THURSDAY, DECEMBER 24, 1903.

## LUNGE'S SULPHURIC ACID.

*A Theoretical and Practical Treatise on the Manufacture of Sulphuric Acid and Alkali, with the Collateral Branches.* By George Lunge, Ph.D., Professor of Technical Chemistry in the Federal Polytechnic School, Zurich. Third edition, revised and enlarged. Pp. xxvii+1214. (London: Gurney and Jackson, 1903.) Price 2*l.* 12*s.* 6*d.*

THE volumes before us, although bearing the above comprehensive title, in reality deal only with the manufacture of oil of vitriol, and together constitute vol. i. of the complete work. It is now upwards of a quarter of a century since this work was first published, and, thanks to the assiduity and painstaking zeal of its author, it still remains the standard treatise on the subject. Ten or a dozen years ago, at the time of the appearance, in fact, of the second edition of this work, it might have been supposed that all that need be known or stated with regard to a manufacture so highly specialised as that of oil of vitriol was already known, and was described in Dr. Lunge's classical work. But it is a striking instance of the essentially progressive character of chemical science that, even in a branch of its application so well established as this, in which, under the stress of competition, some of the acutest intellects which have ever devoted themselves to chemical technology have laboured for years with a view to make it perfect, there should have arisen during the last ten or twelve years what is practically a revolution in the manufacture—a new departure, in fact, which bids fair to alter the whole complexion of the industry.

It is this circumstance, no doubt, which has primarily led to the publication of this new edition. During the last few years there has been an enormous development of the manufacture of sulphuric anhydride, and oil of vitriol itself is being made in increasing amounts by contact-processes. It is commonly believed that the chamber process is doomed. Perhaps it is. But threatened industries, like threatened men, occasionally live long. Indeed, it is Dr. Lunge's opinion that the old lead-chamber will in all probability still yield the principal supply of ordinary sulphuric acid for many years to come. It is interesting to see how, indeed, the more modern processes have indirectly afforded a fresh lease of existence to the older one. The lead-chamber with all its appurtenances is too costly a plant to be lightly discarded, and so long as it can be kept going at a profit, so long will it continue to be used. The manufacture of oil of vitriol by the chamber process is one of those highly developed industries in which, by reason of its magnitude, small economies are all important, and, as Dr. Lunge's book shows, it is only by constant vigilance to prevent waste, and by promptitude to make use of improvements, that it can stave off what some people regard as its inevitable doom.

The compiler of a work of this character who seeks to achieve what Dr. Lunge defines to be his purpose—namely, to furnish chemical manufacturers with a trustworthy guide for actual practice as well as exhaustive scientific and technological information for all students of this branch of industry—must be prepared to suffer many rebuffs and disappointments in his search for truth. There is an obvious reference to this fact in the allusion to the studied reticence of the great acid trusts and "the somewhat narrow-minded apprehension" which fears "that by enlightening their neighbours they might injure their own interests." Luckily for the cause of technology there are manufacturers who, in the words of the author, "are far-seeing and large-hearted enough" not to restrict their experience "within the precincts" of their own business circle. To these men—and the list is a goodly one—Dr. Lunge is indebted for much valuable information.

The interested reader will naturally first turn to Dr. Lunge's account of the so-called contact-process, the process which, as already stated, in some form or other probably marks the direction which the manufacturer of the future is destined to take. In this respect the third edition, which, *pace* Dr. Lunge, we hope does not represent the last opportunity the author will have of treating the subject, constitutes a new departure, and is perhaps its most valuable, as it is its most interesting, feature. Thanks to the special communications of nearly all those who have been mainly instrumental in developing it, and more especially of the large firms concerned, Dr. Lunge has been enabled to elucidate, for the first time, the history of this special branch of a great industry. For much of our information concerning its present state, we are indebted to the Badische Anilin- und Soda-fabrik, who permitted Dr. Knietsch to make known many details of the process in the course of his remarkable and interesting lecture to the Berlin Chemical Society two years ago. The account then given has been supplemented by new and valuable information from the same firm, as well as from other manufacturers in Germany.

As has already more than once happened in the history of technology, and especially in chemical technology, the fundamental idea on which the modern method of making concentrated oil of vitriol depends had its origin in this country. It was Davy who, in 1817, first directed attention to the occurrence of what were at one time classed as "catalytic," but are now generally called "contact," reactions—phenomena which immediately engaged the attention of his relative, Edmund Davy, and thereafter of Döbereiner and Berzelius. But what is of special interest is that some years before Berzelius published his well-known paper on catalysis, the attempt was made in this country to turn contact action to account in the manufacture of oil of vitriol. In 1831 a vinegar manufacturer of Bristol named Peregrine Phillips took out a patent for "certain improvements in manufacturing sulphuric acid, commonly called oil of vitriol, viz., firstly, causing an instantaneous union of the sulphurous acid gas with the oxygen of the atmosphere, and so save saltpetre and the cost of vitriol chambers, by drawing them in proper proportions, by an air-pump or otherwise, through an ignited tube or tubes of platina, porcelain, or some material not acted on by heated sulphurous

acid gas, in which are fine platina wire or platina in any finely divided state. The sulphuric acid formed is absorbed in a lead-lined tower, filled with pebbles over which water is made to trickle down."

With reference to this patent Dr. Lunge writes:—

"Undoubtedly we have here the fundamental features of the contact-process as now employed, and Peregrine Phillips must be called its inventor in the same way as Dyar and Hemming are the inventors of the ammonia-soda process. The history of both inventions presents some common features. Made and patented in England, within a very few years of each other, by persons otherwise absolutely unknown, evidently neither trained chemists nor practical manufacturers in their respective lines, they remained almost unnoticed in the country of their birth; they were taken up in foreign countries, at first by men of science, afterwards by manufacturers, but only after having suffered many checks were they brought to full technical success, both abroad and in England, after an almost equally long interval during which all attempts in that direction were judged hopeless."

There is no "tariff-wall" against the importation of English ideas into Germany. "Almost immediately after the publication of Phillips's patent two German scientists repeated his experiments." These were Magnus and Döbereiner, and on their observations Kuhlmann based his patent of 1838. Three years before this time Clement-Desormes was reported to have written, "I am convinced that in at most ten years it will be possible to make sulphuric acid on the large scale from its constituents without lead-chambers, nitric acid or nitrates." Events somewhat belied this confident prediction. What, however, was not possible during the first half of the last century was found to be perfectly practicable during the later years of the second half.

The space at our disposal precludes any attempt to show in detail how this result has been accomplished. All the main facts are set out in Dr. Lunge's account and in the interesting communications from the Badische Anilin- und Soda-fabrik, the Höchst Farbwerke, from the Schroeder-Grillo firm, the Mannheimer Verein, and last, but not least, in the account of the process as gradually developed under the direction of Clemens Winkler at Freiberg. Together the whole story constitutes one of the most interesting chapters in the history of the development of the manufacture of an article the production and consumption of which have been held to be a measure of the degree of a country's civilisation.

## *RELIGION, LIFE AND GENIUS.*

*Grundriss der Religionsphilosophie.* By D. Dr. A. Dorner. Pp. xviii + 448. (Leipzig: Verlag der Dürr'schen Buchhandlung, 1903.) Price 7 marks.

*Gesammelte Aufsätze zur Philosophie und Lebensanschauung.* By Rudolf Eucken. Pp. 242. (Leipzig: Verlag der Dürr'schen Buchhandlung, 1903.) Price 4.20 marks.

*Friedrich Nietzsche: sein Leben und sein Werk.* By Raoul Richter. Pp. vi+288. (Leipzig: Verlag der Dürr'schen Buchhandlung, 1903.) Price 4 marks.

THE author of the "Grundriss der Religionsphilosophie" brings to his exposition a wide knowledge of the literature of the subject, and a very comprehensive grasp of the forms which religion has assumed in various countries and at different stages of its development. This preliminary mastery of the subject shows itself, not only in the mass of material actually used, but also in the tone of the book; it is marked by a gratifying breadth of treatment. After an introduction on the place of a philosophy of religion in a general scheme of philosophy, there follows a lengthy sketch of the phenomenology of the religious consciousness. From this the author proceeds to the metaphysic of religion, dealing with the existence, essence and actuality of God. This forms the second division of this part; the third is devoted to the psychology of the religious subject, to belief and certainty. The second part is concerned with outward expressions of belief, and deals historically and critically with various developments, from sacrifice to prayer and contemplation, on what may be called the subjective side, and, on the objective side, with local cults, feasts, and symbols. The section concludes with discussions on the relation of religion to morality, knowledge and art. Finally, the laws of the religious life are briefly discussed.

This programme will indicate the comprehensiveness of the author's treatment. The book attains unity in its multiplicity by virtue of the leading idea round which the facts are grouped. Religion, in its widest sense, is taken to be the spiritual life of the individual. As such we expect to find it subject to development; progress is as possible here as elsewhere, and, in fact, the history of the forms of religion shows a gradual purification and emancipation advancing with the gradual refinement of experience. The goal is a union of God and humanity; the end must not be in abstractions, but in the concrete realisation of unity in life and purpose, for which, as for the unity of the world as object of the sciences, the reality of the Divine immanence is the only true ground.

To a great extent this is a position which most thinkers could accept, with the exception of one point. The distinction between the theological and non-theological philosopher rests finally on the view each takes of his ultimate. The author seems well aware that this is the crux; he expressly avoids pantheism, and would assert the rights of the individual. But what, then, is the relation between God and the individual? The answer seems inadequate in so far as certain theological aspects of God are assumed, while no proof is given that contradictions must be unified or that a unity for us can only be grounded in a unity that is for itself. Here the religion and the philosophy make a compromise not altogether unfamiliar. We regret that we cannot follow the author here; others may succeed better, and certainly no one will fail to see that his book is a valuable contribution toward a philosophical treatment of religion.

The essays and addresses of Rudolf Eucken were well worth publishing in book form. They fall into three classes. The first group deals with political philosophy. The author is mainly interested in the opposition of mechanism and spirit which is characteristic of the present age. Man, striving to subdue nature, builds up a vast mechanism; in the human

sphere organisation runs a fervid course; the watchwords are work, efficiency, achievement; the demand is for uniformity; the world is more and more, and yet the individual does not wholly wither; the life of the spirit persists in its claim for recognition, so that there is a progressive differentiation of subject and object, leaving us with the necessity and the problem of a higher synthesis. An essay on the late lamented Finland is characteristic in its generous estimate of the meaning and value of quality as against quantity in political life.

The spirit of this first section pervades the others. The biographical studies, eight in all, range from Aristotle to Karl Steffensen. The study of Goethe is notable for its delineation of a great man, a spirit of informal vigour, broad, active, and penetrating. The discussions on religion resume the thoughts of the first section. As the world grows man seeks escape into the infinite. Religion must progress as the world develops, and so fit itself to effect that redemption of the spirit of man for which the author pleads. The concluding essay deals with the teaching of philosophy, and contains advice worthy of all acceptation.

"Friedrich Nietzsche: sein Leben und sein Werk" is a book that should prove of interest now that Nietzsche's works are being presented in a translation. The life and the work are treated as complementary aspects, a method more than usually fruitful in this case; nothing could be more illuminating for our understanding of this eccentric genius than the Wagner episode; it forms a vigorous chapter in this book, and is a concrete exposition of Nietzsche's character, more effective than any abstract analysis. The second portion of the book, dealing with Nietzsche's writings, is well developed and shows sympathy and insight. To some extent the book is an apology for Nietzsche; the author is clearly aware that not a few will approach the subject with prejudices; not a few will continue to feel that some allowance has to be made for one to whom nature denied a stable equilibrium. As the book says, Nietzsche's power lies in raising rather than solving problems. The author obscures with some partiality those elements in Nietzsche's history which show the natural bias, intending clearly to oppose his own treatment to others which have neglected the genius and made too prominent the pathology of their subject.

G. S. B.

## ATOMS AND THE ÆTHER.

*Hypothese zur Thermodynamik. Versuch einer leichtfasslichen Darstellung einiger Prinzipe der Molekulartheorie mit Zugrundelegung der Keplerschen Gesetze für die Planetenbewegung.* By Victor Grünberg. Pp. vi+73. (Leipzig: J. A. Barth, 1903.) Price 3 marks.

THIS little book consists of a discussion of the elementary portions of the kinetic theory on somewhat novel lines; the main title is therefore misleading; it is true that the subtitle modifies one's expectations to a certain extent, but even then the contents hardly come up to what one is led to hope for. The hypothesis referred to is the following:—the structure of the ether is granular; the ether particles rotate round their axes and circulate round each other; atoms are condensed ether particles, and the circulation of the latter is therefore to be identified with the rotation of the atoms; these in their turn circulate round each other; this motion constitutes the intramolecular rotation; ultimately the molecules circulate round each other.

Four distinct motions are thus introduced, but later on (p. 41) an additional fifth motion appears, another intramolecular motion; in what respect this motion differs from the circulation of the atoms remains a mystery. The molecules (and atoms) attract each other owing to their rotations and to the streams of ether particles which are thereby set up. The centrifugal force arises from the ether pressure when the molecule is made to move in a curvilinear path; this pressure makes equilibrium with the external pressure and the molecular attractions; it is calculated by dividing the centrifugal force by the area of the sphere swept out by the molecule. When this pressure is multiplied by the volume of the sphere, the product is found to be two-thirds of the kinetic energy of the motion of circulation, and this law, which is identified with Krönig's law, is soon extended to the whole gas; incidentally we notice that the volume of N molecules is found to be $N^3$ times the volume of one (?). It is somewhat unpleasant to be reminded of the fact that the curvilinear motion, with its concomitant centrifugal force, does not exist in the gaseous state, the only state in which Boyle's law holds, and is confined to a state intermediate between gas and liquid, whatever that may be.

In the discussion of the adiabatic formula we obtain a momentary glimpse of Kepler's laws, which are so prominent in the title. When the gas is compressed, say to one-eighth of its volume, the distances of the circulating molecules are halved and their velocities thereby doubled: the temperature being proportional to the kinetic energy becomes increased to four times its value; substituting these results in the adiabatic formula we find for the ratio of the specific heats the value 5/3, as required by monatomic gases. We are afraid that a partial success of this kind may have induced the author to attach more value to his theory than we think it deserves.

Temperature depends originally on the rotation of the ether particles; when heat is supplied to the body its ether particles begin to rotate faster; in consequence of this (why?) their circulation, *i.e.* the rotation of the atoms, slows down; on the other hand, the intramolecular motion of the atoms increases, the rotation of the molecules, and thus their mutual attraction, diminishes, and finally the molecular circulation, on which the molecular pressure depends, increases. Obviously the situation is saved by assuming an odd number of motions which increase and diminish alternately! Can anything more arbitrary or unconvincing be imagined? If the reader thinks that this short review cannot be doing the pamphlet justice, let him try for himself.

J. P. K.

## OUR BOOK SHELF.

*Animals of No Importance.* By D. Dewar. Pp. 113. (Calcutta and Simla: Thacker, Spink and Co.; London: W. Thacker, 1903.)

THE essays collected in this little volume have, with one exception (which made its appearance in the *Indian Daily Telegraph*), been previously before the public in the columns of the *Times of India*. Although his style is occasionally somewhat slangy, the author discourses in a pleasant and readable manner on the habits and mode of life of various living creatures commonly met with by the resident in India, inclusive of some of those to be seen on the voyage. Excluding all such animals as come under the denomination of game—whether great or small—he confines his attention to the less attractive, although in many cases by no means the less obtrusive, members of the animal world, and from this lowly aspect of his subject he has chosen the title of the volume.

As a rule, each of the various essays is devoted in the main to a particular species. One of the most amusing of the series treats of the Indian crow—the miscalled *Corvus splendens*—a bird which, despite its store of mischief, Mr. Dewar allows the possession of some redeeming traits. He can, however, scarcely find words to express his detestation of that noisome pest, the common fly—a detestation shared by all who have resided in the east. On the other hand, the spider is a creature for which the author expresses the greatest admiration, ranking its intellectual powers higher than those of ant, bee, or wasp.

Under the title of the "Malaria Middleman" will be found a good popular account of the manner in which the Anopheles mosquito conveys the malaria germ; although it would have been better had the use of "scientist" been avoided. To one sentence in another article, namely, that "dinosaurs and sea-serpents disported themselves in the ocean" (p. 62), we venture to take strong exception. Although, perhaps, one relating to the movements of the fins of flying-fishes is the only zoological observation of any importance, we may commend the work as an excellent practical example of "nature-teaching," and at the same time as showing how the enforced tedium and confinement of Indian hot-weather life may be mitigated by the intelligent observation of the ways of the uninvited denizens of the bungalow and its immediate surroundings. R. L.

*Farming.* By W. M. Tod, M.A. With illustrations by Lucy Kemp-Welch. Haddon Hall Library. Pp. vi+268. (London: J. M. Dent and Co., 1903.) Price 7*s.* 6*d.*

THE Haddon Hall Library has hitherto dealt only with various branches of sport; its incursion into the serious domain of agriculture is therefore rather a novelty, but as Mr. Tod indicates in his opening chapter farming is something more than a business. There are probably few men who have not deep in them the desire to cultivate a plot of land or to breed some kind of animal; it is a form of atavism, civilised man gets his amusement from the pursuits out of which he dragged a hard living in the early world, and farming, like shooting and fishing, has long been the rich man's recreation. The professional can still make a living by it, but the amateur often finds his farm little less costly than his shoot. It would be hardly fair to Mr. Tod to say that his book is intended for the latter class of readers; clearly he has in mind the man to whom farming is bread and butter, but he is very sure that if the farmer sometimes finds the butter spread too thin he may look for abundant compensation in the pure joy of life on the land.

Mr. Tod's book then differs from the ordinary text-book of agriculture in treating his subject from a somewhat more generalised and human point of view; he deals with the functions of the soil, the principles of tillage, manuring and cropping, live-stock, and the system on which a farm should be managed, without any elaboration of detail, but with an intelligent appreciation both of the scientific basis of agriculture and of the other considerations which must regulate its practice. Here and there his statements and recommendations are open to criticism; in a country so diversified as Great Britain, the routine of management must change with the shifting conditions of climate and soil, but in the main the book presents a very sound picture of the farming of the midlands and east of England. Mr. Tod's experience is sufficient guarantee that the book is practical; at the same time he is no blind follower of the old paths, but is insistent that agriculture, to be successful, must adapt itself to the altered state of our markets since the great tradition of British farming was established.

The book is clearly and enthusiastically written, and we can cordially recommend it either to the man who has a little place in the country and wants to do something more than blindly follow the lead of his bailiff, or to the general reader interested in the land and desirous of understanding its great industry. To the young landowner or to the boy who is anxious to take up farming as his walk in life the book will give an excellent picture of the work of a well managed farm, and will serve as an inspiriting introduction to a more technical study of the subject. Like all the volumes of the Haddon Hall series, the book is charmingly produced, well printed on good paper, and with some illustrations by Miss Kemp-Welch which catch the true spirit of the English country-side. A. D. H.

*Queries in Ethnography.* By Albert Galloway Keller, Ph.D. Pp. ix+77. (London: Longmans, Green and Co., 1903.) Price 2*s.* net.

DR. A. G. KELLER'S small book of questions in ethnography is intended for the use of the "intelligent and partially instructed layman." The specialist, he informs us, needs no such manual, and the utterly uninstructed are unfitted to use one with discrimination and result. We agree with him. The 912 questions comprise a very wide range of ethnographical inquiry under the following heads:—(1) maintenance; (2) perpetuation; (3) gratification; (4) religious and superstitious ideas and usages; (5) the societal system; (6) contact and modification.

The system followed has been that developed by Prof. Sumner, of Yale University, and the questions evidently are based also on the admirable "Notes and Queries on Anthropology" edited by Dr. J. G. Garson and Mr. C. H. Read, and on the set of questions issued by Dr. J. G. Frazer. Not one of these books has been written by a field ethnologist, and it is perhaps doubtful whether a field ethnologist would write such a book, as the answers given to such questions by the collector are apt to be snippety, and, with the view of answering the question succinctly, he would be inclined to leave out other descriptive matter which did not appear to be relative to the particular question, but which might be, nevertheless, of supreme importance. Dr. Keller asks "exactly what is meant by 'father,' 'brother,' 'son,' if they do not correspond to our own terms?" This sort of questioning is of little real value; the only satisfactory method is the genealogical one devised by Dr. Rivers (*Journ.* Anthrop. Inst., vol. xxx. p. 74, 1900). Nothing is said about the value of obtaining information concerning different schools of decorative art and the significance of the designs.

Doubtless Dr. Keller's little book will prove of con-

siderable service. Practically all one can say to a traveller is that he should collect full information about everything, and books of this kind are valuable in suggesting topics for inquiry.

*Catalogue of the Lepidoptera Phalaenae in the British Museum.* Vol. iv. Catalogue of the Noctuidæ in the Collection of the British Museum. By Sir George F. Hampson, Bart. Pp. xx+689, plates lv.–lxxvii., and 125 woodcuts. (London: Printed by Order of the Trustees.) Price 15*s.*; plates 16*s.*

THE previous volumes of this important work appeared in 1898, 1900, and 1901 respectively, and we have now to record the publication of vol. iv., which includes the Agrotinæ, the first of the fifteen subfamilies into which the great family of Noctuidæ is divided; 1139 Agrotinæ are described in the present volume, out of the 10,000 to 12,000 known species of Noctuidæ.

As the Agrotinæ are well represented in Europe and North America, this volume will perhaps appeal to a larger number of lepidopterists than its predecessors, which treated of more showy, but principally tropical, moths. For the plates of Agrotinæ trichromatic photography has been employed, as more suitable to represent the generally dull colours of the Noctuidæ than chromolithography, which is considered better adapted to bright coloured moths, such as Arctiadæ.

Most of the leading lepidopterists of Europe and America have helped to make Sir George Hampson's work more complete by the contribution of specimens, or coloured photographs of unique types, and the loan of co-types.

Descriptions of the known larvæ of Agrotinæ are added from various authentic sources, those of North American species being mostly contributed by Dr. Harrison G. Dyar.

The general arrangement of the book is in all respects similar to that of previous volumes, and the execution of the plates is excellent, though one or two figures may perhaps be somewhat undercoloured—not a very serious point, however.

There are small matters on which we think information, when attainable, might have been added, such as the elevations between which mountain species occur (which is only rarely mentioned) and the latitudes at which Arctic species have been found.

As we may reasonably assume that the increase of our knowledge of moths will be still more rapid in the future than it has been in the past, we can hardly expect Sir George Hampson to complete the Noctuidæ in less than ten or twelve volumes. At a rough estimate it is probable that out of the 1139 species described in vol. iv. less than 300 may have been included in Walker's catalogue of 1856–1866. Rather more than 100 species of Agrotinæ have been described by Sir George himself, either for the first time in the present volume, or in previous publications.

*Proceedings of the London Mathematical Society.* Vol. xxxv. Pp. 476. (London: Francis Hodgson, 1903.)

A SPECIAL interest attaches to the present volume from the fact that it marks the retirement from the secretaryship of Mr. R. Tucker after thirty-five years of office. Mr. Tucker was elected a member of the Society on October 16, 1865, and two years later he succeeded G. C. de Morgan as secretary. Mr. Tucker has been responsible for the greater part of the editorial duties connected with the issue of the *Proceedings* from part xii. onwards, and he has succeeded in producing a series of English mathematical transactions of which he may well feel proud.

Among the subjects treated in this volume we note Dr. Hobson's presidential address on the infinite and the infinitesimal in mathematical analysis, and papers by Mr. Conway on light propagation in a uniaxial crystal, by Prof. A. C. Dixon on summation of series and expansion of functions, by Prof. Hill on power series, by Prof. Lamb on wave motions, by M. Picard on existence theorems for differential equations (in French), by Mr. Whittaker on harmonic analyses, by Mr. W. H. Young on sets of points and intervals, and many other papers of equal interest.

*Insist on Yourself. The only Law of Success.* Pp 45. (London: Gay and Bird, n.d.) Price 1*s.* net.

THIS little book is intended to set forth concisely many of Emerson's utterances on the importance and power of individuality. The "thoughts" selected are attractively arranged and nicely printed.

## 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.*]

### The Unusual Sky Colours and the Atmospheric Circulation.

PROF. F. A. FOREL writes me concerning my letter in vol. lxviii. p. 623, that although he did not himself observe the coloured ring around the sun prior to the first of last August, yet he has been informed that it was seen in Europe much earlier. The observers and dates quoted by M. Forel, arranged by localities from north to south, are as follows:—Director Rykatcheff, of the Central Physical Observatory at St. Petersburg, noted an opalescent veil surrounding the sun on October 5 and November 9, 1902, January 21, February 10, 18 and 23, March 17, April 5, May 29, and July 26, 1903. Dr. Busch, at Arnsberg, Westphalia, saw the same thing on November 19, 1902, March 21 and 22, 1903, and Prof. Wolf, at Heidelberg, during January, 1903. Dr. Maurer, at Zurich, observed the ring also in January, on March 27 and 28, June 7, 8, 9, and at the end of July, 1903. Therefore, M. Forel says, very properly, that since the phenomenon was observed practically simultaneously in Europe and America, no hypothesis as to why it appeared first in the last named country is needed. While admitting the truth of the statement, I would remark that a faint whitish ring around the sun was recorded by me here as early as June 26, 1902, although it was not noticed again until the close of the year. The equally early appearance over southern England of a large brownish corona, which became smaller but more conspicuous during the summer and autumn of 1902, is described by Mr. T. W. Backhouse in NATURE (vol. lxvii. p. 174).

M. Forel pointed out in the *Comptes rendus* of the French Academy of Sciences for August 10 that in view of the intermittent character of the brilliant colours of the western sky after sunset during the preceding year, produced, he assumed, by the breaking up of the continuous ring of volcanic dust into separate cloud masses which passed successively over Europe, it became of interest to ascertain whether the present Bishop's ring, unlike its predecessor, was always visible in favourable circumstances. The data mentioned, as subsequently sent M. Forel, proved that the new Bishop's ring was visible only at irregular intervals, as he had surmised. Now, if this phenomenon, as well as the discontinuous sunset glows, were caused by the passage of isolated masses of volcanic dust, it seems possible, by comparisons with observations at distant stations, not only to trace the direction of their drift, but also to determine their approximate velocity. Accordingly, the records at Blue Hill of the occurrence of Bishop's ring and of abnormal glows after sunset during the past year were examined, and the tendency of both phenomena to occur intermittently, but not necessarily simultaneously, was established, even though the transparency of air remained nearly constant.

On comparing these days with those on which Bishop's ring was stated to have been visible at Zurich, and with the dates, from M. Forel's paper, of abnormal sunset glows seen at Morges, it was found that the successive appearances of the respective phenomena occurred here about twenty days later than they did in Switzerland. Of course, the weather conditions at single stations introduce irregularities, so that the conclusion must be regarded as uncertain, but supposing it to be approximately correct, since the stations used lie nearly in the same latitude, and we can assume that the drift of the elevated dust-clouds was from west to east, their velocity in passing around the globe, from central Europe to the eastern United States, was about 30 miles per hour, or a rate considerably less than that found from trigonometrical measurements to be the velocity of the highest ice-clouds.

In the case of the great Krakatoa eruption in 1883, the speed of the ash-cloud as it circled the globe from east to west along the equator, and its slow diffusion toward the poles, was determined from the observation of the successive appearances of coloured suns and brilliant sunset glows in different parts of the world, collected by the Royal Society's committee appointed in 1884. The assistance in solving the problem of atmospheric circulation which a knowledge of the drift of dust ejected into the upper atmosphere by volcanoes situated in the tropics might furnish would certainly justify obtaining all available data bearing on the march of the abnormal sky colours. Mr. Clayton, of this observatory, began the collection of such data some time ago, but was deterred from continuing the work by reason of the difficulty in obtaining definite information. A task of such magnitude belongs properly to a commission possessing the necessary facilities for collecting and discussing the material, so it is hoped that an organisation like the Krakatoa Committee, the admirable report of which was published in 1887, may undertake the study of the recent and present remarkable sky colorations, probably occasioned by the eruptions in 1902 of the volcanoes in Martinique and St. Vincent.

A. LAWRENCE ROTCH.

Blue Hill Meteorological Observatory, Hyde Park, Mass., U.S.A., December 11.

## Internal Oscillation in the Waters of Loch Ness.

I WOULD beg a little space in your columns to direct attention to some of the conclusions which I draw from temperature observations taken last summer in Loch Ness.

Routine observations have been taken at the south-west end of the loch several times a day since the middle of July, and I find that the temperature at any depth between 100 and 300 feet changes with time in a markedly periodic fashion, the duration of a period being approximately three days. At about 200 feet the difference between a maximum and a minimum is something like 5° F. At greater depths the temperature change is less, but of the same period and the same phase. At depths less than 200 feet also the temperature change appears to fall off in magnitude whilst retaining the same period and phase, but here there appear to be other changes more or less obscuring the simple periodic variation. Diagram 1 gives a few observations at 200 feet.

I conclude from these observations, and others taken at different parts of the loch, that there is an internal oscillation in the waters—an internal seiche, similar to the swinging which may be set up in the interface between oil and water lying the one above the other in a trough. For such a motion we require liquids of different density lying one above the other; in the loch the upper waters being warmer are lighter than the lower strata, and I think it probable that the region where the temperature changes most abruptly acts as a surface of separation, and is comparable with the interface between the oil and water in the simple arrangement just mentioned. In Diagram 2 I have tried to illustrate the motion. The shaded portion is intended to represent the warmer water, and the hard line the region where the temperature changes most abruptly. Rough calculations on the assumption that the swinging is of this nature give the period of the order observed. A very remarkable point is the large amplitude of the vibration. At the ends of the loch the isothermal surfaces suffering the greatest displacement may move through as much as 75 feet.

The observations make it probable that this swinging is started by gales and strong winds. Winds produce a slope of the upper isotherms down towards the lee end of the loch, and the stronger the wind the deeper is this effect felt. So that strong winds are able to displace the relatively deep

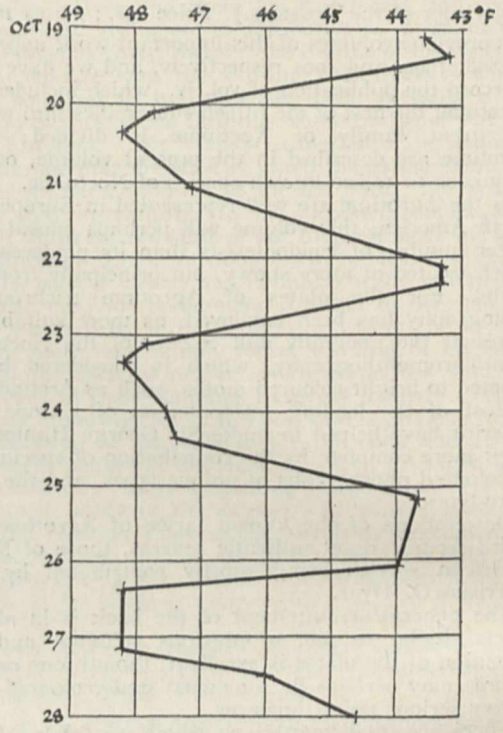


FIG. 1.

isotherms in that region where they act as an interface, and on the wind falling the isotherms swing back and continue to swing freely with a natural period.

Unfortunately it is necessary to wait for the return of summer before more observations can be made bearing on the subject, as the waters are now of almost uniform temperature.

I believe I am right in saying that such a phenomenon had up to this never been even suspected by limnologists.

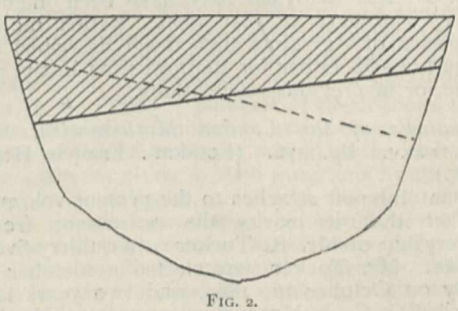

FIG. 2.

I do not think the temperatures of the deeper strata of water in any lake have been systematically observed. The phenomenon seems to me of great interest and worthy of careful study, as it appears to rank in importance along with the ordinary seiches which have been studied with such care and perseverance by Forel and others.

E. R. WATSON.

Scottish Lake Survey, Fort Augustus, N.B., December 12.

## A GREAT RELIGION.[1]

IF any proof were needed of the value of the comparative method in historic research, it is afforded by these handsome volumes. The science of comparative philology produced that of comparative mythology, and the establishing of a system of analytical study of myths and folklore, which extracted meaning from the meaningless, and turned the mere fable into precious fragments of historic record.

The study of myth and folklore revealed certain laws that were common to most systems by which the growth and development of a religion could be studied. First, it established the fact that a religion, be it the most elementary beliefs of a savage people or the fully developed creed of dynastic Egypt or Chaldea, or the sacerdotal system of the Hebrews, was essentially the product of the human mind—religion becomes, therefore, a branch of anthropology, and requires to be studied by the methods of that important science.

No religion of the ancient world so much demands to be studied by the anthropological method as that of Egypt. Its antiquity far exceeds that of all other nations, for many of its component elements belong to the prehistoric age. Viewed as a whole, it is a perfect conglomeration of strange and contradictory elements. Grossly savage beliefs of animal worship and cannibalism are found side by side with the most simple monotheism, and magic and demonology with an elaborate system of eschatology which in the latest times exercised a powerful influence on that of Christianity. Not only was the student faced with this confusion of elements, but there was another serious difficulty to encounter. Unlike the great Aryan or Semitic religions, the Egyptian religion possessed no canonical books like the Vedas or Avesta or the Hebrew scriptures. The Egyptians were not a literary people; there was a scribe caste, powerful through its priestly and official associations, but essentially a caste. Unlike the Babylonians, they had no national epic poems, no exegetical literature.

The only work which in any degree could be considered as the sacred book of the Egyptians was the "Book of the Dead," a mosaic of material of various ages and sources. The student, therefore, who would solve the riddle of the Sphinx and reduce chaos to system and order, must be a bold man, and prepared to face much labour and study. Great scholars had already laboured in the field. Dr. Heinrich Brugsch, in his work "Religion und Mythologie, der Alten Ægypter," had attempted to set forth the chief features of this wonderful religion; he had, however, been hampered by his material. The fine editions of the "Book of the Dead," such as the Ani and Nu papyri of the Theban age, were unpublished, and he had recourse chiefly to late material of the Ptolemaic age, a time when the Egyptians themselves knew little of their own religion. Moreover, Brugsch approached the subject from a classical, Aryan, and philosophical point, a method totally unsuitable for a religion with an African vocabulary. As Dr. Budge justly remarks, "No African language is suitable for giving expression to theological and philosophical speculations, and even an Egyptian priest of the highest intellectual attainments would have been unable to render a treatise of Aristotle into language which his brother priests without teaching could understand." M. Maspero was the next savant who essayed the task, and he had older material, and was the first to apply the anthropological method. He recognised the savage cults in animal worship and magic, and in the pyramid texts of the sixth dynasty.

The astonishing progress of discovery in Egypt during recent years has given an enormous retrospective enlargement to our knowledge of human life in the Nile Valley. Not only is the historic age known with an astonishing degree of detail to its very threshold, but our knowledge now extends far into the dark regions of the prehistoric.

From the graves on the edge of the Lybian plateau we gather not only the records of the life on earth of these people, but also the evidence of their simple creed and hopes of a life hereafter. Here, then, we must look for the beginnings of the religion of Egypt and the birth of the gods. It is now possible to ascertain the conditions of the environment in which the first elements of Egyptian religion grew up.

At the commencement of his work Dr. Budge deals with one of the greatest difficulties of the Egyptian religion—the problem of animal worship. At the time of man's first advent into north-east Africa and the Lybian plateau, the Nile valley presented a very different appearance from that of to-day. Banked by the Arabian and Lybian hills, the latter wooded and swarming with animals, and with great swamps and marshes full of Amphibia and serpents, &c., it was very different from the Egypt of historic times. Man found himself compelled to struggle for existence, not only with human foes, but also with a host of hostile animals. The fear of these produced a worship of them; we have a similar cult in Chaldea in the animal demons, lions, leopards, serpents, scorpions, &c. Man, however, soon demonstrated his superiority to the brute creation; some he killed in self-defence, some he domesticated or rendered serviceable to himself. The Egyptian of these prehistoric times was a cannibal; proof of this is shown by the long and valuable passage describing King Unas hunting, killing and eating the gods. Dr. Budge clearly shows the argument on which cannibalism was based. By eating the hearts and livers of men or gods the king acquired their powers; so also with animals. How early the Egyptian attained to the idea of some immortal element in man we cannot say, but we can see from the burials of the Neolithic age that it was fully developed then. This developed the belief in the god-man or god-king who lived and died and became immortal. He had as Unas the powers of man and of animals, and thus man worship and animal worship were fused by placing the animals' heads on human bodies, as the Babylonians placed human heads on animal bodies. The belief in the god-man—the anthropomorphic cult became the indigenous creed of Egypt—in the form of the worship of Osiris, and Dr. Budge's arguments for its north-east African origin are most convincing. Whatever other forms of religion were developed in Egypt or introduced from without, it remained the faith of *the people*, and continued so until the god-man Osiris became absorbed into the man Jesus Christ. It was the golden thread which ran through the tangled skein of religious life in Egypt for many thousands of years. In elucidating this fact, Dr. Budge has, as it were, established a base line for his study of all the other varied elements in this complex creed. These most important other elements are fully dealt with, but space will only allow us to deal with two, the Ra cult of Heliopolis and the worship of Horus the Hawk, "sky god" and "his blacksmith followers" with its centre at Edfu.

The solar cult of Ra-Tem of Heliopolis shows many traces of affinity with the solar cults of Asia, and this may be accounted for by the position of Heliopolis, but there is a preponderance of native elements. By many it has long been regarded as *the* religion of

[1] "The Gods of the Egyptians: Studies in Egyptian Mythology." By E. A. W. Budge, Litt.D., D.Litt., &c., Keeper of the Department of Oriental Antiquities in the British Museum. 2 vols. Pp. xvii+525 and viii+431; with 98 coloured plates and 131 illustrations. (London: Methuen and Co., 1904.) Price 3*l.* 3*s.* net.

Egypt, owing to the immense power it attained when blended with that of Amen of Thebes, and administered by the most powerful priesthood the ancient world ever produced. Dr. Budge, however, very clearly demonstrates its position as the religion of the court and aristocracy of Egypt, as that of Osiris was the creed of the people. From an early period there was a fusion of the two creeds, and with the Theban school this was carried to the extreme, where Amen Ra assumes the function of Osiris and all the other gods as well, but with the fall of the ambitious hierarchy the old creeds once more asserted their power. This portion of the book is a most interesting and valuable account of one of the greatest religious movements of ancient times.

The revival of the Heliopolitan ritual, and especially the teaching as to the Heaven of the victorious Osirian, is very fully described, and there is here matter of immense value. Here the deceased who has become justified "becomes god the son of god," he takes his seat by the side of God, and eats of the Tree of Life, which is in the midst of the Field of Peace. He lives on light, becomes a being of light, and, as Dr. Budge points out and we must add very quietly, that as this cult was known among the people of Lower Egypt until two centuries after the Christian era, we have here the source from which the writer of the Apocalypse drew his description of the life of the Christian who had "overcome" the world. There is material under the study of the important mother goddess cults which should certainly attract attention from the New Testament critics, for here we have the basis of the Theotokos controversy. This is not the place to discuss theology, so we pass to the more interesting subject of the worship of Horus Behutet, the opponent of Set, with his curious guild of "Blacksmiths." Dr. Budge's remarks on this subject are of importance, as they show how often history is found interwoven with myth. Essentially a solar myth, there is interwoven with it the story of the invasion of Egypt from the south by a superior race who used iron or metal weapons against the flint weapons of the aborigines. To quote Dr. Budge:—

"It is of course impossible to say who were the blacksmiths that swept over Egypt from South to North, but the writer believes that they represent the invaders in predynastic times who made their way from a country in the East, by way of the Red Sea, by some road across the eastern desert. They brought with them the knowledge of working in metals and of brickmaking, and having conquered the indigenous people of the South, that is those around Edfu, made that city the centre of their civilisation."

In later times the material conflict was blended with the mythic, and hence the confused legend of Ptolemaic times. Sufficient has been said to show the rich material Dr. Budge has collected in these two great volumes, but we can only dip into them in this review. The valuable analysis which Dr. Budge gives of those strange works the "Book of the Tuat" and the "Book of the Pylons" will be welcome, for hitherto no authoritative English description of these works has been accessible. The curious illustrations of the journey of the sun through the night hours, which are found on the sarcophagus of Seti I. in the Sloane Museum and in the royal tombs of the nineteenth and twentieth dynasties, certainly depict all the horrors of hell to the simple and uninitiated. The works were, however, essentially sacerdotal, and inscribed in places not accessible to the people, so whatever their teaching might be, it did not affect the popular religion. Dr. Budge is probably right in denying the theory that the Egyptians believed in eternal punishment, but they supplied all the material for a most elaborate illustrated edition of the Egyptian inferno to those who held that doctrine. Hence we find the early Christians giving such vivid descriptions of the fate of the damned.

There are some points on which, however, we must differ from the author. After the very lucid description which he gives of the Egyptian Tuat or Land of Night, he gives us a most valuable excursus on the Hebrew Gehenna and the Babylonian Hell, and would attribute the Rabbinical ideas to Egyptian influence. Great as was the influence of Egyptian theology on early Christianity, the Apocalypse and Coptic writings, it is very doubtful if it attracted the Jewish mind. The Seven-headed Serpent of Revelation is the Serpent of the Week of the Babylonians with seven heads and tails—certainly not the seven-headed serpent of the Egyptians.

In conclusion, we must give a high word of praise to the preparation of the work; the beautiful plates and illustrations, the various tables and indices, render it a work that should win the gratitude of all Egyptologists, and add still more to the writer's reputation as an indefatigable worker and a painstaking scholar.

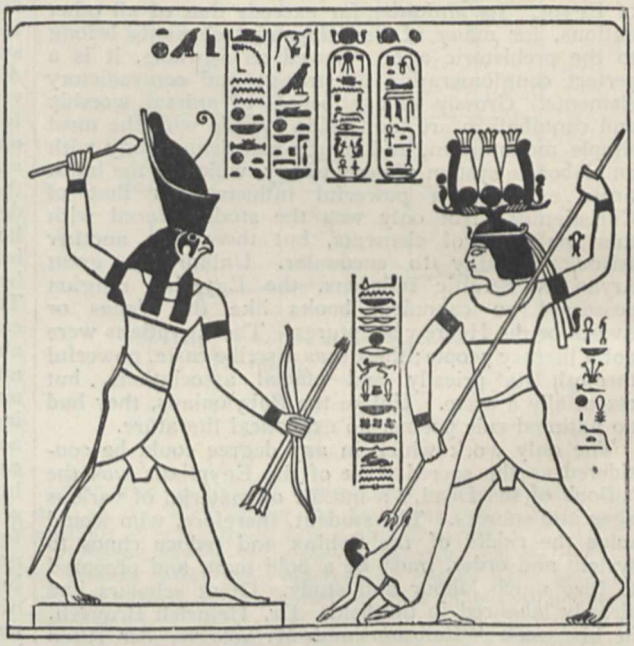

FIG. 1.—Horus of Behutet Armed (Edfu). From "Gods of the Egyptians.")

## SCIENCE IN SOFT RAIMENT.[1]

IN these six agreeable volumes there is an extraordinary family likeness, which the authors themselves perhaps would be very unwilling to recognise.

1 "Wild Nature's Ways." By R. Kearton, F.Z.S. With 200 illustrations from photographs taken direct from nature by Cherry and Richard Kearton. Pp. xvi+296. (Cassell and Co., 1903.) Price 10s. 6d. net.

"A Little Brother to the Bear, and other Animal Studies." By William J. Long. Illustrated by Charles Copeland. Pp. xix+280. (Boston, U.S.A., and London: Ginn & Co., 1903.) Price 7s. 6d.

"Wee Timorous Beasties; Studies of Animal Life and Character." By Douglas English. With 150 illustrations from his photographs of living creatures. Pp. vi+223. (London: S. H. Bousfield and Co., Ltd., 1903.) Price 5s. net.

"Popular Natural History of the Lower Animals (Invertebrates)." By Henry Scherren, F.Z.S. Pp. 288; with 168 illustrations. (The Religious Tract Society, 1903.) Price 3s. 6d.

"Nature's Riddles; or the Battle of the Beasts." By H. W. Shepheard-Walwyn, M.A., F.Z.S., F.E.S. With coloured plate and over 100 illustrations by the author. Pp. xvi+295. (Cassell and Co., 1903.) Price 6s.

"Nature—Curious and Beautiful." By Richard Kerr, F.G.S., F.R.A.S. With sixty-nine illustrations from drawings made by the author. Pp. 274. (London: The Religious Tract Society, 1903.) Price 3s. 6d.

Even "the point of view," on which Mr. Long insists, does not very greatly vary. From book to book we come across the same animals, house-mouse and dormouse, sparrow and kingfisher, fox and squirrel, remarkable shells and strange leaf-insects. The problems are the same—the boundaries of instinct and reason, the methods and reality of protective resemblance, and all the general mystery of life. If Mr. Shepheard-Walwyn aims at inducing his readers "to study for themselves wild nature and her wonderful ways," Mr. Kearton makes the same appeal on his title-page. Mr. Walwyn gives his book an alternative title, "The Battle of the Beasts," his beasts proving in the sequel to be chiefly birds and insects. In like manner Mr. Douglas English chooses for one of his "wee tim'rous beasties" the purple emperor, although among butterflies *Apatura iris* is not tiny, and in Mr. English's own account of it is not timorous. He describes it as displaying while still a mere caterpillar "paroxysms of fury," and by help of its hard and formidable horns successfully repulsing the attacks of an ichneumon-fly. He leaves it to us in the end as a vision of triumphant beauty on its nuptial flight soaring boldly into the empyrean.

The three authors above mentioned compete with one another in a very delightful manner, their illustrations being evidently the result of extreme ingenuity and skill in the art of photography. Mr. Kearton and

FIG. 1.—Dormouse. (From "Wee Tim'rous Beasties.")

others are now making known the devices, sometimes rather comical, by which the wary children of the wilderness have to be outwitted. It is not so easy to win the grace of naturalness in the portrait of a willing sitter. One can scarcely, therefore, expect a cool and unconstrained demeanour from creatures shy and nervous, surprised in their most secluded haunts, and expecting only that they and their young ones are to be robbed and murdered by the camera-fiend. That centaur-like compound of man and machine has in consequence to manage its movements with consummate caution and hours of patience. The plan of stretching a wire, by stepping on which the wild creature will itself open the magic shutter, is no doubt hopeful. But there are ledges of precipitous rocks, accessible only at serious risk of life or limb, to which it is as difficult to attach an electric wire as to put salt on the tail of a hunted bird.

The unelaborate care with which nature moulds and paints her savages, the mild and the merciless alike, so as to make them undistinguishable from their surroundings, has a singular effect on the pictorial success of a photograph. It might almost be said that the better it is the less we like it. The finish and excellence of the scene that is reproduced in all its minutiæ often beguiles the eye to such an extent that it becomes nearly as great a puzzle to find the bird, the nest, the caterpillar or the butterfly, the spider and the spider's web in the picture as it was to detect the real objects in their actual environment of reeds and moss and grass, dead leaves and bare twigs, or a medley of sticks and stones. In this respect Mr. Long in his humorous and entertaining book has a certain advantage. With the help of a clever artist he can make his incidents highly dramatic. He can emphasise what points he pleases in the life and actions of his coons and cats, moose and mink, fat familiar toad or woodcock with an astounding genius for surgery worthy of Hutton the bone-setter.

All the writers seem to agree in lamenting "That villainous saltpetre should be digg'd Out of the bowels of the harmless earth," to destroy their particular favourites, though they cannot help gloating over the hundreds of flies and other insects destroyed by toad or sparrow. But Mr. Long goes a step further in the cause of humanity. It is not only the ordinary gun of which he deprecates the use. The photographic gun must also be tabu. He celebrates the man "who goes to the woods for rest and for letting his soul grow," who is "content just to see and hear and understand," who "has no fret or sweat to get the sun just right and calculate his exact thirty-foot distance and then to fume and swear," as Mr. Long has "heard good men do" (though that, of course, is incredible and a mere aural delusion), "because the game fidgets, or the clouds obscure the sun, or the plates are not quick enough, or," &c. Thus do we scoff at other men's pursuits, and at our own! Mr. Kerr in turn might well laugh to scorn Mr. Long with his canoe and his camp, and his creeping up "through the brûlée to where bear and her cubs are gathering blueberries in their greedy, funny way." What if they should suddenly take a fancy to gathering Mr. Long?

Mr. Kerr says of his own excellent studies, "wherever possible I have made my sketches direct from Nature," with this ingenuous finish to the sentence, "and for this purpose I have spent many hours in the Natural History Museum, Cromwell Road." There, to be sure, no living bears are likely to quicken the pulse or to make the directness of nature-study over exciting. But in compensation, as Mr. Kerr's book will help its readers to perceive, our National Museum contains many of the most wonderful specimens that the globe produces, and though the game is dead and the life is still, they are trophies of all that is most artful and most artistic in nature's handiwork. If, however, the illustration of the watering-pot shell is faithfully reproduced, the example copied cannot be a very good one, since it shows far too faintly the two rudimentary embedded valves to which attention is directed in the text. Protective resemblance is finely exemplified in Mr. Kerr's figure and description of the leaf-butterfly, Kallima, from Mr. Rothschild's museum at Tring, and again by several figures of moths and butterflies in Mr. Walwyn's "Riddles." On the other hand, this much debated hypothesis is ill supported by the unnamed "submarine shellfish" in the latter work. There a species of Pteroceras is represented, a moderately flattened shell with seven long projecting processes, and Mr. Walwyn asks us to believe that this "mimics a crab, whose coat of mail affords him a very complete protection." The author does not trouble himself to say what crab is mimicked, or whether its coat of mail is harder than that of the Pteroceras, or anything like as hard. He does not say whether he ever saw a crab with its legs sprawling about in such impossible positions as the processes of the shell would represent. Above all, he seems to have forgotten that to look like a crab is the worst possible disguise to assume in the sea, unless you wish to say to the first passer-by that has a wide enough mouth, "please, come and eat me."

Mr. Henry Scherren's attractive and compendious little book stands rather apart from the rest. It aims, and aims successfully, at giving the young naturalist a pleasant idea of the invertebrates as a field of study. It is unfortunate that a wrong adjustment of the type on p. 49 has obscured the grouping of the cephalopods. The passage reads as if the second group no less than the first was subdivided into eight-armed and ten-armed species. The confusion is increased by a further accident on the following page, where the name of "the Pearly Nautilus" is attributed to the figure of "the Paper Nautilus," *Argonauta argo*, although it is properly given later on to the *Nautilus pompilius* figured and discussed on p. 56. Such mistakes are likely enough to arise so long as publishers entertain a superstitious dread that the popularity of a book will be impaired by the introduction of technical scientific names. Alone among our authors, Mr. Kerr has been allowed to set this superstition at defiance. The public are seemingly expected to hail with delight such names as Mooweesuk and Musquash, and Chigwooltz and Unk Wunk. Perhaps they are pleasantly resonant of Longfellow's "Hiawatha." Otherwise they are no easier to remember than Linnean Latin. Mr. Long understands this, and kindly supplies a glossary, not of technical names, but of Indian and English. Hence we learn that Mooweesuk is "the coon," and that Nemox is "the fisher," but whether the world has more than one coon or more than one fisher we are left wondering, and what in the world Mr. Long's "fisher" may be remains a problem, one of nature's riddles for Mr. Shepheard-Walwyn to solve.

It may be said of all these books, though their merits are various and their individual merit unequal, that they are good both to give and to receive.

T. R. R. S.

FIG. 2.—The Leaf-Butterfly. Rothschild Museum. (From "Nature—Curious and Beautiful.")

## *INDIAN METEOROLOGICAL MEMOIRS.*[1]

IT was only quite recently that there was noticed in these columns the volume containing the record of rainfall of each Indian station, printed in such a form that the reader could at a glance see the monthly, yearly, or monsoon fall for any year up to 1900. This important volume, published under the direction of Sir John Eliot, is now followed by another equally valuable, embodying all the pressure observations of each station for the whole period of observation up to the end of the year 1902. These pressures are all reduced to 32° F. and constant gravity (lat. 45°), but not for height above sea-level; the elevation of the cistern is, however, added in each case.

Previous to the year 1889, the monthly means given are those of the mean of the ten and sixteen hours' monthly mean, but after that year the 8 a.m. monthly values alone are employed. At the foot of each table the necessary information is given for converting one series into the other, so that no difficulty should be encountered in this respect.

As an indication of the thoroughness with which this compilation has been attended, the attention of the reader may be directed to appendix i., which contains notes on the positions of the observatories and the character of the barometric observations. Appendix ii. includes further important data, for here are collected for each station such valuable notes as makers and kinds of barometers employed, periods of use, positions, corrections to Calcutta standard, &c.

The data included in this volume refer to 121 different stations, and the records in most instances date from the year 1875.

Another memoir that has just recently been published is one which deals with the movements of the upper clouds. The observations were made at six stations, namely, Simla, Lahore, Jaipur, Allahabad, Vizagapatam, and Madras, and were recorded by means of Fineman's nephescopes, a description and illustration of which are given in the text.

The period of observation extended over the years 1895–1900, and in this volume not only is a monthly summary of the data for each of these stations inserted, but also the results of a brief discussion, and a series of twelve plates illustrating the mean directions of the different classes of clouds for each month of the year.

The following are among the chief results which have been gathered from this series of observations, but it is pointed out that a more extended series at

[1] Vol. xv., part i., Brief Discussion of the Cloud Observations Recorded at Six Stations in India. Pp. 112. Vol. xvi., part i., Monthly Normals of Air Pressure Reduced to 32° F. and Constant Gravity 45°. Pp. 184. (Published under the direction of Sir John Eliot, M.A., F.R.S., K.C.I.E., Meteorological Reporter to the Government of India and Director-General of Indian Observatories.)

twenty or thirty selected stations is desired to corroborate these facts and conclusions.

The amount of cirrus cloud is small during the rainy season in Upper India, and increases rapidly southwards, reaching a maximum in southern India.

The amount or frequency of cirro-stratus cloud is large in the dry season in northern India, and decreases rapidly southwards to southern India, where it is very small, as indicated by the Madras and Vizagapatam observations.

The amount of cirro-stratus is much smaller in the wet than in the dry season in Upper India. It is very small in the peninsula, almost as small as in the dry season. It is, on the other hand, of frequent occurrence over the area represented by Jaipur and Allahabad, and more especially in Allahabad.

Alto-cumulus cloud is a cloud of frequent occurrence in northern India throughout the whole year. It is of rare occurrence in the peninsula from November to May, and of occasional occurrence from June to October at Madras.

Cumulus and cumulo-nimbus are of frequent occurrence in the dry season at Simla, Jaipur, Vizagapatam and Madras, more especially at the two last-named coast stations, and are, in fact, the most characteristic clouds of the Indian area. They are of frequent occurrence in the wet season, more especially at the peninsular coast stations and at Jaipur and Allahabad.

It is noteworthy that cumulus and cumulo-nimbus are of much less frequent occurrence in the wet than in the dry season at Vizagapatam and Madras. The former type of cloud is also comparatively rare at Allahabad and the latter type of cloud at Jaipur in the dry season.

With regard to the directions of movements of the different types of clouds at the different seasons of the year, the maps in the volume illustrate the results most clearly. Reference may here, perhaps, be made only to the directions of the cirrus and cirro-stratus during the wet and dry seasons, and the following table sums up the information for the six stations.

| Station | Mean direction of movement in | | | |
|---|---|---|---|---|
| | Dry Season | | Wet Season | |
| | Cirrus | Cirro-stratus | Cirrus | Cirro-stratus |
| Simla ... ... | S. 80° W. | S. 82° W. | S. 85° W. | S. 69° W. |
| Lahore ... ... | S. 86 W. | S. 86 W. | S. 48 W. | N. 81 W. |
| Jaipur ... ... | N. 86 W. | N. 87 W. | N. 78 W. | N. 80 W. |
| Allahabad ... | S. 82 W. | S. 83 W. | N. 83 W. | S. 65 W. |
| Vizagapatam... | S. 4 W. | S. 27 W. | N. 72 E. | N. 65 E. |
| Madras ... ... | S. 13 W. | S. 86 W. | S. 82 E. | N. 87 E. |

It will be seen that the movements of the two kinds of clouds in both seasons are practically the same in Upper or north-west India, but differ very considerably when the stations are more south.

It may further be noted that in the more northern stations the air movement as observed by the upper clouds is very steady in the direction from almost due west to east, and this is more especially so during the dry season from November to May.

During this small number of years of observation it was detected that the mean direction of the cirrus movement varied slightly in the same months or seasons of different years. This variation, as Sir John Eliot states, is almost certainly real, and represents a phase in the upper air movement over a considerable area.

Previous to these cloud observations it had been estimated on theoretical grounds that the south-west monsoon currents reach up to an average elevation of 10,000 to 15,000 feet, no actual measurements having been made. Sir John Eliot here points out that the most remarkable feature of the present cloud observations is the great variability or unsteadiness of the cloud movement during this period up to the elevation of the highest cirrus at Allahabad, in the centre or axis of the trough of low pressure. From cloud measurements made by photogrammeters at Allahabad during the wet seasons (June to September) of the years 1898 to 1900, it was deduced that the variable or unsteady movement in the monsoon trough extended "to a probable elevation of 30,000 feet at least, and perhaps even to 40,000 feet, and that the regular movement in the higher atmosphere from west to east is either suspended or occurs at a much greater elevation than in the dry season."

The important results obtained by determining the movements of the air currents at different heights by means of the observations of clouds indicate that the use of kites and unmanned balloons will perhaps prove a valuable auxiliary.

The appearance of these two important memoirs so recently after the one to which reference has already been made will give the reader some notion of the activity displayed by the Indian Meteorological Department under the distinguished direction of Sir John Eliot, and of the valuable researches which it contributes to meteorological science.

W. J. S. L.

## THE FOOD AND DRUGS ACTS.[1]

THE two Parliamentary papers mentioned below, although widely different in character, are, at bottom, intimately connected with a common question, namely, the effective administration of the enactments dealing with the adulteration of food and drink.

The Food and Drugs Acts are now upwards of a third of a century old. They have been considered and reconsidered by Parliament at various times even down to the year 1899, and in the consideration have had to run the gauntlet of much deliberate obstruction from faddists, federations, and that class of free-fooders which regards any legislative interference with the buying and selling of anything of the nature of food, however bad, as noxious economic heresy, and a restriction of the free play of competition. That the Acts contain compromises, inconsistencies, and anomalies is well known to those who have anything to do with their administration. Nor has the judge-made law by which these anomalies have been interpreted tended to their smoother working; indeed, it has caused them to be absolutely inoperative in certain directions. How imperfect the Acts are is strikingly exemplified in the two papers before us.

The first, and in a sense the most important, of these is the final report of the Royal Commission appointed to inquire into arsenical poisoning from the consumption of beer and other articles of food or drink. It will be remembered that in the latter part of 1900 there occurred a serious epidemic of poisoning which was traced to arsenical contamination of beer at numerous breweries through the use of brewing sugars manufactured by a single firm in the neighbourhood of Liverpool. The arsenic was introduced into these sugars by way of a highly arsenical sulphuric acid supplied by a firm of chemical manufacturers in

[1] Final Report of the Royal Commission appointed to inquire into Arsenical Poisoning from the Consumption of Beer and other Articles of Food or Drink. Parliamentary Paper. Cd. 1848. 1903.

Final Report of the Departmental Committee appointed by the Board of Agriculture and Department of Agriculture and other Industries and Technical Instruction for Ireland to inquire and report upon the desirability of Regulations under Section 4 of the Sale of Food and Drugs Act 1899 for Butter. Parliamentary Paper. Cd. 1749. 1903.

Leeds which had been used in their production. This occurrence was attended with serious consequences, and caused such widespread alarm that it was deemed expedient that a Royal Commission should issue to ascertain the amount of the sickness and death attributable to poisoning by arsenic, and to consider by what safeguards the introduction of arsenic into articles of food or drink can be prevented.

In their first report the Commissioners dealt with the immediate question which led to their appointments, and made certain recommendations with the view of strengthening the hands of the Inland Revenue Authorities in preventing a recurrence of such a catastrophe as that which occurred in the autumn of 1900.

In their second and final report the Commissioners state in the outset what action they took to ascertain what became of the large stock (more than 700 tons) of arsenicated glucose and "invert" remaining at the works of the firm who made it, and also what became of certain arsenicated table syrups (14 tons in amount) which they had placed on the market. It is satisfactory to know that all the contaminated glucose and "invert" sugar was got rid of for purposes unconnected with food, particulars regarding each sale and the undertakings entered into respecting the use of all sugars sold being communicated to the Commission and to the Local Government Board.

As regards the extent of the epidemic, it appears from the evidence of witnesses and from information obtained from medical officers of health that the total number of persons who suffered was certainly not fewer than 6000, and probably considerably more. It is impossible to determine the number of fatal cases with any approach to accuracy. From the returns of the medical officers of health it appears that these were at least seventy, that is to say, there were seventy cases in which arsenical poisoning was entered in the death certificate as the cause of death, or was found to be a cause as the result of a coroner's inquest. These, in the opinion of the Commissioners, do not represent the total number of cases. Deaths occurring before the discovery of the cause of the outbreak were frequently certified as due to "chronic alcoholism" and "cirrhosis of the liver," and in some cases were attributed to Addison's disease and to locomotor ataxy. Other deaths were recorded as due to "alcoholic," "peripheral," or "multiple" neuritis

Not the least valuable result of the inquiry has been to bring together a series of detailed descriptions by competent medical observers of individual cases of poisoning, of different clinical types which they have distinguished, of particular symptoms met with at different stages of the malady, and of pathological changes observed *post mortem*. These descriptions form valuable material for reference and comparison, and merit careful attention.

The Commissioners are of opinion that a considerable proportion of beer brewed in some parts of the country before 1900 contained noteworthy quantities of arsenic, mainly derived from malt and from brewing sugars. It is also evident that before 1900 the degree to which beer had been liable to receive arsenic from malt must have varied greatly in different parts of England. Malt has been shown to have been subject to arsenical contamination in much greater degree when the fuel used on the kiln has been gas coke than when oven coke or anthracite has been employed. It would seem that the fact of greater prevalence of alcoholic neuritis among beer drinkers in Manchester and Liverpool before 1900, when compared with other places, is to be ascribed to the larger proportion of arsenic contained in much of the malt there used, due to the character of the fuel employed in kilning. That malt of this character will give rise to arsenical poisoning was shown by the occurrence of an outbreak in Halifax in 1902, the circumstances of which were carefully inquired into by the Commission.

Incidentally, the Commission has accumulated interesting and valuable information on the question of individual susceptibility to arsenic, on the mode in which it accumulates in human tissues, and on the ways in which it is eliminated. Arsenic was detected in sweat, in the epidermic scales which are freely shed in the condition known as keratosis, in the nails and in hair. It appears that epidermic tissues, which consist principally of keratin, have a special affinity for arsenic, and that the effect of arsenic upon nerve tissue may be related to the fact that nerve sheaths consist largely of keratin.

With regard to the suggested relation between the disease known as "beri-beri"—a disease mainly characterised by peripheral neuritis—and arsenical poisoning, the Commissioners are of opinion that such clinical, etiological and chemical data as they have been able to collect lend no support to the idea of such relation.

Much of the evidence laid before the Commission related to the relative value of different methods of estimating small quantities of arsenic in brewing materials and in food and drink generally. Indeed, there has sprung up quite a plentiful crop of literature on the subject within the last three years, and one effect of the inquiry has unquestionably been greatly to improve our analytical methods of detecting and estimating minimal quantities of arsenic. On the whole the Commission is inclined to recommend the method of comparison of mirrors, obtained either by the so-called Marsh-Berzelius method or by the electrolytic method as worked out by a departmental committee appointed by the Board of Inland Revenue.

A considerable section of the report deals with the various ways in which foods are liable to become contaminated by arsenic, and the precautions which should be taken by manufacturers to exclude it. In the greater number of cases the introduction of arsenic would appear to be due to the use of mineral acids, more particularly sulphuric and hydrochloric acid, in the preparation of ingredients of food. Arsenic may also be introduced in the mineral or organic colouring matters which may be employed to "improve" the appearance of food preparations.

The subject of malt naturally receives much attention. Although the exclusion of small quantities of arsenic from it has proved to be a matter of considerable difficulty, it is satisfactory to know that all the evidence goes to show that it is now commercially practicable to produce malt which either may be considered free from arsenic or in which the amount of arsenic is certainly less than 1/250th grain per pound. Considerations of space preclude us from attempting to show how it has been proved that access of arsenic to malt may be obviated or diminished. No doubt this section of the report will receive from those commercially interested in the matter the attention which its exhaustive treatment merits.

In the concluding sections of their report the Commissioners deal with the present means of official control over purity of food, more especially in relation to arsenic, and discuss the general question as to what improvements are, in their opinion, needed in the official control over the purity of food.

As this is, perhaps, the most generally important outcome of their deliberations, and bears directly upon the question of the efficacy of the machinery which supervises the working of the Food and Drugs Acts, we propose to reserve the consideration of their recommendations to a subsequent article.

## STATE AID FOR AGRICULTURE.[1]

MR. T. S. DYMOND, who has charge of the agricultural education in the county of Essex, has published a valuable little pamphlet on the State aid given to agriculture in Denmark and Hungary, two countries with which he is personally familiar. Both countries can show great gains to the farming industry during the past ten or twenty years, mainly the result of improved education and organisation, but they present an interesting contrast in the way the work has been done. In Denmark the initiative has come from the individual; the State has simply stepped in and assisted whatever institutions for education and research had been started by the people themselves. It is true the Government has founded and liberally endowed the Royal Agricultural and Veterinary College at Copenhagen, and also maintains the higher research stations, but to the cooperative societies and other commercial developments, which have done so much for Danish agriculture, it gives little or no direct help.

In Hungary the conditions are very different; the whole organisation has been created from above; not only has the State founded an extraordinarily complete department for education and research, but it has not hesitated to enter boldly into business and provide financial assistance to the farmers in distressed districts. It develops horse and cattle breeding by the help of great State farms, it has created a flourishing fruit industry, founded credit banks and cooperative societies, and generally adopted the "paternal" standpoint of fostering the farming interests wherever its assistance could be effective. Despite the great success of its efforts, Mr. Dymond considers that there are not wanting signs of State aid having gone too far in Hungary and having become State interference, resulting in a certain measure of discouragement to the enterprise of individuals.

Turning to our own country in the light of these examples, Mr. Dymond would limit the assistance of the State to education and research; the whole genius of the English farmer is opposed to State aid in his business matters. As Mr. Dymond points out, many parts of the country already possess considerable, if but slightly appreciated, facilities for agricultural education; farmers can get their sons educated at very low rates, their manures analysed, their seeds tested, they can obtain expert advice of all kinds as cheaply as in any foreign country. Only if you cross the county boundary none of these good things may be available, and an immense waste is going on through the want of system and the localisation in particular counties of the work that is being done.

Mr. Dymond argues for more central direction, and urges that the Board of Agriculture, which financially assists so much of the work, should assume a certain measure of control and bring the whole country into line.

Appositely enough, on the heels of Mr. Dymond's pamphlet comes the annual report of the Board of Agriculture on the distribution of grants for education and research in 1902–03. From this we learn that the Board gives substantial financial aid, 800*l*. a year with an extra 200*l*. for the maintenance of a farm, to seven colleges of university standing in England and Wales, and also grants smaller sums to eight other schools or colleges, the total expenditure amounting to 8900*l*. per annum. This, however, represents only a portion of the whole expenditure on these institutions; so far as can be made out from the report, the county councils concerned contributed 29,127*l*., which does not in all cases include capital expenditure and outlay on the farm. The total expenditure of all the county councils in England and Wales on agricultural education amounted to 87,732*l*. in 1901–02, and if we consider the distribution of this money, the manner in which comparatively minor matters, like poultry and bee-keeping and manual processes, bulk in the account, a very strong case is made out for more central control, for at present the Board of Agriculture only *inspects* the expenditure of one-third of the whole sum.

The weak side of the Board's outlay is seen in the "special grants for experiment and research." The total allotted is 864*l*. 6*s*. 1*d*.; is this magnificent sum to be taken as an index of the official opinion of the importance of English agriculture or of the value of research? The distribution, too, is curious; 225*l*. is for repetitions of Dr. Somerville's interesting "manure and mutton" experiment, 84*l*. 6*s*. 1*d*. is for trials of maize growing, 50*l*. for experiments on wheat; the Somerset County Experimental Farm, with the astonishing proviso that care shall be taken to keep records in future, gets 100*l*., as does the "Aberdeen Agricultural Research Association." Rothamsted, which we were told in the *Times* last year is being starved for want of funds, gets just nothing at all. There seems a want of proportion somewhere.

1 "Continental State-aid for Agriculture." By T. S. Dymond. (Chelmsford, 1903.)
"Annual Report on the Distribution of Grants for Agriculture and Research in the Year 1902–3." (London: The Board of Agriculture and Fisheries, 1903.)

## ROBERT ETHERIDGE, F.R.S.

IN the death of Robert Etheridge geological science has lost a distinguished worker who was actively engaged for upwards of fifty years.

Born in Herefordshire on December 3, 1819, he settled in early years in Bristol, and was for some time employed in a business house.

His scientific career commenced in 1850, when he was appointed curator to the Museum of the Philosophical Society in that city. This post he held for seven years, during which period he made himself thoroughly acquainted with the local geology, extending his observations into the region beyond Gloucester and Cheltenham, and becoming an active member of the Cotteswold Naturalists' Field Club. Through the influence of Sir Roderick Murchison (who had in 1834 published an "Outline of the Geology of the Neighbourhood of Cheltenham") he was in 1857 appointed one of the palæontologists to the Geological Survey, working at first under J. W. Salter, and assisting Huxley at the Royal School of Mines by giving demonstrations in palæontology.

In 1859 he published his first work, entitled "Geology: its Relation and Bearing upon Mining," being the substance of three lectures which he had delivered before the Bristol Mining School.

During the earlier portion of his service on the Geological Survey, he was occupied chiefly in arranging and naming the Invertebrata of the Secondary and newer strata, and after Salter had retired the Palæozoic fossils also came directly under his charge. Later on, when Jukes questioned the age and relations of the Devonian formation, Etheridge received instructions to re-investigate its palæontology and stratigraphical divisions, and the results of this arduous and important task were published in 1867 in a memorable paper "On the Physical Structure of West Somerset and North Devon, and on the Palæontological Value of the Devonian Fossils."

The list of his published papers is not a long one, but he contributed articles on the Rhætic beds of Aust, Westbury-on-Severn, Watchet and Penarth, and on the dolomitic conglomerate of the Bristol area. His work on the Geological Survey was mainly in the lists of fossils which he prepared for numerous memoirs

from 1858 to 1881. In 1875 he revised and edited a third edition of John Phillips's "Geology of the Yorkshire Coast." For many years he devoted all his spare time to the preparation of a list of British fossils, stratigraphically and zoologically arranged. Of this great work the first volume, dealing with the Palæozoic species, was published in 1888. Two other volumes, on the Mesozoic and Cainozoic fossils, have remained in MS. In all more than 18,000 species were catalogued.

In 1881 Mr. Etheridge, greatly to the regret of his colleagues on the Geological Survey, was appointed assistant keeper in the geological department of the British Museum, and this post he held with much advantage to that institution for ten years, when he retired from the public service.

He was elected a fellow of the Royal Society in 1871. In 1880 the Murchison medal of the Geological Society was awarded to him, and in the same year he was elected president of that Society. The two addresses which he delivered at successive anniversary meetings of the Geological Society were voluminous papers on the analysis and distribution of the British Palæozoic and Jurassic fossils.

These essays, which were based on his great catalogue, formed a foundation for a subsequent elaborate book (published in 1885) on "Stratigraphical Geology and Palæontology." This work, ostensibly issued as part ii. of a second edition of John Phillips's "Manual of Geology, Theoretical and Practical," was almost wholly re-written and very much enlarged by Mr. Etheridge, so that very little of the original text remained. No less than 116 tables of organic remains were incorporated, and very full particulars were also given of the strata in various parts of the British islands.

The stratigraphical knowledge which Mr. Etheridge acquired in his early days at Bristol, and afterwards with the field officers on the Geological Survey, qualified him to give expert advice on economic questions relating to coal, water-supply, &c. In consequence his assistance was frequently sought by engineers and others. During recent years he was engaged as geological adviser to the promoters of the Dover coal-boring, and was occupied on matters connected with it until but a short time before his decease.

A man of untiring energy and vigour, he seemed personally never to grow older, and it was not until lately that he lost his upright bearing, but he never lost the cheery, kindly disposition which endeared him to all his friends and associates.

He died after a few days' illness, the result of a chill, on December 18, soon after he had completed his eighty-fourth year. A good portrait of him was inserted by Lady Prestwich in the "Life and Letters of Sir Joseph Prestwich." H. B. W.

## NOTES.

It is announced that the committee of the Parisian Press Association has decided upon the award of the prize of 100,000 francs placed at its disposal by M. Osiris. The committee has resolved to divide this sum between the two inventions which have in recent times most contributed to the honour of French science. The sum of 60,000 francs has been awarded to Mme. Curie for the continuation of her researches into radium, and 40,000 francs to M. Branly for his labours in connection with wireless telegraphy.

The sum of 30,000 francs has been placed at the disposal of Prof. d'Arsonval by the *Matin*, of Paris, in order to enable him to continue his researches in connection with the properties of radium.

Among the numerous special kinds of radiation recently discovered, not the least interesting are the *n*-rays of M. Blondlot. These rays, which were first discovered in the radiations from incandescent bodies, pass readily through aluminium, glass, black paper, and other substances, but are arrested by lead or by moistened paper. They were at first studied by means of their action upon small electric sparks, but a more convenient means of observing them is due to their action upon feebly illuminated phosphorescent bodies, the luminosity of which is increased when the Blondlot rays fall on them. In a more recent paper, M. Blondlot has found that bodies in a state of strain, such as tempered steel and unannealed glass, give off these rays spontaneously and continuously at the ordinary temperature, and in the current number of the *Comptes rendus* M. A. Charpentier shows that these rays are also emitted by the human body, especially by the muscles and nerves. He points out that this effect may prove to be of the greatest importance in the case of the nerves, as up to the present no external reactions of the nervous system have been observed, and a new field of studies in physiology and medicine is thus opened up.

Dr. Osann, of Berlin, has been appointed professor of mechanics at Clausthal, and Dr. Kippenberger and Dr. Georg Frerichs have been appointed professors of chemistry in the University of Bonn.

The Venetian Academy of Sciences, Letters and Arts, offers prizes of 3000 lire under the Querini-Stampaglia foundation for monographs on the following subjects:—The lakes of the Venetian district, treated from a physiographic and biological standpoint; the works of Manuzi as a critic of Greek and Latin literature; the origins of Venetian painting; and advances in the projective geometry of algebraic surfaces of two dimensions in space of *n* dimensions. Under the Cavalli foundation, a similar prize is offered for an essay on the effects of modern social and economic conditions, &c., on landlords and farmers, with especial reference to the Venetian provinces. Under the Balbi Valier foundation an award of the same amount is offered for advances in medicine or surgery for the period 1902–3, and under the Minich foundation a prize of 3000 lire is offered for embryological researches on the development of the larynx, the trachea, and the lungs in vertebrates and birds. The last day for sending in essays for the Stampaglia prize, on the Venetian lakes, and the Balbi Valier and Minich prizes is December 31, 1903; for the remaining prizes the essays are due at the end of subsequent years.

In the course of excavations on the Lulworth Castle Estate, in Dorset, a number of bronze relics have been found, and have been sent to the Dorset County Museum on temporary loan. The most important object is a bronze sword, 24½ inches long, and, though broken, it is in a fine state of preservation. Other relics are a socket celt, a gold or heavily gilt bronze finger ring, a socket gouge, a hilt of a sword, an object which is believed to be one of the fittings of a car, supposed harness fittings, and a bronze crook.

The following telegram was received from Mr. W. S. Bruce, leader of the Scottish Antarctic Expedition, at the offices in Edinburgh on December 17:—"Buenos Ayres. *Scotia* Stanley. December 2. Refitting here. Hydrograph surveyed 4000 miles unexplored ocean; 70° 25′ south, 17 to 45 W.; 2700 fathoms trawled there; wintered Orkneys; detailed survey. Mossman and five men continue first-class meteorological, magnetical, biological station. Ramsay died August 6. All others robust; *Scotia* splendid.

Bruce." This is the first official information which has reached this country from the expedition. Mr. Allan Ramsay was the chief engineer.

IT is reported by Reuter's Agency that a scientific expedition, organised by the anthropological section of the St. Louis Exhibition, is about to leave England for Central Africa under the direction of Mr. S. P. Verner. With reference to his journey, Mr. Verner is stated to have said that in order to get at the aboriginal life as little changed as possible by civilisation, it is desired to go out of the track of previous explorers and of all settlers. The base of operations will therefore be from the capital of Chief Ndombe, paramount chieftain of the Lunda tribes, at the head of navigation of the Kasai River, the largest southern tributary of the Congo, from which place an effort will be made to penetrate the interior.

A DESPATCH from Taganrog on December 15 states that the Sea of Azov has receded to such an extent during the past five days that the bed of the sea is visible for a distance of several versts. Taganrog is at the head of a bay of the extensive lagoon known as the Sea of Azov, and the depth of water in the roadstead is greatly modified by west and east winds. High winds are reported to have raised clouds of sand which have covered the town, and these are probably responsible for the exceptionally shallow water described in the despatch.

MR. R. I. POCOCK has been elected to the post of superintendent of the Zoological Society's Gardens in succession to Mr. W. E. de Winton.

CAPTAIN STANLEY FLOWER, who was in England for a short time during the summer, has returned to his post at the Zoological Gardens, Giza, Egypt. He writes that the three specimens of the curious "shoe-bill" or "whale-headed stork" (*Balaeniceps rex*) received from the White Nile in 1902 are still in good health and condition in the Giza gardens. No living example of this rare bird has reached England since the arrival of Mr. Petherick's original specimens in 1860.

MR. W. EAGLE CLARKE, of the Museum of Science and Art at Edinburgh, a well-known authority on the migration of birds, passed a month during the migratory season in September and October last on board the lightship on the "Kentish Knock," which is situated in mid-sea off the mouth of the Thames, about twenty miles from land. Mr. Clarke has made a series of valuable observations on the various birds which passed by the lightship during this period, and has obtained many specimens which were killed by flying against the lantern. A full account of Mr. Clarke's experiences will be published in the next number of the *Ibis*.

IT is understood that the authorities of the British Museum (Natural History) and the director of the Geological Survey of Egypt have agreed to the preparation of a joint report on the wonderful discoveries of fossil animals recently made in the Fayûm. Dr. Andrews will proceed to Egypt early next year to examine and catalogue the specimens in the Geological Museum at Cairo, but will not attempt to make further collections. A fine example of the skull of the horned Arsinoitherium (perhaps the most remarkable of all these discoveries) is now exhibited in the central hall of the Museum at South Kensington.

AMONG the contents of the second part of the Bergen Museum *Aarbog* for 1903 is a paper by Mr. H. Broch on the hydroid polyps collected during the cruises of the exploring vessel *Michael Sars* in the North Sea from 1900 to 1902. Several new forms are named and described.

MR. RALPH S. LILLIE has found (*Amer. Journ. of Physiology*, viii., No. 4) that isolated cells and cell-nuclei suspended in cane-sugar solution through which an electric current is passed migrate in some cases with the negative, in others with the positive, stream. The majority of such structures migrate with the negative stream, and this tendency is especially strong in free nuclei and structures consisting chiefly of nuclear matter. Cells with voluminous cytoplasm, on the other hand, tend to move with the positive stream.

THE violets of Philadelphia afford to Mr. W. Stone the text for an article on racial variation in animals and plants, which appears in the October issue of the *Proceedings* of the Philadelphia Academy. In the course of this article the author directs attention to the growing practice among American zoologists of discarding the use of trinomials, and classing as a species every distinct animal form, no matter how slightly differentiated. This usage, it is urged, receives support from the methods of botanical classification. Where is all this splitting going to end? is the question which naturally arises in the minds of old-fashioned zoologists.

THE December number of the *Popular Science Monthly* contains two articles on biological subjects, the one, by Prof. T. H. Morgan, dealing with recent theories in regard to the determination of sex, and the other, by Dr. D. S. Jordan, on the salmon and salmon-streams of Alaska. Dr. Jordan recognises five species of Pacific salmon of the genus Oncorhynchus from these rivers, as well as three kinds of trout (inclusive of the now well-known rainbow-trout), and two other species belonging to other genera. As regards the salmon-tinning industry, the rivers of Alaska may be divided into three groups, king-salmon, red salmon, and humpbacked salmon streams. Those of the first class are the most important, but even these are less valuable than the corresponding rivers of British Columbia, owing to the fact that, from the shorter run, the fishes are nearer the spawning season when they enter, a larger proportion of them having white flesh in June than is the case with their Columbian brethren in August.

"THE GEOLOGY OF WORCESTER, MASSACHUSETTS," by Messrs. J. H. Perry and B. K. Emerson, has been issued by the Worcester Natural History Society (Worcester, Mass., 1903). It is a well illustrated work descriptive of the rocks and fossils of the county, and is written for those who have no technical knowledge of the subject. The interest is mainly petrological and mineralogical.

WE have received the general report on the operations of the Survey of India during 1901–2, prepared under the direction of Colonel Gore, Surveyor-General. Work has been carried on in the United Provinces, and also in the Shan States and Burma. The question of the condition of the existing topographic maps of the country has engaged serious attention, and it is admitted that more systematic arrangements must be made for their revision.

THE State of Indiana has issued in one volume (1903) the twenty-sixth and twenty-seventh annual reports for 1901 and 1902 of the Department of Geology and Natural Resources. Among the papers included is an important essay on the mineral waters of Indiana, by Mr. W. S. Blatchley, State geologist. He gives the location and describes the character of the waters of more than eighty wells and springs. Mr. Robert Hessler follows with an account of

the medicinal properties and uses of the waters. Mr. Blatchley deals also with the gold and diamonds of the State. Gold is widely disseminated in the Glacial Drift, but the occurrence of diamonds, which have been found while panning gold, is only of scientific interest. Mr. G. H. Ashley writes on the Lower Carboniferous area of southern Indiana, and directs attention to the economic products of the rocks, which comprise materials for good building stone, for the manufacture of Portland cement, and glass sands. There are also articles on the Orthoptera and Mollusca, and reports on the petroleum industry.

AT the present time, when the British Cotton-growing Association is fostering the experiments which are being made to grow cotton in various parts of British Africa and in some of the West Indian islands, an account by the principal of the School of Agriculture in Cairo of the impressions gained during a visit to the cotton-growing States in America is particularly opportune. From a consideration of the principal characters of different cottons, and of the exclusive position which is held by Egyptian and South Sea island cotton, the writer shows that it is a matter of considerable importance to improve the quality as far as possible by taking advantage of selection and hybridisation. Practical suggestions are made with regard to the cultivation on the subjects of soil, planting, maturation of the seed, and rotation of crops.

DR. DIXON has added to his contributions towards the elucidation of the mode of ascent of water in tall trees by suggesting a transpiration model, which is described in the *Scientific Proceedings* of the Royal Dublin Society. Over the top of a thistle funnel are fixed two parchment diaphragms converted into semipermeable membranes by soaking first in gelatin and then in tannin. These are arranged so as to leave a small space in which sugar is placed before closing up. A continuous column of water is established from the membranes through the funnel and connections, to a supply of water below. The water enters the artificial cell, fills it, and finally water and sugar soak through the outer membrane. The vapour tension of the water below the lower membrane is greater than that of the liquid in the cell, and the latter is greater than the vapour tension of the liquid above the upper membrane, so that a flow of water takes place from the reservoir upwards.

THE *Transvaal Agricultural Journal*, which is issued quarterly, and has now reached its fifth number, serves to show with how much energy the Agricultural Department of the new colony, under the direction of Mr. F. B. Smith, is attacking the many problems of farming in that country. A more difficult task cannot well be imagined; the disasters of the war, which has denuded the country of its stock, have been accompanied by repeated attacks of epizootic diseases of all kinds, to which new importations of cattle succumb at once; at the same time the greatest drought since 1862 has occurred, and even Kafir labour has been forced up to a price prohibitive to the farmer. The numbers of the *Journal* bear evidence of the diversity and virulence of the diseases of stock that prevail; fortunately they show also that the Agricultural Department is busy with investigations on the origin of the diseases and the best preventive measures against them. The most dreaded diseases seem to be "red water" and the more recently discovered "Rhodesian red water" or "African coast fever," both of which are propagated by ticks as an intermediate host, but though animals get immunised or "salted" against the former, the latter seems invariably fatal.

MESSRS. MACMILLAN AND CO., LTD., have published part v. of "A School Geometry," by Messrs. H. S. Hall and F. H. Stevens. This section contains the substance of Euclid Book vi., with additional theorems and examples.

MESSRS. DAWBARN AND WARD, LTD., have added to their series of useful little "Rural Handbooks" a volume by Mr. H. Francklin on incubating and rearing utility fowls. The principles on which incubators and rearers are constructed are explained, and the advantages of artificial as compared with natural incubation are made clear.

A COPY of the sixth edition of Strasburger's "Lehrbuch der Botanik" has been received from the publisher, Herr Gustav Fischer, Jena. The work has been completely revised, and many sections have been altered in order to adapt them to the present state of knowledge, especially in connection with plant physiology and morphology.

WE have received the year-book of meteorological observations at the station of the First Order belonging to the *Magdeburg Journal* for the year 1900. This is the twentieth volume of the series, and contains, in addition to observations and results recorded in accordance with the international scheme, complete hourly readings and means, observations of earth temperature, evaporation, &c. As regards tabular statements of the results of a well equipped observatory, nothing better could be desired. The autographic registrations of a Campbell-Stokes sunshine recorder have been photochemically reproduced; the cards ranged side by side have a very neat appearance, and give a clear view of the amount of bright sunshine in the different months. During the seven months of April to October there were only thirteen sunless days.

THE Christmas number of *Photography* (London: Iliffe and Sons, Ltd., price 1s.) is a production which will be heartily welcomed by those interested in the artistic side of photography. No pains seem to have been spared to render the book high class in every respect, and the thirty or more full-page and smaller half-tone reproductions from photographs printed on glazed art paper, and the letterpress and line drawings on rough antique paper, are sufficient proof of this statement. The contents of the letterpress consist of six articles on topics of widely different interest. Mr. F. H. Evans, on "The Characteristic Use of the Hands in Portraiture," gives some valuable hints on the conspicuous part played by the hands of sitters, and illustrates his remarks by photographs taken by himself. "Landscape in Pictorial Photography" is contributed by "Fecit," who in this delightful essay uses numerous illustrations of prominent photographers to elucidate his points. Other articles are "Photography in a Wood," by Mr. Will. A. Cadley; "W. Rawlings—a Photographer of Winter," by Monochrome; and, in a lighter vein, the "Walrus" gives an account of the weird inventions of "My Friend Choggles," and "Pettifer" prattles about his experiences of winter photography.

THE report of the ninth meeting of the Australasian Association for the Advancement of Science, held at Hobart, Tasmania, in 1902, has now been published. The volume is edited by Mr. Alex. Morton, the secretary of the Royal Society of Tasmania, and runs to nearly nine hundred pages. The contents of the report, including as they do detailed accounts of the ten sections into which for working purposes the Association is divided, and reports of eight research committees, show conclusively that the Australasian men of science are following very successfully the example set by the parent association. The presi-

dential address for 1902, by Captain F. W. Hutton, F.R.S., dealt with evolution and its teaching. We have also received a copy of the Walker memorial volume published by the Royal Society of Tasmania, and containing the papers on early Tasmania read before the Society during the years 1888–1899 by the late Mr. J. B. Walker, vice-chancellor of the Tasmanian University.

THE report of the U.S. National Museum for the year ending June 30, 1901, has just reached us from the Smithsonian Institution. Part i. of the volume (of 452 pages) contains the report of the assistant secretary and the reports of three head curators, a list of accessions to the museum, and a bibliography of the publications of the museum. The second part will, however, prove of more general interest, consisting as it does of five lavishly illustrated articles. These contributions are, first, a report describing the exhibit of the U.S. National Museum at the Pan-American Exposition at Buffalo in 1901, by Messrs. F. W. True, W. H. Holmes, and G. P. Merrill. This report is illustrated by seventy-two full-page plates, which it would be difficult to improve. Mr. W. H. Holmes also describes the flint implements and fossil remains from a sulphur spring at Afton, Indian Territory, this article being accompanied by twenty-six plates; and the same author deals with the classification and arrangement of the exhibits of an anthropological museum. Mr. Walter Hough discusses archæological field work in N.E. Arizona, and gives an account of the Museum-Gates Expedition in 1901, and with this monograph there are 101 plates, some of which are beautifully coloured. The last contribution is by Mr. J. B. Steere, and is a narrative of a visit to Indian tribes of the Purus river, Brazil.

A QUANTITATIVE study by Dr. Paul von Schroeder (described in the *Zeitschrift für physikalische Chemie*) of the setting and swelling of gelatin has led to some interesting observations, which not only throw light on the phenomena of gelatinisation, but also form an important addition to our knowledge of reversible chemical changes. It appears that gelatin solutions undergo two types of change, a non-reversible hydrolysis by which the setting power of the solution is permanently impaired, and a reversible change as the result of which the jelly melts when heated and slowly solidifies when cooled. The setting power of a solution is accurately indicated by its viscosity. If after rapidly cooling from 100° the viscosity is measured at 25°, a low value is obtained which gradually increases until, if the decomposition of the gelatin has not proceeded too far, it culminates in the setting of the whole mass. By measuring the increment of viscosity during one hour it is possible to predict whether the solution will set in the course of the next twenty-four hours. The reverse process by which the gelatin swells and then dissolves in water presents similar points of interest. Gelatin saturated with water has a higher vapour-pressure than water itself, and loses weight in a saturated atmosphere; the difference of vapour-pressure is, however, very minute, and may be compared with that which exists between drops of different sizes, and causes the larger drops of a fog to grow at the expense of the smaller particles.

AT a meeting of the Institution of Civil Engineers on December 15 several aspects of the important question of water supply were discussed. Prof. J. Campbell Brown read a paper on deposits in pipes and other channels conveying potable water. Analyses were given of incrustations on iron pipes, showing that these incrustations were due to oxidation of the iron of the pipes, whether widespread or in nodules, and that they were not limited to acid waters, but were common to acid, alkaline, and neutral waters. Investigations were recorded showing that slimy deposits on the inner surface of pipes, &c., were produced by gelatinous and filamentous iron-organisms which grew and extracted iron from the water, and died at one end while they grew at the other. Solid rock particles were entangled in this slime, and binoxide of manganese was deposited by chemical action, and this also was entangled in the mass of the gelatinous iron-organisms. Messrs. Osbert Chadwick and Bertram Blount introduced the subject of the purification of water highly charged with vegetable matter, with special reference to the effect of aëration. They showed that the purification of tropical waters was very difficult; they had found that treatment with iron was efficacious, but the treatment must be more thorough than with ordinary water-supplies. The character of these waters charged with vegetable matters rendered the removal of the iron difficult. Systematic aëration, so as to ensure an abundant supply of oxygen, was requisite. An apparatus had been devised in which the water was caused to flow through perforated plates, emerging in streams of small diameter and exposing so large a surface per unit volume of liquid that rapid absorption of oxygen from the air was made certain.

THE additions to the Zoological Society's Gardens during the past week include two Malabar Mynahs (*Poliopsar malabaricus*) from India, presented by Mr. A. F. Vine; two South Albemarle Tortoises (*Testudo vicina*) from the Albemarle Islands, presented by the Captain and Officers of H.M.S. *Amphion*; two Hybrid Parrakeets (between *Palaeornis eximius* and *Psephotus haematonotus*), four Limbless Lizards (*Pygopus lepidopus*) from Australia, deposited.

## OUR ASTRONOMICAL COLUMN.

RADIAL VELOCITIES OF β AURIGÆ.—M. G. A. Tikhoff, of the Pulkowa Observatory, has recently concluded a research on the relative velocities of the spectroscopic binary β Aurigæ, and publishes his results in No. 3916 of the *Astronomische Nachrichten*.

The forty-one plates on which the results are based were obtained by M. Belopolsky, nineteen during the early part of 1902 with a Rutherford spectroscope, and twenty-two at the end of 1902 and the beginning of 1903 with a new Töpfer three-prism spectrograph. The relative velocities of the components are given in a table, which also shows the exact time at which the plates were taken and the interval since the last conjunction, and they show a maximum of 228 km. per second, on March 24, 1902, to zero.

The curve obtained on plotting these results gave 3d. 23h. 30·4m. as the period, and it also indicates that the system is not only a binary one, as announced by Prof. Pickering in 1890, but is made up of more than two bodies. This is confirmed by the spectrogram obtained on January 21, 1903, in which the line Hγ is made up of four components, indicating the existence of four separate bodies with different velocities.

M. Tikhoff has arrived at the conclusion that the system is made up of two pairs, each pair consisting of a star giving strong lines and another giving weak lines, and each element making a complete revolution about the centre of gravity of its pair in 19·1 hours. The ratio of the masses of the two groups is near unity, and the proper motion of the whole system as deduced from the magnesium lines at λ 4481 and λ 4352 is −16 km. per second. The epoch of conjunction may be taken as February, 1903, 3d. 10h. (Pulkowa M.T.).

THE "DOUBLING" OF THE MARTIAN CANALS.—In discussing the instrumentality of "contrast" in producing the duplicated appearance of Martian canals, M. E. M.

Antoniadi directs attention to some experiments made by him which showed that when single, elliptical, dark spots were examined for a long unbroken period they appeared to develop a duplication similar to that observed in Martian phenomena. He also states that Schiaparelli repeatedly saw the well-defined dark seas with lighter interiors, and when the narrower seas, such as the Mare Cimmerium, Lacus Niliacus, and Sinus Sabæus were observed steadily for a long time, they manifested a tendency to beget islands which exactly resembled in shape the areas in which they appeared. M. Antoniadi directs attention to the fact that these islands always appeared to be surrounded by "dark canals," and he has therefore arrived at the conclusion that their appearance, and the apparent "gemination" of the canals, are simply results of the physiological effects of "contrast" (*Astronomische Nachrichten*, No. 3916).

OBSERVATIONS OF LEONIDS AND BIELIDS AT ATHENS.—In a communication to the Paris Academy of Sciences, M. Eginitis, director of the Athens Observatory, records the following observations of the Leonid and Bielid showers made at Athens during November:—

*Leonids.*—November 14, 11h. 50m. to 18h. (Athens M.T.), twelve meteors, appearing to emanate from radiants situated at $\alpha=152°$, $\delta=+25°$, and $\alpha=156°$, $\delta=+20°$, were seen.

November 15, 9h. 50m. to 17h. 50m., 187 meteors were observed from the following radiants:—$\alpha=150°$, $\delta=+22°$; $\alpha=153°$, $\delta=+21°$; $\alpha=152°$, $\delta=+24°$.

November 16, thirty-three meteors observed, chiefly from a radiant situated at $\alpha=150°$, $\delta=+17°$.

This shower appeared to attain its maximum between 15h. and 16h. on November 15. The general colour of the meteors was red, their velocities moderately swift, and their mean brightness equivalent to the fourth magnitude.

*Bielids.*—A watch was kept for this shower on the evenings of November 22, 23 and 24, but no meteors were seen on November 22, possibly because the sky was very hazy.

From 7h. 46m. to 16h. on November 23, fourteen meteors were seen, chiefly emanating from a radiant situated at $\alpha=23°$, $\delta=+43°$. On November 24 eleven meteors were observed, and these indicated the existence of two radiants, one at $\alpha=26°$, $\delta=+46°$, and the other at $\alpha=26°$, $\delta=+43°$.

In general the Bielids were red in colour and equivalent in brightness to the fifth magnitude stars; they moved so swiftly that their very short paths were hardly visible (*Comptes rendus*, December 7).

## THE HIGHER EDUCATION OF WOMEN.

THE adequate provision of secondary and higher education for English girls and women is to be regarded as one of the accomplishments of the latter half of the nineteenth century. In 1850, for instance, the popular idea here and elsewhere was that women were intellectually incapable of benefiting by higher instruction. To quote Dr. Leslie Waggener, of the University of Texas, "it was seriously questioned whether the 'female' mind could untangle the intricacies of pure mathematics, could appreciate the abstruse speculations of metaphysics, or could follow, step by step, the inductions of a scientific investigation." Fifty years' experience has, however, demonstrated the complete fallacy of this preconception. Speaking at the Cambridge University Extension summer meeting in 1900, Mrs. Henry Sidgwick, principal of Newnham College, said of higher education for women, "I do not think its desirability is any longer seriously doubted by anyone who has looked into the facts, and whose opinion on the question is worth considering." Similarly, President Eliot, of Harvard College, in an address in 1896, referring to the university over which he presides, remarked, "it is a quarter of a century since the college doors were opened to women. Since that time, where girls and boys have been educated together, it has become an historical fact that women have made rapid strides, and captured a greater number of honours in proportion to their number than men."

So complete a change of opinion on a subject of such importance as the suitable education of the larger half of the human race deserves attention, and the steps in the movement which has resulted in the recognition of the claims of women at most universities throughout the world, supply a profitable study for all students of educational problems. A comparison, too, of the present provision of university courses for women with their complete non-existence in 1850 should serve to cheer those men of science and others who are endeavouring to improve our national education in other directions. It is gratifying, in beginning a brief historical summary of the growth of the movement to provide secondary and higher education for women, to be able to state that among the first efforts in this direction were those made in England. The absence of public secondary schools for girls in this country, and the impossibility of obtaining really educated governesses, were the causes which led the late F. D. Maurice and others to work with the Governesses' Benevolent Institution to improve matters, and the labours of these pioneers led to the establishment, in 1848, of Queen's College, London, the original object of which institution was to train women teachers. In the following year Bedford College, London, was founded, and so successful has it been that it is now one of two colleges for women which are constituent colleges of the reconstructed University of London. A good start having been made, the movement grew and ere long flourished greatly in several localities. The North London Collegiate School for Girls was established by Miss Frances Buss in 1850, and the Ladies' College at Cheltenham in 1853. The thorough education of the daughters of middle-class families had become sufficiently general in 1863 to convince the University of Cambridge of the advisability of at least trying the experiment of admitting girls to the local examinations conducted by them in various centres throughout the country, and in 1865 girls were formally admitted. Then came the Schools Inquiry Commission of 1864, which, after sitting for three years, reported at the end of 1867. Ladies were called upon by the Commission to give evidence as to the provision for the secondary education of girls, and, to quote Mrs. Henry Sidgwick again, "The assistant commissioners, who had examined and reported on the condition of secondary education in various districts, gave a deplorable account of the insufficiency of the girls' schools, and of the immense difficulty of finding any adequately-educated female teachers for them." In 1872, the National Union, under the presidency of Princess Louise, was started to reform girls' education. This association soon established the Girls' Public Day Schools Company, and at present, this company alone, has 34 schools, about 7000 pupils, and about 600 teachers of different grades.

This cursory glance at the history of the attempts made to supply English girls with secondary education is necessary, because the need created by the establishment of these schools for highly qualified women teachers directed attention to the necessity for the provision of higher education at English colleges and universities, a need which had hitherto been completely ignored. The recognition of the claims of women to as much education as they desire has in England been brought about gradually, and it will be convenient to indicate the more important steps taken since the foundation of Queen's College, London, in 1848, and then to outline, as exactly as possible, the present state of things in other countries. It will simplify matters, too, to deal with different countries separately, and to take the universities of Great Britain and Ireland first, and in most detail.

### GREAT BRITAIN AND IRELAND.

Special lectures for women were started in connection with the University of Cambridge in 1870. Girton College was incorporated at Cambridge in 1873, though it had been in existence at Hitchin since 1869, and from its inauguration had prepared its students for the examinations of Cambridge, where women were first informally examined for the previous examination in 1870, and for the tripos examination in 1872. Girton was "designed to hold in relation to girls' schools and home training a position analogous to that occupied by the universities towards the public schools for boys." In 1871, a house of residence for women attending university lectures was opened in Cambridge, and this institution became known, in 1875, as Newnham Hall, and was constituted a college in 1880. In the same year as Newnham College was incorporated, the uni-

versity appointed a syndicate to consider the question of conferring degrees on women, with the result that in 1881, though degrees were refused, formal admission for women to the previous and tripos examinations was granted. And up to the present time the privilege of receiving degrees is withheld, though women are admitted by courtesy to almost all lectures. A syndicate appointed in 1896 recommended that degrees be conferred by diploma without permitting admission to membership of the university, but the proposal was rejected by the Senate in 1897 by 1713 votes to 662. The concession of 1881 still regulates the admission of women to the examinations of the university. In order to be permitted to take the tripos examinations women must reside at Girton or Newnham, and admission to these colleges is only granted to students who have passed the previous or some other recognised examination. A class list of female students is published after the examinations, along with the list of members of the university; the method of arrangement is the same in both cases, and certificates are given to women stating the class or place in class attained in each examination.

At Oxford, lectures and classes were started for women in 1873, and examinations were instituted for them two years later. An association for encouraging the education of women was formed in 1878, and is still in active existence. Through the secretary of the association women are admitted to nearly all the lectures given in Oxford, and the council of the association registers all women students. These students are either in residence at Somerville College (founded 1879), Lady Margaret Hall (1879), St. Hugh's Hall (1886), St. Hilda's Hall (1893), or belong to the Society of Home Students, comprising students who reside in private families and are supervised by the council of the association. In 1884, honour moderations and final honour schools of mathematics, natural science, and modern history were opened to women, and from time to time admission to the examinations of other schools was granted, but it was not until 1894 that they were free to present themselves for examination in all the subjects in which men may take the B.A. degree. Women are not eligible for degrees. Congregation rejected a proposal, in 1896, to admit women to degrees or to grant them diplomas recording their success in the final schools examinations. An important difference between Oxford and Cambridge is that at the former, university women are admitted to the pass as well as to the honour schools, and for either examination; an outside student is equally eligible with those who have studied and resided at Oxford.

As regards the extent to which women avail themselves of the facilities offered by the Universities of Cambridge and Oxford for their higher education, it may be said that, during the session 1901–2, Girton and Newnham together had 292 students, while in 1902 there were at Oxford 228 registered women students. The whole number of women students who took honours in the various triposes at Cambridge from 1881, the year in which they were opened to women, to 1900 was 1036, and of these 180 took honours in natural science, the numbers in mathematics being 250 and in classics 227.

The University of London, which received its first charter in 1836, was the first English university to recognise the claims of women. In 1867 the university was granted a supplementary charter, under which it was enabled to offer certain special certificates to women. In 1880 women were admitted to all the degrees, honours, and prizes which were at the disposal of the university, and in 1882 women graduates were admitted as members of convocation.

The University of Durham, by a supplementary charter granted in 1895, opened all its degrees except those in theology to women. Women are admitted to university lectures on the same conditions as men, but to qualify for the degrees women must reside at Durham in the women's hostel provided by the university.

The University of Wales, which came into existence under the charter of 1893, admits women to its examinations and degrees, as members of the university, on the strictest equality with men, and women are equally eligible for any office created by the university. Much the same is true of the recently constituted universities, such as those of Birmingham and Liverpool, and at the university colleges throughout the country no distinction is made between the sexes.

So far as the Scottish universities are concerned, that is to say, the Universities of Aberdeen, Edinburgh, Glasgow, and St. Andrews, it is only necessary to say that the Universities (Scotland) Act, 1889, included a provision "to enable each university to admit women to graduation in one or more faculties, and to provide for their instruction." An ordinance to this effect was passed in 1892, with the result that women are in every case admitted to the degrees in arts, science and medicine, and at Aberdeen to the degrees in law. The university lectures are, as a rule, open to women, but in some cases separate instruction is provided for them.

Despite current rumours, there are at present in Ireland but two universities, Dublin University, or Trinity College, Dublin, and the Royal University. The admission of women has been approved by the council of Trinity College, and a recommendation was brought before the Senate on June 9 of this year and sanctioned by an overwhelming majority. In the case of the Royal University of Ireland, which, like the old University of London was, is purely an examining body, all degrees, honours, scholarships, and even junior fellowships are open to students of either sex, and candidates for medical degrees alone are required to pursue fixed courses of study at special colleges.

Before reviewing the regulations for the admission of women to continental universities, a digression, interesting at least to men of science, may be permitted. What is the character of the education given in schools for girls by the women who have had the advantages resulting from the concessions now described? What part does science take in the curricula of the schools administered by university women? It may at least be said that it is becoming increasingly understood that household management is a branch of applied science; cookery and laundry-work are, in some quarters at least, recognised as applications of chemistry to domestic needs; and hygiene and physiology are appreciated to some extent as the foundations upon which the arrangements for the health of the home should be based. But the adherence to these commonplace truths is still too much a matter of theory, and the present methods of teaching in girls' schools are based almost exclusively upon what has grown up in the schools for boys. Prof. Armstrong, at this year's meeting of the British Association, offered a strong protest in this connection. He said, "When I consider what my own children have done at school, what girls generally are doing, I am in despair—the training is so hopelessly unpractical, so academic, so narrow in its outlook. There is so little insight and originality displayed by women in diagnosing and providing for women's requirements; female educators are so obstinate and difficult to persuade, so limited in their conceptions." More recently that vigorous and brilliant author, Mrs. F. A. Steel, has written: "Read through, for instance, the Education Act—new or old does not matter, since any Education Act I have ever heard of errs with equal and intolerable ignorance—and see if the one great unalterable difference in physiological life between a boy and a girl is even considered. It is not. And yet it is, it must be perforce, a potent factor in the whole question of girls' education."

The fact is that as yet we have not had sufficient experience in the direction of girls' education to come definitely to final conclusions. Speaking comparatively, it is a new movement, and such warnings as those just quoted, useful though they are as hints that caution and a reconsideration of the special needs of girls are necessary, should not lead to violent changes which are likely to do more harm than good. Though many questions raised are as yet insoluble, one thing at least seems tolerably clear, and that is the desirability of the introduction into all schools for girls of instruction in the scientific method. The inculcation of habits of exact observation, of accurate measurement, and of the absolute necessity for deriving all conclusions from sufficient premises, habits which are most easily and satisfactorily formed by the study of suitable branches of science, will act as the most effective corrective to the feminine disposition to arrive at conclusions intuitively, and to assert that a thing is so because it is so.

It may be pointed out here that there seems, judging

from the statistics of popular examinations, a disposition, in selecting the branch of science which shall form the foundation of the scientific instruction in girls' schools, to be guided rather by æsthetic than by educational considerations. To take one instance, in the local examinations of the University of Cambridge in 1902, while in the preliminary grade 1776 boys presented themselves in various branches of physics and chemistry, there were only 175 girls offering these subjects; on the contrary, 481 girls offered botany as compared with 65 boys. The same thing was true in the junior and senior grades; in the former about 5000 boys took up various subjects of physics and chemistry as compared with 300 girls, and in the latter the numbers were :— boys, more than 1300, girls, just over 100; in botany, on the contrary, the number of junior girls was 754, junior boys 29, of senior girls 261, senior boys 14. It is not suggested that it is impossible to inculcate scientific methods by means of the study of botany, for Prof. Miall has shown the contrary quite conclusively, but a knowledge of current text-books and methods leads to the belief that, nowadays at least, the above contention is a just one.

The urgent need at present, and one which might well engage the earnest attention of men of science, is to formulate a scheme of scientific instruction for girls' schools which, while inculcating the fundamental principles of physics and chemistry, shall lead to an intelligent application of these principles to the practical requirements of the household, whether in the kitchen, in the nursery, or in the general sanitary arrangements. Though such a course might well form the basis of the science teaching, there is no reason why an intelligent acquaintance with animate nature should not also be made. Nor need the special requirements of those girls who will later, instead of devoting their energies to home-life elect to take up scientific or medical work, be neglected. Since, as the imposing list of women engaged in scientific work given in the "English-woman's Year-Book," and the growing number of women doctors (177 were registered in the British Medical Register in 1894) show, there is an increasing attraction for women in the study of science, due provision for specialisation in science should be made in those secondary schools where girls remain until nineteen.

### The Continent of Europe.

In dealing with the provisions made for the university education of women in the different European countries, it is a little difficult to present inclusive generalisations. The local conditions vary so widely, and the national peculiarities are so various, that the most satisfactory plan is to deal separately with those countries in connection with which materials are available. Moreover, it is difficult within the limits of a single article, to attempt to summarise the history of the attempts made to improve matters so far as the higher education of women is concerned, and in the main it will be necessary to limit attention to the present state of affairs.

In Austria, to take the countries in alphabetical order, a decree of 1897, revising one made by the Minister of Education in 1878 regulating the admission of women to the universities of that country, ordained that any woman more than eighteen years of age who is a native of Austria may be admitted as a hearer to the philosophical faculty of an Austrian university, provided she has passed the *Reifeprüfung* or equivalent examination. The order for the admission of individual women is in the hands of the dean of the faculty, but an appeal may be made from his decision to the Minister of Education. Women hearers are under the same regulations as men. In 1896, Austrian women who had studied medicine at a foreign university were placed on the same footing as their countrymen in obtaining Austrian degrees in medicine. It is interesting to note in this connection that the first Austrian woman who obtained the degree of doctor of medicine did so at Vienna in 1897.

Women have been admitted to the universities of Belgium on the same conditions as men since 1883, though it must be stated that the Free University of Louvain is an exception, and does not admit women. Since 1890 an increasing number of Belgian women have availed themselves of the opportunity of university education.

To the Danish universities women have been admitted under the same conditions as men since 1875, and may take examinations and degrees in all faculties except that of theology, in which there is a special examination for women.

In Finland, women who wish to enter the University of Helsingfors, the only university in the country, must obtain the special permission of the chancellor of the university. Notwithstanding this impediment, there were in 1900 more than 200 women studying in the university.

All the courses in all the faculties and schools of the French universities with the exception of the *cours fermés* and the practical work are public, and open free of charge to persons of either sex as hearers. Matriculated students alone may attend practical work and the *cours fermés*; and to matriculate both men and women candidates must present a *diplôme de l'enseignement secondaire*. Women may become candidates for degrees on the same conditions as men. *Attestations d'études supérieures* are given by some faculties to hearers who have attended the courses regularly. In the provincial universities no requirement is made as to sex, but in Paris the hearer, to obtain the certificate, must have taken a bachelor's or an equivalent degree. It must be noted that not quite all the medical courses are open to women. The number of women students registered in French universities at the beginning of 1898 was 871, of whom 469 were studying medicine and 80 different branches of science. In the previous session 72 university degrees were obtained by women, but only one was in the science faculty, though 15 others were successful licentiates in science.

The universities of Germany do not treat women in a uniform manner. The conditions under which women study vary in different centres. As a rule, women are admitted only as hearers to the lectures of the philosophical faculty, though some German universities have permitted attendance in the legal and medical faculties. In the winter session of 1898–9, 414 women were in attendance at the ten Prussian universities as against 117 in 1895–6. At Berlin, Freiburg, Göttingen, Heidelberg, and Tübingen, women have been granted the degree of doctor of philosophy (Ph.D.). Even when women are admitted to the philosophical faculty of the universities they are mostly there on sufferance; they have no rights, and do not count as students. As Dr. Isabel Maddison has said, "the whole question of the admission of women to the universities has given rise to much discussion in Germany, and is still far from being settled. Many Germans regard the higher education of women as undesirable, and there is a strong objection manifested by a large number of the professors and students alike to the admission of women to the universities . . . the seriousness of purpose and the ability of individual women who have studied in Germany have, it is believed, done much towards destroying the prejudice against women students in the minds of the professors under whom they have worked."

In Greece, the National University in Athens was opened to women in 1895. The other institutions in the country of university standing, such as the English School of Archæology, admit women to their lectures. In 1895, too, the philosophical and medical departments of the universities of Hungary were opened to women by the Minister of Education, but to enter the universities they have to fulfil exactly the same conditions as men.

In Italy, in the Netherlands, and in Norway, women may enter the universities on a footing of equality with men. In Italy two classes of women students are admitted, viz. regular students and hearers. In the Netherlands no distinction is made between men and women; the latter are allowed to matriculate and to take degrees. Since 1884 women have been admitted to the lectures and degrees of the University of Christiania, and where there is no special regulation which prevents them, women may also compete for the scholarships and prizes.

All Russian universities exclude women. Special classes are held at St. Petersburg for the higher instruction of women under the supervision of the Minister of Public Instruction.

Speaking generally, the universities of Spain, Sweden, and Switzerland are open to women students. The Spanish universities have been open in a general way to women since 1857, when the universities of the country were placed under the control of the General Director of Public Education, but

Spanish women have made little use of the facilities offered. In Sweden, women appear to be excluded from the theological faculties, but since a Royal decree of 1870 they have been able to take medical degrees, and from 1873 the legal and philosophical faculties have been open to them. The seven universities of Switzerland are, without exception, open to women; the conditions under which they study vary somewhat in different universities.

AMERICA.

All courses and degrees of Canadian universities are, as a rule, open to women on the same terms as men, though in some cases they study for medical degrees in separate medical schools. The colleges of the various universities do not generally possess boarding accommodation for the students, who reside in boarding houses approved by the college authorities.

It is impossible at the end of a general article to do more than give one or two salient facts in reference to the higher education of the women of the United States. The report for 1899 of the Commissioner of Education states: "The barriers to women's higher education seem effectually removed, and to-day eight-tenths of the colleges, universities, and professional schools of the United States are open to women. . . . . The obtaining of a collegiate education gives the women more ambition to enter a profession, or if they decide to marry, it is stated that—'The advanced education they have received has added to their natural endowments, wisdom, strength, patience, balance, and self-control . . . and that in addition to a wise discharge of their domestic duties, their homes have become centres of scientific or literary study or of philanthropy in the communities in which they live.'"

The number of women undergraduate and resident graduate students in the colleges of university standing in the United States in the year 1900–1 was very nearly 47,000, and of these about 21,500 studied in colleges side by side with men. During this year 5050 degrees were conferred on women, nearly half as many as were gained by men, viz. 11,463.

Such are, in the barest outline, the leading facts as to the attitude of the more important countries towards the higher education of their women. The reader who desires more detailed knowledge should refer to the following sources of information, upon which the writer has largely based his conclusions:—"Handbook of British, Continental and Canadian Universities, with Special Mention of the Courses Open to Women," "Supplement to ditto, for 1897," by Dr. Isabel Maddison (New York: the Macmillan Co.). "Educational Systems of Great Britain and Ireland," by Graham Balfour (Oxford: Clarendon Press). "Education in the Nineteenth Century," edited by Dr. R. D. Roberts (Cambridge: University Press). "Growth of Educational Ideals during the 19th Century," by Sara A. Burstall (*The School World*, 1902). "Englishwoman's Year-Book, 1903" (Black). "Annual Reports of the Department of the Interior," by the Commissioner of Education (Washington: Government Printing Office).

A. T. SIMMONS.

## *CAVE EXPLORATION IN IRELAND.*[1]

HERE is little doubt that the visit, a few years back, of the enthusiastic M. Martel, whose "Irlande et Cavernes anglaises" forms such pleasant reading, did much to rouse new interest in Irish caves. Dr. Forsyth Major soon after examined the Irish fossil Mammalia in the Dublin Museum of Science and Art, where Dr. Scharff was at the same time summarising his researches on the origins of the European fauna; on this question the pre-Glacial and post-Glacial Pleistocene remains naturally throw a considerable light. Mr. R. J. Ussher, already distinguished by his published work on southern caves, was fortunately again willing to devote his time to exploration. Circumstances were thus favourable to the formation of a committee, which, aided by grants from the Royal Irish Academy and the British Association, has examined certain caves near Ballymote, in the county of Sligo, and is actively engaged on others near Edenvale, in Clare.

The present report is a well edited quarto paper, with several illustrations. Mr. George Coffey, keeper of the collection of Irish antiquities in the Dublin Museum, deals with the traces of human occupation, and, like most of the contributors, has personal knowledge of the caves. The geological section is greatly strengthened by the visit of Mr. G. W. Lamplugh to Keshcorran, and his association as joint-author in the report. Messrs. A. S. Kennard and B. B. Woodward describe the Mollusca, and are known as specialists in this comparatively unworked branch. Mr. E. T. Newton, F.R.S., has identified the remains of birds, while Prof. D. J. Cunningham, F.R.S., describes the scanty human bones. In work where wide deductions may be founded on a single fragmentary relic, this specialisation among the contributors cannot be too highly praised.

Mr. Ussher's general description provides an interesting introduction to the detailed essays. Messrs. Cole and Lamplugh then show that the caves depend for their form on the joint-planes in the massive limestone, and that they were excavated by solution in pre-Glacial times. Glacial detritus then became banked against the slope, and crept into the caves from their mouths. As the ice melted, characteristic mounds of similar material were deposited in the lowland below Keshcorran.

A good part of the deposit within the caves is derived from the solution of the limestone, and includes characteristic bipyramidal crystals of quartz. A spicular crystalline material, mingled with the calcareous tufa, affecting polarised light, and soluble in acids, has unfortunately so far eluded determination. The possibility of the discovery of pre-Glacial remains in such caves in Ireland is pointed out.

As Mr. Ussher indicates, in commenting on Mr. Newton's list of the bones of birds from the caves, the smew, the grey plover, and the little auk are now rare inland, even in winter; the discovery of their remains has therefore some bearing on the climate during their occupation of Keshcorran. Dr. Scharff, in his account of the mammals, identifies the Arctic lemming, not previously known in Ireland. The remains of horse, obtained, with one exception, from the upper stratum of the principal cave that was examined, show that "horse-flesh probably formed one of the principal articles of diet of the cave-men." The traces of the mountain or Irish hare, the true *Lepus timidus* of Linné, indicate a larger animal than that now prevalent in Ireland. Bear (*Ursus arctos*) is represented by a fine left ramus of a lower jaw and very numerous remains. The distribution of the bones of all these animals is easily realised from the small maps provided, on which those found in the upper stratum are indicated separately from those in the lower.

Mr. George Coffey considers that man's occupation of the caves does not date back to a very remote period. Charcoal is frequent in the upper layers, and its distribution, together with the objects found, suggests a brief occupation of the caves in Neolithic times, and a more prolonged settlement when bronze and iron were both common. This latter occupation seems to have been as recent as the eighth to the eleventh century of our era, and Mr. Coffey ingeniously pictures the bear as responsible for the general avoidance of the locality in earlier times.

Mr. R. Lloyd Praeger, now editor to the Royal Irish Academy, summarises the results, and his detailed plan and the illustrative plates are worthy of the body which has undertaken their publication. G. A. J. C.

[1] "The Exploration of the Caves of Kesh, County Sligo, being the First Report of the Committee, consisting of Dr. R. F. Scharff (chairman), George Coffey, Prof. Grenville A. J. Cole, R. J. Ussher, and R. Lloyd Praeger (secretary), appointed to Explore Irish Caves" (*Trans.* Royal Irish Academy, vol. xxxii. sect. B, part iv.). Pp. 46 and 3 plates. (Dublin, 1903). Price 2*s*.

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE.*

PROF. A. G. BOURNE, F.R.S., professor of biology at the Presidency College, is to take up the duties of Director of Public Instruction, Madras.

MR. H. J. MACKINDER, lecturer in economic geography at the London School of Economics, has been appointed director of the School in succession to Prof. W. A. S. Hewins, who has resigned the post.

ANNOUNCEMENT is made that Sir J. S. Burdon-Sanderson, F.R.S., regius professor of medicine at Oxford, has placed his resignation of the professorship in the hands of the vice-chancellor of the university.

THE Mysore Durbar has, says the *Pioneer Mail*, established four scholarships of 40 rupees a month each to encourage the study of analytical chemistry in the laboratory of the agricultural department. The scholarships will be tenable for one year, and will be open to candidates who have taken the B.A. degree in physical or any other branch of natural science. Students awarded scholarships will have to give an undertaking to serve the State for one year if required to do so, or to refund the money in case they refuse to serve.

IN a recent address at the distribution of prizes to the students of the classes held under the Liverpool School of Science subcommittee, Sir Philip Magnus, referring to the progress made in the provision of technical education in this country during the last few years, said that in 1886 the number of students in technological classes registered by the City Guilds Institute was 7660, and, during the past session, that number has increased to 38,638. Moreover, apart from the sum of more than 1,000,000*l.* which local authorities expended last year on technical instruction as defined by the Technical Instruction Act, the State contributed the sum of 605,143*l.*, as against a total of 107,583*l.* in the year 1886, whilst the total State contribution last year to education generally amounted to more than 9,000,000*l.*, as against little more than 3,000,000*l.* in 1886.

AN appeal is being issued by the Senate of the University of London for funds to build and endow an institute of medical sciences under the control of the university. A letter signed by the chancellor of the university, Lord Rosebery, the vice-chancellor, principal and others has been circulated urging the claims of such an institute. Owing to the great changes which have taken place in medical education of late years, due to the increasing attention given to the teaching of the scientific subjects, it has become impossible, the letter states, for each medical school, out of the income derived from the fees of students, to build, equip, and maintain the laboratories, fitted with costly apparatus, which are necessary for modern scientific teaching. The faculty of medicine, a body consisting of 350 recognised teachers of the university, has ascertained the views of the teachers of the medical schools, and has recommended the Senate to establish an institute for the teaching of physics, chemistry, biology, anatomy, and physiology.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Astronomical Society**, December 11.—Prof. H. H. Turner, F.R.S., president, in the chair.—Dr. A. A. **Rambaut** read a paper on two drawings of the Mare Serenitatis by John Russell, R.A., which afforded some hitherto unpublished evidence with regard to the appearance of Linné in 1788. Dr. Rambaut showed photographs of the original drawings, on which Linné appeared as a white spot, and not as a crater.—Mr. **Saunder** showed and described a photograph of one of the earliest maps of the moon, made by Langrenus about 1645.—The **Astronomer Royal** showed photographs of Comet Borrelly 1903 and Comet Perrine 1902, and pointed out their great similarity in appearance.—The Astronomer Royal also gave an account of the observations of the recent shower of Leonid meteors on the morning of November 16.—Mr. **Denning's** paper on the same subject was also read. There was complete agreement among the observers as to the maximum being between 17h. 30m. and 18h.—Mr. J. C. W. **Herschel** read a paper on an examination of the relative star density on different parts of the plates forming the Harvard photographic star map, from which it appeared that the maximum density was at about 9° from the centre of the plate, after which it fell off very rapidly.—Mr. **Crommelin** presented his ephemerides for physical observations of Saturn, 1903–4, and gave the different values that had been found for the planet's rotation period.—The secretary read a paper by Prof. G. W. **Hough** on the rotation period of Saturn deduced from his observations of the white spot first observed by Prof. Barnard on June 15.—Mr. Maunder read a letter from Mr. Percival **Lowell**, in which the latter affirmed his conviction of the reality of the canals of Mars, and also of the markings on Venus.—Prof. **Turner** described his graphical method for determining the local or Greenwich time of sunset at different places within a given region, and Mr. Benson spoke of a somewhat similar method previously devised by him.—The secretary read a paper by Mr. P. H. **Cowell** on the semidiameter, parallactic inequality, and variation of the moon derived from the Greenwich meridian observations from 1847·0 to 1901·5.—Mr. H. C. **Plummer** described and illustrated his paper on oscillating satellites.

**Zoological Society**, December 1.—Dr. Henry Woodward, F.R.S., vice-president, in the chair.—Prof. E. Ray **Lankester**, F.R.S., exhibited and made remarks upon some specimens of Medusæ reported to come from the Victoria Nyanza. Prof. Lankester also exhibited some drawings showing the hair-whorls on the face of two specimens of the okapi.—Mr. F. E. **Beddard**, F.R.S., exhibited and made remarks upon a portion of the large intestine and the cæcum of a boa (*Boa constrictor*) which had died in the Society's Gardens. The walls of the intestine in the neighbourhood of the cæcum and of the cæcum itself were thickened and inflamed. The cæcum was filled with a hard mass consisting of small stones and a number of the snake's own teeth, the presence of which, it was thought, had given rise to the inflammation.—Mr. Beddard also exhibited, on behalf of Mr. G. A. Doubleday, a hairless specimen of the common rat (*Mus decumanus*) which agreed in its characters with a so-called variety (*Mus nudo-plicatus*) of the common mouse figured in the Society's *Proceedings* (1856, p. 38, mamm. pl. xli.).—Dr. Walter **Kidd** exhibited a drawing of an *Oryx beisa* showing a reversed area of hair along the median line of the back, a character which was found only in ruminants, but not in all of them.—Mr. Oldfield **Thomas** exhibited an example of the naked rodent which he had in 1885 described as *Heterocephalus phillipsi*, but now thought should form a special genus, proposed to be called Fornamia, as its possession of only two cheek-teeth proved to be constant. The specimen had been presented to the British Museum by Dr. A. G. W. Bowen, R.N. A second species of Heterocephalus, distinguished by its smaller size and much smaller teeth, was described from British East Africa and named *H. ansorgei*.—Mr. G. A. **Boulenger**, F.R.S., exhibited a young hybrid newt (*Molge marmorata* ♂ × *M. cristata* ♀) obtained by Dr. Wolterstorff, of Magdeburg, in his aquarium, as reported in the *Zoologischer Anzeiger*, September 21. This specimen agrees in all external characters with *M. blasii*, de l'Isle, of which one of the original specimens, from near Nantes, S. Brittany, forming part of M. Lataste's collection, was also exhibited.—Mr. F. E. **Beddard**, F.R.S., read a paper on the tongue and windpipe of the American vultures, and remarked upon the inter-relations of the genera Sarcorhamphus, Gypagus, and Cathartes.—A communication from Miss Dorothy M. A. **Bate** contained an account of the species of mammals—fifteen in number—hitherto recorded from Cyprus. One subspecies—*Crocidura russula cypria*—was described as new to science.—The secretary, on behalf of Dr. R. N. **Salaman**, read a report on the *post-mortem* examination of the polar bear which had recently died in the Gardens. It stated that death was undoubtedly due to an aneurism of the aorta, which was possibly caused by a sharp bone at some previous time penetrating the œsophageal wall and lacerating the aortic wall.—A communication from Sir Charles **Eliot**, K.C.M.G., contained an account of thirty species of cryptobranchiate molluscs of the family Doridida from the east coast of Africa and Zanzibar. Of these eighteen were described as new.—A communication from Dr. A. G. **Butler** contained evidence in proof of the fact that the cardinal finch known as *Paroaria cervicalis* was only an immature condition of *P. capitata*.—Dr. P. Chalmers **Mitchell** read a paper on the occasional transformation of Meckel's diverticulum in birds into a gland.

**Geological Society**, December 2.—Sir Archibald Geikie, F.R.S., vice-president, in the chair.—Notes on the garnet-bearing and associated rocks of the Borrowdale volcanic series, by the late Mr. Edward E. **Walker**. A detailed description of sills and dykes of garnet-bearing rocks in the Langstrath Valley is given, and similar rocks are described, occurring as dykes and sills around the Eskdale granite and the Buttermere granophyre, and also in the Armboth-Helvellyn area. They consist of diabase, porphyrite, and granophyre. The rocks appear to be related to the Eskdale and Buttermere masses of intrusive rocks. Garnets are also found in a group of rocks below the great banded ashes and breccias of the Scawfell group, and in the rocks of the Scawfell group itself. These rocks often have a streaky structure, which exhibits types resulting from infiltration along planes of weakness, lamination of ash, flow of igneous material, and dynamic action on included fragments. The banded ashes of the Scawfell group also contain garnets. The garnets are of the almandine type. They often have a ring of felspar around them, which, when the intrusive rocks are studied, suggests that the mineral is original; but similar rings occur around garnets in the ashes, showing that the felspars may be formed in solid rock.—A contribution to the Glacial geology of Tasmania, by Prof. J. W. **Gregory**, F.R.S. After giving an analysis of previous contributions to this subject, the author describes the evidence obtained by himself personally in the northern portion of the island. The town of Gormanston stands on a Glacial moraine of recent geological age, formed later than the excavation of the Linda Valley, and occurring as a bank projecting from the southern side of the valley. The moraine is composed of typical Boulder-clay, and behind it are bedded clays, probably accumulated in a glacier lake above the moraine dam. An erratic of fossiliferous limestone, scratched all over and partly polished, is mentioned, while a railway has cut through an enormous boulder of black Carboniferous Limestone 16 feet in length. The northern face of Mt. Owen appears to be ice-worn to the height of about 1900 feet, while the base of the Glacial deposits is not more than 700 feet above the sea. The general evidence suggests that the Eldon Range and the central plateau formed the gathering-ground of the ice which flowed westward and south-westward. A map is given to show the range of Pleistocene glaciation so far as it has been recorded, and also to indicate localities of the glacial deposition, which probably dates from the Carboniferous period. The lowest level at which evidence of Pleistocene glaciation has been found is 400 feet on the Pieman River. Many of the deposits are little more altered than those of northern England, despite the heavy rainfall, and the aspect of some of the rock-scoring is very recent.

**Entomological Society**, December 2.—Prof. E. B. Poulton, F.R.S., president, in the chair.—Mr. G. T. Porritt exhibited, on behalf of Mr. T. Ashton **Lofthouse**, a specimen of *Xylophasia zollikoferi* taken at Sugar, near Middlesbrough, Yorkshire, on September 26 last. He said he believed that this was only the second specimen which had been recorded as having been taken in Britain. Mr. McLachlan, F.R.S., said the strongest evidence existed that a very large immigration of insects from the nearest Continental coast took place during the exceptional (for this year) spell of warm and calm weather prevailing towards the end of September, and he was of opinion that the specimen of *Xylophasia zollikoferi*, taken by Mr. Lofthouse in Yorkshire, formed an item in this migratory swarm. Mr. Eagle Clarke had witnessed such immigration when staying on board the "Kentish Knock" lightship for the purpose of studying bird-migration. He had witnessed a considerable immigration of *Vanessa cardui*, for instance, amongst many other insects, and not the least remarkable of his observations was the fact that *V. cardui* flies at night during migration as well as by day. Mr. McLachlan remarked that the laws governing migration in insects were at present little understood, and urged upon entomologists the necessity of obtaining a clearer insight into their working.—Mr. Malcolm **Burr** exhibited, and remarked on, a specimen of *Dinarchus dasypus*, Illig., belonging to a family of five or six species confined to the Balkans.—The president exhibited a series of photographs sent by Mr. A. H. **Thayer** to illustrate his views on the significance of the colours and patterns of butterflies' wings. The insects had been photographed on masses of foliage and flowers, and it was obvious that the dark ground-colour harmonised with the dark shadow behind and under the vegetation, while the light markings stood out as conventionalised representations of single flowers and flower-masses.—The president also exhibited the eyeless imagines and pupa-cases of *Ennomos autumnaria*, in illustration of his remarks at the meeting on November 18. Imagines produced by unblinded larvæ were also shown for comparison.—The Rev. Francis D. **Morice** read a paper entitled "Illustrations of the Male Terminal Segments and Armatures in Thirty-five Species of the Hymenopterous Genus Colletes."

**Faraday Society**, December 8.—Prof. A. K. Huntington presided.—The total and free energy of the lead accumulator, by Dr. **Lehfeldt**.—Bitumen in insulating compositions, part i., by Mr. J. A. **Sutherland**. Little or no trustworthy data have been published as to the use of bitumen for electrical purposes. The chief source of bitumen is Trinidad Lake, where there is estimated to be a quantity of nine million tons, which appears to be renewed to the extent of 20,000 tons annually. More than 150,000 tons are exported yearly. Bitumen is also found in Venezuela, California, and on the shores of the Dead Sea; it occurs in some limestone (asphalt) as an impregnation, about 10 to 15 per cent. being present, but it does not pay to extract it from this source. Its physical and chemical properties and constitution, which are fully dealt with in the paper, prove it to be infinitely superior to gas or coal tar for insulation and durability. The object of the present paper is to invite discussion and the views of electrical engineers to assist the author in the completion of his experiments, and to enable him to draw up a satisfactory definition of bitumen, so that users may secure the best results from its valuable non-hygroscopic and insulating qualities.

**Royal Meteorological Society**, December 16.—Capt. D. Wilson-Barker, president, in the chair.—Mr. W. **Marriott** gave some account of the meteorological work of the late Mr. James Glaisher, F.R.S. Mr. Glaisher was best known to the public for the twenty-eight balloon ascents which he made for scientific purposes in 1862–9 on behalf of the British Association committee. The highest ascent was that from Wolverhampton on September 5, 1862, when the height of about seven miles from the earth was reached. Mr. Glaisher was rendered insensible, while Mr. Coxwell's hands were frozen, and he was only able to open the valve of the balloon by tugging at the rope with his teeth.—A paper by Mr. J. R. **Sutton** on certain relationships between the diurnal curves of barometric pressure and vapour tension at Kenilworth (Kimberley), South Africa, in the absence of the author was read by the secretary.

PARIS.

**Academy of Sciences**, December 14.—M. Albert Gaudry in the chair.—The principal characters of band and line spectra, by M. H. **Deslandres**. The two classes of spectra have one important property in common, they are both formed by the repetition of similar groups of lines or bands, but there are numerous points of difference, the repetition of the groups being regulated by functions of different form in the two cases; line spectra are also affected by alteration of pressure and by an intense magnetic field, whilst band spectra are unaffected under similar conditions. The experiments made by the author, especially on the line and band spectra of nitrogen, are not in agreement with the usual view that line spectra correspond to the vibrations of the atoms, and band spectra to those of molecules. The views of Runge are also criticised, and the need of further experimental work pointed out.—Spectroscopical studies of the blood made on Mt. Blanc by the late M. Henocque, by M. J. **Janssen**.—The discovery of cones of Sequoia and of pine in the Portland strata in the neighbourhood of Boulogne-sur-Mer, by MM. R. **Zeiller** and P. **Fliche**.—On the suppression of magnetic hysteresis by an oscillating magnetic field, by M. P. **Duhem**. The author applies the theories previously developed by him to the experimental results of M. C. Maurain. M. Marconi has attributed the effects produced in his receiver to the suppression of magnetic viscosity, and M. Tissot to the suppression of

hysteresis; according to the author's theory it is the intervention of the viscosity which determines the suppression of the hysteresis.—The direct preparation of cyclohexanol and cyclohexanone starting from phenol, by MM. **Sabatier** and **Senderens.** The vapour of phenol mixed with hydrogen in excess and passed over reduced nickel at 215° to 230° C. gives a mixture of cyclohexanone and cyclohexanol. The vapour of this mixture, passed over reduced copper at 330° C., gives hexanone in a practically pure state; the same mixture, mixed with an excess of hydrogen and passed again over reduced nickel, gives the pure cyclohexanol. The method is general, and has been applied with success to the cresols.—On partial differential equations of the second order, by M. **Hadamard.**—On a generalisation of the theory of algebraical continued fractions, by M. E. **Goursat.**—On the differential equation of Riccati of the second order, by M. George **Wallenberg.**—A simple method permitting of the registration on the walls of a rotating cylinder of great pressures with small forces, by M. Albert **Hérisson.**—An internal combustion motor firing by compression, by M. **Cannevel.** In the motor described, the ignition is produced by a compression of about 30 atmospheres.—On a new method of measuring thicknesses and refractive indices, by MM. J. Macé **de Lépinay** and H. **Buisson.** The method consists in the observation of the rings of parallel plates and the fringes of mixed plates. The thickness of the plate is measured approximately to 0·01 mm., and the excess measured by the fringes, results having been obtained with plates up to 36 mm. thick. With plates of quartz of this thickness, the refractive index can be measured with an accuracy of some units in the seventh decimal place. Measurements on the same block of quartz, carried out on different portions of the plate, gave differences of four units in the sixth place, although the quartz was apparently perfectly homogeneous.—On the ionisation of phosphorus, by M. Eugène **Bloch.** Independent measurements of the mobilities, the coefficients of recombination, and of the ratio $\epsilon = \alpha/4\pi(K_1+K_2)$ for phosphorus ions lead to perfectly concordant results, the agreement giving the best demonstration of the real ionisation of phosphorus.—Study of a contact resistance, by M. A. **Blanc.** A contact resistance is of a very different nature from a metallic resistance, and is, under certain conditions, a reversible function of the intensity of the current. It undergoes an irreversible diminution whenever it is traversed by a sufficient current during an appreciable time, and this last phenomenon depends on the direction of the current.—On the distortion developed by shock in notched test-pieces, by M. A. **Pérot.** The effect of notching the test-piece is to limit to a narrow region the deformation produced, which is then recorded automatically by a photographic method. Diagrams are given showing the curves obtained with different specimens of the same metal.—Luminous sensation as a function of the time for coloured light. Discussion of the results, by MM. André **Broca** and D. **Sulzer.** A study of the retinal fatigue for different colours. Sources of light very rich in blue rays, such as the electric arc or very powerful incandescent burners, are injurious to the eye. The mean radiations of the spectrum, for which the energy is at a maximum, are those for which the human eye works most economically.—The emission of the *n*-rays (Blondlot rays) by the human organism, especially by the muscles and nerves, by M. Aug. **Charpentier** (see p. 182).—The action of a mixture of oxygen and hydrochloric acid on some metals, by M. Camille **Matignon.** Most of the metals of the platinum group are attacked by hydrochloric acid in the presence of air. Palladium and ruthenium are slowly attacked in the cold; iridium, rhodium and osmium at 150° C., the chloride being formed in all cases.—On the constitution and properties of the silicon steels, by M. Léon **Guillet.** Only steels containing less than 5 per cent. of silicon can be utilised; after tempering, these steels offer great resistance to shock, this power of resistance being relatively higher in high carbon steels. The results agree with those of M. Osmond in proving the existence of two solutions of silicon in iron, the one Fe—Si, the other Fe—$Fe_2Si$.—A new method for determining the critical points in iron and steel, by M. O. **Boudouard.** A modification of the self-recording method of Saladin, in which only one thermo-couple is required instead of two.—On meteoric irons, by MM. F. **Osmond** and G. **Cartaud.** Meteoric irons, on account of the extreme slowness of their cooling, show the normal state of equilibrium of the alloys of nickel and iron, whilst terrestrial alloys are in a metastable state.—On the preparation of the sesquiselenide of iridium, by MM. C. **Chabrié** and A. **Bouchonnet.** The selenide was prepared by the action of a stream of hydrogen selenide upon a solution of an iridium salt. It is amorphous, insoluble in nitric acid, and gave figures on analysis corresponding to $Ir_2Se_3$.—On the acetates of the alkaline earths, by M. Albert **Colson.** No acetochloride of calcium or magnesium, corresponding to the known barium salt, could be isolated.—The action of bromosuccinic and dibromosuccinic acids upon the pyridine and quinoline bases, by M. Louis **Dubreuil.** The action varies with the base and the solvent; by varying the experimental conditions malic, fumaric, bromofumaric, bromomaleic, and acetylenedicarboxylic acids can be isolated.—On a new tri-iodophenol, by M. P. **Brenans.**—Stereoisomerism in the esters of substituted camphocarbonic and methylhomocamphoric acids. Ethylcamphocarbonic acid, by M. J. **Minguin.**—Mercurammonium iodides of the primary and tertiary amines, by M. Maurice **François.**—On the esterification of phosphoric acid by glycerol, by M. P. **Carré.**—The origin of pearls, by M. Louis **Boutan.**—On the elementary factors of heredity, by M. Georges **Coutagne.**—On the geology and subterranean hydrology of the Eastern Caucasus, by MM. A. **Yermeloff** and E. A. **Martel.**—The supposed alcoholic fermentation of animal tissues, by M. F. **Batelli.** The results of the experiments described confirm those of Cohnheim, the alcoholic fermentation of the sugar obtained *in vitro* by extracts of the organs of higher animals being due to the presence of micro-organisms, and not to the action of an enzyme or of a nucleoproteid of animal origin.—Contribution to the study of amylo-coagulase, by M. A. **Boidin.**—Functional correlations between the poison glands and ovary in the common toad, by M. C. **Phisalix.**—The conditions special to the circulation of the glands in activity, by MM. G. **Moussu** and J. **Tissot.**

## CONTENTS.