhead.

The same difficulty of adequate insulation must have militated against many attempts made in the past to supply electricity from artificial but old-fashioned high-potential sources, especially when the area to be supplied extended over many acres.

It must be further remembered that any metallic network not really charged, but kept practically at zero potential by leakage to earth, would be presumably detrimental to the growth of plants beneath it; inasmuch as it would tend to screen them from the natural inductive electrification to which they are entitled.

OLIVER LODGE.

Fish and Drought.

THE summer of the year 1911 will long be remembered for its excessive heat and dryness. These were especially trying to the inhabitants of streams and shallow lakes or ponds. I had the opportunity of studying a remarkable instance of this, which I think is worth recording.

The Château of Marchais, with its magnificent domain, the property of the Prince of Monaco, lies about 16 kilometres east of Laon, in the department of Aisne, and is well known as one of the best shooting estates in France. The sketch (Fig. 1) represents the park. It occupies a rectangle surrounded by a ditch or moat, A, B, C, D, consisting of four canals, each 1250 metres long and 16 metres wide, and carrying usually a depth of 1½ metres of water. These canals form a continuous sheet of water, 5 kilometres long, and there is a bridge, *a*, *b*, *c*, *d*, over each of them. The country, though well-wooded, is flat and peaty, and the level of the water in the ditch is that of the water in the ground all round it. Like the ground-water, it is subject to rise and fall according to the wetness or dryness of the season.

When I arrived on the morning of September 29, I observed that the ditch was quite dry, with the exception of the small tank or enclosure (*f*) for ducks at the lodge known as the Porte Rouge, where entry to the park is obtained over the bridge marked (*b*). Yet the water of the ditch is always full of fish, principally carp, tench, perch, and pike. Now there was nothing but dry mud. *With the water the fish had entirely disappeared, and without leaving a single dead one to mark where they had before abounded.*

On the evening of September 29 a violent storm of wind and rain broke, and it raged over the whole of northern Europe until October 1. I was curious to see the effect which this first important rain, which marked the breaking of the drought, would have on the ditch.

It is right to say that the full significance of the dryness of the ditch and the absence of dead fish had not sufficiently impressed me. I only felt that I was witnessing a

remarkable occurrence in nature and it excited my curiosity, but at first this curiosity went very little beyond considering how long it would take for the water to get back. With only this in my mind, I went round the park on the afternoon of September 30, when the weather had moderated a little, and I found that pools of water had begun to collect in places in the ditch, but I did not examine them, and I arrived at the conclusion that a little steady wet weather would soon fill the ditch up again.

On October 1 the weather was still very bad, but between the showers I took a walk along the margin of the ornamental water (*h*) on the west side of the château (*k*), which is connected with the south canal of the moat. A pool of water had collected here, and there was quite a quantity of small fish, not more than 10 or 12 centimetres in length, swimming about in the water, which did little more than cover its muddy bottom to a depth of at the most 4 or 5 centimetres, in which these small fish were able to swim. I noticed that the water was turbid and that the mud was

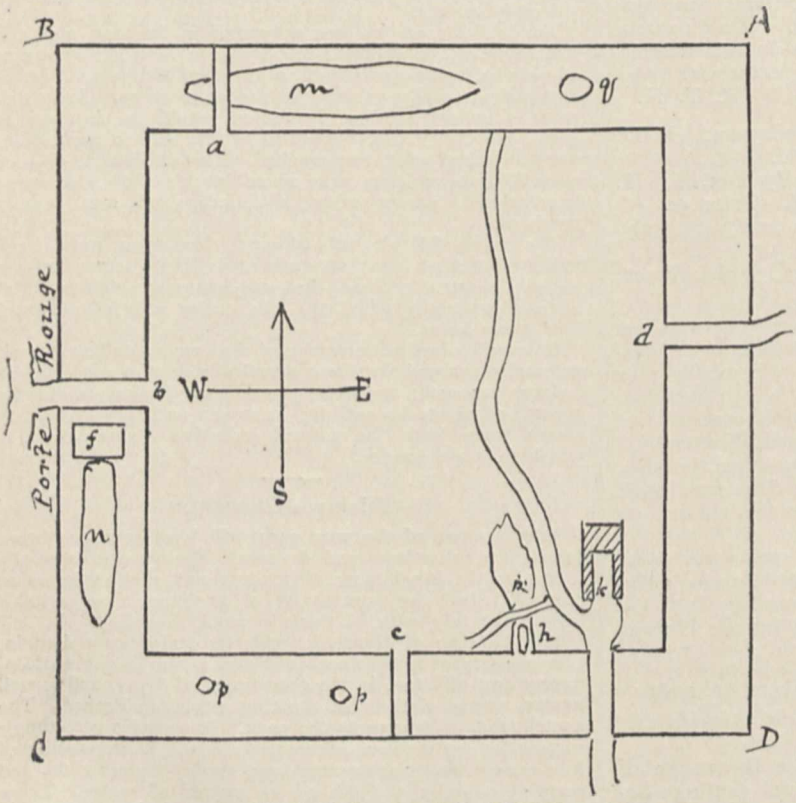

FIG. 1.—Sketch Plan of the Park of Marchais.

everywhere being stirred up by the fish. They were darting hither and thither, being disturbed by my presence on the bank, and, whenever they altered their course, they contrived to raise a dense cloud of mud, in which they were able for a short time to conceal themselves from view.

Two days before these fish were invisible, and now they had reappeared in an isolated shallow pool, which also had no existence two days before. *It was evident that all these fish had been covered by the dry mud, and must have released themselves the moment they thought there was enough water for them to swim in.* There was not by any means too much water for the crowd that was moving about in it. I was fascinated by what I saw, especially as it seemed to be in every way likely that the process of release was still going on. But the release of a buried fish would be sure to be accompanied by a cloud of mud, which could not be easily distinguished from that produced by a fish already in freedom and swimming about. Still, considering the shallowness of the water and the very favourable position for following everything that went on in it which I occupied on the bank, I was convinced that there would be some noticeable difference between the two classes of cloud, and I was not mistaken. After waiting and watching for some time, I saw a mud-cloud rise in the very shallow water, bringing a fish with it to the surface belly upwards. It lost no time in righting itself and swimming away with the others. A living fish can adopt this attitude only when it has not got full control over its movements, and this is pretty sure to be the case at the moment when it releases itself from burial. By waiting a little longer I witnessed two or three repetitions of this remarkable act.

In a pool such as that which I had under observation, in which the water was not more than two or three centimetres deep, the liberated fish reaches the surface almost as soon as it quits the bottom. In any case it is highly probable that the fish would arrive at the surface before it had fully seized the situation, and the nervous impulse had arrived at the muscles and started them in their righting and locomotive activity.

In water a very little deeper it is probable that the fish would be able to right itself before floating clear of the cloud of mud produced by its struggles in the act of self-exhumation.

In the afternoon I went round the park, and found an extensive pool (*m*) which had collected in the north canal and occupied its western half. There were great shoals of fish, principally perch, darting about, and, in their alarm at being surprised in unusually shallow water, stirring up clouds of mud everywhere. Amongst them was one large pike, quite 40 centimetres in length. The water shoaled off to nothing at both ends of the pool, and in the middle it was perhaps 30 centimetres deep. The pool was far too long to be watched like the smaller one, and I was not able to observe any individual release from the mud. However, I noticed that, with the exception of the large pike, the fish were all small; I estimated them to be not more than 10 to 12 centimetres long.

From the western end of this pool, round the north-west corner and along the western canal to the bridge (*b*), at the Porte Rouge, the canal was quite dry. At the Porte Rouge there was the small enclosed tank for ducks (*f*), and beyond it the canal was again dry. The bottom of this canal does not consist of the fine mud which is found in the north canal; it is hard, sandy, and marly, and there was no sign of life in it anywhere. The same class of bottom with absence of life prevailed in the south canal.

On October 2 the weather had improved, although it was very cold, and I studied the canals both in the morning and the afternoon. In the large pool in the north canal I found the quantity of fish augmented, and I especially noticed that there were many more large fish present than before, and the average size of the fish was decidedly greater than on the previous day; perch of at least 20 centimetres in length were present. The bigger fish had probably started to bury themselves earlier than the smaller ones, and had buried themselves deeper. I saw the big pike of the day before, and two others of the same species, but very much smaller, had appeared. *One dead perch was floating in the pool, the first dead fish that I had encountered.* In the afternoon it seemed to me that the average size of the fish in the pool was still on the increase. The west and north canals presented the same appearance as before.

On October 3 the weather kept fair but cold. I went round the park and found the big pool in the north canal much the same as on October 2, the number of large perch having apparently increased, but there was no new feature of importance. In the course of my tour, after passing the Porte Rouge, I found that the part of the west canal south of this lodge had begun to collect water, which already covered the bottom, forming a pool (*m*), extending to within a short distance of the south-west corner. Under the

water, which was perfectly clear, the light grey bottom was still cracked and apparently unsoftened, and there was not a trace of life of any kind. In the south canal the bottom was generally dry, with, however, every here and there pools of water measuring about one metre across, and in these also there was no trace of life. I learned that anglers never fish in these canals, because they know that they will catch nothing.

In the afternoon I revisited the north canal, and instead of following the big pool westwards, which promised nothing new, I turned to the right and followed it eastwards towards the north-east corner. I had not gone very far before I encountered a phenomenon of which I had already perceived the possibility, namely, *a premature resurrection resulting in widespread death.* This part of the canal was apparently dry, in the sense that the bottom was exposed to the air, but nevertheless moist enough to be called wet. Owing, probably, to a slight general rise of the ground-water of the neighbourhood, enough water had been able to filter through the mud of the bottom and to rise to the surface and overflow, producing a very shallow pool (*q*), not more than 2 or 3 centimetres deep or more than a metre across. The wetting of the mud below by this infiltration must have aroused the sleepers, who then all started to rise at the same time. But when they released themselves from the mud there was not enough water to float them all, and a formidable struggle for existence was going on at the time of my visit, and the quantity of dead and dying fish lying all round the edges of the pool furnished sufficient evidence of its fierceness. The poor fish would no doubt have willingly re-buried themselves and so saved their lives when they perceived their mistake, but the stronger ones, which were in possession of the only part of the pool which could be called liquid, kept shouldering them outwards on to the mud, where they died in the air. When I left the struggle was still going on, and it looked as if the level of the water was falling, so that it is unlikely that many, if any, would be able to retrieve their mistake by burying themselves again. As I left for England the next morning I was not able to continue my observations.

Although the years vary much as regards humidity, and in dry summers the supply of water in the ditch has often fallen to a pretty low ebb, I was informed that the last time that the ditch became quite dry was in the year 1814, almost a hundred years ago; therefore *the experience of the summer of 1911 must have been a new one for all the fish in the ditch, yet the general manœuvre of protective burial was carried out without a casualty.* In order to accomplish this a fine instinct was necessary to perceive the impending drying up of the canal, and then commence the operation betimes so as to finish it before desiccation was complete.

It must be remembered that the area of canal having the muddy bottom, which alone is capable of receiving them, is very restricted; and from the number of fish that came out of it in the short time that I was observing they must have been packed very closely, and in such an orderly way that, with the return of water in sufficient quantity, they were able to take to it again apparently without having suffered at all.

Although the instinct of the fish seems to have sufficed to make them foresee and provide for the dryness, it does not seem in all cases to have been sufficient to enable them to judge correctly the right moment for beginning their release.

Of the different species which inhabit the waters of the ditch, the carp and the tench have the habit of burying themselves in the mud every winter; but the perch and the pike have not this habit; both can be caught at any time in winter, even under a covering of ice; yet both the pike and the perch must have buried themselves with quite as much skill as the carp or the tench.

But in a climate like that of this part of France shallow lakes and ponds may suffer shortage of water by congelation as well as by evaporation; and the Prince informed me that he remembered one winter when in many places the water of the ditch was frozen almost, if not quite, to the bottom, and quantities of pike and perch were frozen into the ice. This form of desiccation did not prompt them to seek refuge in the mud.

It is evident that if the summer of 1911 had marked the beginning of a secular period of dryness, such that the canals were not again to be flooded, the fish which took to the mud in that summer would be kept there. They would die and decay *in situ*, and would be perfectly preserved in well-arranged though crowded masses. Eventually, if the change of climate was final, they would form a rich and interesting bed of fossil fishes. But the interest would depend not only on the abundance of fossils in the muddy matrix of one part of the trough-like formation; it would be intensified by their complete absence in the hardened marly matrix of the other part.

Before serious drying took place the ditch, or trough, was covered by a continuous sheet of water in which the fish and other creatures could circulate freely to all parts. So soon, however, as actual desiccation appeared to be imminent, the fish must have concentrated themselves in a body over the districts of muddy bottom in which they knew they could take refuge as a last resort. *When desiccation was complete every fish in the ditch, without a single exception, had succeeded in burying itself in one or other of these restricted areas of mud. Not one of them appears to have made the mistake of seeking refuge in the marly bottom.* When completely dry the ditch, or trough, consisted of two formations, the more extensive consisting of hard sandy marl and destitute of life, the less extensive consisting of soft mud and teeming with aquatic life. Further, the two formations are contiguous as well as contemporaneous, and together they cover an area of not more than eight hectares.

As illustrating the geological significance of the facts just recorded, the following passage may be quoted from Sir Archibald Geikie's "Text-book of Geology" (1903), p. 1003:—

"The water basins of the Old Red Sandstone might be supposed to have been, on the whole, singularly devoid of aquatic life, inasmuch as so large a proportion of the red sandy and marly strata is unfossiliferous. In some of the basins, where the sediment is not red and sandy, it is evident that life was extremely abundant, as is shown, for example, by the vast quantities of fossil fishes entombed in the grey bituminous flagstones of Caithness and Orkney. It may be observed that where grey shales occur intercalated among red sandstones and conglomerates they are often full of plant remains, and may contain also ichthyolites and other fossils which are usually absent from the coarser red sediments. There would appear to have been occasions of sudden and widespread destruction of fish life in the waters of the Old Red Sandstone, for platforms occur in which the remains are thickly crowded together, yet so entire that they could not have been transported from a distance, and must have been covered over with silt before they had time to decay and undergo much separation of their plates."

The last sentence of this passage seems to describe the actual condition of the muddy bed of the moat round the Park of Marchais as it would appear to a geologist after the necessary interval of time had elapsed which is required to separate the date of the death of the crowd of fishes which voluntarily entombed itself in the mud before desiccation was complete, and the date at which the stratum of mud and remains so produced would be entitled to rank as a geological formation. I do not know if there are any adequate data for arriving at a trustworthy estimation of the probable length of this interval. It is quite distinct from what is understood as the age of the geological formation.

The barren districts of sandy and marly matter at the bottom of the ditch would, after the lapse of the same, or perhaps a shorter, interval furnish perfectly unfossiliferous strata, which would suggest to the geologist of later date that the water basin in which it had been laid down had been singularly devoid of aquatic life. Yet, in a sense, it would not be inaccurate to say that the water basin in which the muddy strata holding the crowded fish remains had been "laid down" teemed with life, and that the barren strata had, in the same sense, been "laid down" in water devoid of aquatic life, although the two bodies of water formed one continuous sheet of very restricted dimensions. *It would seem, therefore, that a material barrier is not necessary to separate even a small body of*

water into two basins and to maintain them distinct, the one of which may be full of life and the other practically barren.

There is an important point, which should not be missed, in the similarity between what took place this summer at Marchais and what may have taken place in Caithness or Orkney in the Old Red Sandstone period. The fishes which buried themselves in such numbers in the mud this summer, though they were fortunately released, were in the strictest sense contemporaries, and were all buried in the mud within a few days of each other. Moreover, in ordinary circumstances, at least in summer, the mud is untenanted. If the fish were to migrate into the barren waters covering the marly bottom, and their return were barred while the water over the mud evaporated and the secular drought set in, this same mud-bed would be met with in later ages as an unfossiliferous stratum. *So that the fossil fishes which are found in these strata must be held to have gone into occupation only when the signal, intelligible to them, was made that complete desiccation was going to take place. Once in a way this desiccation turns out to be secular, and we have a rich bed of fossils.*

In conclusion, I think that the behaviour of the fish in the ditch at Marchais in the summer of 1911 adds one more fact to the body of evidence which goes to show that, *in the production of geological formations, transportation of material has probably been the exception rather than the rule.*

J. Y. BUCHANAN.

The Inheritance of Mental Characters.

I HAVE just read Dr. Archdall Reid's paper "Methods of Research," communicated to the Eugenics Education Society. Situated as I am in Scotland, it was impossible for me to attend the discussion which I understand took place recently, and I had no opportunity of reading his paper until he sent it to me. He makes certain statements with regard to a very controversial point, the inheritance of mental characters; and, having had no chance of criticising these, I should be much obliged if you would give me the opportunity of doing so.

Prof. Pearson, as quoted by Dr. Reid, says:—"We inherit our parents' tempers, our parents' consciousness, shyness, and ability, even as we inherit their stature, forearm, and span." This statement may be loosely expressed and open to misinterpretation; but no one has a right to assume, without further explanation, that more is meant than the inheritance of capacity or absence of capacity for making particular acquirements, whether Prof. Pearson actually had this idea in his mind when he wrote or not. At any rate, by ability he undoubtedly means capacity for making acquirements.

Dr. Reid says:—"Pearson's statement is utterly without significance, utterly devoid of all content. Founded with such an air of scientific accuracy on statistics and family histories which have such an appearance of scientific precision, it is so vague as to be quite nonsensical." This statement certainly does not err on the side of vagueness. If it is as true as it is definite it reduces the mental capacity of all men to that dead-level of competence or incompetence which is the apparent ideal of Socialists and trade unions; it necessitates the adoption of some other explanation than the action by selection upon the inborn variations for the evolution of man's capacity for making mental acquirements; and it leaves the undoubted existence of variations in mental capacity, including feeblemindedness, unaccounted for.

Unless Dr. Reid believes that the intellectual development of man has been brought about by the action of some supernatural power or by the inheritance of acquired characters, he must believe that it has been due to the action of natural selection upon inborn variations. The term "mental character" is used by both Dr. Reid and Prof. Pearson in such a way that both inborn and acquired characters are included. The former classes the speaking of English, the latter temper, shyness, and ability, as mental characters. Many, perhaps most, of our mental characters, using the words in this loose sense, are acquirements; but these acquirements depend upon an inborn capacity for making them, and this capacity, like all inborn characters, is subject to variations. Without this it is difficult to see how man's capacity for making mental acquirements could ever have been evolved. Apply the method, which Dr. Reid supports so strongly and explains so clearly, to his own examples and those of Prof. Pearson! All normal English children speak English. All normal French children speak French. The particular language spoken is an acquirement, dependent upon the environment. But it is impossible for Dr. Reid to maintain that, given precisely the same opportunities, all individuals are likely to attain the same degree of skill in the use of the language they have acquired. Moreover, they will vary in the facility with which they acquire skill in the different ways of using the language. Some may readily acquire an abundant flow of words in speaking; others may more easily attain a facile and clear style in writing. Does Dr. Reid believe that a great English orator or writer would not, *ceteris paribus*, have been a great orator or writer simply because his medium happened to be French instead of English? This variability in the capacity for making acquirements must apply to all acquirements. An individual may be able to acquire a high degree of development in music under comparatively unfavourable conditions, but be quite incapable of rising, even to the average, in mathematics under favourable conditions, and *vice versa*. Unless the existence of these variations in mental capacity and the possibility of their transmission from parents to offspring are admitted, it is impossible to account for the evolution of the human intellect by the action of natural selection upon inborn variations.

Now take Prof. Pearson's first example, as quoted by Dr. Reid—temper! I do not think that anyone will quarrel with the postulate that this word is used to express the control, or lack of control, over the emotions exhibited by an individual, the strength of the emotion being a variable quantity according to the susceptibility of the individual to the stimulus producing the emotion. This susceptibility will vary just as grocers' scales vary from a delicate chemical balance, though both respond in a similar manner to the same kind of stimulus. "Good-tempered" implies the possession of a high degree of control or a low degree of susceptibility, or a combination of both. "Bad-tempered" means a lack of control or a great susceptibility, or a combination of both. Dr. Reid might contend that the example of a bad-tempered parent might produce a bad temper in the child. On the other hand, it is at least equally probable that the exhibition of bad temper on the part of a child to a bad-tempered parent would bring swifter and greater punishment than would have been the case had the parent been good-tempered; and thus the bad temper in the child would be more than usually checked. In the absence of direct evidence of a comprehensive and conclusive nature we must assume, given identical environment, that the susceptibility to stimuli tending to produce manifestations of temper is different in different individuals, and is an inborn character; that the capacity for acquiring control over the emotions varies in different individuals, and is an inborn character; and that these variations are transmitted in an increased or lessened degree to their offspring by the parents. These inborn characters are, of course, susceptible to great modification by the environment.

Using, I believe, methods approved by Dr. Reid, I have thus come to the same conclusion that Prof. Pearson has arrived at by a different road, and hold that mental characters are transmitted from parents to offspring, though I fully realise the great extent to which these inborn characters may subsequently be masked by superimposed acquirements. If this conclusion be correct, then the consideration of the inborn mental characters of the parents is even more important, from the eugenic point of view, than that of the inborn physical characters, and far more serious than any question relating to education.

What has surprised me is that on all previous occasions Dr. Reid's opinions seem to have been in complete accord with the arguments put forward here. Hence I do not understand his unqualified condemnation of a statement which does not appear, on the face of it, to be at variance with his own views.

CHARLES WALKER.

Glasgow, October 12.

Nature of Light Emitted by Fireflies.

THE nature of the light emitted by fireflies (Malacodermidæ fam., genus Luciola) has hitherto been very little investigated. The idea that it is phosphorescent seems to have been generally accepted. On observing the beautiful green fluorescence of the light emitted by the insect when it is put in a glass tube, we were struck by the close resemblance of this light to that of the Crookes's tube. Could it be like that of the X-rays?

An inquiry was instituted to see how it affects photographic plates through different media. Various media were tried, and the results obtained by interposing wood, dark brown leather, flesh, and black paper are described below. It may be remarked here that the light emitted by the insect is so fitful and faint that it is rather difficult to keep it steady, and it will be too much to expect this faint light to give more than shades of varying depth on the plates. It was observed that the capacity of the insect to affect the photographic plate depends on the length of the exposure. When the insect was put on a naked plate for a few seconds, it did not affect the plate, but when it was similarly held on the plate for one minute, its effect was distinctly visible. After a series of experiments, therefore, two hours' exposure in the case of paper and flesh, and three hours' exposure in the case of leather and wood, were considered sufficient.

(1) An extra rapid photographic plate was placed in a dark slide, and three insects were then placed on the slide beneath a watch glass; the whole plate was affected and gave dark grey print after an exposure of three hours. Without the insect, the plate gave a black print on a two minutes' exposure to lamp-light.

(2) An extra rapid photographic plate was enclosed in English tanned leather of a dark brown colour 1 mm. thick. The three insects were placed on the leather, with the result that the plate gave a dark grey print after three hours' exposure; a similar plate, similarly enclosed, when exposed to lamp-light for two minutes gave a black print

(3) The three insects were placed in a small tube open at one end, which was enclosed in a piece of flesh (mutton) 1·5 mm. thick; this was placed on a naked plate in a dark room. Where the light was not intercepted by the glass of the tube, the plate showed a white print after an exposure of two hours. A similar plate was covered with a piece of flesh of similar thickness and exposed to lamp-light; the resulting print was dark grey after two minutes' exposure.

(4) A similar plate was enclosed in black paper and the insects placed on it beneath a watch glass; the resulting print was, after two hours' exposure, light grey; while a plate similarly covered exposed to lamp-light for two minutes was very slightly affected, and gave a very dark grey print. The plate exposed to lamp-light without any media for two minutes gave a light grey print.

It was seen that the insect light approaches lamp-light in the intensity of its effect on the photographic plate, even when the different media opaque to light are interposed between the two.

The light emitted by the insect cannot therefore be taken as phosphorescent. It may be, perhaps, premature to conclude that some of the rays emitted by the insect are X-rays, but it may be safely asserted that these rays are, at least, similar to X-rays and ultra-violet light in so far as they render certain opaque media transparent and are intercepted by glass. We hope this short note may be the precursor of elaborate experiments on the subject leading to some definite results.

PURAN SINGH.
Dehra Dun, November 2. S. MAULIK.

Trematode Generic Names Proposed for the "Official List of Zoological Names."

(1) THE International Commission on Medical Zoology, appointed by the Graz International Zoological Congress, has made its first report on the names of Trematode genera parasitic in man.

(2) Four members, namely, Blanchard (Paris), Monticelli (Naples), Stiles (Washington), and Zschokke (Basel), unanimously agree that the following eleven names are, from the present point of view of systematic zoology and nomenclature, the correct names for the genera in question, and that the species cited as genotypes are the correct types according to the International Rules of Zoological Nomenclature:—

Clonorchis Looss, 1907, February 1, 147–152, type *sinensis*.

Dicrocoelium Dujardin, 1845a, 391, type *lanceatum* = *lanceolatum* (= ? *dendriticum* sub judice).

Fasciola Linnæus, 1758a, 644, 648–649, type *hepatica*.

Fasciolopsis Looss, 1899b, 557, 561, type *buskii* (seu *buski* teste Blanchard).

Gastrodiscus Leuckart in Cobbold, 1877e, 233–239, type *sonsinoii* (seu *sonsinoi* teste Blanchard).

Heterophyes Cobbold, 1866a, 6, type *aegyptiaca* = *heterophyes*.

Metorchis Looss, 1899b, 564–566, type *albidus*.

Opisthorchis Blanchard, 1895f, 217, type *felineus*.

Paragonimus Braun, 1899g, 492, type *westermanii* (seu *westermanni* teste Blanchard).

Pseudamphistomum Luehe, 1908, 428–436, type *truncatum*.

Watsonius Stiles and Goldberger, 1910, 212, type *watsoni*.

(3) The following commissioners have not voted:—Jaegerskioeld (Gothenburg), Looss (Cairo), Luehe (Koenigsberg), Pintner (Vienna), and Shipley (Cambridge).

(4) Notice is hereby given that the undersigned will wait until July 1, 1912, for any zoologist to raise any objection to any portion of this report, and that on that date all names to which valid objection is not raised will be forwarded to the International Commission on Zoological Nomenclature with the motion that these names be included in the "Official List of Zoological Names" provided for by the Graz Zoological Congress.

(5) All correspondence on this subject should be addressed to the undersigned.

C. W. STILES.
(Secretary International Commission on Zoological Nomenclature.)
Hygienic Laboratory, Washington, D.C., November 11.

Dews in 1911.

IT may interest readers of NATURE to know that between July 31 and September 5 this year I collected a total amount of dew equivalent to one-fifth of an inch of water, whilst in 1909, between August 3 and September 12, about one-tenth of an inch was collected. That is to say that this year the dews were twice as heavy as in 1909, or we may state that during the above-mentioned period of this year the deposit of dew in my instrument was equivalent to 20 tons of water per acre. Of course, most of this was evaporated, but that amount of water could have been collected with adequate means.

This year has been disastrous to the so-called dew-ponds, and I would remind readers of the view expressed in a letter to NATURE of May 14, 1908, that the ponds are "simply water butts in which rain-water is stored." A pond on the summit of St. Boniface Down, Ventnor, which I visited on September 1 this year, was absolutely dry.

I have been led to write this note because Mr. Martin, in his interesting letter in last week's NATURE, p. 77, says that "this year the absence of rain for so long brought about a remarkable absence of dew." This was not my experience, except on two or three clear nights when the air seemed to be very dry.

The details of my measurements and of my instrument I hope to publish elsewhere. SIDNEY SKINNER.
South-Western Polytechnic Institute, Chelsea, S.W., November 18.

The Colours of Fishes.

INTEREST as to the sources of colours in birds and insects has been revived by Prof. Michelson in *The Philosophical Magazine* for April, and by Mr. Mallock at the Royal Society. The inquiry will be assisted if fishes may also be included. Nature reveals no more vivid form of shifting tints than we see in the common mackerel, which is a fish without scales. In August I was able to watch them immediately after the fish had been taken from the sea I

was surprised to find the skin so firm and tough; I almost expected to spoil it in handling; the delicate colours seem as if they might be tender like the bloom of a grape. With the smooth, but not sharp, edge of a knife I scraped the surface somewhat vigorously without damaging the lovely play of blue and green light.

Two or three weeks elapsed before I could examine dried pieces of the skin with a microscope. There did not appear to be any orderly markings which could lead to diffraction; nor could I find a flaking tendency which would suggest thin plates. The glancing of the colours from blue to green is lively, but I should think it is not due to wave interference. Pigments can be greatly modified by a change in the angle of incident light, according to the qualities of lustre surfaces as described by Helmholtz, and the polarisation principles worked out by Jamin. These two considerations form the basis of an important portion of the comprehensive discussion given by Michelson.

W. B. CROFT.

Winchester College, November 13.

The Weather of 1911.

WITH reference to Sir Edward Fry's letter in NATURE of November 16 in regard to the weather of 1911, without presuming to reply on behalf of meteorologists to his question as to whether any real cause can be assigned for the brilliance and heat of its summer and autumn, may I be allowed to suggest that the relatively high temperature of the North Atlantic, during the period, presumably conduced to warmth and sunshine? Since April the surface temperature of the North Atlantic has been, for the most part, above the average, and during the months of June to September, inclusive, largely above. Not only through the agency of winds from seaward has air temperature over our islands been raised by the abnormal warmth of the ocean, but also, it seems probable, through the diminution of cloudiness, and the corresponding increase of sunshine attributable to the small difference, thus ensuing between the temperature of the sea and that of the air above it.

Moreover, during a bright summer, the heat which the earth receives through solar radiation may be greatly in excess of that which it parts with at night by terrestrial radiation.

CAMPBELL HEPWORTH.

2 Amherst Road, Ealing, W., November 18.

ROTATION PERIOD OF THE SUN.[1]

SINCE the introduction of the Doppler-Fizeau principle one of its most interesting and important applications has been to the determination of the velocity of the sun's rotation by the investigation of shifts of the spectrum lines corresponding to various points on the solar limb. Much of the pioneer work in this direction was done by Vogel, Young, Langley, Cornu, and Dunér, the results obtained by the latter at Upsala from 1888 to 1903 serving as the standard for future workers. Dunér's determinations referred to points between the solar equator and 75° north and south heliographic latitude, the observations being made at intervals of 15°. During 1903–6 Halm made a series of observations at Edinburgh, employing the same differential method as Dunér.

All these observations having been made by visual methods, it was considered of importance that the photographic method should be tried, and this was commenced on the completion of the Snow telescope on Mount Wilson in the spring of 1906. In June, 1907, the tower telescope, with vertical spectrograph of 30 feet focal length, was completed, and thenceforward the observations for rotation were made with it, the spectra being of such greatly increased resolving power that the investigation was considerably facilitated.

[1] "An Investigation of the Rotation Period of the Sun by Spectroscopic Methods." By W. S. Adams and J. S. Lasby. Washington D.C., Papers of the Mount Wilson Solar Observatory. Vol. i., part i. (The Carnegie Institution, 1911.)

Five series of observations have been made—two dealing with lines selected from the spectrum of the general reversing layer, two with the Hα line of hydrogen, and the fifth with the blue line of calcium at λ 4227. As the lines of hydrogen and calcium give results differing widely from those obtained for the reversing layer, the various sections are treated separately in the discussion.

The 1906–7 series of observations were made in conjunction with the Snow telescope, having a spectrum scale of 1 mm. = 0·71A, on a list of lines selected as being representative of the different strata involved. Those made in 1908, with the tower telescope and spectrograph of 30-feet focal length, are with a spectrum scale of 1 mm. = 0·56Å. For the reversing layer photographs twenty-two standard solar lines were selected for observation, representing the elements La, Cr, Zr, Fe, Mn, Ni, Ti, and the compound CN.

In the general discussion it is shown that the two series of observations are in substantial agreement for latitudes between 0° and 50°. Above 50° the

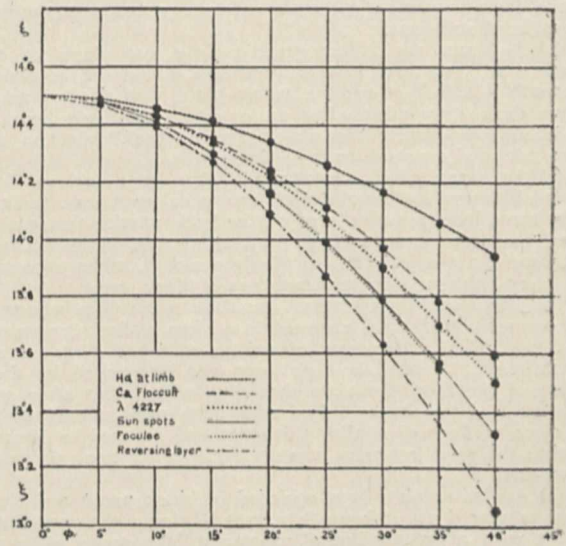

FIG. 1.—Curves showing variation of angular velocity with latitude for sun-spots, faculæ, calcium flocculi, reversing layer, λ 4227, and Hα. To facilitate comparison the curves are all reduced to the common origin of 14·50°. Differences in the amount of equatorial acceleration are indicated by lack of parallelism in the curves.

1908 observations give slightly smaller values, the greatest difference being about 0·039 km. at 70°. It is surmised that these small differences may be partly due to small systematic errors in the earlier series, and partly to actual proper motions in the vapours constituting the sun's reversing layer.

The general results do not indicate any definite variation of the sun's rate of rotation, except it be of long period. This conclusion is emphasised by the close agreement of the Mount Wilson results with those given by Dunér.

One of the most notable results brought out clearly by these observations is the fact that the lines of different elements give different values of the rotation velocity. Thus lines of lanthanum and cyanogen give low velocities, while certain lines of manganese and iron give comparatively high velocities. A table is given showing the residuals on forming the differences in the values of the angular velocity for each line from that of the mean of all the lines. The systematic variation is at once rendered evident by the marked preponderance of positive or negative residuals. The results corresponding to the different elements are, on

closer examination, found to be in close agreement with other evidence we have about the differences of level in the solar atmosphere. Lanthanum and cyanogen are usually regarded as low-level constituents, and they are also conspicuous in the present instance in showing consistently low velocities for the solar rotation. This indicates that the period of rotation increases as we approach the surface, or that the outer layers of the atmosphere rotate much more rapidly than those lying close to the photosphere. These facts are in good accordance with the results obtained for hydrogen and the other substances which are characteristic of high levels above the photosphere.

All the observations may be well represented by a slight modification of the Faye formula, showing that it may be applied with great accuracy to determinations of the sun's rotational velocity to within 10° of the pole. The adopted formula for representing the Mount Wilson observations is—

$$\xi = 11{\cdot}04^\circ + 3{\cdot}50^\circ \cos^2 \phi,$$

where ξ is the daily angular velocity, and ϕ the solar latitude. In this connection it is of interest to review

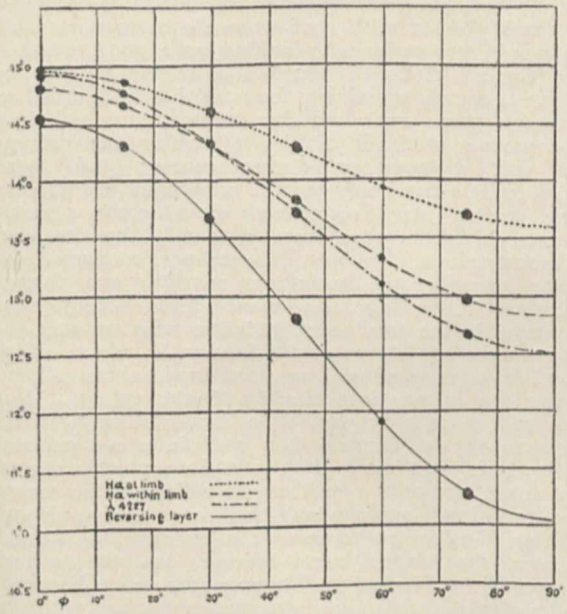

FIG. 2.—Curves representing the values of the angular velocity given by the empirical formulæ derived from the observations of Hα, λ 4227, and the reversing layer. For the last named the mean of the two series of observations is used.

the values of this equation which have been given by some of the more important determinations of the solar rotation made during the last century.

Observer	
Carrington	$\xi = 14{\cdot}42^\circ - 2{\cdot}75 \sin 7/4\ \phi.$
Spoerer	$\xi = 8{\cdot}55 + 5{\cdot}80 \cos \phi.$
Maunder	$\xi = 12{\cdot}43 + 2{\cdot}01 \cos^2 \phi.$
Dunér	$\xi = 10{\cdot}60 + 4{\cdot}21 \cos^2 \phi.$
Halm	$\xi + 12{\cdot}03 + 2{\cdot}50 \cos^2 \phi.$
Adams (mean of two series)..	$\xi = 11{\cdot}04 + 3{\cdot}50 \cos^2 \phi.$
Adams λ 4226	$\xi = 12{\cdot}5 + 2{\cdot}4 \cos^2 \phi.$
Adams Hα	$\xi = 13{\cdot}6 + 1{\cdot}4 \cos^2 \phi.$

It will be noticed that both λ 4227 (calcium) and Hα (hydrogen) give considerably higher rotational velocities than the general elements of the reversing layer. The equatorial acceleration is considerably greater for λ 4227 than for Hα at the limb. The discussion of the numerous results is made much clearer by several diagrams; two of these are here reproduced, showing the main features outlined in this necessarily brief summary of a very extensive investigation. A word of caution is given as to the interpretation of certain results shown by the tables. Thus if the lines showing systematic large or small values of the angular velocity are specially considered, it is seen that there is an apparent increase towards the sun's pole. Comparison of the results found for sun-spots, faculæ, and the calcium flocculi gives the following sequence in order of *decreasing* equatorial acceleration: (1) spots and faculæ, (2) λ 4227, (3) calcium flocculi, (4) Hα. The reversing layer shows a greater amount of equatorial acceleration than any of these.

CHARLES P. BUTLER.

MAGNETIC OBSERVATIONS AT THE COLABA OBSERVATORY.[1]

THE two somewhat formidable volumes referred to below contain a most valuable compilation of observations extending over sixty years, together with a discussion of the results presented in a form in which they can be used in further investigations. Observations on terrestrial magnetism were started at the Colaba Observatory, Bombay, in 1840, but it was not until the year 1846 that regular records were obtained. When it was found that disturbances were likely to be caused by the electric traction which was being introduced in Bombay, it was decided to move the observatory to a more suitable site at Alibág, about eighteen miles away; and after securing duplicate records at the two stations in 1904 and 1905, the magnetic work at Colaba was finally abandoned in 1906. The first volume, extending over 264 pages, contains a complete description of the instruments and processes of reduction. The methods employed are described in great detail—some may think, perhaps, with too great diffuseness—but many interesting points are brought out incidentally. The complete record, for instance, of the monthly values of the magnetic moment of one of the standard magnets, extending over nearly forty years, is probably unique. This magnet does not show any tendency to approach a steady state: it is rather the annual diminution amounting to about the thousandth part of its value which has become steady.

Great attention is deservedly given to the temperature corrections. These were originally determined by means of thermometers suspended on the wall of the magnetometer room, and the corrections were obtained by assuming that the magnets had the same temperature as the walls. This—as is now found—has led to errors. A remarkable discrepancy between the diurnal variation deduced from eye observations taken above ground, and that deduced from the photographic records taken in the magnetometer room, led Mr. Chambers to suggest that the amplitude of the variation might be different according as the magnetometer is placed above or below the surface of the ground. Since the observatory was dismantled Mr. Moos has made a careful comparison of the temperature variations observed by the thermometers on the walls with those recorded by thermometers placed in the exact position of the original magnets, and found—as might have been expected—that the variations here were smaller. Rectifying the previously applied temperature corrections, it was found that the diurnal variations as observed in the two positions became identical.

1 "Magnetic Observations made at the Government Observatory, Bombay, for the Period 1846 to 1905, and their Discussion." By N. A. F. Moos. Part i., Magnetic Data and Instruments. Pp. v+261+plates. Part ii., The Phenomenon and its Discussion. Pp. xiv+vii+iv+265–782+plates. (Bombay: Government Central Press, 1910.)

In part ii. the results are discussed. After a detailed account of the secular and annular variations, the diurnal variations are examined from all possible points of view. The Fourier coefficients are calculated, and the differences between quiet days and the average values for all days are examined. An interesting chapter deals with magnetic disturbances and their effects on the periodic changes; the results obtained seem to be in agreement with those noted in other places. When the curves of different localities are compared, Mr. Moos finds that the progression of an average disturbance appears to be made up of a common pulse which commences everywhere simultaneously, a further change taking about ten or eleven hours to reach its maximum, and finally an accentuated diurnal wave. This last point is of some importance.

The special discussion of quiet days brings out the result that the absolute value of the horizontal force is higher, but that the annual variation is practically the same whether derived from these quiet days or from all days. It is interesting to find that when the quiet days are selected with reference to the magnetic state of the whole earth, the results differ less from the average of all days than when the quiet days are selected by purely local conditions. This result may prove to be of considerable significance to anyone seeking an explanation of the after-effects of a magnetic disturbance, for it seems to show that these after-effects are confined to those parts of the earth which have been affected by the storm.

Special attention must be directed to the chapter which deals with lunar effects. The influence of the moon on terrestrial magnetism—which undoubtedly exists—may either be an atmospheric effect or be due to the tidal distortion of the earth. It is of the highest importance to decide which it is, and for this purpose it is necessary to obtain the lunar variations at a number of different stations. Mr. Moos has done his share of the work for Bombay, but there are too few observatories which give sufficient data to allow a general discussion of lunar effects. The last two chapters deal with the connection of terrestrial magnetism with solar spots and its relation to meteorological and seismic phenomena.

Mr. Moos deserves the highest credit for having undertaken a work of such enormous labour as the preparation of these two volumes must have involved. We have only two criticisms to make. Some credit should have been given to the earlier observers, to whom the observatory of Colaba owes, in the first instance, its deservedly high reputation. Reference ought, for instance, to have been made to the volume published in 1872 by Mr. Charles Chambers, whose name only occurs in connection with a paper on the lunar effect published in the Philosophical Transactions. The second criticism may seem trivial, but is provoked by an unnecessary amount of trouble caused to the reader who looks at the laudably complete table of contents only to find that the references (in the second volume) are all to paragraphs and not to pages. Some of these paragraphs cover a great number of pages, and much irritation is caused by the time spent in turning over page after page until the right paragraph is found. The references should either have been made to pages, or the number of the paragraph should have been printed at the top of every page.

The two volumes, even with their minor faults of diffuseness and occasional obscurities of expression, form a most valuable book of reference, which no doubt will be extensively used by everyone wishing to obtain an insight into the complicated phenomena of terrestrial magnetism.

AGRICULTURAL EDUCATION IN THE UNIVERSITY AND THE SCHOOL.[1]

WHEN the council of the Reading University College decided to develop their agricultural department, they very wisely began by taking stock of the situation, and in view of the report of the departmental committee appointed by the Board of Agriculture to investigate agricultural education in England and Wales, they decided to go abroad for information. For the report confesses that the majority of English farmers are not reached by the agricultural colleges at all; indeed, one witness went so far as to assert that not more than 5 per cent. of the farmers of England are directly affected by them.

Agricultural colleges have, however, gained the confidence of the farmers of Canada and the United States. A deputation appointed by the college therefore visited the Macdonald College, St. Anne de Bellevue; the Central Experimental Farm, Ottawa; the Ontario Agricultural College, Guelph; and the Cornell and Wisconsin Universities in the States, to discover what features these institutions possess that enable them to gain the confidence of the farmer. At all the institutions the question of rural life as a whole is frankly dealt with, and women's courses, as well as men's, are arranged. Taking as a good example the Guelph College: there is a woman's institute where a complete training for rural life is afforded to women; there are altogether thirteen hundred men and women students, a third of whom are taking the full diploma or degree course; and there is so great a bond between the college and the farmer that during June, 1910, more than 40,000 agriculturists visited, or were expected to visit, the plots and demonstrations. In 1909, the college conducted definite experimental work on nearly 5,000 farms. Further, the college has about eleven official missionaries in the province: graduates who are sent out to gain the confidence of the farmer, to advise where possible on agricultural matters, and, above all, to bring the farmer into touch with the college. But the college is only part of a larger scheme. The Government of Ontario has a definite agricultural policy briefly set out in the report, into which we need not enter, except to note that the college is the centre for teaching, experiment, and constructive ideas. "From Guelph go forth to the country the trained farmer, the trained rural teacher, and the trained housewife." The college, however, is in no bondage to its official position, nor does its connection with the University of Toronto give it any airs of superiority or cold academic aloofness; it is closely in touch with its province by countless personal ties and shows a lively and vigorous sense of its responsibility.

With local modifications the same remarks apply to all the other colleges visited. In all cases the college is the centre of agricultural life for its district, and its staff is primarily concerned with the improvement of the local rural life.

Why is it that the Canadian and American colleges have succeeded so well, whilst the English colleges, whatever else they have achieved, have certainly not become the centre of rural life in the country? Partly, the deputation consider, because the English farmer is already highly competent and can only be helped by very able specialists. He has behind him a long tradition, and need look to no one for advice; in Canada and the States, on the other hand, the farmer has usually no tradition and must perforce turn to

[1] Agricultural Education: Report of a Deputation appointed by the Council of University College, Reading, to visit selected centres of Agricultural Education and Research in Canada and in the United States.

Memorandum on the Principles and Methods of Rural Education. (Board of Education, 1911.)

some honest, disinterested source for information; naturally he goes to the college. In England matters have sometimes been made worse by the appointment of rather poor agricultural instructors and by the fact that education is associated in the farmer's mind with heavy county rates.

Thus the success of the Canadian and American colleges, as compared with that of the English colleges, is partly to be attributed to differences in local conditions, and the deputation failed to discover a system that they could transplant here with any hope of success. They learnt much, however, and they applied the experience gained to their own problem at Reading and drew up a scheme for a complete agricultural department. Into the details of the scheme we need not enter; the principles on which it is based, however, seem to us to be very sound. First and foremost they consider that the staff must be competent. "In making any new appointment of major rank it is impossible to exaggerate the importance of securing a first-class man. . . . No proposition receives more lip-homage in educational circles, and perhaps none is more frequently flouted in practice." That a university agricultural department staffed in this way would be eminently successful is beyond dispute, and all interested in agricultural education will hope that Reading will have the means and the courage to go ahead. For as the deputation found out, specialisation is very necessary in agricultural work; indeed, they might have quoted the precisely parallel case of medicine. No college would think of setting up a professor of medical knowledge and one or two assistants as a medical school. Yet most colleges think the arrangement does sufficiently well for agriculture; only one agricultural department has more than one professorship; indeed, at one of our oldest universities even the examinerships are not specialised, one and the same person being required to examine both in agricultural botany and agricultural chemistry!

Passing now to the memorandum on the principles and methods of rural education issued by the Board of Education, it is quite evident that a serious effort is being made to bring the education of the country school into some sort of relationship to the conditions of country life. But in reading through it we are not convinced that the Board has grasped the fundamental difference between the conditions of life, and even the outlook upon life, in the country and in the town. The reader instinctively feels that no new method is being evolved, but the old system (which has not been a conspicuous success in the rural district) is simply making a second appearance in a dress with some agricultural trimmings. The organiser who is responsible for giving rural significance to the schools is at present "primarily an expert in agriculture in the narrower sense, and it will probably always be desirable that this should be the case." But why? Why not men who primarily possess insight and imagination, who can get to the essentials of the problem, and devise methods of dealing with it? However, teachers and country authorities alike realise its importance, and we may be closer than we think to the new rural education.

THE NOTIFICATION OF TUBERCULOSIS.

FOR some time past public opinion has slowly but gradually been educated on the question of the infectivity of pulmonary and certain other forms of tuberculosis. When notification of phthisis as an infective disease was first mooted, a loud outcry was raised, not only by the public, but even by medical men. Certain enlightened communities, however, recognising the importance of such notification, early obtained powers to put into operation a system of voluntary notification. It was argued, and very wisely, that until the medical officer of health and his committee could be put in possession of information concerning centres of infection, little could be done to prevent the dissemination of infective material from these centres. It was maintained, further, that notification, voluntary on the part of the patient and his medical attendant, was preferable to no notification at all, in so far that in the first place some information as to the presence of tuberculous patients would be provided, and, in the second, some experience as to the working of the system would be obtained.

The present chief medical officer of the Local Government Board, even when he was medical officer of health for Brighton, has always been in favour of voluntary notification of tuberculosis, whilst so far back as September, 1908, the present President of the Local Government Board announced during the sittings of the International Congress on Tuberculosis at Washington that he had promoted an order that in workhouses and similar institutions the notification of pulmonary phthisis should be compulsory. Mr. Burns has made the study of tuberculosis peculiarly his own, and the further development of notification and the extension of the compulsory clauses of the Infectious Diseases Notification Act to this disease is but the natural outcome of this systematic study by men keenly interested in the preservation of the public health. Moreover, there is a general feeling that even this is not the last of the measures of preventive legislation to be taken.

It is now recognised that tuberculosis is to be stamped out or cured by no single method or system. The centres of infection are so varied, the phases and types of the disease so numerous, and the condition of the patients so diverse that siege must be laid to tuberculosis in very different fashions, as occasion may require. Only after obtaining a knowledge of the individual cases can those in authority set to work to classify them in such manner that appropriate measures may be taken to meet the requirements of these cases, as they are searched out and examined.

The advanced cases of consumption—patients who are left to linger on, badly fed, wretchedly housed and clothed, weak, distressed, and disheartened—are most dangerous centres of infection, and the only satisfactory way to deal with them is to place them in hospitals where, in comparative comfort, relieved from anxiety as to their shelter and daily bread, segregated as regards infection, but visited by their friends from time to time, they may pass the remaining months or years of their life. Remove these, the most dangerous, cases to hospitals—for they are dangerous so long as they remain amongst their fellows—and they become harmless. For other patients dispensary treatment may be all that is necessary; but as experience is gained many of these will no doubt be sent to sanatoria, partly for initial treatment and rest in order that the cure may begin under the most favourable conditions, and the patient may make a "good start," but also in order that he may be educated in the care of himself, and that he may render himself less dangerous to others with whom he may have to live and work.

During the last fifty years the death-rate from tuberculosis has fallen more than 30 per cent. With proper application of compulsory notification and stern tackling of the problems that it will disclose, at least as great, and probably a still greater, fall of this death-rate may be prophesied at the end of the coming couple of decades.

FOOT-AND-MOUTH DISEASE.

APPOINTMENT OF A COMMITTEE OF INVESTIGATION.

THE recurrence of this disease in England during the present year has been a source of grave concern to all engaged in agricultural and live-stock industries. It is, however, a matter for congratulation to the Board of Agriculture, and its veterinary department in particular, that the disease has been stamped out again with such a comparatively small loss. There have been eighteen outbreaks this year, with 467 animals affected, an approximate average of 26 animals in each outbreak. This is truly remarkable considering that foot-and-mouth disease is probably the most rapidly contagious of all epizootics.

During the four years immediately preceding the present year, there were five outbreaks with 127 animals affected, each outbreak being suppressed in little more than a week, at a total cost of a few thousand pounds. This has only been possible as the result of early diagnosis and the immediate slaughter of all affected and contact animals. The importance of drastic and immediate action can be well realised by noting some of the latest Continental returns. In Germany during August alone there were 37,737 outbreaks of foot-and-mouth disease; in July 12,385 were recorded in Holland, 4,097 in Belgium, and 16,027 in France, where it has been estimated that the loss will amount to more than fifteen millions sterling.

The new Minister for Agriculture has therefore taken a very wise step in appointing a committee, as announced in Parliament last week, "to inquire into the circumstances of the recent outbreaks of foot-and-mouth disease and to consider whether any further measures can be adopted to prevent their recurrence." The committee of twelve is to be presided over by Sir Ailwyn Fellowes, and includes the members of Parliament for South Wilts, St. Patrick's Division of Dublin, Barkston Ash, Carmarthen West, Newmarket, and North Bucks, together with Major E. M. Dunne, Mr. R. Carr, Mr. E. E. Morrison, Mr. E. P. Nunneley, and a member of the Central Chamber of Agriculture. They are to be assisted by the veterinary and administrative officers of the Board.

Of greater importance, however, is the proposal to appoint an expert scientific committee to proceed to India, where the disease is unfortunately very rife, to investigate the special characteristics of the disease, its etiology, the means by which it is contracted and spread, and practicable means of prevention. It is to be hoped that tangible results will be attained, so that we can continue to enjoy the markets of the world for our live-stock, as the result of the freedom of these islands from such animal scourges.

DR. W. SUTHERLAND.

IT is with regret that we have observed the report of the sudden death, on October 4, of Dr. William Sutherland, at his residence, Stawell Street, Melbourne, as recorded in *The Melbourne Age*. Dr. Sutherland was born in Scotland in 1859. At the age of ten he went with his parents to live in Melbourne. He obtained a Government exhibition, and finished his preliminary education at Wesley College. From there he went to the University, where he took his Master of Arts degree, obtaining the highest honours each year in mathematics. The winning of the Gilchrist scholarship in his final year enabled him, under the terms of the exhibition, to go to London University College. He was then only twenty years of age. Three years later he returned to Australia, having obtained a degree in science.

From that time until his death Dr. Sutherland devoted himself entirely to original scientific research. He contributed papers to scientific periodicals in America, England, and on the Continent. His first line of thought led him to inquire into the molecular constitution of matter in its various phases of liquids and solids. Later he devoted attention to the subject of viscosity. His papers, which appeared mainly in *The Philosophical Magazine*, are well known to the scientific world. They are distinguished by great width of reading in the latest phases of the subjects he treated, combined with very bold speculation always brought into ample comparison with experimental knowledge. His greatest success was the discovery, in 1893, of the relation connecting the viscosity of a gas with the temperature; the result of a very ingenious, though not quite demonstrative, theoretical argument, and amply confirmed by all subsequent work. His writings were copious in all problems connected with molecular physics, whether they concerned laws of attraction between molecules, the nature of emulsion in its physiological ramifications, the application of electrons and of electrochemical ideas to the properties of matter, the molecular structure of water, or many other subjects. His generalisations were, indeed, so numerous that it was often a difficult task to try to estimate their value. Although Dr. Sutherland had thus contributed a large number of papers to various scientific journals, he never published anything in book form. He preferred to devote his energies entirely to original work and research. For a period he discharged the duties of professor of physics at the Melbourne University during a temporary absence of the occupant of the chair; but in the main he preferred freedom and control of his time. His relations with the University staff were cordial and intimate. He was an examiner at the University and at the College of Pharmacy, and was also connected with the scientific work of the School of Mines.

J. L.

NOTES.

WE are informed that Dr. Glazebrook, the director of the National Physical Laboratory, who has been seriously ill since the end of September with enteric fever, is now making satisfactory progress. After so long an attack of fever his recovery must necessarily be somewhat slow, and it may yet be some little time before he can be regarded as convalescent; but there is good reason to hope that the recent marked improvement may be maintained.

THE case of the *Hawke* and *Olympic* collision, which is now before the Admiralty Courts, is directing considerable attention to the influence of passing vessels upon each other, particularly when those vessels are travelling in the same direction at speeds not differing greatly from each other. Experiments are now being made at the William Froude Tank of the National Physical Laboratory, with models of the *Hawke* and *Olympic*, to test whether such an influence was present and acting at the time of the collision. The president of the Admiralty Court and the various counsel paid a visit to the experiment tank on Saturday last and witnessed a large number of experiments with the models. These were of wax, and were towed from the carriage, or bridge, which spans the large waterway of the tank. The general theory of the influence of passing ships upon each other is the outcome of the "stream-line" theory of the late Prof. Rankine; and we hope to give a fuller account of this shortly.

AN earthquake of unusual strength was felt on November 16 at about 9.25 p.m. (Greenwich mean time) in the south of Germany, throughout Switzerland, and in

the east of France and the north of Italy. It was followed by two others of less importance early on November 17, one shortly after midnight, the other at about 3 a.m. The reports so far available in this country are singularly meagre. There does not seem to have been any loss of life, but slight damage to property occurred in several places, such as Constance, Stuttgart, Freiburg, Mülhausen, and Hechingen, and, though it is difficult to credit the statement, at Munich. Leaving the last-named place out of account, the area of slight damage is about 140 miles long from east-north-east to west-south-west, and 90 miles wide, and contains about 10,000 square miles. The centre may have been about 10 miles to the north of Schaffhausen. The shock was felt so far as Dresden, 310 miles from this point, so that the disturbed area may have contained as much as 300,000 square miles. It is thus probable that the focus was situated at some depth. The vibrations were recorded at several distant observatories—in this country at Shide and West Bromwich. At Heidelberg, Besançon, and Potsdam the recording levers were deranged or broken.

A DISCOVERY of remarkable prehistoric burials has been made by the Broadstairs Archæological Society in the grounds of a private school. During excavations a series of Saxon graves came to light. Under these, and therefore of an earlier date, were found a number of graves arranged round a circular trench, in which the bodies had been buried with the arms and legs flexed. Nothing was found to give a clue to the date of these circular burials; but Mr. F. G. Parsons, who is making an examination of the bones, is of opinion that they belong to the Bronze age. Whatever the antiquity may prove to be, the find is one of importance, for we know very little of the inhabitants of Kent prior to the Saxon period. The remains, which are somewhat fragmentary, are to be placed in the museum of the Royal College of Surgeons, where they may be compared with other finds of a similar nature which have been made in the south-east of England. In the current number of the Journal of the Royal Anthropological Institute (vol. xli., p. 101) Mr. Parsons gives an interesting description of Saxon remains found in a cemetery near Folkestone.

FURTHER details of the Wright gliding experiments are now to hand. On Tuesday, October 24, the best flights were made in the teeth of a wind which was recorded by a gauge raised 12 feet from the ground to be blowing at 50 miles an hour. Orville Wright made nineteen successive glides, one, the last, enduring for 9m. 45s., and extending over a distance of nearly a quarter of a mile. During his seventeenth glide he remained stationary in the air for 5m. 11s., the whole glide lasting 7m. 15s. The following day twenty glides were made by Orville Wright and Alexander Ogilvie, but as the wind was slight nothing remarkable was achieved. On October 26 twenty-four flights were made, one of which lasted 2m. 15s. This was the last day before breaking up the camp. The new automatic stability device, which had arrived, was not fitted to the machine, and its trials were postponed to a later date. To the description of the machine used, given in NATURE of November 9, the following details may be added:—As the cutting-down of the skids necessitated the removal of the "blinkers," a vertical surface or keel-plane was fitted to the front edge of the main planes immediately to the right of the pilot, the object being to keep the glider directly head on to the wind. Furthermore, a boom projecting in front of the main planes some five feet carried a bag of sand, as the pilot's weight was insufficient to keep the machine level in high winds.

PROF. W. H. PERKIN, F.R.S., and Prof. E. Rutherford, F.R.S., have been elected corresponding members of the Munich Academy of Sciences.

THE Institute of Chemistry announces that Mr. Bertram Blount will deliver the second lecture on "Cement" at King's College, Strand, W.C., on Friday, December 1.

PROF. ANDREW MCWILLIAM, professor of metallurgy in the University of Sheffield, has been appointed by the Government of India to the newly created post of metallurgical and analytical inspector of steel in India.

WE learn from the *Revue scientifique* that the German Society of Aërial Navigation has constructed at Feldberg, in the Schiefergebirge, a geographical observing station for the study of aërial currents, and for the issue of a service of wind warnings.

THE council of the Royal Meteorological Society has awarded the Symons gold medal to Prof. Cleveland Abbe, of the United States Weather Bureau, in recognition of the valuable work which he has done in connection with meteorological science. The medal will be presented at the annual meeting of the society on January 17, 1912.

WE learn from *Science* that Mr. Waldemar Lindgren, who has been connected with the U.S. Geological Survey since 1884, and since 1907 has been in charge of the investigations of metalliferous deposits and of metal statistics, has been elected chief geologist, in succession to Dr. C. Willard Hayes.

THE Société Française de Physique has arranged a series of nine lectures on "Modern Ideas on the Constitution of Matter," by Madame Curie, Profs. Langevin, Perrin, Weiss, and other distinguished physicists. They are to be delivered on Saturday evenings during the next four months either at the Sorbonne or at the rooms of the society, and are open to all members of the society. The example set by the French society might with advantage be followed by some of our societies.

AT a meeting of the executive committee of the British Science Guild, held on November 15, it was announced that arrangements were being made to hold occasional evening meetings of the members, at which papers or lectures would be read, to be followed by discussions. Also further papers have been received on the subject of the conservation of the natural sources of energy, and it is hoped to publish this report before the close of the year. The subjects of coordination of charitable effort and postal reform were also discussed.

ON previous occasions we have referred to the mining operations made this year by the Duke of Sutherland to determine if the gold deposits in the Kildonan district of Sutherland could be worked at a profit. In our issue of September 28 (vol. lxxxvii., p. 425) we announced that information received from the field showed the experiments had been a financial failure. The report of Mr. William Heath, the expert entrusted with the operations, has now been commented upon in the Press. Mr. Heath says:—"This field cannot be worked by any method so as to realise on the most liberal estimate anything like half the working expenses."

THE president of the Royal College of Surgeons, Sir H. Butlin, delivered at the college two lectures (November 13 and 15) on "The Parasite of Cancer." Sir H. Butlin maintains that the cancer cell is a new creation, an independent organism most closely resembling a protozoon,

which lives as a parasite in the body of the animal which is suffering from cancer. He apparently does not suggest that it is a parasite derived from without, but that the host by some inscrutable means has fashioned it out of its own tissues.

THE death is announced, in *The Times*, of Dr. W. W. Webb, at Exeter, in his fifty-fourth year. Dr. Webb resided for some years at Netley, and was appointed curator of the Natural History Museum at the Royal Victoria Hospital, being awarded the Martin memorial gold medal and the Sir Joseph Fayrer's prize for pathology at Netley in 1883. He was the author of a guide for intending candidates for commissions and for junior officers of the Indian Medical Service, a manual of vaccination, and a work on the currencies of the Hindu States of Rajputana.

MR. JOSEPH COLLINSON, writing from the Animal Friend Society, asks for protection for the badger, as this sadly persecuted animal has dwindled down almost to extinction. Many well-known landowners have made praiseworthy efforts to protect the badger, and warmly advocate his preservation. "The protection of the badger," remarks Sir Harry Johnston, "ought to be made universal in the law of the land, quite as much as in the case of interesting wild birds," a sentiment which will receive the approbation of all who are interested in preserving the wild fauna of their native country. No other animal has made such a wonderful struggle for existence; and it is hoped by Mr. Collinson that protests may be made in time to prevent his total extermination.

THE second International Congress of Entomology will be held at Oxford on August 5–10, 1912, under the presidency of Prof. E. B. Poulton, F.R.S. Further particulars will be announced shortly. The executive committee proposes to find for members of the congress lodgings in the town, or rooms in one or more of the colleges at a moderate charge; rooms in college will be available only for men. The executive committee invites an early provisional notice of intention to join the congress, in order to be able to make the arrangements for the necessary accommodation. The proceedings of the first congress are in the press and will be published shortly. All communications and inquiries should be addressed to the General Secretary of the Executive Committee, Dr. Malcolm Burr, c/o the Entomological Society of London, 11 Chandos Street, Cavendish Square, London, W.

IT was suggested at a meeting of the Anglo-German Friendship Society, held at the Mansion House on November 2, under the presidency of the late Lord Mayor, that an Anglo-German Exhibition should be held in London in 1913. We learn from *The Times* that the idea has been favourably received, and an influential committee has been formed to forward it, under the presidency of the present Lord Mayor, consisting of the Lord Chancellor, the Duke of Argyll, Lord Brassey, Lord Avebury, Lord Weardale, Lord Courtney of Penwith, Lord Shuttleworth, Sir Frank Lascelles, Sir West Ridgeway, Sir Vezey Strong, Sir William Mather, Sir Ernest Tritton, Mr. Harry Lawson, M.P., and Mr. Alfred de Rothschild, with Mr. Cyril Rhodes, the honorary secretary of the Anglo-German Friendship Society, as honorary secretary.

THE London meeting of the Institute of Metals will be opened at the Institution of Mechanical Engineers on Tuesday, January 16, when the president-designate, Prof. W. Gowland, F.R.S., will deliver his inaugural address on the subject of "Copper and its Alloys in Early Times." The whole of Wednesday, January 17, will, if necessary, be devoted to the reading and discussion of a number of papers, amongst which may be mentioned the following:—Properties of certain copper alloys at high temperatures, G. D. Bengough; further experiments on the inversion at 470° C. in copper-zinc alloys, Prof. H. C. H. Carpenter; the influence of oxygen on copper containing arsenic or antimony, R. H. Greaves; the nomenclature of alloys, Dr. W. Rosenhain; poisoned brass, and its behaviour when heated in vacuo, Prof. T. Turner; and a paper by Dr. Carl Benedicks, of the University of Stockholm, dealing with some novel experiments on a zinc-antimony alloy.

WE regret to record the death of Mr. Eugene William Oates, at Edgbaston, on November 16, at sixty-six years of age. Like many other Indian officials, Mr. Oates, who served (chiefly, we believe, in Burma) for thirty-two years in the Public Works Department of India, devoted his leisure time to the study of the ornithology of the country in which he was long resident. His earliest ornithological work appears to be a "List of the Birds of Pegu," published in Calcutta in 1881, and a couple of years later appeared his "Handbook to the Birds of British Burmah, &c.," published in London, in two volumes. This was followed, in 1898–9, by a "Manual of the Game Birds of India," which likewise formed two volumes, and was published at Bombay. Somewhere about this time he appears to have retired from the service of the Indian Government, for in 1889–90 his name appears as editor of the second edition of Mr. A. O. Hume's "Nests and Eggs of Indian Birds," published, in three volumes, in London. His knowledge of Indian ornithology led Dr. Blanford to select Mr. Oates to write the first two volumes on birds in the "Fauna of British India," which appeared respectively in 1889 and 1890; and later he was engaged by the trustees to compile the "Catalogue of Birds' Eggs in the British Museum," the first volume of which was issued in 1888 under his own name, while in the other three this appears in conjunction with that of Captain Savile Reid. Mr. Oates's knowledge of Indo-Burmese ornithology was very extensive, and his work careful and elaborate.

THE committee of the British Antarctic Expedition has made an earnest public appeal for further contributions towards the support of Captain Scott's expedition in Antarctica. Through ill-fortune, unforeseen expenses have been incurred. On her voyage south after leaving New Zealand on November 29, 1910, the *Terra Nova* experienced terrible weather, and the damage done to the ship has entailed a heavy bill for repairs; and the cost of new stores to replace those lost on this voyage has to be met. After defraying these unexpected disbursements the money left will be hardly enough to enable the committee to pay until the end of March, 1912, the allowances of the wives and relatives of the officers and men of Captain Scott's party. On these accounts alone the committee must somehow raise more money. In addition, however, it is imperative that there should be no delay in securing further funds if the honour of first reaching the South Pole is to be secured for Captain Scott. The *Terra Nova* on her journeys unexpectedly came across the Norwegian expedition under Captain Amundsen, who also is trying to reach the Pole. The committee asks for 15,000*l.* by December 1, so that a telegram may be sent before the *Terra Nova* sails south to reassure Captain Scott that the necessary funds will be forthcoming. We agree with the committee that it would be pitiful if Captain Scott and his party were allowed to fail for want of financial support. We are confident that the appeal to the patriotism of our men of

wealth will not be in vain, and that the honour of this country in the world of science and exploration will be maintained by the generosity of the wealthy men at home and the efforts of the men of action now in south polar regions. Contributions should be sent to the treasurer, Sir Edgar Speyer, at 7 Lothbury, London, E.C.

THE advantage of the application of physiological knowledge to the problems of Egyptian archæology is shown in a clever explanation of the origin of the representation of an ancient standard found on the slate palette of King Narmer, which was discovered at Hierakonpolis, in Upper Egypt. It appears again in a specimen of the twelfth dynasty unearthed by Prof. Flinders Petrie below the palace of Apries, at Memphis. Dr. C. G. Seligmann and Miss M. A. Murray, in the November number of *Man*, point out that this curious figure represents the placenta, which is still, according to Mr. J. Roscoe, held in reverence by the Baganda, as it is supposed to contain the external soul of the chief, and is hence preserved at his birth. It was carried in procession by a special official, because the safety of the reigning sovereign was believed to depend upon its being carefully preserved.

IN the first part of the Journal of the Royal Anthropological Institute for the current year, Prof. A. Keith examines a collection of skulls, principally those of Negroes from the Congo Free State and Nigeria. These constitute four groups: those from Nigeria, the Congo, the Korawp, on the frontier of the German Cameroons, and a group of tribes including the Ekoi and Kabila of Nigeria, and the Fortit and Bongo of the Nile region. From the present distribution of the Negro tribes in equatorial Africa, Prof. Keith comes to the following conclusions:—There has been free intermigration; in the course of their evolution, the tendency of one tribe has been towards the accentuation of one set of characters, of another towards another set. Thus the Dinka acquire high stature and narrow heads; the typical Nigerians low stature and narrow heads; the Basoko wide, short heads and low stature; the Buruns wide heads and high stature. Interbreeding may have played its part; but if it had played a great part we should have found greater physical uniformity than there is. The influence of Arab blood on these tribes has probably been exaggerated.

THE Bulletin of the Johns Hopkins Hospital for September (xxii., No. 247) contains articles on Zabdiel Boylston, inoculator, and the epidemic of smallpox in Boston in 1721, by Dr. Fitz; medical notes on the "Divine Comedy" of Dante Alighieri, by Dr. Dernehl; and on "Molière and the Physician," by Dr. Kahn. A new department has been created in the Johns Hopkins University, to be known under the general title "Art as Applied to Medicine." Its purpose is to bridge over the gap existing between art and medicine, and to train a new generation of artists to illustrate medical journals and books. The instruction given is designed for the needs of two classes: (1) for medical students, and (2) for artists. The department is in charge of Prof. Max Brödel, and a synopsis of the two courses is given.

A REPORT by Dr. F. J. H. Coutts, on an inquiry as to condensed milks, has been issued by the Local Government Board. It contains much important matter on the history, methods of manufacture, composition, and use of condensed milk, with suggestions as to administrative control, labelling, &c. Condensed milk occurs as full-cream or machine-skimmed, and may be sweetened, partially sweetened, or unsweetened. The composition of the different brands varies somewhat; *e.g.* in the full-cream and fully sweetened the fat varies from about 9·0 to 13·7 per cent., and the sucrose (generally beet sugar) from 37·2 to 41·5 per cent. The condensed milks, except occasionally in the unsweetened brands, which are sterilised, generally contain some micro-organisms (up to several thousand per cubic centimetre), but they show no disposition to multiply either in the unopened or in the opened tins, as a rule. Diluted condensed milk, however, becomes a favourable medium for the growth of bacteria. The process of condensation appears to be fatal to the tubercle bacillus. The importance of condensed milks is in connection with infant feeding. The skimmed condensed milks are to be absolutely condemned for this purpose, owing to the small fat content. Infants fed on condensed milks seem to suffer from more infantile ailments, and the mortality is higher among them, than among those fed on cow's milk. As regards cost, the condensed milks are slightly more expensive than equivalent amounts of cow's milk and sugar. The labelling of some of the brands is very misleading to the poorer and illiterate mothers who principally use them. It is suggested that the skimmed brands should be labelled as unfit for infant feeding, and that some declaration of the content of fat and of substances foreign to milk should be obligatory on the labels.

A SIGNED portrait, accompanied by a memoir, of the late Mr. G. H. Verrall, the distinguished authority on British flies, forms the chief feature in the November number of *The Entomologist's Monthly Magazine*.

IN referring to his bird-marking experiments in the November number of *British Birds*, Mr. Witherby remarks that "the number of birds marked has steadily increased until this year the splendid total of just 9500 has been reached. In the first year of the inquiry only 2200 rings were used, but in the next year 7900 were placed, so that the number of birds 'ringed' by the readers of *British Birds* now amounts to nearly twenty thousand." The large increase in the number of rings implies, of course, increased expenditure, to meet which additional contributions are solicited.

IN its report for the year ending June 15, 1911, the Northumberland Sea-fisheries Committee gives a summary of the results of the experiments in marking fish and crustaceans which have been carried on locally during the last few years, together with tables and charts. The experiments in breeding lobsters show that an abundant supply of absolutely pure sea-water is essential to success; and it is interesting to note that during the year one of the officials had the opportunity of observing a lobster during the process of shell-changing. Experiments on Holy Island show that a vast area is available for the culture of mussels, to be used either as bait or food; and observations are also recorded on the spawning of cod.

TO *Naturwissenschaftliche Wochenschrift* for October 29 Dr. A. Kobelt contributes a long article on the physiological origin of markings and colour in the animal kingdom. Attention is directed to the prevalence of pigment in the neighbourhood of the great sensory and nervous structures, as exemplified by the dorsal stripe of many mammals and some lizards, the dark lateral line of fishes, the frequency of dark markings on the muzzle, and especially the concentration of colour in the eye and its neighbourhood. The hue of the ground-colour of animals is attributed by the author to the existence of an equilibrium between the effects of light-stimulus and the influence of the sense-organs, which leads to an equality in, and a large

increase of, the sensory cells. Disturbance of this equality gives rise to colour-markings. Apparently Dr. Kobelt does not believe in protective coloration.

THE Purdue University Experiment Station has taken a leaf out of the business man's book, and freely advertises its results among farmers. The Bulletins, a number of which are to hand, are written in a manner likely to attract, and demonstrate that the yield of maize can be considerably increased on the ordinary farm without a great expenditure, but solely by the adoption of improved varieties or better fertilisers. New crops have been introduced, and improved and more economical rations have been drawn up for dairy stock.

WE have received from the United States Department of Agriculture, Bureau of Entomology, catalogue by E. R. Sasscer of recently discovered Coccidæ and by D. Moulton of the North American Thysanoptera, and also an annotated bibliography of the Mexican cotton-boll weevil by F. C. Bishopp. Publications of this type are extremely valuable in enabling investigators to find their way through the appalling number of entomological publications that are put out at a rate probably unequalled in any other subject.

The National Geographic Magazine for September is largely devoted to two studies of Troglodytes, one by Mr. F. E. Johnson describing those of southern Tunisia, the second by Miss E. H. Brewer the cave-dwellers in Cappadocia. Some French officers divide the Tunisian Troglodytes, whose presence in that region is noted by the historian Sallust into three groups: those living in excavations in the ground, those occupying caves or holes in the hillside, and those living in houses superimposed one upon the other, the higher chambers being reached by precarious staircases or stones projecting from the walls. The Troglodytes in the Uskub Valley in Asia Minor occupy holes excavated in curious rock cones. Prof. Sterrett, of Cornell University, who has studied them, believes that this form of dwelling dates so far back as the Hittite period. Both these accounts of two remarkable races are illustrated by a series of admirable photographs.

IN the *Zeitschrift der Gesellschaft für Erdkunde* (No. 7) Dr. A. Rühl discusses the part played by isostasy in the formation of peneplains. He considers that when an elevated land mass is subjected to long-continued erosion the isostatic equilibrium is destroyed, and as a result, after a greater or less period of time, a new upward movement will take place, but to a less extent than originally. Local conditions will determine at what stage these isostatic movements will occur. The development of the earth's surface would not be a continuous operation, but rather one strongly periodic in character in which short periods of active orogenetic and epeirogenetic movement would be succeeded by relatively long periods of erosion. Orogenetic movements occurring would cause fracturing of the earth's crust, and eroding agencies would become active, removing material and redepositing elsewhere. This will destroy the isostasy, and sooner or later a warping or tilting of the whole land mass will occur.

PART iii., vol. xli., of the Records of the Geological Survey of India contains the usual annual statistics of the mineral production of India, the year here dealt with being 1910. Upon the whole, the production is just about stationary, the value of the output showing an increase only of some 12,000*l*., whilst its total is 7,700,000*l*. The principal item, as before, is coal; the total output is just over 12 millions of tons, showing an increase of about 177,000 tons over 1909; on the other hand, prices have fallen again to about what they were before the boom of 1907–8, and may be looked upon as at about a normal level. The industry is evidently in a sound condition; the output per miner shows a satisfactory increase, and exports have gone up and imports have gone down by 43 and 36 per cent. respectively. Owing to the above-noted fall in price, the value of the coal output in 1910 is 324,321*l*. lower than in 1909; but, as explained, this is a healthy symptom so far as the coal industry is concerned. The next most valuable output on the list is that of gold, which is practically stationary at 2,200,000*l*. These two minerals are by far the most important amongst Indian mineral products, accounting for about three-fifths of the total value. The production of manganese ore shows a fair increase, the total for 1910 being just over 800,000 tons; prices were also rather better than they were in the previous year, so much so that whilst the quantity produced was increased by 20 per cent., its value was increased by no less than 40 per cent. The production of both mica and petroleum has fallen off during the year under review. Upon the whole, it may be said that whilst not chronicling any brilliant results, the statistics before us show a steady progress in the mining industry of our Indian Empire.

THE excessive rains of Saturday and Sunday last have occasioned considerable and extensive floods at many places in the south and east of England, and in Kent and Sussex a great deal of land is under water. The Weather Report issued by the Meteorological Office for the week ending November 18 shows that the total rainfall for the period was largely in excess of the average over the entire kingdom. The heaviest falls occurred in Scotland and Ireland, where in parts the rainfall for the week was about three times the average amount. Falls of more than an inch in twenty-four hours occurred in all parts of the kingdom; and at Worthing the measurement for the three days ending November 18 was 3·27 inches. The autumn rainfall for the eleven weeks commencing with September is now in excess of the average in all districts except in the north and west of Scotland, the north-east of England, and the Midland counties. The greatest excess for the autumn is 3·00 inches in the Channel Islands, which is followed by 2·85 inches in the south of Ireland and 2·73 inches in the south-east of England. The greatest deficiency of rain since the commencement of the year is 6·56 inches in the Midland counties, where the aggregate fall, so far, is only 16·53 inches. The temperature last week was largely in excess of the average in all the English districts, the excess amounting to nearly 5° in the east of England. The duration of bright sunshine was generally deficient.

THE meteorological chart of the North Atlantic for November issued by the Deutsche Seewarte gives an interesting account of a hurricane experienced on July 12 in the South Atlantic, near lat. 30° and long. 30°, by four out of five sailing vessels which left Chilian ports between May 17 and June 14, the tracks of which are laid down for the whole voyage to the English Channel. It is noteworthy that the storm occurred with a relatively high barometer; the synoptic charts drawn for July 10–13 show that a shallow depression lay over the coast of central Brazil on July 10, and that on the following day it had divided into two parts, the centre of one being on the coast in 20° S. and the other in about 26° S., long. 39° W. From the chart of July 12 it appears that the two systems had coalesced, and had travelled in a south-easterly direction. The atmospheric conditions are considered to be very striking (notwithstanding that it was the southern winter),

the more so as the disturbance proceeded from the somewhat low latitude of 20° S.

THE marine turbine speed-reducing gear fitted by the Westinghouse Company, of Pittsburg, to the United States collier *Neptune* is described in *The Engineer* for November 17. This is a modified form of the Melville-Macalpine gear with double-helical pinion and spur wheel. The power transmitted is 4000; the pinion keyed to the turbine shaft runs at 1250 revolutions per minute, and the screw shaft at 130—a reduction of nearly 10 to 1. The pinion shaft is not carried in rigid bearings, but is borne in a long sleeve, which is provided with three hydraulic pistons above and three below. The movement from the central position is trifling—two or three thousandths of an inch—but the liquid correction gives the gear a certain amount of elasticity, reduces shock and noise, and conduces to the sweet running of the gear. The *Neptune* has given great satisfaction on its trials.

WITH the view of ascertaining the resistance of reinforced concrete strong-rooms to attack by oxy-acetylene blow-pipes, tests were recently made on a slab prepared by the Indented Bar and Concrete Engineering Company, of Westminster. The results are described in *The Engineer* for November 17. The oxy-acetylene blow-pipe was applied to the slab for twenty-four minutes, at the end of which period, after much raking out of the resulting glass formed by the fusion of the sand, and accompanied by a deafening roar from the blow-pipe, a hole 3·5 inches in diameter was made through the slab. Whenever a steel bar was met the metal-cutter, *i.e.* a stream of pure oxygen directed on to the white-hot steel, was brought into action, and the steel instantly fused away. The concrete was the material which gave the trouble, the metal-cutter being powerless to act upon it. The same thickness of steel of any grade could not have resisted the metal-cutter longer than about four minutes. The test slab was 6 inches thick; 0·55 cubic foot of oxygen and 0·45 cubic foot of acetylene were consumed in the test, which clearly is strongly in favour of reinforced concrete as contrasted with steel.

A COPY of the Year Book for 1911 of the Indian Guild of Science and Technology has been received. The object of the guild is to cooperate in promoting the knowledge and application of pure and technological science in India with a view to the improvement of the methods of economic production and the amelioration of the sanitary condition of the people. Prof. Smithells, F.R.S., is the general president of the guild; and among the list of patrons we notice the names of Sir Henry Roscoe, F.R.S., Sir William Ramsay, K.C.B., F.R.S., and Prof. O. N. Witt. The year book runs to 135 pages, and contains an official report of the annual general meeting, held on December 19, 1910, of the activities of the various sections, and the speeches at the annual dinner. In addition, a number of scientific articles, many of them concerned with pressing Indian problems, are included. Altogether the guild, which is only in the third year of its existence, has entered upon a career of great usefulness.

MESSRS. NEWTON AND CO., 3 Fleet Street, E.C., have just issued a supplementary list of lantern-slides, in which several sets of slides of scientific interest are included. Among these subjects are remarkable examples of achievements of photography, pictures taken by Prof. R. W. Wood with ultra-violet and infra-red rays, photographs of snow crystals taken by Mr. W. A. Bentley, wild flowers, glaciers, and other scenes in Switzerland, and architectural hygiene.

OUR ASTRONOMICAL COLUMN.

THE SPECTRUM OF BROOKS'S COMET, 1911c.—With the three-prism slit spectrograph (No. iii.) and a small objective-prism spectrograph of 10 cm. focal length, both attached to the Pulkowa 30-inch refractor, Prof. Belopolsky secured several photographs of the spectrum of Brooks's comet during October. Eight hours' exposure with the slit spectrograph on October 4, 5, and 6 showed the bands 473 $\mu\mu$ and 431 $\mu\mu$ clearly, and others faintly; in each case the several maxima in each band were measured, and the wave-lengths are given to six figures. Measures of the radial velocity of the comet gave +15 km., agreeing with the ephemeris.

With the smaller spectroscope monochromatic images of the comet were found at 560, 516, 473, 405, and 388 $\mu\mu$, each image being sharply defined on the red side; special measures gave the values 388·36 $\mu\mu$ and 387·52 $\mu\mu$. Bands in the continuous spectrum extended from 420 to 421 $\mu\mu$ and from 402 to 405 $\mu\mu$. On October 1 the bands were equal in intensity, but on October 10 that at λ 388 was the brightest; this band only gave a faint trace of the tail (*Astronomische Nachrichten*, No. 4535).

THE CHEMICAL UNITY OF THE COSMOS.—In the current number of *Scientia* Prof. Fowler has an interesting article in which he sums up the evidence showing the chemical unity which exists among all the bodies of the visible universe, so far as our present means permit us to examine them. Kant and Laplace suggested such a unity; but it was not until Kirchhoff and Bunsen, in 1859, supplied the key which opened up to us celestial spectrum analysis that the suggestion could be practically tested. Several factors still interfere in many cases with the proof of absolute coincidence of wave-length in comparing radiations in different spectra, but Prof. Fowler believes that all celestial spectra will sooner or later come within the scope of laboratory reproduction. Most of the strong lines in the solar spectrum are already origined, and the sun has been shown to take its place in an orderly sequence of stellar forms. Then, again, the study of the various elements, under varying laboratory conditions, initiated by Sir Norman Lockyer, has provided us, so far as the main variations in celestial spectra are concerned, with terrestrial parallels for the stellar departures from the sun's spectral features.

SUN-SPOTS AND FLOCCULI IN 1910.—In addition to the values for December, 1910, No. 12, vol. i., of the *Boletin Mensuel del Observatorio del Ebro* contains the *résumé* of the solar and meteorological observations made during 1910. The spot areas were low throughout the year, and no spots were recorded at all in August, September, and December. The reduced area for spots, in both hemispheres for the whole year, was 165 millionths of the solar hemisphere, and for flocculi the analogous value was 401 hundred-thousandths, the ratio between the two being 24·3. Taking the hemispheres separately, the values for the northern was 42, and for the southern 123, millionths for spots, and 114 and 287 hundred-thousandths for flocculi. The mean heliographic latitude of spots was 10·1, and for flocculi 10·2. During the year there were 301 groups of flocculi occurring with spots and 525 occurring without, and the tabulated summary shows that those groups occurring with spots were decidedly of a more compact character than those occurring without.

ASTROGRAPHIC CATALOGUE, PERTH (W.A.) SECTION.—In the preparation of the International Astrographic Catalogue the section dec. −31° to −41° was allotted to the Perth Observatory, West Australia, which has just published the first volume of results. The complete measures will occupy thirty-six volumes; and the present issue, the first to be completed, is vol. iv. The method of work is briefly explained by Mr. Cooke, but a general introduction will appear later. It is believed that the faintest stars shown on the centre of the Perth plates are of about mag. 11·5, those at the extreme corners 10·5; and the present volume contains the measures of the rectangular coordinates and magnitudes of 13,636 star images between R.A. 18h. to 24h. on plates with centres in declination −32°.

THE CASE-HARDENING OF STEEL.

THE autumn meeting of the Iron and Steel Institute was to have taken place in Turin, but unfortunate circumstances rendered this impossible. None the less, a series of important papers by Italian authors were presented—and taken as read—at the meeting held recently in London. Most of these papers were of the nature often met with at foreign meetings of this institute—*i.e.* records of metallurgical resources and achievements of the country. On this occasion, however, two Italian papers of a different character were laid before the institute. These deal with the case-hardening of steel, and are both from the pen of the well-known Turin metallographer Prof. F. Giollitti, whose name proclaims his close relationship to the present Prime Minister of Italy.

The two papers in question are entitled "On Case-hardening by Means of Compressed Gases" and on a "New Industrial Process for the Case-hardening of Steel." The striking fact brought out by these papers is that the Italian metallographers who have worked on this subject have evolved order out of chaos by treating the whole question as one of physico-chemical equilibrium between the various solids and gases present during the process. It is to be regretted that Prof. Giollitti did not carry out his avowed original intention of giving a detailed summary of the more important researches on this subject conducted by him and his collaborators at Turin, but the mere bibliography of some fifteen memoirs is sufficiently impressive. The results of these researches are, however, summed up by the author in his present paper in a series of conclusions which are very definitely laid down. If we may accept Prof. Giollitti's statement that his views are fully established, the fundamental facts of case-hardening are as follows:—

(1) Solid carburising agents, without the intervention of gases, have only a slight action.

(2) The specific effect of nitrogen is very weak, and only in the presence of cyanides, ferrocyanides, &c., does the effect of volatile nitrogen compounds become marked.

(3) The specific carburising effect of carbon monoxide is enormously greater than that of any solid cementing agent. Pure carbon monoxide carburises iron at all temperatures between 700° C. and 1300° C., and it produces a greater depth of carburisation in a given time than any other carburising agent. Both the depth and intensity of the cementation can be accurately regulated, as they are governed by equilibrium conditions, which can be definitely ascertained and adhered to.

(4) The use of carbon monoxide as the principal cementing agent makes it possible to obtain softer and better graded cementation than is obtainable by other means.

The new industrial process which Prof. Giollitti bases on his experimental results is, in effect, a specially mechanically arranged furnace, which makes it possible to charge and discharge a vertical muffle with the articles to be case-hardened in a very short time. So soon as the muffle is charged with the steel, which is introduced at a red heat, the remaining free space of the muffle is filled with hot granulated carbon, which, the author tells us, flows into the interstices like a liquid. Then a current of carbon monoxide or of dioxide is passed in at a measured rate for a definite time and at a measured temperature, and any desired degree of hardening can be obtained. The effect of the direct contact of the steel with the solid granular carbon appears to be the production of a thin outer skin of very highly carburised steel, while the effect of the gases gives a less highly carburised region extending for some depth into the metal. In the Giollitti muffle it is possible to withdraw the solid granulated carbon at any desired stage, and to continue the cementation with the gas alone, merely leaving enough carbon in the muffle to secure equilibrium of the gases (CO and CO_2) with solid carbon. Tables of analyses are given which show that the result of such treatment is somewhat to lower the carbon concentration of the extreme outside layer and to reduce the carbon concentration gradient inwards to almost any desired extent. This treatment, therefore, removes the risk of cracking and shelling which arises from the rapid changes in carbon content which occur in articles case-hardened in the ordinary way, and more especially by the use of cyanides or ferrocyanides. By the new method it is claimed that cementation of very great depth can be safely obtained, even with special alloy steels, which tend to become "rotten" on the surface when cased by other means. Whether the Giollitti muffle and method will realise all these expectations practical experience alone can show, but there is no doubt that these Italian investigators have thrown a flood of new light into a formerly obscure region of steel metallurgy.

The character of this new light is perhaps more clearly shown, so far as the scientific point of view is concerned, in the paper by Giollitti and Carenvali on case-hardening in compressed gases. The work described in this paper is based on the researches of Schenk on the equilibrium of the systems consisting of Fe, C, CO, and CO_2; Fe, Fe_3C, CO, CO_2; Fe, FeO, CO, CO_2, and other systems consisting of the mutual compounds of the elements iron, carbon, and oxygen at various temperatures and pressures. The experiments of the present authors were conducted by means of a small electric resistance furnace placed inside a steel cylinder, and partially filled with both granular carbon and steel specimens, into which compressed carbon dioxide was fed at known rates. The authors found, in general, that the rate of cementation increased with the pressure employed, but they also found that when certain pressures were exceeded, in spite of their intimate contact with incandescent solid carbon, the surfaces of the steel specimens became thickly coated with oxide, although vigorous cementation had taken place in the metal immediately beneath the oxide layer. Thus they show the photomicrographs which are reproduced in Figs. 1 and 2; in No. 1 we see the section of the region of a carbon steel close to the surface, which was covered with a thick layer of oxide, and the highly carburised nature of the steel close to this surface is at once evident. In No. 2 we see the section of an alloy steel (in this case a nickel-chrome steel) which exhibits an altered, highly carburised layer close to a deeply oxidised surface; the magnification in both cases is 65 diameters.

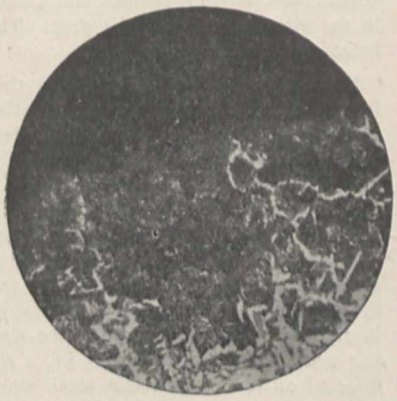

FIG. 1.

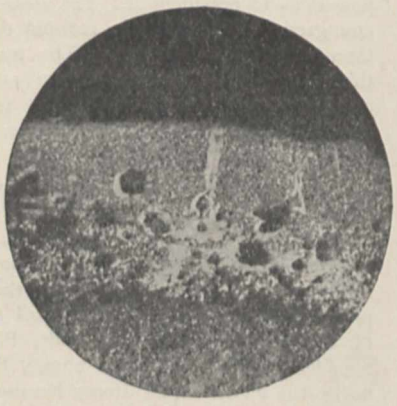

FIG. 2.

In the case of chrome-steels such a paradoxical result had already been observed by Charpy, who expressed his results by stating that apparently in the action of carbon-monoxide on iron-chromium alloys the two metals behaved independently, the iron becoming carburised, while the chromium is oxidised. The present authors show that such an opinion is not justified; the explanation of the apparent paradox lies in the equilibrium conditions of the systems referred to above. For every temperature and concentration there is a critical pressure above which oxide, as well as carbide, of iron is present in equilibrium with CO, CO_2, and C. The addition to iron of a baser metal, such as chromium or manganese, lowers this critical pressure

until—in certain alloys—it falls below the ordinary atmospheric pressure, and oxidation as well as cementation takes place. On the other hand, the addition of a "nobler" metal, such as nickel, raises the critical pressure and allows of the use of gases under higher pressures for cementation without risk of spoiling the articles by surface oxidation. Two interesting conclusions are drawn by the authors. The first is that for a given steel there is a limiting pressure for cementation, by means of carbon-carbon-monoxide mixtures, beyond which surface oxidation sets in. The second is that in the case of chromium alloy steels the pressure of CO and CO_2 must be diminished below atmospheric to allow of cementation without oxidation. Since it is only the partial pressure of these gases, however, which comes into effect, this diminution below atmospheric pressure can be produced by simple dilution. It follows, and the authors describe an experimental verification, that in these circumstances oxidation can be avoided by diluting the stream of "cementing" gases (CO and CO_2) with air. The oxygen, of course, combines with the granulated carbon in the furnace to form CO and CO_2 in the proportions required by the equilibrium conditions, while the remaining nitrogen acts as a diluent and produces the desired effect.

We have here a series of remarkable deductions and experimental verifications of facts which appear almost incredible to any steel-worker not conversant with the theory of physico-chemical equilibria; indeed, the practical man will probably find it difficult to believe them until he has tried for himself. None the less, there is here a basis for the rational and scientific conduct and control of a process hitherto largely based on "rule of thumb."

W. ROSENHAIN.

THE INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.[1]

THE annual volume of the Transactions of the Institution of Engineers and Shipbuilders in Scotland, which at the close of the session 1908–9 had 1650 members upon its roll, contains several valuable papers. The president, Mr. C. P. Hogg, in his address, after passing in rapid review some of the outstanding developments in engineering during the past 100 years, directed attention to some of the problems of the future; in his opinion the nineteenth century demonstrated how to utilise the forces of nature, while the problem of the twentieth century will be how to do so efficiently.

Mr. C. A. Ablett in a paper on electrically driven reversing rolling mills described in detail the Ilgner system, in which the power, supplied under very economical conditions by a steam turbine or a gas engine, is applied to drive a reversing mill. The mill motor is a direct-current shunt-wound machine; interposed between it and the source of power supply is a fly-wheel converter set in order to provide a system by which the mill motor may be started, stopped, reversed, and kept under control in regard to speed without loss of energy, and at the same time to enable a control apparatus of reasonable dimensions to be employed. The electrical equipment of a 36-inch cogging mill at Osnabrück was described as an example of this system, and the paper was illustrated by a series of drawings and photographs of the plant; especial attention was given to the flexible coupling between the fly-wheel and the electrical machines of the converter set.

In the discussion on this paper Mr. T. B. Mackenzie expressed the opinion that German steel makers were able in many cases, owing to their skilful utilisation of waste energy, to roll their steel at lower rates for power than usually obtained in this country; he believed that in the steel works of the future there would be no reciprocating steam engines employed—the whole of the power needed would be generated by gas engines in a central station and distributed electrically to the various mills.

In a paper by Mr. A. Melville, the "Simplex" method of concrete pile foundations was described; the essential principle of this system was the driving into the ground of a 16-inch diameter steel tube closed at the lower end either by a loose point or a pair of hinged jaws, which open when the tube is eventually withdrawn and permit concrete, either plain or reinforced, to be passed through, filling up the entire space originally occupied by the tube simultaneously with the withdrawal of the latter from the ground. This system has now been extensively employed in the United States, and is rapidly coming into use in this country; the cost was stated to be about 2*s*. 6*d*. per cubic foot of pile when no reinforcement was used.

The important problem of the design of surface condensers, more important than ever since the introduction of the exhaust steam turbine, was dealt with in a paper by Mr. R. M. Neilson, who stated that empirical methods must be abandoned, and the area of cooling surface calculated in a rational manner so as to allow a given vacuum to be guaranteed under given conditions. The author proceeded to work out a scheme for the design of condensers, allowing for the varying conditions found in practice, and then offered a series of valuable suggestions as to the most profitable lines on which experimental research might in the future be conducted. In the discussion Prof. Mellanby directed attention to Dr. Stanton's researches into this problem, and Mr. Weir pointed out that in a condenser for a turbine-propelled torpedo-boat he was able with a vacuum of 28·7 inches to secure a condensation of 27 lb. per square foot of cooling surface.

Other papers published in this volume are steamship repairs by electric and autogenous welding, by Mr. H. S. Younger, descriptive of processes by which repairs can be carried out either by electric welding or by means of the oxy-acetylene process on damaged material so as to make it serviceable again; some tests on board ship to ascertain the water consumption of engine-room and deck auxiliaries, by Mr. C. F. A. Fyfe; and Prof. Mellanby's description of a new experimental steam engine at the Glasgow and West of Scotland Technical College.

T. H. B.

[1] Transactions of the Institution of Engineers and Shipbuilders in Scotland. Vol. liii. Fifty-third session, 1909-10. Edited by the Secretary. Pp. xxxii+429 (Glasgow: The Institution, 1910.)

TICKS.[1]

THE rapid advance that has been made in recent years in scientific and medical knowledge with regard to diseases caused by parasitic Protozoa and other microscopic organisms has had the secondary result of directing attention to the insects or other invertebrate animals which are often the agents in the dissemination of the disease-causing parasites. Mosquitoes, tsetses, and other biting flies, fleas, and other ectoparasites are now being collected eagerly and studied earnestly in all parts of the world, less perhaps by professed zoologists than by medical men and others, to whom the practical importance of these pests is a greater stimulus to investigation than the purely scientific interest which the creatures may possess in themselves. Hence special attention has been directed to the various groups of blood-sucking arthropods so soon as their connection with particular diseases has been made known. Mosquitoes were the first to come into prominence when their connection with malaria was discovered; then biting flies, and especially tsetse-flies, when their *rôle* in disseminating trypanosomiases of animals and human beings was made known; and next fleas have been the subject of close study, when their relation to the spread of plague became apparent. There remain three important groups of ectoparasites: ticks, lice, and bugs. It is well known that ticks play a considerable part in spreading diseases. In human beings, African relapsing fever is caused by a spirochæte transmitted by a tick; hence its popular name of "tick-fever." In animals, various deadly diseases, known collectively as "piroplasmoses," because caused by a minute blood-parasite belonging to the genus Piroplasma, or allied genera, are known to be transmitted by various species of ticks; such are the "red-water" or "Texas-fever" of cattle, and similar diseases of horses,

[1] "Ticks, a Monograph of the Ixodoidea." By G. H. F. Nuttall, C. Warburton, W. F. Cooper, and L. E. Robinson. Part i., Bibliography of the Ixodoidea, by G. H. F. Nuttall, L. E. Robinson, and W. F. Cooper. Price 6*s*. net. Part ii., by G. H. F. Nuttall and C. Warburton. Price 12*s*. net. (Cambridge University Press, 1911.)

dogs, and other domestic animals in various parts of the world.

For the medical or veterinary practitioner, who cannot be expected to be an expert in every branch of science as well as in his own art, it is of the highest importance that the scientific knowledge of the ectoparasites that are likely to disseminate diseases should be brought together and summarised in such a manner as to be accessible to those whose vocation brings them into contact with these pests. Exhaustive monographs of the various blood-sucking invertebrates are of the greatest practical as well as scientific value. The work under review is the first attempt to deal in this manner with ticks, a somewhat repulsive group of arachnids which has attracted the special attention of but few professed naturalists, and of which the literature, though considerable in bulk, is extremely scattered, and much of it inaccessible. Consequently, experts on this group have been rare, and the identification of a species has often been a matter of extreme difficulty.

The main results of the labours of Prof. Nuttall and his colleagues will be to collect together all references to works dealing with ticks, and to give accurate descriptions, accompanied with illustrations, of every valid species of tick in such a way that it will be possible for anyone in any part of the world to identify a tick, of a species already known, by aid of this monograph. The undertaking is therefore one which, if successfully carried out, will fill a great gap and render an important service.

The first two instalments of the monograph are before us. Part i. contains the bibliography of ticks, which covers 68 quarto pages of references. The bibliography is printed only on one side of the paper, so that those who wish to keep it up to date can cut it up and make a card-catalogue of it. Part ii. contains two sections, the first dealing with the classifications of ticks, the second with the genus Ixodes, Latreille, 1795, of which fifty-one valid species are recognised. Following the descriptions of these species, of which all but two are accompanied by illustrations, are notes on the geographical distribution, on doubtful species, and on the biology of Ixodes, and a synonymic list of condemned and doubtful species, together with a list of the collections in which the types are to be found.

A detailed criticism of this work could only be undertaken by an expert writing for experts. We note, however, that the bibliography seems to contain a great many references to works, ancient and modern, which are little more than literary curiosities, and it would, we think, have been useful to separate the chaff from the wheat by indicating in some way those references which advance the scientific knowledge of the group and are to be taken seriously. For our part, we are sceptical as to the utility, in a work of this kind, of references to the opinions of Aristotle, Pliny, and Moses. The fact that the ancients believed ticks to be without an anal aperture may be an interesting "tit-bit," but it is not of much value, scientific or practical, to those who wish to study ticks at the present day. The illustrations are good and very clear, and the work seems singularly free from misprints. Prof. Nuttall has a curious fancy for using inverted commas, in some cases not for quotations, apparently, but for familiar expressions, such as "rattled like peas" or "put in the way of finding their food"; if these are quotations we do not recognise them, nor are we put in the way of finding their source.

A work of this kind tends, by aiding investigation and discovery, to hasten the advent of the period when it will itself be out of date. It makes it easy for anyone to collect ticks, to identify them, and to discover and describe new species; hence long before it is completed it will probably require supplements. The study of these parasites, interesting not only to the practical man, but also to the naturalist, as remarkable instances of adaptation to a mode of life which is peculiar, if to ourselves unpleasant, will be greatly advanced by the publication of this monograph; and both classes of investigators will owe a debt of gratitude to the labours of Prof. Nuttall and his collaborators for raising the scientific knowledge of ticks to a plane in which rapid progress is rendered possible in the future.

SEISMOLOGY AT THE BRITISH ASSOCIATION.

WE have before us the sixteenth report of the Seismological Committee of the British Association. There may be reasons why this particular report should be known as No. 16, but for those interested in seismological literature such a title may be misleading. As a matter of fact, this association has published fifty-two annual reports about earthquakes, some of which, like those by the late Robert Mallet, are reference works for all who are students of seismology. I direct attention to this matter as an indication that Great Britain has not been behind in investigations relating to earth physics. In certain directions it is far in advance of many others.

The first fact to be gathered from this report is that the British Association, in its endeavour to make a seismic survey of the world, enjoy the cooperation of about sixty stations, which are fairly evenly distributed over the surface of our earth. It is remarkable to note that colonial Governments, and particularly cable companies, have established observing stations on many oceanic islands, as, for example, at Cape Verde, Ascension, St. Helena, Fernando Noronha, Mauritius, Seychelles, Cocos, Fiji, and other places. On March 28 this year the Legislative Council of Bermuda passed a "Seismographic Act" enabling the Board of Public Works to purchase and maintain instruments for recording earthquakes. Other colonial Governments have taken similar steps; whilst the English Government gives direct assistance to an International Association which has its headquarters at Strassburg. An item of considerable interest in the report refers to Double and Multiple Earthquakes, about which we read the following:—

"Attention has frequently been drawn to the fact that an earthquake as it radiates may cause a collapse of strata which is in an unstable condition, and thus give rise to one or more secondary disturbances. The great earthquake of Lisbon in 1755 gave rise to secondary shocks in England, Ireland, and probably in many other countries. In the volume containing Physical Observations made in the Antarctic Regions in 1902–3, published under the superintendence of the Royal Society, p. 92, I gave illustrations of secondary earthquakes the genesis of which corresponded in time with the arrival of two particular phases of primary disturbances. That the third phase or the large waves of a seismic disturbance as they travel round the world, causing the crust of the same to rise and fall like a raft on an ocean swell, should give rise to one or more secondary disturbances is not surprising. Farther than this, any of the latter which may be *greater or less* than their parent may in turn become the originator of farther settlements. *One megaseism may therefore cause a relief of seismic strain throughout the world.*"

Of multiple earthquakes a number of illustrations are given. If the interpretation put upon them is correct, it means not only a help to those who wish to analyse seismograms, but a considerable advance in our knowledge of what is taking place beneath our feet. A shake in one place means a shake in many, and it may be added that the *foci* of these are probably in that region where cooling is taking place most rapidly.

In another section of the report we read about the "Synchronism of seismic activity in different regions." For example, it is found that during the last 300 years the times of activity in Italy, although separated from each other by irregular intervals, have varied between five and twenty years, and that these dates of activity in Europe closely corresponded with dates when there had been marked activity in Japan.

Under a section headed "Megaseismic Frequency" we see that between the years 1899 and 1909 there had been 508 world-shaking disturbances in winter months and 468 in summer months, which practically means that there are as many large earthquakes at one period of the year as at any other.

In connection with seismological work, measurements have been made of the deflection of the vertical by the tidal load of the Solent. At Ryde, close to the sea front, it was found that a 10-foot tide caused a deflection of

0·85″. At Bidston, two miles from high-water mark, a similar tide caused a deflection of 0·2″. From these observations inferences have been made bearing on the selection of sites for an observatory, the difference in elasticity of different types of rock, and other matters.

Reference is also made to tidal-load experiments carried out in Pennsylvanian railway tunnels, and to observations made by Mr. J. J. Shaw with horizontal pendulums in collieries in the Midlands.

Following this are catalogues of strong shocks which have occurred in the United States of America, Peru, and Chile, together with epitomes of unpublished notes relating to destructive earthquakes received from Secretaries of State of the Foreign, Colonial, and India Offices. All these will be of use, not only to the seismologist, but also to the man of business.

Lastly, we have a peculiar catalogue, probably the first of its kind. For want of space it only refers to the five years 1899–1903. For these years it gives all the world-shaking earthquakes, whether they originated on land or beneath an ocean. The times at which each disturbance originated, and the latitude and longitude of its epicentre, are specified. Dual or multiple earthquakes are linked by brackets, and the positions of origins are shown on a map. Inasmuch as this catalogue refers to reliefs of strain throughout the whole world, and not simply to earthquakes which have occurred on land surfaces, it seems possible that it may be used as a basis for new investigations.

A note at the end of the report shows that although records obtained on smoked surfaces are extremely good for large disturbances, they fail to record very small movements, which possibly may represent disturbances which were large at their origins.

A communication from Prof. H. H. Turner was a note on the periodigram of earthquake frequency. The conclusion arrived at was that no period of from seven to twenty years existed, or was shown in the materials which he had examined. These materials, however, only referred to large earthquakes which had originated on or near to land surfaces.

Mr. Maxwell Hall communicated a paper on the solar cycle: the Jamaica rainfall and earthquake cycles. The earthquakes observed in Jamaica closely followed the periods of sun-spot activity.

A paper by Mr. Napier Denison, of Victoria, B.C., has been referred to separately (NATURE, November 2).

JOHN MILNE.

SOME RECENT WORK ON SEX.

AT the Portsmouth meeting of the British Association there were several communications to Section D (Zoology) relating to recent work on sex, an account of which is subjoined.

Mr. Geoffrey Smith referred to the theory he put forward at last year's meeting to account for the effect of the parasite Sacculina upon the sexual characters of its host, the crab Inachus, according to which the development of adult female characters in infected crabs of both sexes was held to be due to the production in excess of a yolk or fatty material in the blood similar to that which is stored in the ovary of a normal adult female. Mr. Robson's work (see below) shows clearly that the presence of Sacculina profoundly influences the fat metabolism of its host. Mr. Smith has made observations on the fluctuations in growth of the comb of fowls, which demonstrate the close connection between fat metabolism and the development of the female characters. Measurements show that the combs of hens are continually fluctuating in size, the changes being rapid and between wide limits; a comb may increase 200 per cent. in area in three weeks. It was found that such rapid increase of the comb invariably took place just before a period of egg-laying began. The hen's comb is composed of two walls of fibrous and vascular tissue, between which is a loose core of connective tissue, which at the period of egg-laying becomes infiltrated with fat, and to this cause is due the sudden increase in the mass of the comb. This increase takes place when the ovary is storing up large quantities of yolk, *i.e.* when large amounts of fatty material are being conveyed in the blood to the ovary. Here, then, is another instance of a simultaneous effect upon the ovary and a secondary sexual character brought about by the presence of an excess of fatty material in the blood. Mr. Smith suggested that this case is analogous to that of Inachus infected with Sacculina.

Mr. G. C. Robson described observations, made recently by him in Naples, to test Mr. Smith's theory that Sacculina stimulates the production in the host crab of a yolk-forming substance similar to that developed in the normal female and stored in the ovary at the time of sexual maturity. He examined the blood of the crab Inachus, and especially the lipochromes, which, by reason of their solubility in fat, may be regarded as evidence of the presence of fat. He found a large quantity of fat in the blood of sexually mature females with ripe ovaries, and also that the amount of fat in the blood of infected Inachus was considerably greater than that in the blood of non-infected males and immature females. The blood of moulting individuals of both sexes was also found to have a high fat content, but not so high as in infected examples and breeding females. An increased fat content was also registered in the liver of infected crabs, and there was strong presumption that this was also the case in the breeding female. Mr. Robson also dealt briefly with the changes in colour in the blood lipochromes, and suggested that in all probability the fate of infected crabs is death from starvation, owing to their inability to obtain enough foodstuff of fatty nature for their own immediate needs.

Dr. Cresswell Shearer gave an account of his recent investigations on the archiannelid *Dinophilus gyrociliatus*, collected at Plymouth. This species produces two kinds of eggs, some small, destined to give rise to the small and rudimentary males, others almost six times as large, and also more numerous, which give rise to the large females. The two kinds of eggs are laid together. In a few days the males hatch full-grown and sexually mature, while the females leave the egg in a small and immature condition: just previous to leaving the egg-capsule they are fertilised by the small males. Sections of females at this stage show the sperms collected on the ventral side of the gut at the junction of stomach and intestine, *i.e.* where the future ovary will appear, but as yet no trace of the latter is visible. The ova appear much later, when the female has grown very considerably in size. Shortly after the female germ cells appear, each is seen to be joined by a spermatozoon, the head of which becomes imbedded in, or attached to, the nuclear wall. Ultimately the nucleus of each primitive ovum is composed of two portions, one derived from the spermatozoon, the other from the female cell. These two elements do not fuse, but retain their individuality throughout the various oogonial divisions (about forty to fifty in all). In the majority of these divisions the male and female portions of the nucleus divide equally, so that a similar amount of nuclear material, both male and female, goes into each daughter cell. Now and again, however, the female half of the nucleus seems to divide before the male portion, so that the latter is, as it were, left behind, and is shut off entirely from one of the daughter cells. Of the two resulting daughter cells one has, therefore, the whole of the male part of the original nucleus and its share of the female part, while the other has its share of the female part only. This appears to be the sex-determining factor, for of the two daughter cells the former, which has its share of the female and the whole of the male element, becomes the female egg, while the latter, which has a portion of the female nucleus only, becomes a male egg. Both kinds of eggs, once the sex-determining division has taken place, grow rapidly, absorbing and building up into themselves other immature egg cells with which they come into contact, and in which the divisions of the two portions of the male and female nuclear substance have been equal. The outcome of this process is that the female egg is fertilised, but the male egg is not fertilised in the ordinary sense of the term: but it is impossible to speak of it as really unfertilised, as it has been directly under the influence of the spermatozoon in all the oogonial divisions previous to the sex-determining one. It is only in the late stages, shortly before the female egg is laid, that the two parts of the nucleus fuse beyond recognition.

Prof. C. J. Patten discussed the vernal-plumage changes

in the adolescent blackbird and their correlation with sexual maturity. He held it to be an unsafe procedure to determine the maturity of a bird by its plumage markings; the testes should also be examined macro- and microscopically. He agreed that, as a rule, there is no difficulty in distinguishing the male blackbird in its first spring plumage from the adult of the corresponding time of the year, for the former is usually dark brownish-black with a blackish beak, and the latter jet-black with a yellow beak. But Prof. Patten had specimens in which the yellow coloration of the beak appeared during the first year, coupled with plumage so nearly approaching jet-black that, on general inspection, the bird might pass as being fully mature, the yellow beak being usually regarded as the last sign of maturity. In the birds just mentioned the yellow pigment was developed precociously, and its development outstripped in time the assumption of the true adult plumage, which would not follow until the next year. The testes were 5 mm. long and 2·6 mm. broad, while those of mature birds taken at the same time (the first two weeks in March) were 18 mm. and 10 mm. respectively. In the former there was no sign of spermatogenesis. Prof. Patten concluded that the adolescent blackbirds above described would not have reached maturity until next spring, despite the fact that the beaks were yellow.

THE LAKE VILLAGES IN THE NEIGHBOURHOOD OF GLASTONBURY.[1]

THE second season's exploration of the Meare Lake Village by the Somersetshire Archæological and Natural History Society began on June 5, and was continued for three weeks under the joint supervision of Messrs. A. Bulleid and H. St. George Gray. The ground excavated was situated in the same part of the village, and was directly continuous with last year's work.

The digging included the examination of the remaining portion of Dwelling-mound VII., the whole of Mound VIII., and portions of Mounds IX., X., and XI.

With reference to the construction of the above mounds, two, *i.e.* Mounds VIII. and IX., had special points of interest, and call for mention here. Taken as a whole, however, this part of the work has been up to the present time somewhat disappointing, as little additional information has been gained regarding the structure generally apart from that already acquired at the Glastonbury Lake Village.

Mound VIII. was of medium size, consisting of five floors and situated north-east of Mound VII. No hearth was discovered associated with the two uppermost floors, which were separated with much difficulty throughout. An interesting series of eight superimposed baked clay hearths was, however, found belonging to Floors iii., iv., and v., surrounded by thick layers of fire-ash. The hearths varied from 2 feet 6 inches to 5 feet 3 inches in diameter.

Mound IX. was of large size, consisting, apparently, of two floors, and was only partially examined. Below the clay was a thick layer of black earth composed of charcoal, fire-ash, and débris containing quantities of bones of animals and fragments of pottery. Under the black earth a well-preserved platform of timber was disclosed, bordered by the remains of the wattled wall of a circular dwelling. This timber was chiefly arranged in a north-east and south-west direction, and by far the larger number of the wall-posts were made of squared oak, a feature not hitherto noticed in the dwellings previously examined.

The relics discovered this season were scarcely so numerous as last year. A summary of them is appended.

Bone.—The bone objects were not very numerous. The most interesting specimen is a smooth pin without head, having a long recess, or notch, along the middle of the shaft. A similar object was found with late Celtic remains on Ham Hill, South Somerset (Taunton Museum), and another on the Roman site at Iwerne, Dorset (Pitt-Rivers Museum, Farnham, Dorset). The other specimens include two tibiæ of horse (sawn and perforated), two large polishing-bones, pins, a dress-fastener, part of a drill-bow, and two objects of worked bird-bone.

Worked Carpal and Tarsal Bones of Sheep or Goat.—A large number of "bobbins" and other objects, showing signs of considerable use, have been found, especially in Mound VII., where so many weaving appliances were discovered. Many of these bones are perforated in different directions; others have transverse markings, some deeply grooved and very smooth.

Worked Shoulder-blades of Ox and Horse.—At the end of last season no fewer than thirty-two of these objects had been found, all in Mound VII. Four more were collected from the same dwelling this year, and two others in adjacent mounds. Two of those found in Mound VII. are ornamented with large examples of the dot-and-circle pattern. In all instances the bones are smooth, and the longitudinal spine had been cut down considerably. Many of them are perforated at the articular end (probably for suspension). They have been found where weaving implements are abundant, but their use remains to be explained.

Crucibles.—Fragments of two found this year.

Bronze.—Fifteen objects of this material were uncovered this year, but no fibulæ are included. There are three finger-rings, one ornamented by a cable pattern, two rivets (one of a new type), an awl, three thin moulded bosses, part of a belt-fastener, and a large part of the bordering of a perishable scabbard, including the bulbous chape. Perhaps the most interesting remains of bronze is a pair of pins with disc-shaped heads and arched stems.

Flint.—In addition to a number of flakes, a scraper and two or three finely worked knives have been found.

Glass and other Beads.—The beads are numerous and varied. Nine were found last season; eighteen specimens this year. The collection includes two polished bone ring-beads. Six of the beads are of a yellow opaque glass and two pale blue (also opaque). One of the finest specimens is a ring-bead of clear sea-green glass, and two are dark blue. A small blue bead is ornamented round the sides by a continuous wave pattern; two globular beads of clear white glass are ornamented in yellow, one by a spiral device, the other by a herring-bone pattern. The smallest bead is little more than one-eighth of an inch in diameter.

Antler.—The numbered objects of this material have now reached the total of seventy-three, twenty-four being found this season, including three antlers of roe-deer, one bearing knife-cuts, another being shaped as a knife-handle. Nothing of exceptional interest has been found this season, many being pieces of cut antler impossible to name. The two hammers found have not been perforated for fitting handles. Several examples of the so-called "cheek-pieces," perhaps used in connection with the bridles and bits of horses, have been found; but the precise use of many of these objects is very doubtful, and their shaping and perforating vary very considerably.

Weaving-combs of Antler.—Again we have a fine series, bringing the former number of twenty-one up to a total of thirty-five. Mound VII., which must have been a weaving establishment, contributes no fewer than twenty-nine of the number. No dwelling in the Glastonbury Lake Village produced more than nine of these combs. One example is dentated at both ends with twelve and thirteen teeth respectively. The largest, having ten teeth, is $7\frac{3}{4}$ inches long. Several of them are ornamented with transverse and oblique lines, and one, at least, with dots and circles.

Iron.—The objects of iron are mostly fragmentary, and much corroded, as usual. The "finds" include a chisel, knife, file, and an awl in its handle of antler; also an earth-anvil. The latter was found on the top floor of a mound, and only a foot deep below the flood-soil, through which, owing to its weight, it may probably have sunk subsequently to the occupation of the village.

Kimmeridge Shale.—Objects of this material have this season been increased from twelve to twenty-one, and they are more numerous than in the neighbouring village of Glastonbury. These objects are parts of lathe-turned arm-

[1] Report presented at the Portsmouth meeting of the British Association (Section H) of the committee appointed to investigate the lake villages in the neighbourhood of Glastonbury in connection with a committee of the Somersetshire Archæological and Natural History Society. (Drawn up by Messrs. Arthur Bulleid and H. St. George Gray, the directors of the excavations.)

lets, with three exceptions, viz. a set of three roughly cut heavy rings, which may have been used in connection with horse-harness. In section, one of the armlets (half) measures no fewer than 21 mm. by 16 mm.

Lead and Tin.—Last season three net-sinkers of lead were found, to which one has been added this year. The first object of tin has been found, viz. a small whorl (? bead) ornamented with encircling lines of small punch-marks.

Querns.—Compared with the Glastonbury Lake Village these are plentiful at Meare; but the circular rotary querns are rare as compared with the saddle-shaped specimens, of which some well-preserved examples have been found.

Other Stone Objects.—Parts of circular blocks of stone have been found, slightly recessed on one face and having a narrow rim; they show signs of intense heat, and may be parts of moulds for casting thin bronze. A large assortment of stone hammers and whetstones has been found.

Sling Bullets.—Several of the baked clay sling bullets typical of the period have been collected. Under the clay floors of the mounds three groups of selected ovoid stones were discovered, the numbers being 99, 182, and 347 respectively.

Spindle-whorls.—The former number of twenty-three has this season been increased to forty-three. Most of them are formed from discs of lias; a few are of baked clay, two being very large.

Pottery.—Shards of pottery have been very numerous—some three or four hundredweights. All of them have been scrubbed and preserved, being sorted under the numbers of the dwellings. Several complete pots may probably be built up some day. The proportion of ornamented fragments is high as compared with those from the neighbouring village, and a great many new and highly ornate designs have been added to the collection. Very little ornamented pottery was discovered in the deepest layers, and much of it bearing typical late Celtic designs was found just under the flood-soil. The coarser plain pots were generally found in the black earth and brushwood below the clay floors.

Human Remains.—Two pieces of skull and one bicuspid tooth.

Animal Remains.—Found abundantly. The perforated boars' tusks and canine teeth of large dog were no doubt used as personal ornament. The enormous number of bones of young animals indicates that the inhabitants of this marsh village must have been great meat-eaters. The remains of beaver and otter are frequently met with, and also a considerable number of bird-bones.

LEGISLATION AGAINST INSECT PESTS AND PLANT DISEASES.[1]

THE effort to secure national legislation to keep out new and dangerous insect pests or plant diseases which may be brought in with imported nursery stock has been actively favoured by the U.S. Department of Agriculture, just as the department in the past has promoted and secured legislation enabling it to exclude from the country diseased animals or to quarantine and stamp out animal diseases whenever such have appeared. In the case of domestic animals, the exercise of these powers has brought enormous benefit, and has worked entirely satisfactorily to the livestock industry. It is reasonable to believe that like benefits to fruit and forest interests, including the nursery business, will undoubtedly come from similar legislation to exclude insect pests and plant diseases.

The immediate danger which led to the recent effort to secure legislation was the discovery in 1909 of the abundant importation and wide distribution into the United States of nursery stock infested with brown-tail moth nests and occasional egg masses of the gipsy moth. During the years 1909 and 1910 such infested stock was carried into twenty-two States, covering the country from the Atlantic seaboard to the Rocky Mountains. During the first of these years no fewer than 7000 winter nests of the brown-tail moth, containing approximately 3,000,000 larvæ, were found in shipments into New York State alone—seed material enough to infest the whole United States within a few years. During the second of these years 617 of these nests were found on nursery stock shipped into the State of Ohio, and a much larger number, approximately the same as the year previous, were again sent into New York. Smaller numbers of these nests, proportioned to the amount of nursery stock received, were sent into other States east of the Rocky Mountains during both these years. Fewer brown-tail moth nests were received during the season just ended (1910–11), owing to the agitation in this country and more strict supervision by foreign Governments.

So far as possible, this stock, as voluntarily reported by customs officers and railroads, has been examined and the brown-tail nests removed or destroyed by State authorities, or, where these were not available, by agents of the Bureau of Entomology of the United States Department of Agriculture. Undoubtedly many shipments have not been reported or examined, and it is quite probable that local infestation has already started at different interior points. The history of both the gipsy and brown-tail moths in New England shows that these insects may be present for several years without being noticed, slowly gain headway, and then suddenly develop their full power of destructiveness.

It is scarcely necessary to comment on the danger from the careless introduction and wide distribution of these two orchard and forest pests. In a limited district in New England more than a million dollars a year have been spent for a long period in a mere effort to control these two insects, and the General Government is now appropriating three hundred thousand dollars annually to endeavour to clear them from the border of main highways and thus check their spread. These expenditures do not take into account the actual damage done, but they do serve as a measure of the danger to the whole country from the recent distribution of these two insects on imported nursery stock.

As further illustrations of the constant risk from lack of legislation may be mentioned two very recently introduced insects which will undoubtedly prove very expensive pests in future years. The European alfalfa leaf-weevil, on the authority of the entomologist of the Utah Experiment Station, Mr. Titus, was probably brought into Utah on packing of nursery stock or other merchandise from Europe. This leaf-weevil has already destroyed much of the value of the important alfalfa crop of Utah, and is spreading into adjacent States. The other illustration is the Oriental cotton scale (*Pulvinaria psidii*), probably the worst scale pest of citrus and other subtropical plants in southern Asia. This scale insect has recently been introduced into Florida on imported stock, and is already well established there.

New plant diseases, against the entrance of which there is at present no bar, may even more seriously jeopardise the farm, orchard, and forest products of this country. Imported potatoes from Newfoundland are now bringing in the potato wart disease, which, wherever it has been introduced in Europe, and also in Newfoundland, puts a stop to potato culture. The importation of white-pine seedlings is now bringing in the European white-pine blister rust, which, if established and disseminated, will destroy much of the value of our white-pine forests. Absolute quarantine against these two plant diseases is the only means of keeping them out. The chestnut disease, now practically shown to have been introduced on trees imported from Japan, illustrates what may quickly happen from such unchecked introductions.

More than half of the important insect enemies and plant diseases now established in the United States have been brought in on imported nursery stock, and new insect enemies and new diseases are being thus introduced every year. Twenty different insect pests, new to the United States, some of them very formidable in the Old World, have been intercepted in the inspections of the imported material by this department this year, and this does not include the introduction of brown-tail moth nests and other European pests with imported seedling stock.

A properly enforced quarantine and inspection law in the past would have excluded many, if not most, of the

[1] From Circular No. 37 of the U.S. Department of Agriculture.

foreign insect enemies and plant diseases which are now levying an enormous annual tax, amounting to several hundred million dollars, on the products of the farms and orchards of the United States.

In spite of the many pests which have already gained foothold, and the control of which will be a permanent annual charge on production, there remain many other insect pests and plant diseases with equal capacity for harm which, fortunately, have not yet come in; and it is to protect from these new dangers that legislation is now sought, not with the intention of prohibiting the trade in imported stock, but to throw such safeguards around it as will most protect both the importers and the subsequent purchasers of such stock.

The insect pests and plant diseases that have come in are probably here for all time, but certainly no reasonable objection can be made to the effort to safeguard the future. The conscientious importer will be benefited, and the home producers, the dealers, and all the great fruit and forest interests will be protected by suitable inspection and quarantine legislation.

The San Jose scale had become established in California on stock introduced from China about 1870, and was known to be one of the most serious of orchard pests. With proper supervision and quarantine it undoubtedly could have been limited to the Pacific Coast indefinitely. A quite unimportant importation of stock from California by a prominent Missouri nurseryman in the early 'nineties established this scale in several eastern nurseries, and this led to the first concerted effort to obtain a national quarantine and inspection law. The failure to reach an agreement among the nurserymen, fruit-growers, and entomologists as to suitable legislation prevented anything coming from this effort, although several Bills were introduced in Congress from time to time. In the meantime, the San José scale became so widely distributed by transportation on nursery stock that quarantine against this insect was no longer practicable; and the United States is now being taxed, and probably will be for all time, many million dollars annually because there was no law under which strong hold could have been taken of this danger at the outset.

As elsewhere noted, the recent effort to secure legislation followed the entry and wide distribution in the United States of brown-tail moth nests on nursery stock, chiefly from northern France. The discovery about the same time of the entry of the potato wart disease from Newfoundland, and the white-pine blister rust, chiefly from one district in Germany, greatly emphasised the immediate need for Federal control.

In the measure now before Congress, inspection of imported nursery stock is left to the different States instead of being undertaken by the Federal Government. A complete system of notification is provided for, however, both through the requirement of a permit and by subsequent advices to be given by the customs offices, the broker or first receiver of the stock, and the common carrier transporting it.

The first clause of the Bill is as follows:—It shall be unlawful for any person, firm, or corporation to import or offer for entry into the United States from any foreign country any nursery stock unless and until a permit shall have been issued therefor by the Secretary of Agriculture, under such conditions and regulations as the said secretary may prescribe, and unless such nursery stock shall be accompanied by a certificate of inspection in manner and form as required by the Secretary of Agriculture from the proper official of the country from which the importation is made to the effect that the stock has been inspected and found free from injurious plant diseases and insect pests: *Provided*, That this section shall not be construed as applying to plants or plant products solely intended for and adapted to use as food, but to nursery stock or other plants or plant products for propagation: *Provided further*, That nursery stock may be imported for experimental or scientific purposes, without the certificate of inspection or the permit of the Secretary of Agriculture hereinbefore required, upon such conditions and under such regulations as the Secretary of Agriculture may prescribe: *And provided further*, That nursery stock imported from countries where no official system of inspection for such stock is maintained, may be admitted upon such conditions and under such regulations as the Secretary of Agriculture may prescribe.

One clause in the Bill makes provision for quarantining foreign districts or particular plant products in foreign districts to exclude diseases or insect enemies which cannot otherwise be kept out. This is the provision which has been most objected to by importing nurserymen, and especially by importers who have invested in foreign nursery enterprises in France. It is not the intention to apply this section except in the case of diseases or other dangers which cannot be kept out by inspection or disinfection; in other words, at present it would apply only, so far as is known, to the potato wart disease and the white-pine blister rust. Another clause provides for quarantining districts within the United States where new diseases or insect enemies have gained a foothold until such districts have been freed from such disease or insects.

PRACTICAL STANDARDS FOR ELECTRICAL MEASUREMENT.[1]

THE committee has to regret the death since the last meeting of the association of Dr. G. Johnstone Stoney, F.R.S. He had been a member since 1861, and up to a few years since continued his active interest in the work. In its earlier stages his skill in definition and his admirable choice of nomenclature had proved invaluable to the committee. The collected reports which are to be issued shortly will indicate how large a share in the establishment of the C.G.S. system of units is due to him.

Republication of Reports.—The republication of the reports is not yet completed, but this should be done within the present year. The proofs of the reports from 1862 to 1883 have been finally revised, and the remaining proofs will soon be ready.

Lorenz Apparatus.—The progress made has been satisfactory. Preliminary experiments have shown that the apparatus is uninfluenced by changes in the earth's magnetic field, and that the thermal E.M.F.s at the brushes on the two discs very nearly balance. With the form of brush in use at present there are sudden changes in the difference of the thermal E.M.F.s amounting to 2×10^{-7} volt, and it may be difficult entirely to eliminate these. With other forms of brushes, *e.g.* those made of gauze, the difference was often 1000 times as great. It was this difficulty which led Lord Rayleigh in 1883 to amalgamate the edge of the disc, and as a further improvement Prof. Viriamu Jones and Prof. Ayrton used mercury jets instead of brushes. Since in the present apparatus the changes are only 1 in 10,000 of the difference of potential produced in one arrangement of the brushes and fewer for a second arrangement, it is hoped that mercury contacts will not be necessary. Further experiments will be made in order to obtain greater perfection, if such is possible.

Resistance Standards.—The construction of new mercury standards of resistance in accordance with the specification of the London Conference is being proceeded with, and some of the standards will be completed this year. Similar work is in progress in France, in Germany, in Austria, and in the United States. In the last-named country four standards have had all their constants determined, and the resistance unit so obtained is in very close agreement with that obtained from the old National Physical Laboratory standards.

In the committee's report for 1908 it was shown that many manganin resistance coils—some of which were purchased by the committee in 1895—were very changeable in resistance, and in consequence frequent comparison with mercury standards was necessary. In 1908 it was shown at the Bureau of Standards, and confirmed at the National Physical Laboratory and at the Reichsanstalt, that these changes were largely due to the effect of moisture on the shellac covering the wire. To eliminate this source of trouble many of the coils were hermetically sealed in 1909,

[1] Report presented at the Portsmouth meeting of the British Association by the Committee on Experiments for Improving the Construction of Practical Standards for Electrical Measurements.—Lord Rayleigh (chairman), Dr. R. T. Glazebrook (secretary).

and it is satisfactory to record that they are now much more constant. The importance of this hermetical sealing is so great when manganin resistances are to be sent to such places as cable stations in the tropics that the attention of instrument manufacturers is directed to the matter. Standard coils are readily sealed, and boxes of coils may be sealed in metal cases. The following figures for standard coils of manganin show the advantage of hermetical sealing :—

Nominal value		100 ohms		1,000 ohms	10,000 ohms
		No. 2450	No. 740	No. 2449	No. 2448
Open coils	Oct. 1903	99·9959	1,000·153	1,000·012	10,000·24
	,, 1904	100·0002	0·172	0·244	2·40
	,, 1905	0·0048	0·218	0·494	3·57
	,, 1906	0·0092	0·248	0·668	3·82
	,, 1907	0·0132	0·266	0·814	3·74
	,, 1908	0·0288	0·302	1·130	3·85
Hermetically sealed in paraffin oil.	June 1909	0·0369	0·365	1·046	5·53
	,, 1910	0·0384	0·357	1·075	5·56
	,, 1911	0·0399	0·359	1·069	5·61

It will be noted that the changes during the last three years are very small.

Silver Voltameter and Standard Cell.—Although the actions which take place when a current passes through a solution of silver nitrate, as in a silver voltameter, are now well understood, the effects of septa—such as silk, filter paper, and porous porcelain—are by no means clear, and experiments have, therefore, been made to decide whether any septum at all should be used in a voltameter. Such experiments were suggested at the Washington meeting in 1910. The results of the experiments made at the National Physical Laboratory indicate that a septum of any kind is usually a source of trouble, and may produce secondary reactions during the electrolysis which affect the weight of the silver deposit. Fortunately, voltameters have been designed which render a septum unnecessary; and these may be useful, not only in precise current measurements with the silver voltameter, but for the deposition of metals other than silver.

The reproducibility and constancy of the Western normal cell are still being carefully examined. The chief anomaly is the hysteresis effect mentioned in last year's report; for this effect we have no explanation, although one is much needed, as probably it would enable cells to be made so as to remain even more constant in E.M.F. than at present. It is necessary to point out that while the effect is called a hysteresis one, the E.M.F. does not lag behind the temperature. Briefly put, with ascending temperatures the E.M.F. changes in close agreement with the temperature–E.M.F. formula, but with descending temperatures the E.M.F. changes too rapidly, corresponding to values at temperatures lower than the temperature of the cell by from 3° to 15°.

The committee had hoped to make this the last report; but in view of the fact that the republication is not complete, it asks for reappointment, with Lord Rayleigh as chairman and Dr. R. T. Glazebrook as secretary.

THE LOCH LEVEN WATER-POWER WORKS.[1]

THE Loch Leven Water-power Acts were obtained in 1901 and 1904, authorising the construction of works to utilise the rainfall of the western slope of Rannoch Moor for power for industrial purposes.

The catchment-area for the Loch Leven works is the basin of the River Blackwater, and is 55 square miles in extent, lying between Lochs Treig, Ossian and Rannoch, and Glen Coe. Rain-gauges established in 1905 and 1906 have given average readings of more than 70 inches for the Blackwater basin and 80 inches for Kinlochleven. No compensation-water had to be supplied, this feature greatly increasing the available power. The site of the reservoir is favourably contoured for storage purposes, and the full reservoir is about 7½ miles in length and half a mile in breadth. Its greatest depth is 75 feet, and it impounds more than 20,000 million gallons of water. The Blackwater dam is 3112 feet in length, with a maximum height of 86 feet, its top surface being 1068 feet above Ordnance datum. About half its length is formed as a waste-weir in six horizontal steps of 6 inches each.

The foundation is of an exceptionally sound character; only a few feet of the surface beds had to be removed to obtain a satisfactory foundation. The dam is built of large blocks of stone embedded in a matrix of ordinary concrete, with fine concrete facework. The valve-tower contains the six valves of the three draw-off pipes, the spindles being carried up to the valve-house above top water-level. The draw-off pipes lead to the upper penstock chamber, whence the water is delivered over a measuring weir into the conduit. Water is conveyed to the pipe-track by this conduit, which is 3½ miles in length; it is of square section, 8 feet by 8 feet, and is laid to a general gradient of 1 in 1000.

Along the route of the conduit and above the same lies a catchment-area of 3½ square miles, with a rainfall of about 75 inches, the greater part of which is drained by three streams. These have been laid under contribution by collecting their water and turning it into the conduit. Electrical transmitters and recorders indicate to the valve-keepers at the lower penstock chamber the changes taking place in the contribution of the side streams, enabling them to take advantage of the extra water and reduce the draw-off from the reservoir, thus storing an equivalent quantity of water in the reservoir. The conduit discharges its water into the lower penstock chamber, of about 300,000 gallons capacity, where it is measured and delivered to the pipes as required.

From the penstock chamber water is conveyed to the power-house in six welded steel pipes of 39 inches diameter. The track is 1¼ miles in length, and the fall of 935 feet yields a normal static pressure of 406 lb. per square inch. Water is distributed from the six main pipes to the various turbines by a system of pipes comprising two omnibus pipes and six feeders, all of 39 inches diameter. Each "bus" pipe with its three feeders forms one complete system, the two systems being at different levels to enable branches to cross. One branch from each bus pipe feeds each turbine. At the top of the pipe-track, immediately below the penstock chamber, automatic cut-off valves have been installed to stop the flow of water in the event of a burst occurring on the main pipe-lines.

The works described have cost about 600,000*l.*, and are now the property of the British Aluminium Company. The construction was begun in August, 1905, and the factory commenced working in February, 1909.

As regards the plant erected in the power-house at Kinlochleven, the aggregate power installed is 30,660 horse-power at the generator couplings, the generators being capable of a maximum output of 21,088 kilowatts. Nine main units and two exciter units are erected, each unit consisting of a turbine and two generators. The main turbines are of the Pelton-wheel type, with two water-jets, and are designed to give 3200 B.H.P. as a maximum; each drives two generators coupled in parallel, and having an output up to 2200 kilowatts together. The two small exciter units are also of the Pelton-wheel type, each driving a pair of generators on one shaft. These consist of an exciter and lighting machine, capable of giving an output up to 550 kilowatts, and a traction machine up to 94 kilowatts capacity.

Efficiency and governor tests were carried out on the main units, and governor tests on the exciter units. The results obtained showed that the turbines did not quite reach their anticipated output, and that their efficiency was slightly below that guaranteed by the makers. The efficiency was improved about 2 per cent. by increasing the area of the lower jet, but keeping the top jet of the original size, and by this alteration the turbines were enabled to give the specified output at the guaranteed efficiency.

It was found during the tests that the generators were liable to flash over if the voltage increased excessively, and

[1] From abstracts of two papers: (1) The Loch Leven Water-power Works, by A. H. Roberts; and (2) The Hydro-electric Plant in the British Aluminium Company's Factory at Kinlochleven, by F. B. Sonnenschein, read at the meeting of the Institution of Civil Engineers on November 14.

that they were also liable to flash over if a circulating current flowed round the two armatures of the dynamos on the same shaft running in parallel, when load was thrown off. An electrical protective device was therefore designed and fitted to each pair of generators, which automatically breaks the field-circuit when either of these two conditions arises.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The opponents of the statute allowing exemption from Greek in the case of candidates for honours in mathematics and natural science, which is to be submitted to Convocation on November 28, have put out a circular in which their objections are stated. One of their principal contentions is that when Greek becomes optional at the universities, the teaching of that language will be given up at many of the smaller schools throughout the country, and that in consequence many boys who are capable of profiting by the study will be deprived of the opportunity of instruction in Greek during their school career. The authors of the document say that while deprecating the abolition of compulsory Greek, they are favourable to a reform in existing methods of teaching and examination.

PROF. JOHN PERRY, F.R.S., will deliver an address at the opening of the new mechanical engineering laboratory of the Municipal Technical Institute, Belfast, on Friday, November 24.

MR. S. MANGHAM, formerly Frank Smart student in botany at Cambridge, has been appointed lecturer in botany at Armstrong College (University of Durham). Lord Grey has accepted the office of president of the college.

SUBSCRIPTIONS for 30,000*l.* to meet the conditional pledge of 10,000*l.* from the General Education Board have been received by Middlebury College. It is stated in *Science* that one-half of the fund will be reserved for general endowment.

AT the Sir John Cass Technical Institute, Aldgate, E.C., on Wednesday, November 29, Mr. H. Livingstone Sulman, president of the Institution of Mining and Metallurgy, will distribute the prizes and certificates gained by students during the past session.

THE Ontario correspondent of *The Times* announced on November 19 that the first day's subscriptions from Montreal to the million-dollar fund for McGill University reached 66,735*l.*, including 10,000*l.* telegraphed from London by Dr. James Douglas, who was formerly professor of chemistry at Morrin College, Quebec.

THE fourth annual dinner of old students of the Royal College of Science, London, is to be held at the Imperial College Union, Prince Consort Road, South Kensington, on December 13, at 7.30 p.m. The sixth annual dinner of the Finsbury Technical College Old Students' Association is to be held at the Trocadero Restaurant on December 9, at 7.30 p.m.

MRS. C. KAYLER has given 1000*l.* to University College Hospital to found and endow a lectureship in memory of her father, the late Dr. Sydney Ringer, F.R.S., formerly consulting physician to the hospital. The lecturer will be selected every two years, and will take as the basis of his lecture original research carried out by him in the physiological or pharmacological laboratories of University College or in University College Hospital Medical School.

THE death of Lady Reichel, which occurred at Bangor the next day after the degree ceremony noted in last week's NATURE, will be felt as a loss by all those interested in higher education in Wales. As wife of the principal of the University College of North Wales, Lady Reichel, while holding no important official position, had by her personality and influence rendered indirect services, of the value of which it would be difficult to form an adequate estimate, to the cause of education.

THE Board of Agriculture and Fisheries has awarded the following research scholarships in agricultural science:—P. G. Bailey (Cambridge), J. Clayton (Cambridge), J. T. Edwards, E. T. Halnan (Cambridge), J. Hammond (Cambridge), J. A. Hanley, G. E. Johnson (Birmingham), C. G. P. Laidlaw (Cambridge), A. E. Lechmere (Bristol), J. W. Lesley (Cambridge), A. Neville (London), and G. T. Spinks (Cambridge). These scholarships have been established in connection with the scheme for the promotion of scientific research in agriculture, for the purposes of which the Treasury has sanctioned a grant to the Board from the development fund. The scholarships, which are of the annual value of 150*l.*, and are tenable for three years, have been established in order to train promising students, under suitable supervision, with a view to their contributing to the development of agriculture, either by carrying out independent research or by acting in an advisory capacity to agriculturists.

AT the annual meeting of the Mathematical Association to be held in January next, the following papers will be presented:—What should be omitted in arithmetic? J. B. Sachs; mathematical work in training colleges, Rev. E. M. Radford; some unrealised possibilities in mathematical education, G. St. L. Carson; the work of the International Commission on mathematical teaching, C. Godfrey; the calculus as a school subject, C. V. Durell. In addition the following subjects for discussion are proposed:—A recognised universal sequence of propositions in geometry for schools, H. G. Mayo; the educational value of the mathematics examination, E. F. Edwards; the logic of algebra, whether or where we should teach it, S. Andrade; the treatment of parallel lines, Rev. J. J. Milne; differentiation and integration as purely algebraic processes, W. F. Sheppard; is the educational prestige of mathematics lessening? G. St. L. Carson; the elementary teaching of the calculus, Rev. E. M. Radford; first lessons in algebra, W. A. Richardson.

IN connection with the work of the General Education Board of the United States, we learn from *Science* that conditional appropriations amounting to 127,000*l.* have been granted to six colleges and universities by the board of trustees. Applications from twenty-four institutions were presented. From this list the board selected six, among which is distributed conditionally the available funds as follows:—to Bucknell University, Lewisburg, Pa., 7000*l.* towards 32,000*l.*; to Earlham College, Richmond, Ind., 15,000*l.* towards 80,000*l.*; to Furman University, Greenville, S.C., 5000*l.* towards 20,000*l.*; to Grinnell College, Grinnell, Ia., 20,000*l.* towards 100,000*l.*; to Smith College, 40,000*l.* towards 200,000*l.*; to Southern Methodist University, Dallas, Tex., 40,000*l.* towards 200,000*l.* During the meeting attention was directed to the fact that since Mr. Rockefeller made his first contribution to the board for the promotion of higher education, contributions have been made to ninety-one institutions, amounting to 1,525,000*l.*, towards a total of 7,182,000*l.* Fifty-one institutions to which the board has made conditional contributions have completed the subscriptions for the supplemental sums required, and to these institutions the board has already paid 700,000*l.* in cash. As a result of the campaigns made by these fifty-one institutions, their assets have been increased by more than 3,800,000*l.* Their student bodies have increased by 2047, 183 new professors have been employed, and the annual payment to professors in these fifty-one institutions has been increased 84,300*l.*

As indicative of the growing appreciation of the value of higher education in science and technology among the native aristocracy of India, the following remarks, recorded in *The Pioneer Mail*, from a speech at an educational conference by the Nawab Bahadur of Dacca are interesting. Supporting the statement that "the want of a combined course of education has to answer for the degraded state of our community," he said:—"It is none the less due also to our utter indifference to technical, industrial, agricultural, and commercial education. If we had developed our industrial resources, improved our agriculture, and learnt business, hunger would not have peeped in our peasants' houses. Our interests would not have clashed had we not flocked to the general line of education only, but turned to other branches for which we might have special aptitude and be better fitted. The inevitable consequences of this wanton neglect of these branches have been the cramming of all offices and pro-

fessions, and the poverty of the people. Our trades and industries are dying out, and prosperity is out of the question if we do not revive them. Our lands are immense treasures, for gold is buried there if we only render them productive. We cannot grow one quarter of what they do in the civilised countries of Europe and America for the same area. There is immense room for improvement in all these directions, especially in agriculture; and although there has been a general awakening, and Government has been kindly lending its help, our capitalists do not come forward to invest money in such undertakings." He concluded:—"I would most earnestly appeal to you to try to create an indomitable passion for education in your friends, relatives, and fellow-brethren, without which our vociferation for the regeneration of our community is but crying in the wilderness."

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 16.—Sir Archibald Geikie, K.C.B., president, in the chair.—Sir E. Ray **Lankester**: The discovery of a novel type of flint implements below the base of the Reg Crag of Suffolk, &c. (1) Flint implements of human manufacture have been discovered by Mr. J. Reid Moir, of Ipswich, in the detritus beds at the base of the Red Crag in Suffolk, and by Mr. W. G. Clarke at the base of the Norwich Crag in Norfolk. (2) These implements are of a novel type—the "rostro-carinate," or "eagle's beak"—but include also scrapers, hammers, and large one-sided picks. They do not include any forms resembling the Chellian and Acheuilian ovate implements. The sub-crag type (rostro-carinate) is essentially compressed from side to side. The Chellian and Acheuilian and Moustierian types are essentially depressed or flattened like a leaf. (3) They were manufactured at a period previous to one of severe glaciation, which set in before the lowest beds of the Red Crag and Norwich Crag were deposited, and characterise a phase of human development earlier than any hitherto known by equally indisputable evidence. (4) The rostro-carinate implements were not improbably used for dressing and smoothing the skins of animals. (5) On the land surface from parts of which these implements were moved into the detritus beds at the base of the East Anglian "Crags," similar implements remained, which were embedded in the subsequent deposits of the Glacial period, and have been found in a few isolated instances in mid-glacial sands and Boulder Clay. (6) The Red Crag is commonly regarded as of greater geologic age than its proper fauna would indicate. Its mammalian fossils are derivatives of an earlier age, and the few molluscs of Pliocene character found in its earlier layers are lingering survivors from a warmer condition of the sea. They became extinct at the early onset of the conditions proper to the Red Crag sea. The Red Crag should be grouped with the Pleistocene rather than with the Pliocene series. (7) The race of men who manufactured the sub-crag flint implements probably lived on the land surface not remote from the sea during the period of the Coralline Crag, which was characterised by a warmer climate than that of the Red Crag, and may justly be regarded as marking the close of Pliocene conditions in this part of Europe. The land barrier joining Britain to Scandinavia, which had kept the southern part of what is now the North Sea from access of cold northern waters ever since the earliest Tertiary period, disappeared at the beginning of the deposition of the Red Crag. (8) If these propositions are justified, it remains a question for later inquiry whether the men who made the sub-crag implements were of greater antiquity than those who made the implements (so-called eoliths) of the high plateau gravels of Kent, or than those recognised by some archæologists as makers of roughly chipped flints found in other localities, but not hitherto generally admitted as of human workmanship. (9) In any case, the implements from the sub-crag beds in East Anglia are of special and very distinct type, and cannot be associated with any known from any other locality.—Prof. E. W. **MacBride**: Studies in heredity. I.—The effects of crossing the sea-urchins *Echinus esculentus* and *Echinocardium cordatum*. Many biologists have investigated the question as to how far paternal and maternal characters are transmitted when different species of echinoderms are crossed, and have arrived at inconclusive and contradictory results. The reasons for the unsatisfactory results of their investigation are largely to be found in incomplete study of the normal development of the species to be crossed, and consequent dependence being placed upon characters which are either slightly marked or variable in the normal larva. There are two cases where the larvæ are distinguishable from one another by sharply marked characters, about the presence or absence of which there can be no possible doubt. The first case, that of the late larvæ of *Echinus miliaris* and *E. esculentus*, which are distinguished by the number of ciliated epaulettes, has been investigated by De Morgan and Shearer, who find that the hybrid in all cases shows purely maternal characters. The second case, that of the larvæ of *Echinus esculentus* and *Echinocardium cordatum*, the larvæ of which are distinguished by the presence of an aboral spike in those of the latter species and its absence in those of the former, forms the subject of this paper. It is shown that the eggs of Echinocardium fertilised by the sperm of Echinus give rise to hybrids which show the paternal character in the total absence of the spike, whilst the eggs of Echinus fertilised by the sperm of Echinocardium form a fertilisation membrane, but then undergo cytolysis. Loeb and his pupils have been able to fertilise the egg of sea-urchins with the sperm of animals belonging to different classes of animals. In all these cases the larvæ are a purely maternal type. It is, therefore, startling to find that when the eggs of Echinocardium are fertilised with the sperm of a creature so far apart in systematic position as Echinus the paternal character should be so clearly marked in the hybrid.—Prof. W. M. **Thornton**: The influence of ionised air on bacteria.—Dr. T. Graham **Brown**: The intrinsic factors in the act of progression in the mammal. (1) By means of a stimulus (namely, section of the spinal cord) central in application, although remote from the local centre, the act of progression may be induced in muscles de-afferented by the cutting of their appropriate posterior spinal roots. It occurs thus after all the muscles of both hind limbs have been de-afferented, and all but the recording pair have been put out of action by motor paralysis. (2) The act of progression as exhibited by these muscles, and thus induced, scarcely differs, if indeed it differs at all, from the act similarly induced when the afferent parts of the recording muscles have not been broken. (3) In either case the reaction, as evidenced in movement at the ankle-joint, shows three periods. In the first the record is characterised by a state chiefly of maintained flexion. In the last there is a state characterised by maintained extension. Intermediate between these there is a period of "balance," in which the movements of progression are most perfect. (4) *The rhythmic sequence of the act of progression is consequently determined by phasic changes innate in the local centres, and these phases are not essentially caused by peripheral stimuli.* (5) *The proprioceptive stimuli which are generated by the contraction of muscles taking part in the act (when the appropriate posterior spinal roots are intact) play a regulating, and not an intrinsic, part in the act. Their chief importance may be in the grading of the individual component movements to the temporary exigencies of the environment.*—Dr. J. L. **Jona**: The refractive indices of the eye media of some Australian animals.—S. G. **Paine**: The permeability of the yeast cell.—G. A. **Buckmaster** and J. A. **Gardner**: Ventilation of the lung in chloroform narcosis. The authors give a number of plethysmographic tracings to show the lung-ventilation during chloroform anæsthesia with different percentages of chloroform and ether, and also analyses of the blood gases. They show that with unimpeded respiration under anæsthesia by chloroform given at a slight positive pressure the ventilation of the lung takes place at a lowered level. During a narcosis in which respiration continues the lung-ventilation is diminished in the first three minutes by about 60 per cent. of its original value, and by a similar amount after prolonged anæsthesia. They consider that the carbon-dioxide content of the blood is reduced below a threshhold value by any state of hyperpnœa prior to administration of the drug, and this diminution in carbon-dioxide content *plus* the diminished excita-

bility of the respiratory centre would suffice to slow or abolish the activity of the centre. Gas analyses actually show that with a deep and rapid respiration there is a marked fall in the carbon-dioxide content of the blood. They also bring forward evidence to show that the diminution in oxygen content of the blood during chloroform narcosis is not due entirely to diminished alveolar ventilation, but to the action of the drug on the red corpuscles.—Lord **Berkeley** and M. P. **Appleby**: (1) The boiling point of water; and (2) the boiling points of some saturated aqueous solutions.—Dr. R. T. **Glazebrook**, W. R. **Bousfield**, and F. E. **Smith**: The heating effect of the currents in precise measurements of electrical resistance.

Linnean Society, November 2.—Dr. D. H. Scott, F.R.S. president, in the chair.—Dr. D. H. **Scott**: The Palæozoic fern *Zygopteris Grayi* (Williamson). The group of comparatively simple ferns (Primofilices of Arber, Cœnopteridæ of Seward) to which this plant belongs is chiefly known by petrified specimens showing structure. Correlation with impressions showing the habit has seldom been possible; fronds, however, belonging to a Zygopteris have been identified. *Z. Grayi*, a species founded by Williamson in 1888, is a rare fossil. A new specimen, from Shore Littleborough, in Lancashire, was found by Mr. Lomax last year, and series of transverse and longitudinal sections were prepared. The question whether this species belongs to Ankyropteris or Etapteris, as these genera are defined by Paul Bertrand, has been disputed. The new specimen is certainly an Ankyropteris, as shown by the presence of "peripheral loops" of small-celled xylem on the leaf-trace. Thus the view of Paul Bertrand is confirmed; it appears to hold good for all known specimens of *Z. Grayi*. *Zygopteris*, or, as we may now call it, *Ankyropteris Grayi*, is a highly developed member of the Primofilices, and presents interesting analogies with the curious genus Asterochlæna, recently described in full detail by Paul Bertrand.—Miss Edith E. **Bamford**: Pelagic actinian larvæ. The author stated that the collection of actinian larvæ from the Indian Ocean consists of thirteen different types, the chief interest lying in the four zoanthidean larvæ, all being new species of the genus Zoanthina, Van Beneden, represented by single specimens.—A. O. **Walker**: The distribution of *Elodea canadensis*, Michx., in the British Isles in 1909. *E. canadensis*, Michx., is said to have been first seen in Ireland in 1836 and in Berwickshire in 1845. By 1850 it had become so abundant in many parts of the British Isles as to be a serious nuisance by choking up canals, watercourses, and drains, and all attempts to clear it out failed. It was found, however, that after a few years it died out, or became comparatively scarce and feeble. Information on the subject is given in the paper from twenty-four counties in England and Wales, six in Scotland, and three in Ireland, showing, on the whole, that the plant has decreased of late.—Dr. J. **Murie**: The "slipper limpet" (*Crepidula fornicata*). It was pointed out that the "limpets" have now become a nuisance on the oyster-beds of both Kent and Essex. Originally they were imported from America, coming among the barrelled oysters brought over for relaying. They have since become thoroughly naturalised, and on the Blackwater and River Crouch are dredged up in tons attached to the oysters, mussels, &c. Unlike the starfish, devourers and arch-enemies of the oyster, or the mussels, which smother them, and the whelk tingles, which bore through their shells, the "slipper limpet" is more of a commensal parasite and messmate, partaking of the oyster's food. But what now chiefly renders them a serious menace to oyster-culture is the labour and expense involved in constant dredging for them, as likewise the necessity for individually chopping them off by "cultack" before the oysters are presentable for sale or replanting.

Zoological Society, November 7—Mr. Frederick Gillett, vice-president, in the chair.—T. E. **Gunn**: The presence of two ovaries in certain British birds, more especially the Falconidæ. The author outlined the views held by the majority of English morphologists on the reproductive organs of adult female birds, and enumerated examples which he had collected during a number of years where the right as well as the left ovary was present, and, so far as could be ascertained, in the two cases of which sections had been made, where the right ovary was functional. He pointed out the extraordinary preponderance in his examples of paired ovaries occurring in the Falconidæ, as compared with those derived from any other source, and remarked that in that family the ovaries were usually placed symmetrically one on either side of the vertebral column and at about the same level. In examples other than the Falconidæ this symmetrical arrangement was the exception rather than the rule, the right ovary generally occupying a position almost directly below the left, in the left half of the body-cavity, which, in the author's opinion, suggested a half-way home on the road leading to the final disappearance of the right ovary.—D. **Seth-Smith**: The moulting of the King penguin (*Aptenodytes pennanti*) in the society's Gardens. The author referred to Mr. de Winton's paper on the same subject which appeared in the Proceedings in 1898. The specimen observed by Mr. de Winton did not moult until it had lived sixteen months in the Gardens, whereas the specimen now in the menagerie had moulted twice in six months. The author stated that the new feathers were almost fully grown before the old ones were shed, and that the latter had to be rubbed off by the bird's beak or feet, as they were firmly attached to the sheaths of the new feathers. The paper was illustrated by photographs, which showed the bird in various stages of the moult, as well as by specimens of the shed feathers.—Prof. A. D. **Imms**: Some Collembola from India, Burma, and Ceylon, with a catalogue of the Oriental species of the order. Four genera and twenty-eight species were described as new, amongst the latter the most remarkable being a form unique among Collembola in possessing a median cercus to the fifth abdominal segment, and for the reception of which a new subfamily was formed. The total number of Collembola known from the Oriental region was stated to amount to fifty-three species comprised within twenty-seven genera.—Prof. P. P. **Sushkin**: Ontogenetical transformations of the bill in *Ardea cinerea*. The author gave a description of the gradual development of the bill in a series of embryos and young specimens of the heron upon which he had made observations. The simple rhamphotheca proved to be only a late stage of the compound one, and the form of the Ardeine bill he regarded as a derivative one, and discussed its resemblance to those of allied forms.

MANCHESTER.

Literary and Philoscphical Society, October 31.—Prof. F. E. Weiss, president, in the chair.—Thomas **Thorp**: A new method for testing the curvature of parabolic mirrors. The method consists in tilting the mirror with a delicate tangent screw so that each portion of the mirror is successively brought into a horizontal position.—Miss P. C. **Esdaile**: A study of the scales of the salmon. It was shown that no two scales of the many scores examined from different parts of the one fish had the same number of lines, though they all had the same number of *annual* markings. Research during the past year indicated that the number of lines in each annual group increases gradually on scales taken from near the head to those taken near the fleshy (adipose) fin; and then from this position to the tail there is a decrease in the number of lines in each annual group. Also, the scales on the upper side of the body have fewer lines than those on the lower side. Thus the scales are not all of the same size, increasing in length and breadth as the number of lines increases. Near the adipose fin, the part of the fish with nearly the smallest girth, the scales are, so far as is known, the longest and broadest, and have the greatest number of lines. The results clearly indicate that as yet it would be premature to state how many lines are formed during each year or each month.

November 14.—L. V. **Meadowcroft**: A geometrical treatment of geodesic torsion.—Dr. A. A. **Mumford**: Observations on some factors which have caused the improved physique of boys at the Manchester Grammar School during the last thirty years. In comparing the differences in height, weight, and physical development generally of the boys at the school during the period 1881–6 as compared with the period 1905–10, the author discussed the causes—better housing, improved diet, greater insight into the meaning of parental responsibility as regards health, &c.—to which he attributed the remarkable increase in height and weight of the boys. He referred to the changed attitude

towards athletics and physical culture, particularly during the earlier ages, prevailing to-day, and, further, directed attention to the fact that, from the statistics he put forward, it appeared that the later the onset of infectious diseases can be postponed beyond the earliest years of childhood, the better it would appear to be for the future growth and vigour of the child.

PARIS.

Academy of Sciences, November 13.—M. Armand Gautier in the chair.—J. **Violle**: A reversion of the double rose to the single form. A de Dijon rose, which for the last twelve years had borne large numbers of the usual double flower, possibly as a consequence of the dry and hot summer suddenly in September developed on all its branches single roses. These were followed eight days later by a crop of the usual double rose.—A. **Laveran** and D. **Roudsky**: Concerning the action of oxazine (triaminophenaxoxonium), chloride, and acridine (diphenylmethane) on trypanosomes. An account of experiments on the cause of the disappearance of the centrosomes from the trypanosome under the action of oxazine.—Pierre **Termier**: The tectonic in French Basque country.—J. Ph. **Lagrula** and H. **Chrétien**: The Brooks comet (1911*c*); its photographic appearance and its spectrum. The photograph showed a clearly defined globular nucleus with a tail formed of numerous filaments, nine of which were sufficiently well marked to measure their angles of position. The spectrum was photographed on a pinacyanol plate, recording from the ultra-violet to the red. It proved to be very similar to the spectrum of the Daniel comet taken with the same apparatus. The spectrum was continuous, with the cyanogen and carbon bands superposed.—A. **Demoulin**: The Ω surfaces.—L. **Schlesinger**: A differential system with fixed critical points.—G. **Kowalewski**: A property of the transformations of Volterra.—M. **Jouguet**: The acceleration of waves of shock in wires.—Jean **Becquerel**: The propagation of light in fluorescent bodies. Neither in the ruby nor the emerald does the state of fluorescence sensibly modify the velocity of propagation of the radiations of the same period as those emitted. Within the limits of accuracy of these experiments a fluorescence absorption does not appear to exist.—Kr. **Birkeland**: Celestial phenomena and experimental analogies. Photographs of further experiments made with a magnetic globe as kathode in a large Leyden jar. The examples given in the reproductions of the photographs include the imitations of Saturn's ring, of some nebulæ, and of the sun-spots.—Pierre **Weiss** and O. **Bloch**: The magnetisation of nickel, cobalt, and of alloys of nickel and cobalt. For those alloys for which magnetic saturation was possible, the Curie constant was found to be a linear function of the percentage composition of the alloys.—Chaspoul and Jaubert **de Beaujeu**: Researches on the radio-activity of the waters of Vals-les-Bains. No general relation appears to exist between the radio-activity of water and the mineral constituents. In the bicarbonate waters of Vals, however, the free carbonic acid varies in the same sense as the radio-activity.—Pierre **Girard** and Victor **Henri**: Concerning some new hypotheses on the molecular state of bodies in solution. The van 't Hoff-Arrhenius theory of solution has recently been criticised adversely by Colson and Fouard, the former on the basis of cryoscopic measurements, the latter from the results of osmometric experiments. The author shows reasons for supposing that in the experiments of Fouard the equilibrium observed was not that due to the true osmotic pressure, but was the result of osmotic currents of electrostatic origin. It is concluded that the facts brought forward by MM. Colson and Fouard cannot be regarded as controverting the theory of van 't Hoff and Arrhenius.—E. **Boismenu**: The hypoiodous amides. Details are given of the mode of preparation and properties of the iodine derivatives of acetamide, propionamide, and formamide. These all contain the group —NI, are decomposed by water, decolorise indigo, and liberate from a solution of potassium iodide twice the amount of iodine contained in the molecule. They are very unstable, and the stability decreases as the molecular weight is lower.—M. **Lespieau**: Some properties of monobromacrolein. Monobromacrolein gives pyrazol when treated with hydrazine hydrate; the aldehyde does not react with pure hydrocyanic acid, but a violent reaction is induced by the presence of a trace of potassium cyanide, the product being a nittile alcohol giving the acid $CH_2:CBr.CH(OH).CO_2H$.—E. **Chablay**: Researches on the metallic alcoholates.—P. L. **Viguier**: Attempts at the direct preparation of tetrolic aldehyde. An account of unsuccessful attempts by three methods to prepare tetrolic aldehyde.—Marin **Molliard**: The action of various polyureides and of hippuric acid on the development and tuber formation of the radish. Tuber formation was found to be favoured by the presence of sodium urate.—C. **Picado**: The epiphyte Bromeliaceæ as a biological medium.—P. A. **Dangeard**: The sulphur bacteria.—M. **Radais** and A. **Sartory**: The toxic properties of the *Mapou* (*Agauria pyrifolia*). The leaves, flowers, fruit, and seeds of this plant contain a very toxic substance or substances soluble in water or weak alcohol. Boiling the solution does not destroy the toxicity. There are some indications that the toxic substance is a glucoside.—Paul **Godin**: Some conclusions from my researches on growth in man relating to puberty.—A. **Magnan**: A human acephalous monster.—Jacques **Pellegrin**: The aquatic vertebrates of the Sahara.—Louis **Semichon**: The heterogonic cycle of *Pterocallis tiliae* and the presence of chlorophyll.—D. **Keilin**: Certain constant sensitive organs in the larva of Diptera and their probable significance.—Henri **Agulhon**: The mechanism of the destruction of the diastases by light. Experiments with succase, laccase, and tyrosinase showed that these three diastases are not attacked by ordinary light in a vacuum. The ultra-violet rays from a quartz mercury vapour lamp partially destroys them, although not to so great an extent as when oxygen is present. The hypothesis that the actual agent destroying the diastases is hydrogen peroxide, formed by the action of the light, accords well with the experimental facts.—H. **Gaehlinger** and A. **Tilmant**: The caseifying action of certain lipoids.—Maurice **Lugeon**: Some consequences of the hypothesis of a dualism of the Palæozoic foldings in the western Alps.—G. **Le Cadet**: The origin of the electrical manifestations of storms, on the occasion of the observation of cyclones in China seas. In the vertical terrestrial electric field a vortex with horizontal axis can develop influence charges and sufficient differences of potential to cause disruptive discharges.—J. **Vallot**: The protection of observatories at high altitudes against lightning. In the two observatories on Mt. Blanc, one is surrounded by metal directly connected with the rock on which it stands by numerous metallic connections, and this has never been struck by lightning. The other, the Janssen Observatory, stands on snow, and connection has to be made with the earth by means of a cable 100 metres long. In spite of numerous alterations and additions to the protecting apparatus, this observatory has been repeatedly struck, and electrical phenomena have been observed inside the building, in some cases lasting for more than two hours, and resulting in personal injury to the occupants and fusion of various metal instruments and utensils. It is concluded that for buildings established on snow at a considerable distance from rock there is no means known of protecting against lightning.—M. de Montessus **de Ballore**: The distribution of seismic instability in Bolivia.

BOOKS RECEIVED.

Heroic Lives of the Nineteenth Century. By C. Scudamore. Pp. vii+351. (London: G. Routledge and Sons, Ltd.) 3*s*. 6*d*.

The Boy Fancier. By F. T. Barton. Pp. xx+435. (London: G. Routledge and Sons, Ltd.) 5*s*.

The King to his People: being the Speeches and Messages of his Majesty George V. as Prince and Sovereign. Pp. xviii+452. (London: Williams and Norgate.) 5*s*. net.

The Importance of the Jews for the Preservation and Revival of Learning during the Middle Ages. By Dr. M. I. Schleiden. Translated by M. Kleimenhagen. Pp. 63. (London: Siegle, Hill and Co.) 1*s*. 6*d*. net.

The Queen of the Castle. By A. Wilson. Pp. 144. (Ilkeston: H. Wilson and Co.) 6*d*. net.

The World's Minerals. By L. J. Spencer. Pp. xi+212+40 coloured plates. (London and Edinburgh: W. and R. Chambers, Ltd.) 5*s*.

The Mind of Primitive Man. By F. Boas. Pp. xi+294. (London: Macmillan and Co., Ltd.) 6s. 6d. net.

Unity in Nature: an Analogy between Music and Life. By C. E. Stromeyer. Pp. x+589. (London and Manchester: Sherratt and Hughes.) 12s. 6d. net.

Outlines of Education Courses in Manchester University. Pp. viii+189. (Manchester: University Press.) 3s. net.

A Text-book of Practical Chemistry for Technical Institutes. By Dr. A. E. Dunstan and F. B. Thole. Pp. x+335. (London: Methuen and Co., Ltd.) 3s. 6d.

Plant Life and Evolution. By Prof. D. H. Campbell. Pp. iv+369. (New York: H. Holt and Co.) 1.60 dollars net.

Ministère de l'Agriculture. Direction de l'Hydraulique et des Améliorations Agricoles. Service des Grandes Forces Hydrauliques (Région des Alpes). Compte Rendu et Résultats des Études et Travaux au 31 Décembre, 1910. Tome iv. Pp. 556. Annexe i. Cartes. Pp. 14+8 maps. Annexe ii. Nivellements. Thirty-three plates.

An Elementary Treatise on Cross-ratio Geometry, with Historical Notes. By the Rev. J. J. Milne. Pp. xxiii+288. (Cambridge: University Press.) 6s.

A Primer of Astronomy. By Sir R. S. Ball, F.R.S. Reissue. Pp. viii+228. (Cambridge: University Press.) 1s. 6d. net.

Chemie und Technik. By Dr. G. Bugge. (Bücher der Naturwissenschaft, ii. Band.) Pp. 190. (Leipzig: P. Reclam, jun.)

The Sun. By C. G. Abbot. Pp. xxv+448. (London: D. Appleton and Co.) 7s. 6d. net.

The Process of the Year. Notes on the Succession of Plant and Animal Life. By H. H. Brown. Pp. 180. (London: S.P.C.K.) 2s. 6d.

An Intermediate Text-book of Botany. By E. Evans. Pp. viii+394. (London: Longmans and Co.) 6s.

Philosophy. By N. M. Butler. Pp. vii+51. (New York: Columbia University Press; London: Frowde.) 4s. 6d. net.

Charles Darwin and Samuel Butler. A Step towards Reconciliation. By H. F. Jones. Pp. 28. (London: Fifield.) 1s. net.

The Advance of Photography. Its History and Modern Applications. By A. E. Garrett. Pp. xiii+382. (London: Kegan Paul and Co., Ltd.) 12s. 6d. net.

A History of British Mammals. By G. E. H. Barrett-Hamilton. Part ix. Pp. 121–168. (London: Gurney and Jackson.) 2s. 6d. net.

A Text-book of the Principles of Physics. By Dr. A. Daniell. New and revised edition. Pp. xxv+819. (London: Macmillan and Co., Ltd.) 17s. net.

A Text-book of Physics. By Prof. L. B. Spinney. Pp. xi+605. (London: Macmillan and Co., Ltd.) 12s. net.

Ancient Hunters, and their Modern Representatives. By Prof. W. J. Sollas, F.R.S. Pp. xvi+416. (London: Macmillan and Co., Ltd.) 12s. net.

Selsey Bill: Historic and Prehistoric. By E. Heron-Allen. Pp. xvi+404+3 maps+lvii plates in text. (London: Duckworth and Co.) 2l. 2s. net.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 23.

ROYAL SOCIETY, at 4.30.—On the Iron Flame Spectrum and those of Sun-spots and Lower-type Stars: Sir N. Lockyer, K.C.B., F.R.S.—Sinhalese Iron and Steel of Ancient Origin: Sir R. A. Hadfield, F.R.S.—On the Conductivity of a Gas between Parallel Plate Electrodes when the Current approaches the Maximum Value: Prof. J. S. Townsend, F.R.S.—Spectroscopic Investigations in connection with the Active Modification of Nitrogen. II. Spectra of Elements and Compounds excited by the Nitrogen: Hon. R. J. Strutt, F.R.S., and Prof. A. Fowler, F.R.S.—The Less Refrangible Spectrum of Cyanogen, and its Occurrence in the Carbon Arc: Prof. A. Fowler, F.R.S., and H. Shaw.—Note on the Monatomicity of Neon, Krypton, and Xenon: Sir W. Ramsay, K.C.B., F.R.S.—The Adherence of Plain Surfaces: H. M. Budgett.—On the Resistance to the Motion of a Thread of Mercury in a Glass Tube: G. D. West.—The Distillation of Binary Mixtures of Metals in vacuo. Part I. Isolation of a Compound of Magnesium and Zinc: A. J. Berry.—Analysis of Tidal Records for Brisbane for the Year 1908: F. J. Selby.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Automatic Reversible Battery Boosters: R. Rankin.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Huxley Memorial Lecture.—The Early Inhabitants of Western Asia: Prof. F. von Luschan.

INSTITUTION OF MINING AND METALLURGY, at 8.—The Development of the Copper Queen and the Warren Mining District: Dr. James Douglas.

CHEMICAL SOCIETY, at 8.30.—*Extra Meeting.*—Prof. Harold B. Dixon, F.R.S., will deliver the Berthelot Memorial Lecture.

FRIDAY, NOVEMBER 24.

PHYSICAL SOCIETY, at 5.—The Maximum Value of the Electric Stress between Two Unequal Spherical Electrodes: Dr. A. Russell.—The Cubical Expansion of Fused Silica: F. J. Harlow.—On the Temperature Coefficient of Diffusion: B. W. Clack.—The α Particles emitted by the Active Deposits of Thorium and Actinium: E. Marsden and T. Barratt.—The Magnetic Transition Point of Cementite: S. W. J. Smith, W. White, and S. G. Barker.

SATURDAY, NOVEMBER 25.

ESSEX FIELD CLUB (at Essex Museum of Natural History, Stratford), at 6.—More about Dr. Benjamin Allen (1663–1738), of Braintree, and his Common-Place Book: Miller Christy.—A Bronze-age Pit-dwelling at Epping, Essex.—Notes on White Varieties of Flowers: C. Nicholson.

MONDAY, NOVEMBER 27.

ROYAL SOCIETY OF ARTS, at 8.—The Carbonisation of Coal: Prof. Vivian B. Lewes.

INSTITUTE OF ACTUARIES, at 5.—A New Method of approximating to the values of Last Survivor Annuities on two or more lives, and to the values of Joint Life Annuities when the advantages of Makeham's Law are not available: G. J. Lidstone.

TUESDAY, NOVEMBER 28.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Prehistoric Monuments in the Outer Hebrides and their Astronomical Significance: Capt. Boyle T. Somerville, R.N.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Electric Lighting of Railway Trains: The Brake-Vehicle Method: R. T. Smith.

WEDNESDAY, NOVEMBER 29.

ROYAL SOCIETY OF ARTS, at 8.—The Efficiency of the Aëroplane: A. E. Berriman.

FRIDAY, DECEMBER 1.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Brake-lining Coefficients of Friction: J. and W. Legg.

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