THURSDAY, AUGUST 4, 1898.

THREE BOOKS ON PRACTICAL ELECTRICITY.

The Potentiometer and its Adjuncts. By W. Clark Fisher, A.M.I.C.E. Pp. x + 194. (London: *The Electrician* Printing and Publishing Company, Ltd.)

The Principles of Alternate Current Working. By Alfred Hay, B.Sc., Lecturer on Electrotechnics at the University College, Liverpool. Pp. xi + 276 + iv. (London: Biggs and Co.)

Electric Wiring for the Use of Architects, Underwriters, and the Owners of Buildings. By Russell Robb. Pp. 183. (London and New York: Macmillan and Co., 1896.)

MR. FISHER'S book is another example of the *Electrician* series of technical manuals, written by specialists for those engaged in electrical work. They generally contain very valuable information which could hardly be obtained, except by the expenditure of much trouble, from any other source; they are written with a knowledge of what is important for, at any rate, the practical reader, and they are illustrated in most cases by well-executed drawings of instruments and machinery. All these merits Mr. Fisher's book possesses. It is clear and concise, and has a distinct first-hand value of its own, as the work of one who has himself made the tests and investigated most of the questions which he discusses.

The book starts off with a general description of potentiometer testing, then there is a detailed account of the Crompton potentiometer, and of batteries and galvanometers suitable for use in the kind of work under consideration. The galvanometer which receives most attention is the so-called d'Arsonval instrument. The author is quite right in referring to this galvanometer as a Thomson (not "Thompson," as in the text) or Kelvin instrument. As a matter of fact the galvanometer use of the recorder coil and magnet is, if we remember rightly, explicitly referred to in the original siphon-recorder patent, and several laboratory workers had found the arrangement a very convenient form of galvanometer for various purposes long before "d'Arsonval galvanometers" were ever heard of.

The discussion of standards of E.M.F., and especially the behaviour of the Clark cell, is one in which Mr. Fisher has taken a prominent part, and the chapter on this subject contains much useful information, especially on the subject of the recuperative power of the cell after the passage of a current through it.

Next follow chapters on standard resistances, platinum-thermometry, the erection of apparatus, and the Crompton potentiometer in use, all of which are very valuable. Many practical details, which will materially facilitate the carrying out of the tests, are given under the last two heads.

The book closes with a historical chapter and an account of "bridges" of different kinds. The latter contains a summary of the improvements of the various forms of bridge for low-resistance comparisons which have been suggested in the course of the work of Messrs. Griffiths and Callendar.

This book shows the great advance which resistance testing has made during the last seven or eight years. It is apt, however, to be forgotten in these days of splendidly arranged and made potentiometers that the method is far from new, and is essentially that used long ago by Matthiessen and Hockin in their careful comparisons made in the early days of electrical testing work. The ordinary fall of potential method for the comparison of resistances is the fundamental idea; indeed, a potentiometer method with resistance slides was in use in Lord Kelvin's laboratory when the writer was there fifteen or sixteen years ago, and other arrangements, depending on the same method, were employed as convenience or the work in hand dictated, without any idea that they were other than obvious applications of electrical principles.

While, as we have indicated, the book is a very valuable one, we should like it better if some modes of expressions were modified.

The phrase "tumbled to the fact," for instance, does not seem much of an improvement in brevity or accuracy, or anything else, on the older-fashioned expression "grasped the fact."

Then, again, there is here and there a suspicion of smartness, which is no doubt quite superficial, but would be better absent.

The author's historical notes with respect to Poggendorf (*sic*) are rather curious. It appears that after searching English books in vain for an account of Poggendorff's work, the author ultimately found the desired information in a French electrical dictionary. We had thought the editor (from 1824 to 1877) of the *Annalen der Physik* was fairly well known even in this benighted country; and that references to his papers and an account of their contents were pretty generally available in that great and easily accessible work of reference, Wiedemann's "Elektricität." And, after all, the French dictionary account seems "to leave to desire." Poggendorff did not edit the *Annales de Physique et de Chemie* (*sic*), but the *Annalen der Physik und der Chemie;* with the French journal *Annales de Chimie et de Physique* he had nothing to do.

These are, however, slight blemishes in Mr. Fisher's book, and we hope they will be all cleared away very shortly in a new edition.

Mr. Hay's "Alternate Current Working" is a very good book indeed. It gives in very moderate compass an exceedingly valuable digest of most of the facts and theories of alternate working which it is necessary that students should know. The treatment is generally clear and elegant, and well elucidated by graphical representation of theoretical and experimental results.

The first chapter deals with the graphical representations of functions and elementary trigonometry; the second with scalar and vector quantities, simple harmonic and other periodic functions.

In the next chapter the subject proper of the book is entered on, and it is then in the succeeding chapters developed and discussed, in its theory and practical applications, in a very complete and satisfactory way. The enumeration of a few of the chief topics will give

some general idea of the scope and purpose of the work. After a general treatment of alternating currents, chiefly following the law of sines, the practical measurement of power in alternating circuits, the effects of phase displacement, effects of capacity, displacement currents, are all dealt with. Then the transformer is introduced by (1) a chapter on mutual inductance, in which the theory of some important cases of mutually influencing currents is explained, and the rationale of the growth of the current in the outer layers of a conductor and its penetration inwards are touched upon, and (2) a chapter in which the very important case of two mutually influencing circuits, containing simple harmonic electromotive forces, is very well explained by means of vector diagrams.

Here we may incidentally remark that we very much prefer on the whole the analytical treatment of this kind of problem, supplemented by a full graphical exhibition of the results, to an attempt to give a graphical treatment purely of the subject. The analysis is easy enough, if only people will concentrate their attention on the thing to be understood, and generally be at a little real trouble. The purely graphical process is somewhat fatiguing after all, and, while the student may understand a discussion of such a problem as this, he is not likely, unless he obtains some skill in analysis, to be very self-dependent in new questions which may arise. A great deal of the girding at mathematicians and exalting of so-called common-sense and practical methods of treatment (often only illustrations of results otherwise to be demonstrated) is the veriest clap-trap.

However, of anything of this kind there is not a trace in Mr. Hay's book; on the contrary, no difficulty is shirked, and he takes a course which, whether we think it the best or not in all cases, has been suggested to him by experience gained in the efficient school of electrical engineering of which he is in charge at Liverpool.

The running of alternators is next entered on, and synchronous motors, and single phase and polyphase currents, and induction motors generally, with the measurement of power in polyphase circuits, conclude the book.

Want of space prevents our giving a fuller appreciation of this unpretending but very scientific and accurate little book. It is in all respects a piece of good work, and has already proved, we doubt not, thoroughly acceptable to students.

Mr. Russell Robb's treatise on electric wiring gives a useful account of systems of distribution, methods of wiring, and the code of rules for electric wiring now accepted by underwriters throughout the country. The first two chapters on the electrical units, Ohm's law, and such subjects, seem to us for the most part unnecessary. The explanations and analogies are very briefly and somewhat vaguely stated, and an elementary knowledge of these subjects on the part of the reader had better have been taken for granted. Certainly it is not here given, and the only effect the generalities stated can have will be to lead the ordinary business man, *e.g.* the town councillor interested in an electric lighting scheme, to delude himself into fancying he knows what current, electromotive force, and resistance really signify. However, Mr. Robb has done a very useful thing in printing the other parts of his book. The style and get-up of the book are very good, though the size of page, paper, &c., do not strike us as very well chosen. A smaller page, thinner paper, and flexible covers, with excision of the introductory matter referred to above, would have given a much lighter and more convenient book to carry about for reference when wanted. A. GRAY.

THE ANGORA GOAT.

The Angora Goat; and a Paper on the Ostrich. By S. C. Cronwright Schreiner. 8vo. Pp. xv + 296; illustrated. (London: Longmans, Green, and Co., 1898.)

NO one taking up this little volume and looking merely at the cover would have the slightest intimation that it included a chapter on ostriches, and since some of the notes contained therein are of considerable interest, it is well that its existence should be noted. Another surprise is the absence of either preface or introduction, although, perhaps, the book is none the worse for the omission.

When a work commences with references to popular natural histories as the sources of the scientific information, it may be taken as a general rule that the author is insufficiently acquainted with his subject, and is a stranger to the methods of zoological research. Athough thus handicapping himself at the start, Mr. Schreiner very soon shows that he has a complete grasp of all the essential facts connected with the Angora goat and its relations to other wild and domesticated breeds, both from the point of view of the naturalist and from that of the agriculturist and the manufacturer. And he has succeeded in producing a work which cannot fail to be of considerable interest to all those intereste d in the origin of our domestic animals.

Since Darwin's time, it must be confessed that the attention devoted by naturalists to domesticated animals has been of the very slightest; and this is distinctly to be regretted, since there seems little doubt that much is to be learned from them concerning the capacity for variability in species. And here it may be mentioned that a gallery exhibiting the different breeds of domesticated animals is a desideratum in this country. If it cannot be attempted in the British Museum, it might be commended to the attention of the Royal Agricultural Society.

To return to our subject, the author is quite orthodox in accepting the descent of the domestic breeds from the Persian wild goat (*Capra hircus ægagrus*, as it may well be called), and rejecting the markhor heresy. He next proceeds to show that there is no decisive evidence as to when or where the wild goat was first domesticated, but that there is great probability the Angora breed is one of considerable antiquity.

"It seems quite clear," he writes, "that from remote times the mohair goat developed in the region of Central Asia Minor, and gradually became localised there, the territory which it occupied eventually being restricted to that portion which pre-eminently suited it, the region round Angora, until at last the pure-bred animal was found only there. A continuous course of in-breeding, through a long period of time, fixed it true to type, and made it eventually a thoroughbred; but this also made it small and delicate."

The author also quotes several writers who have pointed out that the climate of Angora exhibits a remarkable tendency to the development of a silky coat in animals of several kinds, this tendency displaying itself among cats and greyhounds, as well as in the goats. Very interesting is his suggestion that the so-called mohair of the Angora goat really corresponds to the under-fur or "pashm" of the wild goat, the ordinary fur of the latter being represented by the "kemp" of the former. If this prove to be well founded, it would be decisive for the origin of the domestic breeds from the wild goat, in contradiction to the markhor (*Capra falconeri*), since under-fur is not developed at all in the latter species.

Although it is considered probable that the Angora originally formed a single pure breed, there is evidence of subsequent crossing with the common Kurd goat, by means of which several sub-breeds have resulted, one of them being now hornless. Crossing seems also to have taken place with a local breed descended from the well-known shawl-goat of Kashmir.

After several chapters devoted to the extent and value of the mohair trade in Turkey, the author comes to what appears to be the chief subject of his work, namely the first importation of the Angora into Cape Colony, and the subsequent development of the South African mohair trade. First of all, in 1725, the experiment was tried of introducing Kashmir goats into the Cape, but it turned out a failure; and probably this was fortunate, since, in the first place, it is a much less valuable animal than the Angora, having only a comparatively small quantity of "pashm" at the roots of its long hair, and, secondly, there is a strong probability that even this would disappear under the influence of a hot climate. Of Angoras the first importation took place in 1838; and it is practically to a single female and her one kid that the existing stock owes its origin. To improve the crosses thus produced between the Boer goats and the Angoras, fresh importations have continued from time to time from that date up to 1896; and some idea of the value attached to high-class blood may be gathered from the fact that no less a sum than 450*l.* has been paid for a single pure-bred ram, and 205*l.* for a ewe. Unfortunately, with some of the importations, pleuro-pneumonia was introduced into the Cape, and, with the usual virulence of such diseases in a new field, played terrible havoc with the flocks. Inoculation and other remedies seem, however, at last to have pretty well stamped out the plague.

In a later chapter statistics and tables are given showing the value of the Cape trade in mohair and goat-skins from the year 1857 to the present time. Of the former commodity the maximum value appears to have been reached in 1895, when the sum realised was 710,867*l.*; while in the latter 1890 was the record year, the declared value then being 142,425*l.* The two final chapters on the Angora are devoted to its importation into the United States and Australia respectively. In the States, although the number of goats in comparison with the population is relatively small, the trade seems to be in thriving condition. Not so in Australia.

"Apart from the suitability or otherwise of Australia to Angora goat farming, the failure to establish the industry there is amply accounted for by the fact that Australia is so perfectly adapted to sheep; so that the question is, after all, not so much whether the Angora will thrive and pay, but whether it will thrive and pay better than the Merino. Goats and sheep never do equally well on the same veld; that which is peculiarly adapted to the one never suiting the other nearly so well."

Did space permit, many more equally interesting extracts might be taken from Mr. Schreiner's work. To many of our readers, as to his reviewer, the extent and value of the mohair trade will doubtless come as a revelation, and since everything relating to the prosperity and wealth of the empire ought to be of interest to every patriotic Englishman, the book may lay claim to a wider circle of readers than might at first sight be attracted by its title.

From mohair to ostrich feathers—another important article of British African trade—is a wide jump, but the portion of the book devoted to this subject is of so much interest, that a few words must be given. And here the interest is not so much from the commercial as from the natural history point of view. Mr. Schreiner strongly combats the generally accepted theory of the polygamous habits of the ostrich.

"Every authority," he writes, "that I have consulted holds that the ostrich is polygamous, but the evidence against polygamy is very strong: a pair make the nest; the hen lays all her eggs (a full sitting) in that nest; the hatching of the eggs and the care of the chicks are shared equally by cock and hen; the cock loses his sexual vigour, and leaves his attention to the hen, soon after beginning to sit; and one hen to a nest yields the best results."

It is true that nests are frequently seen in which two or more hens are laying, but the author believes that such hens have been unable to obtain a mate for themselves, and have attached themselves, *nolens volens*, to one already provided with a partner. In such a nest the eggs get shifted about and never receive regular incubation, with the result that few or no chicks are hatched; this alone forming a strong argument against polygamy being the normal habit. Furthermore, it is added that travellers frequently mistake large chicks for hens, thus asserting polygamy when it is non-existent. The conclusions of one who has had such unusual opportunities of observation should, to say the least, receive the most respectful attention on the part of stay-at-home naturalists.

R. L.

ASTRONOMICAL RELIGION IN EGYPT.

Creation Records discovered in Egypt. By G. St. Clair. Pp. xii + 492. (London: Nutt, 1898.)

THE idea that the religious observances of the Egyptians were founded upon facts of astronomy deduced by them is very old, and almost every text of any length which is published affords additional proof of the substantial correctness of the idea; it could, in fact, hardly be otherwise. Since the visible emblem of the great god of the early Egyptians was the sun, and since the representatives of the lesser gods were the moon and stars, it follows that every religious ceremony which was celebrated publicly in Egypt must have had reference to the conditions and movements of the celestial bodies.

It is quite easy to recognise certain evident proofs of this fact, such as the drawing along of a model of the boat of the sun in a procession to typify the sun's course in heaven, or the drawing of the boat of the god Seker round the sanctuary at dawn in imitation of the sun's motion, but many other equally evident proofs are not so easily explained. We know tolerably well what ceremonies were performed, but we know not the why and the wherefore. In making inquiries into such difficult matters it is important to remember that the knowledge of astronomy possessed by the Egyptians has been greatly overrated, just as their knowledge of mathematics has been, from time immemorial, over-estimated; they probably knew more of both subjects than the rest of the world in the early period of their history, but the limits of their exact knowledge were reached tolerably soon.

No better proof of this statement can be found than in the excellent essay of Sir Norman Lockyer, entitled the "Dawn of Astronomy," a work which has not received the attention which it deserves from certain Egyptologists. It is, however, unnecessary to repeat here the deductions which he has carefully drawn from carefully ascertained facts. Two of the most important results of his work are the certainty with which we may now accept the conclusions that astronomical religion in Egypt dates from a period which may be measured by thousands of years, and the discovery of the principles which guided the Egyptians in planning the sites of their temples from Memphis to the Sudân.

Passing from general considerations such as these we come to Mr. St. Clair's book on "Creation Records discovered in Egypt," wherein we have the first fruits of fifteen years' systematic study of mythology, and an attempt to construct methodically the mythology of the Egyptians. Mr. St. Clair claims, and claims rightly, that it was impossible to understand Egypt's religion and mythology until the various documents which the Egyptians themselves wrote on these subjects had been studied and translated; but the question which naturally arises is, Have enough of these documents been studied, and have they been correctly interpreted? Mr. St. Clair does not pretend that his work is final, and therein is much to be commended; but beyond doubt it shows great industry, and a catholic use of authorities and writers which is not commonly to be found in the book of a man who is attempting to promulgate a theory, however sound or however learned. He has read, apparently, everything which he thought would bear upon his subject, and has fitted a number of facts together with considerable ingenuity; more than this, he states his conclusions and deductions with modesty. Of course many of his conclusions will be combated with vigour, and many will be rejected off-hand; still the whole book is suggestive, and much of it will be accepted by students of astro-theology. The great storehouse from which Mr. St. Clair has drawn is the "Book of the Dead," and it will astonish many to see what an extraordinary collection of facts he has deduced from it; it is, however, a pity that he did not make more use of the early version of the work such as we find on the coffins of Amamu and the Mentu-heteps.

After a table of the Egyptian dynasties, and chapters on the Calendar and its relation to Egyptian Myths, we have a series of essays on the gods, the Nile, the reign of Rā, celestial cities, &c.; these are followed by another series of short chapters on the Creation, Deluge, Confusion of Tongues, and the doctrine of a future life, which many readers will think the most interesting part of the book.

Certain omissions are in places noticeable. Thus in the section on the Creation (p. 420 f.) we notice no account of the story of the Creation as told in the papyrus of Nesi-Amsu; the belief in the necessity of eating the scarabæus in order to obtain children, which exists to this day in the Sudân, ought to have been discussed. It is interesting to point out also that as Thoth was held to be a healer of diseases, so also was the ape, which represented him and was sacred to him, and that this idea of the ape's powers is extant in Egypt to the present day. Barren women have been seen to pass their bodies over Egyptian statues of apes, and to pray at the same time that the disease of barrenness from which they were suffering might be done away by these means; Mr. St. Clair might have instanced several survivals of this nature. On p. 96, for *tet* read *khat*; and to the five constituent parts of the body and soul there enumerated add *ren*, "name"; *khu*, "intelligence"; *sekhem*, "form"; and *âb*, "heart."

PSYCHOLOGICAL SCIENCE.

Psychologie als Erfahrungswissenschaft. By H. Cornelius. Pp. v + 445. (Leipzig: B. G. Teubner, 1897.)

Primer of Psychology. By E. B. Titchener. Pp. ix + 314. (London: Macmillan and Co., Ltd. New York: The Macmillan Company, 1898.)

Outlines of Descriptive Psychology. By G. T. Ladd. Pp. xi + 428. (London: Longmans, Green, and Co., 1898.)

Versuch einer Darstellung der Empfindungen. By W. Przibram. Pp. 28, with five plates. (Vienna: Alfred Hölder, 1898.)

THE marked difference in contents and tone of the four works before us is a striking proof of the extent and variety of the topics embraced in the modern science of psychology. By far the most original and important of the four is the work of H. Cornelius, which treats the problems of psychology, in the main, from the epistemological point of view, with unusual carefulness of statement, and still more unusual lucidity of style. The author is clearly familiar with the recent literature of the subject, English and French as well as German; but the writers whose influence is most clearly traceable in his treatment of his material are both Germans, Avenarius and Mach. The author's attitude towards the main problems of psychological science may be briefly summarised as follows: — Psychology, as the science of "psychical facts," is the only possible basis of a sound general philosophy. Its special task is, by describing those psychical facts in the simplest possible terms, to explain the growth and meaning of the more or less artificial and complicated hypotheses which we frame to ourselves in every-day life, and in scientific reflection, about the nature of the world. In

pursuance of this task Mr. Cornelius first devotes a chapter to the question, "What are the ultimate elements into which mental processes can be resolved by analysis?" and then proceeds to trace in detail the formation of derivative psychical products of ever-increasing complexity. In this way he passes in review, one after another, all the most important concepts of physics, æsthetics and ethics. The most noticeable feature of the chapter on the elementary processes is the admission of "ideas" by the side of sensations as a distinct class of primitive mental facts. It is significant that the two best "Psychologies" of recent years, those of Stout and Ebbinghaus, agree in this rejection of the old theory that an "idea" is merely a weaker "impression." Among the many admirable things in Mr. Cornelius' work, which space will not allow me to mention in detail, specially admirable are the careful and elaborate account in Chapter ii. of the growth and meaning of the concept of objective existence and the discussion of the concept of "truth" in Chapter vi. Mr. Cornelius' philosophical position is, as becomes a follower of Avenarius, one of "naïve realism"; that is, he contents himself with explaining how the plain man's ordinary notions of objective existence, of things and of causes, naturally arise from the workings of the psychological mechanism; and he abstains from any metaphysical theories as to the agreement or disagreement of these notions with "reality." Perhaps it may be necessary to remark, for the benefit of any one to whom the term is new, that "naïve realism" is, in fact, almost the same doctrine as the "idealism" of Berkeley's "Three Dialogues."

Physiological psychology falls outside the scope of Mr. Cornelius' treatise, and is explicitly relegated in his introduction to its proper place as a useful appendage to the direct investigation of mental phenomena; he has, however, some ingenious remarks on the "ambiguous" character of the relation between stimulus and sensation which challenge the validity of current methods of formulating the results gained by the "method of just perceptible alterations." His contention, which certainly seems reasonable, is that as the position of the "Unterschiedschwelle" in any series of experiments depends largely upon the direction in which the changes of stimulus have been taking place, it is not permissible to assign to it a value derived by taking the arithmetical mean of the values obtained by varying the stimulus in both directions.

Prof. Titchener's "Primer" is a brief and brightly-written account of the main facts of psychology as seen by a disciple of Wundt, and is better adapted than any work which has as yet come into the present reviewer's hands to serve as a first book for the beginners for whom it is designed. Two most excellent features of the little book, from this point of view, are the price list of psychological apparatus, and the often singularly ingenious problems and exercises appended to the various chapters for home or class work. As was to be expected from Prof. Titchener, the standpoint adopted throughout is that of the new "experimental" school. Here and there one may notice little points of detail, which it is to be hoped the author will improve in a second edition. For instance, the statement on p. 40, that "colours" are "really mixtures of pure colour and brightness" seems to involve a confusion between colour as directly perceived (psychological colour) and the physical and physiological conditions of colour perception. Again, the treatment of "Weber's law," on p. 50, is so brief and meagre as to be rather harmful than helpful to a beginner. There should surely have been some attempt to explain to the beginner what is meant by saying that a certain sensation of pressure, 2P, is double another sensation P. In asserting, with rather more confidence than the ascertained facts seem to warrant, the existence of special "pain-spots" in the skin, as well as in extending the conception of association to cover virtually the whole ground of mental synthesis, Prof. Titchener is presumably following the lead of his master's "Physiologische Psychologie." There is also, perhaps, an excess of loyalty in the adoption of the Wundtian theory about the functions of the frontal lobes (p. 90–91). These however are, after all, very minor blemishes in a work which is on the whole admirably adapted for interesting the young student in a difficult and to some extent repellent subject. It should perhaps be mentioned that the present work is quite independent of the author's "Outlines of Psychology."

Prof. Ladd's "Outlines of Descriptive Psychology" covers much the same ground as Prof. Titchener's little book, and is addressed to the same class of readers. As compared with Prof. Titchener, Prof. Ladd can hardly be recommended to the beginner as a good master. His style is difficult and slightly verbose, while the comparative paucity of experimental detail and the constant reiteration of vague qualifying phrases, like "as it were," "so to say," suggest that he does not always feel quite sure of his ground. The fact is there is far too much for the beginner in Prof. Ladd's "Outlines." There is a good deal of implied metaphysics which can only puzzle a young student, and even apart from the metaphysics, which are probably unconscious, some of the more complicated psychological problems are dealt with in a way that is at once too difficult for the beginner, and too short and easy for the advanced psychologist. It would for instance, have perhaps been better in a work designed as a first book for beginners, to say nothing about the controversy between "nativist" and "empiricist" views of space-perception; but, if the matter was to be introduced at all, a view that has the support of such authorities as Stumpf and James, should not have been dismissed with the curt reflection, "this view is . . . obviously false." Prof. Ladd is perhaps at his best in one or two of the later and more specially philosophical chapters, notably in the last of all, which contains, besides a good summary of the ascertained facts about brain localisation —in which, however, Flechsig is rather disrespectfully treated—a really excellent defence of the popular view of the relation of mind to body.

The posthumously published little pamphlet of W. Przibram is devoted to an attempt to construct a mathematical theory of sensation by means of the symbol $\iota(=\sqrt{-1})$ and its successive powers. Of the value of Mr. Przibram's tract as a contribution to mathematics, I am hardly competent to judge; the singular arbitrariness of its psychological assumptions seems to me to deprive it of any serious significance for the psychologist.

The values of the successive powers of ι of course recur in sets of four; consequently the author boldly affirms that there are only four classes of sensation, and that sensations of temperature are identical in kind with sensations of pressure, and smells with tastes. Pain and pleasure (*Wollust*) appear as opposite special qualities of touch, and are equated with the taste pair bitter-sweet, and the sound pair $e - b$). So again the antithesis red-green is said to correspond to cold-hot and $c - g$.

It is hard to believe that a mathematical theory which involves these and numerous other equally unmeaning assertions can be turned to any serious account by psychologists. A. E. TAYLOR.

OUR BOOK SHELF.

Elementary Practical Zoology. By Frank E. Beddard, M.A. (Oxon.), F.R.S. Pp. vi + 210; with 93 illustrations. (London: Longmans, Green and Co., 1898.)

THIS little book is written as a guide to the elementary zoology required by the Science and Art Department. There already exists at least one work designed for this special purpose, and several others more or less adapted for these examinations. Most of these have been written by men who though teaching zoology can hardly claim to be specialists in this subject; consequently, on coming across a book written by such a well-known zoologist as Mr. Beddard, one naturally expects that the work will be something out of the common. We are afraid that any one taking up this book with such expectations will be disappointed; for although this book may be better than those already in existence, we do not consider that Mr. Beddard has done either himself or the subject justice in it, the book having the appearance of being turned out in a hurry and without due care.

In spite of Mr. Beddard's remark we still believe in Huxley's method of working from the known to the unknown, and should rather have seen the book commence with the frog than with the amœba.

One of the most disappointing portions of this book is the chapter dealing with the earthworm. Mr. Beddard, as is well known, is perhaps our greatest authority on the Oligochæta, and one consequently expects that this chapter would be very superior; but even here we find evidence of want of care, the very illustrations being bad. The first one (Fig. 9), stated to be a side view of the worm, is really a latero-ventral view, and what the row of setæ on the left margin of the figure are is difficult to imagine; they do not tally with the description, nor do they exist in any of our common earthworms. Figs. 12 and 13, too, are curious combinations of the anatomical characters seen in *Lumbricus* and *Allolobophora*, two worms that have been so long confused in the practical text-books; but the author does not state that they are combined figures, and the student will look in vain for the origin of the lateral œsophageal vessel on the twelfth segment, or for six "hearts" in a worm with three pairs of calciferous glands.

So throughout the book we find this lack of care in the preparations of the illustrations, which latter should be of the greatest importance in a practical text-book, and especially in one in which the author frequently states that a description of a given set of organs is unnecessary as the illustration will explain the facts.

Some of the figures are combinations from several published by well-known teachers, and during the process of combination they have suffered considerably; so much so, that the originators will hardly care to see their names attached to them. In the diagram of the vascular system of the frog, after Howes, the *anterior abdominal* is represented as entering the liver quite independent of the *hepatic portal system*, and the latter is indicated in part as joining *directly* with the inferior *vena cava*.

We have yet to learn that the teeth on the radula of the snail are calcified, and that the rabbit has only one deciduous premolar on either side of the lower jaw.

We have only drawn attention to a few of the errors which occur in this work, and we cannot congratulate Mr. Beddard on its production. In our opinion the more elementary a book is the more correct should be its facts, and the greater should be the care expended on it.

M. F. W.

Elementary Conics. By W. H. Besant, Sc.D., F.R.S. Pp. 176. (London: George Bell and Sons, 1898.)

Examples in Analytical Conics for Beginners. By W. M. Baker, M.A. Pp. 87. (London: George Bell and Sons, 1898.)

OF these two volumes of the "Cambridge Mathematical Series," Dr. Besant's book is practically a reprint of the first eight chapters of his "Conic Sections treated Geometrically," which has for so many years held its ground as a favourite text-book among teachers. "Geometrical Conics" seems to be rather less "the fashion" now than it was formerly, and we hope that the present issue, containing all the more important propositions in a small compass, will encourage students in looking up geometrical proofs instead of trusting too exclusively to the often cumbrous and ill-understood methods of coordinate geometry.

Mr. Baker's collection of examples, though intended primarily for the use of Sandhurst and Woolwich candidates, will be welcomed by University students as well. Most beginners in coordinate geometry find the want of a thorough drilling in simple examples which are straightforward applications of book-work, before they can fully grasp the significance of the principles involved. Such exercises this book is intended to supply; but perhaps the most useful feature is the set of questions on "book-work," as these cannot usually be found in any text-book. G. H. B.

Dobbie's Horticultural Handbooks. Edited by William Cuthbertson. *Pansies, Violas, and Violets.* By Charles Jordan, John Ballantyne, Jessie M. Burnie, William Cuthbertson. Pp. 102. (London: Macmillan and Co., Ltd., 1898.)

TO all who grow for pleasure or profit the delightful flowers treated of in the book under review, the present work is to be recommended. In the space of about a hundred pages as much information regarding the evolution of the various varieties of the flowers, their botany, the methods of growing for the garden or for exhibition is given as is likely to be necessary for most readers. And the sentimental side is not overlooked, for some thirteen pages are devoted to the poetry of the subject, short extracts from the writings of various poets being gathered together in praise of the flowers under consideration. The work is illustrated by several very clear wood-engravings.

The Mechanical Engineer's Handy Office Companion. By Robert Edwards. Pp. viii + 70. (London: Crosby Lockwood and Son, 1898.)

THIS small book is what it professes to be, viz. a "handy office companion," giving, as it does, in a succinct form a variety of information likely to be required by mechanical engineers in their every-day office work. At the end of the volume appears a somewhat invidious list of books on mechanical engineering, and allied subjects, which the author recommends to his readers. We miss from the list the titles of very many books which we should have thought merited inclusion as much as several to which attention is called.

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.*]

Metargon and the Interplanetary Medium.

THE detection of metargon, and the statement that its spectrum, at all events, closely agrees with the Swan-spectrum, seems to possess a very great interest for the physics of our solar system. It gives a new and expected support to the assumption of an interplanetary atmosphere, which, as I shortly hope to show, will enable us to indicate the solution of most problems relating to the comets, and probably, also, to the sun.

This medium, which gives the acetylene-bands together with the cyan-bands, is already known through different observations :—

(1) In the absorption spectrum of the sun.

(2) In the emission spectrum of the highest beams of the corona (Tacchini).

(3) In the spectra of *all* comets, traversing all parts of the interplanetarian space.

(4) In the occluded gases of meteorites.

(5) Now, at last, as a constituent of the atmosphere of the earth.

The last observation completes the foregoing series, so that we can say that this medium now is found everywhere ; as we should expect to find it, if it really forms a common atmosphere to our planetary system. J. R. RYDBERG.

Lund, July 21.

Metargon.

PROF. SCHUSTER in his last communication on "The Spectrum of Metargon" says, "taking the spectroscopic evidence by itself, it points in the direction that the gas under examination is a compound of carbon either with argon or with a so far unknown body."

This observation has reference to the gas obtained by the volatilisation of a "white solid," amounting to about 1 per cent , which separates during the liquefaction of argon, as stated by Prof. Ramsay and Mr. Travers in their Royal Society papers on the "Companions of Argon." "The argon separated is a liquid, but at the same time a considerable quantity of solid was observed to separate partially round the sides of the tube, and partially below the surface of the liquid." Further, "inasmuch as the gas differs very markedly from argon in its spectrum and in its behaviour at low temperatures, it must be regarded as a distinct elementary substance, and we therefore propose for it the name 'metargon' It would appear to hold the position towards argon that nickel does to cobalt, having approximately the same atomic weight yet different properties." Now, a year ago Lord Rayleigh was kind enough to allow me the use of a sample of pure argon for the purposes of liquefaction. The gas, amounting to about 250 cc., was enclosed in a sealed bulb to which was attached a narrow quill tube for easy condensation in liquid air. I have repeatedly liquefied this sample, and have always obtained a perfectly clear fluid argon free from turbidity, opalescence, or any solid matter. In previous papers I have shown that a very small fraction of a per cent of gaseous impurity, which separates as a solid in the presence of a liquid, can be detected in this way. Thus 0·04 per cent. of carbonic acid in dry air gives an opalescent liquid when similarly treated, and the same thing occurs with oxygen containing less than 0·1 per cent. of chlorine. It would, indeed, be strange if anything like 1 per cent. of a gas giving a white solid at the temperature of liquid air could under similar circumstances escape detection if present in Lord Rayleigh's sample of argon. The question, then, is, Where can the metargon of Prof. Ramsay and Mr. Travers be? JAMES DEWAR.

Royal Institution, August 1.

Liquid Hydrogen.

IN a previous letter I said Mr. Hampson's "*attempt to justify going behind my back in his relations with a member of the staff of the Royal Institution is a too transparent subterfuge to require further comment*," and if I had not reason to feel the necessity of the use of cautious language when using your columns, I should have employed even stronger condemnatory terms.

Considering Mr. Hampson was not seeking from the Royal Institution some general scientific information, but experimental help to improve upon methods of research in which I was actually engaged, and to which my assistant must necessarily be privy, his proceedings were utterly indefensible.

Now Mr. Hampson *tries on a further justification* by pointing to the position of the person who introduced him to the "member of the staff." When Mr. Hampson gives the name of the "senior partner," I will be in a position to judge whether that gentleman's acquaintance with me was such as to fairly warrant him in transferring the introduction to the professor.

In the meantime the question remains, Why did Mr. Hampson, like other persons of University standing desirous of special knowledge or help in the possession of the Royal Institution Chemical Department, not address me in a manly way and request an interview ? If he could not write, then why did he not call and send up his card ? Why this pretended necessity for an introduction from a superior person of "familiar acquaintance" as a preliminary to a "confident hope of gaining" my "attention directly" ? Yet this punctilious gentleman suggests in extenuation that he entertained the possibility of a "*chance meeting*" with me here. How considerate of my position ! The course of action Mr. Hampson succeeded in carrying out was admirably adapted to create antagonism between the professor and his assistant.

Mr. Hampson now says : "It is strange Prof. Dewar, having himself published his belief that his assistant is capable of being 'got at' by a complete stranger, should in the very next line attach some importance to that gentleman's account of the transaction." This is, in other words, a covert suggestion that my assistant's veracity is not comparable with his own. Had my assistant ever dreamt that what I regard as a far too precipitate kindness to a "complete stranger" would ultimately be used as material to support an attack upon the character of the professor and the credit of this Institution, I do not doubt for a moment he would have acted with more dignified reserve and cautious consideration ; in spite of Mr. Hampson's persuasive influence and the tempting allurement of the introduction from the "senior partner of a large chemical firm in London of the highest standing."

Verily no man can serve two masters at any time, far less when both are engaged on the same research. If conduct like this, which Mr. Hampson has the boldness to characterise as "simple and straightforward," is to be tolerated, the inviolate relations between professor and assistant are ruined, and there is, indeed, an end to any combination of science and morals.

Royal Institution, July 31. JAMES DEWAR.

The Medusa of Lake Urumiah.

I HAVE received to-day a telegram from my son, Mr. R. T. Günther, posted this morning at Tauris, in which he states that the "Medusa" reported by travellers to inhabit in immense numbers Lake Urumiah, proves to be a species of *Branchipus*.

Kew, July 27. ALBERT GÜNTHER.

Distillery Pollution.

THE disposal of the effluents from distilleries and other works is a matter of first interest not only to the proprietors of the works, but also to the riparian owners on the banks of streams on which such works are usually situated, and a few remarks on the possibility of avoiding the Law Courts in matters of pollution of rivers may be of interest, especially to the owners of distilleries. In the Spey district of Scotland, for instance, the great increase of distilleries, both in number and in malting capacity, has in recent years so increased the effluent that although any one distillery may not in itself seriously pollute so large a body of water as the Spey, yet their joint effluent is so great, it is alleged, that the pollution is serious, prejudicially affecting fish life, spawning and the taking of the fly by salmon, and rendering the river otherwise unfit for primary uses. Be these allegations true or false, the fact remains that at the present moment interdict hangs over one distillery—the Macallan Glenlivet Distillery—and if no method is found of avoiding the discharge and consequent fungoid growth, &c., there is no saying what may be the issue and ultimate result to what is now a

very large industry. It is not proposed to discuss the two sides of the question—the maintenance of the industry or the preservation of the purity of such a fine river as the Spey, or other rivers similarly situated—but rather to consider what can be done to meet both sides. Now it may be held as true that there is no operation to which the burnt ale or spent lees of a distillery can practically be subjected to, that will render the effluent innocuous. The effluent may be evaporated or spread over irrigation fields, or treated with chemicals or charcoal, and yet the processes are in one way or another defective; and there appears but one solution, not to pass the effluent into the rivers, but take it away in pipes or barges to the sea. In many cases this is quite impracticable, even by the joint action of a number of distilleries; but in some cases the effluent has successfully been taken miles in pipes and discharged into the sea. As is known from large experience in outfall pipes for sewage and paper works effluents, it requires a carefully designed arrangement, the cost of which can only be determined after a minute survey; and usually the cost turns out to be too great, and then there appears to be one solution by passing the effluent out in the form of a fine spray from the top of a high chimney or iron lattice tower. The natural question at once asked is: But you pollute the air instead of the water, and what the better are you for doing so? In the first place, what is discharged is not a gas which, if of a noxious quality, might hurt by being inhaled. It is not like soot, which might leave a black mark on your face or clothes. The spray, if it fell on your skin or clothes, could do you no harm, or at least infinitesimal harm. It is not a poisonous liquid, as cattle can drink it. If it fell on trees or grass, except in large quantities, which would not be the case, it would not burn them. Pollution of air is not objected to unless it be in great excess; indeed, we all pollute the air to our neighbours' and our own disadvantage. We send out gases and smoke from our chimneys, which find their way to our neighbours' carpets and curtains and clothes, and we put out the foulest of gas—viz. sewer gas—daily and hourly from the ventilating pipes of our modern house drains, and many of our factories, electric light stations, &c., pass out gases which individually one would say would be sufficient to affect a whole city. There are many physical reasons which make the great difference on the harmless nature of air pollution from water pollution, and that is the cubic capacity of the polluted substance.

In the case of air the air stream is measured in cubic miles, whereas the water stream is a matter of cubic feet; again, the water flows in one fixed channel, whereas the wind and air stream is constantly varying; again, water pollution is worst just when it is put into the river, whereas air pollution is spread over a large area and is thoroughly mixed up before it comes down, possibly one mile or two miles from where it issued from the chimney.

Again, it may be said that even supposing the spray be harmless, yet it would be very disagreeable to be subjected to a fine rain or Scotch mist when near the distillery. Let us consider a distillery sending out four gallons per minute. An ordinary non-condensing engine uses 20 lb. of water per H.P. per hour, so that the quantity discharged from the top of the chimney is no more than what is sent out from a steam engine (high pressure) of 120 I.H.P., and we know from experience that this can be discharged without being felt, and in most weathers even becoming invisible 100 feet away. If it were practicable to reduce the effluent to a state of fine division as fine as the globules of the so-called white steam, and emit it from the top of a chimney, the solution of the matter would be found at once. It does not at present either appear practicable to reduce the effluent to such a fine state of division, nor fortunately is it necessary to do so, as experiment shows that ordinary sprayed particles are rapidly evaporated and absorbed. Take a spray such as barbers use, and spray it from a height of 5 feet in a still atmosphere, and measure the quantity evaporated in its descent. It will be found that at least 1/8th has been lost. Do the same at 10 feet, and it will be found that 1/4th is lost. Theory points to very rapid evaporation, as the particles get small as the surface becomes rapidly large in comparison with the cubic capacity of the spheres. Another good example of rapid evaporation and absorption by the air is to use the spray over a piece of glass. In ordinary weather only a very short space of time renders the sheet glass quite dry again. These two experiments, and our experience of the discharge from steam engines pointing to this, that instead of experiencing a mist or fine rain, the particles would be so minute and so widespread that no one might suffer any inconvenience, indeed might be quite unconscious of the fact that the spraying was going on except from seeing the white steam mist issuing from the chimney of the distillery.

Coming now to a more practical view as to what would be necessary to obtain the desired effect, and trials lead to this, that for a discharge of four gallons per minute it would be necessary to have a pump to pump up this small quantity, also an air pump to pump about forty times the volume liquid, a 5-H.P. oil engine with air pump attached, such as is used in lighthouses for supplying the air blast to fog signals, being ample. The necessary length of pipes leading up to the spraying apparatus with a number of nozzles, and above all a high point of discharge, completes the arrangement.

The height of discharge is evidently one essential of success. The height will vary with the amount of the effluent, and whether the works be situated on a moor, near a town, or in a cleft in the hills, or among high trees.

The increase in the velocity of the wind with height is an important factor. In measuring the velocity at 50 feet, 100 feet and 200 feet, we find a great increase with height, so that instead of a point of discharge of 200 feet being only capable of doing twice what a height of 100 feet will do, as one might at first suppose, yet a little consideration will show, as the area is a measure of the degree of dispersion, that it will disperse successfully much more. In fact whereas 100 feet might discharge one gallon, 200 feet might discharge eight gallons per minute. It would appear, therefore, that to attempt to deal with the effluent by spraying at a low level, as has been in some quarters suggested, is simply to court failure. The point of discharge must be high, but "how high" is a matter which at present is unknown; nor, indeed, can it be definitely fixed, as has been pointed out, each individual work requiring special consideration of the circumstances. There is one other point that requires to be considered in connection with the whole matter, and that is compensation for water abstraction. At present distillers use the water, and what is not sent off as whisky is returned to the stream. But in the case of carrying the effluent to the sea, compensation would require to be given to the stream by means of reservoirs, and with the spraying apparatus a complicated question would arise as to how much really found its way back into the water-courses of the particular drainage area. This is largely a legal question, but it is not clear how the spraying process could differ from the discharge into the atmosphere of an ordinary steam engine, and so it would appear that water compensation for the stream was with this system unnecessary.

C. A. STEVENSON.

The Nature and Habits of Pliny's Solpuga.

I HAVE never seen one of the Arachnoids in a hive, but have received them several times from trustworthy bee-keepers who have found them in the hives "killing and eating the bees." Other insects do the same thing, especially Formicids and Mutillids. Of course the latter, with more chitine, are better fitted to resist the attack of the bees than are the soft-bodied Datames. It may be that these Solpulgids have some protective scent that makes their entrance to the dark recesses of the hive safe.

A. J. C.

Claremont, Cal., June 23.

THE VACCINATION BILL.

IN connection with the recent discussion on the vaccination question, nothing strikes the inquiring observer more than the shortness of the collective memory of a people, unless, indeed, it be the fact that people are easily led by any small knot of agitators who will shout loudly enough and asseverate with sufficient force and frequency.

That this is true not only of what may be called the masses, but also of their selected representatives in the House of Commons, is evident from what has recently transpired in that august assembly. The career of the Vaccination Bill has been marked by many stormy passages and by very varying fortunes, and now that it has passed through its first stage, there appear to be few who are even partially satisfied. This is a result

such as might have been anticipated. Weak concession is not compromise; whilst, on the other hand, obstinate resistance to amendment, from whichever side of the House the overture is made, cannot be put to the credit of the intelligent statesmanship of some of our legislators.

Looked at dispassionately, this question should be largely one of principle; but granting this to its full extent, it must always be recognised that sentiment under certain circumstances may rout principle entirely. Such being the case, principle must in minor points give way to sentiment.

To a very large extent, the present outcry against vaccination is the direct result of the practical disappearance of small-pox from our midst, such disappearance having been brought about by thorough vaccination. This statement may be traversed by some, but all statistics, British and foreign, go in the same direction on this point. At one time every child was expected to have an attack of small-pox, just as certainly as at the present day it is expected to contract an attack of measles. Indeed, children were often put into the way of being infected in order that they might get the attack over as soon as possible. This was so in spite of the fact that the mortality was frightfully high, and that amongst those who survived the attack, blindness, deafness, scarred features, and even greater deformity was perhaps the rule rather than the exception.

Those who then had experience of this small-pox were ready enough to accept vaccination for their children and for themselves. They had almost daily experience of horrors such as we cannot now realise (unless we have passed through a cholera, a plague, or a severe typhoid epidemic), and they were ready to try anything which would give even promise of some amelioration, however slight, of the severity of the attack. We have it on the authority of medical men who were instrumental in carrying on the earlier vaccinations, that the better a population was vaccinated the fewer were the cases, the less was the mortality, and the slighter were the ensuing deformities. For some time, so long indeed as those lived who had known small-pox before vaccination, there was no agitation against vaccination; but as soon as a people arose who knew not small-pox, and who knew not its terrors, the slight discomfort of vaccination was rebelled against.

Two of the most thoroughly vaccinated people in the world are the Scotch and the Swiss. In Scotland the public vaccinator's post is almost a sinecure in most districts, because the parents, of their own free will, call in their medical attendant, in whom of course it may be assumed they have every confidence, to advise them and to perform the operation for them as soon as it is thought to be necessary. The result is that by the time it is six months of age, almost every child is vaccinated under the very best possible conditions, *i.e.* when it is in good health, and is suffering from no teething, skin, or digestive trouble. If a certificate of vaccination under such conditions, or one that it is deemed by the medical attendant advisable to postpone vaccination, were demanded by the registrar, as is now done in Scotland, more thorough vaccination than is now obtained would undoubtedly be the result.

An unvaccinated family or colony is a danger to the community. How firmly this is held in Switzerland is evidenced by the fact that no child is allowed to receive its education at the hands of the State until it has been vaccinated. What is the result? That in Switzerland almost every child which has reached school age is fully vaccinated, and in order to save trouble, *i.e.* to take the best period for the performance of the operation, the child is usually vaccinated before the process of "teething" commences. As is well known, vaccination during this early period has many advantages. In the first place the child is protected during the period when it is otherwise most susceptible to attack by the disease, and at a period when the percentage mortality is highest. Then, too, this is the period when the child can most easily be kept clean and at rest, *i.e.* before it is able to walk and knock its arms about. The irritating and irritable teething period has not commenced, and perhaps most important of all, the child is, or should be, taking chiefly milk foods, so that intestinal and cutaneous irritations and eruptions are of comparatively infrequent occurrence. If in this country these points were more carefully attended to, we should hear far less of eruptions and convulsions "due to vaccination."

It is all very well to talk of the liberty of the subject—the parent—in connection with vaccination, but is it right that this should interfere with the rights of the child? By the Factory Acts children of tender years are protected (more or less efficiently) against the cruelty and greed of parents. Under the Educational Act children are sent to school and prepared to take some respectable part in the world's work. It has even been suggested (often by those who are loudest in their denunciations of compulsory vaccination) that children should be clothed and fed as well as educated at the expense of the State; but as soon as the State steps in to put the child in a position to preserve its life or its sight in the presence of an epidemic of small-pox, there is an outcry by these same people against the invasion of the liberty of the subject and the rights of the individual. Under the Public Health Act a Medical Officer of Health has certain powers that override such liberty or license of the individual as may by its manifestation be dangerous to his neighbours; and even the common law steps in to prevent the cruel or ill treatment of children. It is therefore surely reasonable that helpless children should not be handicapped in life, or be made centres of danger for those around, by being left absolutely unprotected against the attack of a disease which, if unmodified, usually leaves marks both deep and lasting on its victim.

Under the circumstances it is a matter for consideration whether some concession should not be made to sentiment. The days for martyrdom are over, and many of the vaccination "martyrs" have developed and bloomed, because in the first instance they have been too careless to conform to the requirements of the law; once a martyr, however, always a martyr. Is it not a politic suggestion that the onus of objection should be thrown on the shoulders of those who do not wish to have their children vaccinated? If a man takes the trouble to go before a magistrate (or two), and affirm in open court that he has a deeply-rooted objection to vaccination, he may be looked upon as a faddist; but his children might be exempted from vaccination until such time as an epidemic of small-pox made its appearance, when the compulsory rule should at once be put into force. In order that this might be done, the onus of reporting unvaccinated children should rest with the objector, who would be in the position of a ticket-of-leave man who would come up for judgment, and whose children would at the same time come up for vaccination in the presence of an epidemic. Those who would take this trouble might be exempt; but those who would not, could no longer pose as martyrs when failing to comply with such reasonable regulations, and so they would come under the lash of the law.

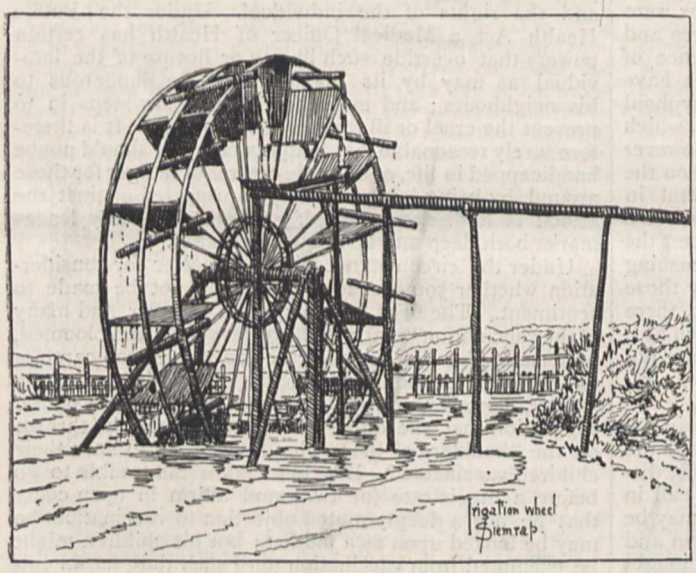
The Vaccination Bill can scarcely pass into law in its present form; its passage in such form would afford evidence that however able a large body of men may be, and however well endowed with common sense, they have not as a body the capacity to legislate, or the backbone to stand out where expert evidence, which is the only evidence that is of any value in this case, is placed in opposition to a fad—not a popular fad—but a fad held by a very small but noisy and self-assertive, and therefore, from the parliamentary point of view, powerful minority. The country as a whole is not against vaccination;

Parliament might therefore legislate for the few, at the same time keeping a very tight grip on those to whom, for sentimental reasons, it grants any indulgences.

Re-vaccination, though not so important as primary vaccination, will at some time have to be considered. Vaccinators are taunted with the fact that, although Jenner maintained that vaccination would confer life-long immunity against small-pox, they are now asking for re-vaccination. Jenner could speak only for his time. Where he goes beyond his facts his theories have not all been confirmed as the result of a wider experience; but where he kept to facts, and argued from his own observations, he has been proved to be right in almost every instance. It would, indeed, be a dark look-out for medicine if whilst accepting all that is true of the work of our predecessors, we find ourselves by tradition looking out for nothing that is new. The fact that all Jenner's statements have not been implicitly accepted, should be an argument in favour of those that have been confirmed.

MR. WARINGTON SMYTH ON SIAM.[1]

THE good use which Mr. Warington Smyth has made of his five years in Siam is already familiar to geographical readers from several papers published by the Royal Geographical Society, and a wider public will welcome the two volumes which tell in greater detail, and in a more ambitious literary style, of his journeys in that interesting country. Although to a reader unversed in the classical languages the occasional Greek and Latin quotations seem to savour of pedantry, no one can help being attracted by the manly and modest way in which Mr. Smyth recounts his adventures. He disclaims anything in the way of original exploration, and the fulness with which he renders their due to every previous traveller and to all his companions and his assistants, may perhaps lead careless readers to imagine that there is little new or original in the book. Perusal of the chapters will soon dissipate such an idea. Very few travellers have brought to their task more individual energy and enthusiasm, and some have made for themselves a reputation for vast acuteness and reckless daring with less solid basis than that which Mr. Smyth leaves his readers to discover.



Irrigation Wheel at Siemrap.

The professional aspects of the work of the Director of the Department of Mines ("the other half of the Department" is incidentally referred to) have been touched on very lightly, as is proper in a popular book, but enough is said to impart a solid interest to the journeys which are described. Mr. Smyth does not conceal his enthusiasm as a yachtsman, and his exploits in a small sailing-boat, cruising along the stormy shores of the Gulf of Siam for weeks at a time, are much more remarkable than the quiet record of them might lead a landsman to suppose.

The book, of course, contains some chapters on the political situation in Siam, concerning which nothing need be said here, and for the rest it consists of the narratives of journeys interspersed with remarks on the various peoples and customs of the country. A resolute attempt is made to adopt a systematic spelling of Siamese names, and the result is at first sight a little disquieting. *Mekawng* is no doubt preferable on principle to the familiar *Mekong*, but until the eye gets used to it, it suggests Mr. Rudyard Kipling's efforts to phoneticise the language of the young British soldier. We are not sure whether the rule of established custom, which saved Calcutta from its Hunterian disguise, might not also be invoked in favour of Mekong, as appears to have been done for Bangkok.

Mr. Smyth commences with a description of the river and port of Bangkok, the mud-bar at the mouth of which he describes in considerable detail. The advance of the land at the head of the Gulf of Siam is very rapid, on account of the immense quantity of silt carried down by the Menam. Had the water been clear enough to allow of coral growth, the shoals might possibly have rendered the harbour impossible of approach, so that the muddy water in a measure neutralises the effect which it produces. The Menam valley is next described, and an excellent point is made as to the introduction of railways in such a country as Siam. The author is strongly of opinion that the Siamese—a race of born watermen—would benefit more by the improvement of the natural waterways and the construction of canals, than by introducing railways, for which there is no pressing demand. That railways are valuable as means of conveying traffic past interruptions to rivers, or connecting places not already united by water, is not contested.

A series of chapters on the Lao States and the Mekawng gives opportunity for much pleasant description of places and people. The gold of the river valley, which is obtained by washing the gravel, is not likely in Mr. Smyth's opinion to pay Europeans for working. The Mekawng boat, however, is a thing to admire if not to imitate. Its foundation is a great tree-trunk hollowed by the adze, then sunk in the river until water-logged, next steamed over a fire until soft enough to stretch and have the knees and frames put in. A hull so fashioned will never leak, draws little water, is handy to manage, and lasts for twenty years without requiring substantial repairs.

The coasting trip along both shores of the Malay peninsula was of almost greater interest, as fewer Europeans have passed that way. The remarkable weathering of the limestone rocks is described, and several of the structures confidently assigned by previous travellers to volcanic action are shown by the author to be simply the result of weathering. The tin workings of the coast were visited and are admirably described. The Chinaman rules on the tin fields, and constitutes a

[1] "Five Years in Siam, from 1891 to 1896." By H. Warington Smyth, M.A., LL.B., F.G.S., F.R.G.S., formerly Director of the Department of Mines in Siam. With maps and illustrations by the author. In two volumes. Pp. 330, 338. (London: John Murray, 1898.)

political problem of a somewhat complex kind. He is essential to the development of the country and the production of revenue; but his secret societies, and not the law of the land, receive his homage. Mr. Smyth never tires of contrasting the dirty, greedy and ill-mannered Chinaman with the dainty, generous, and courteous Siamese or Shan; only one of the despised race finds favour in his pages—a boatbuilder who created the very clever little vessel in which the voyage to Chantabun was made. This voyage is the subject of several chapters describing visits to various places in Siamese Cambodia, including the famous ruby and sapphire workings east of Chantabun.

Appendices to the number of eighteen give a great deal of interesting information on many matters, economic, scientific, æsthetic, and archæological. The peculiar tides of the Gulf of Siam are discussed, and the singular musical instruments of the country described

Off Sam Roi Yawt: the three hundred peaks.

at length, while some Siamese airs are also reproduced. One of the most interesting of the appendices compares the naval architecture of modern Siam with that of ancient Rome and Egypt. The resemblance of the Siamese and Egyptian vessels, both canoes and sailing-boats, is very remarkable, not only in build but in the manner of working.

Mr. Smyth has illustrated his text throughout with his own clear and characteristic sketches. He comments strongly, but not too strongly, on the unsatisfactory plan of allowing an artist at home, who never saw the scenes himself, to "finish" the sketches of a traveller. Possibly first-rate photographs would be more valuable than the sketches; but they are far preferable to the inferior photographic work too often brought home by amateurs from tropical countries. The specimens of these sketches reproduced will show their interest.

HUGH ROBERT MILL.

THE NATURE OF THE ANTAGONISM BETWEEN TOXINS AND ANTITOXINS.

THE subject of toxins and antitoxins, though still in its infancy, is one which possesses considerable importance not only to the scientific world, but also to all members of the community. In the cases of snake poisoning, and diphtheria especially, the curative results that follow the administration of antitoxic serum are most marked, and it is in connection with these two conditions that the subject has been principally worked out. Important and interesting as these results are, foreshadowing as they do a new method of therapeutics in many other diseases, there are still two fundamental questions which have hitherto remained unanswered. The first of these is, What is the nature of the substances in question? The second is, What is the nature of the antagonism between them?

In a paper recently presented to the Royal Society (June 9), Dr. C. J. Martin and Dr. T. Cherry, of Melbourne, have given a very definite and conclusive answer to the second of these questions. The first, the nature of the substances themselves, still demands fuller investigation. The authors show, however, in confirmation of work previously performed by one of them (C. J. M.), and independently by Dr. T. G. Brodie, that the materials in question have a high molecular weight, and fall into the category of proteids or proteid-like substances. A method of separating substances of large from those of smaller molecular size in a solution containing both, consists in filtering it under high pressure through a film of gelatin supported in the wall of a Pasteur-Chamberland filter. The antitoxin of diphtheria does not pass through such a filter; it is probably a globulin, or at any rate its molecular size is of the same order. When antitoxic serum is filtered in the manner

just indicated, the whole of the proteids, and together with them all antitoxic virtue, is absent from the filtrate. Toxin, on the other hand, the molecular size of which is of the albumose order, is not held back by the filter. Corresponding results are obtained with the toxin and antitoxin of snake venom.

Coming now to the second question, the nature of the antagonism between these substances, we find that it is one on which a difference of opinion has hitherto been held. Behring, Ehrlich, Kanthack and Brodie maintain that the antagonism is of a chemical nature, and that the antitoxin neutralises the toxin much in the same way that an alkali neutralises an acid. Buchner, Calmette, Metchnikoff, and others, on the other hand, regard the action as an indirect one, operating in some way through the medium of the cells of the organism. The work on which such an assertion rests may be instanced by a typical experiment of Calmette's on cobra poison. The venom is not attenuated by heating its solutions to 68° C. for ten minutes; the antitoxin is, however, completely destroyed by this treatment. Mixtures of cobra toxin and antitoxin, which produced no symptoms when injected into rabbits, killed similar rabbits in a few hours if, after the mixture had remained in contact for ten minutes, it were heated to 68° C. for another ten minutes before injecting; hence the conclusion that the toxin and antitoxin do not interact *in vitro*, but only *in corpore*, and therefore that the action cannot be explained as a simple chemical operation between the two.

Such an experiment is not, however, conclusive; it can be easily repeated with the same result, but the source of fallacy is that it takes no account of the factor—*time*. Every chemical operation has a certain definite velocity coefficient, and the rapidity of action under any circumstances when the reacting compounds are in solution depends upon this coefficient, and also upon the product of the active masses of the compounds present. Temperature will also exercise an important influence.

Remembering the high molecular weight of both toxin and antitoxin, one would *a priori* expect the velocity coefficient of any reaction between them to be a high one, and in addition the solution would contain relatively few molecules; so it is not surprising that any chemical operation should occupy a very appreciable time. If the two substances are left in contact for more than Calmette's ten minutes, the substances completely neutralise each other *in vitro*.

The following table gives a summary of Martin and Cherry's principal experiments with snake venom. On reading along any horizontal line will be seen the influence upon the result of the time during which the toxin and antitoxin were allowed to operate upon each other, with proportion of active masses constant. On reading any vertical line, the influence of varying proportions of active masses with time of operation constant is indicated. The thick line separates off the fatal results from those in which the rabbits lived. All other factors were kept constant. The solutions were mixed in the varying proportions, and stood at laboratory temperature (20°–23° C.). At stated intervals, by a stop-watch, portions were pipetted off, and the reaction terminated by rapidly raising the temperature to 68° C. in a water bath. They were kept at this temperature for ten minutes, cooled, and kept for injection.

Proportion of toxin to antitoxin per kilo		Control venom only.	Time allowed for interaction of toxin and antitoxin, temp. 20°–23° C.					
Antitoxin.	Toxin.		2 mins.	5 mins.	10 mins.	15 mins.	30 mins.	Injected unheated 8 mins.
1 c.c.	2 fatal doses.	Died 15 hours.	Lived (very ill for 2 days).	Lived (ill 1 day).	Lived (no symptoms).	Lived (no symptoms).	Lived (no symptoms).	Lived (no symptoms).
1 c.c.	3 fatal doses.	Died 12 hours.	Died 20 hours.	Died 28 hours.	Lived (ill 2 days).	Lived (ill 1 day).	Lived (no symptoms).	Lived (no symptoms).
1 c.c.	4 fatal doses.	Died 9 hours.	Died 13 hours.	Died 15 hours.	Died 23 hours.	Lived (very ill 2 days).	Lived (no symptoms).	Lived (no symptoms).

Exactly corresponding results were obtained with diphtheria toxin and antitoxin; and we may conclude by quoting an experiment with these substances, in which a different *modus operandi* was adopted. Similar experiments have been recently performed by Brodie, and published in his Arris and Gale lectures; his results completely coincide with those of Martin and Cherry.

A solution of toxin containing eight fatal doses per kilogram of guinea-pig in each c.c. was mixed with sufficient antitoxin to more than completely neutralise all the toxin. This mixture was allowed to remain *in contact at 30° C. for two hours*, and then filtered through the gelatin filter. Varying quantities of the filtrate were injected into guinea-pigs up to nearly 4 c.c. per kilogram of body-weight; that is, a quantity originally containing thirty-two fatal doses. The filtrate was quite innocent. The guinea-pigs suffered no inconvenience, and gained weight while under observation in small cages. The injections produced no local œdema.

If the toxin had remained unaffected beside the antitoxin, there was nothing to prevent it passing through the filter in virtue of its relatively small molecular size. As, however, it did not do so, we can only conclude that it had entered into some sort of chemical relationship with the relatively large molecules of the antitoxin during their sojourn together prior to filtration.

W. D. H.

A MINISTER OF EDUCATION AT LAST.

THE Duke of Devonshire made a most important speech on Monday in introducing a new Bill relating to Secondary Education.

The Bill really seeks to reconstruct the whole of our haphazard organisation dealing with Education, Science and Art; whether the recommendation will do harm or good depends upon the reconstructors, and who they are does not appear. It should, however, be a matter of congratulation that the lamentable condition of our present want of system, which has been known to educa-

tionists for many a long year, is at last recognised by those who are responsible for its inefficiency.

We gather from the *Times*, (the Bill has not yet been published) that the Government has now come "to the natural and logical conclusion, a conclusion which almost every other civilised nation has reached long ago, that there should be a comprehensive educational department dealing, generally speaking, with our national education as a whole, and presided over by a real Minister of Education. . . . There is to be a Board of Education, as there is a Board of Trade and a Local Government Board, and the new Board is, like these, to have a responsible Minister at its head, the President of the Board. Under him, the present Education Department and the Science and Art Department are to be amalgamated into one office, with one Secretary; and many of the educational powers of the Charity Commissioners are to be at once taken over by the new Board."

We reprint the latter part of the Duke's speech.

The Bills I have to propose are of an extremely limited character. The first proposes to create a central educational authority. Much that is done in it could properly be done by an administrative order by the Government; but in order to obtain Parliamentary sanction to the policy which we propose, we have thought it more desirable to embody our proposals in a Bill. At the present time the President of the Council or the Vice-President of the Council is for many purposes the Minister of Education; but under them are what are virtually two distinct Boards, the Education Department and the Department of Science and Art. We propose to bring these two Departments together to make out of them one office under the control of one permanent Secretary. We propose to put an end to the Committee of Council and to the office of Vice-President of the Committee of Council. We propose to create a Board of Education on the model of the Board of Trade, the Local Government Board, and the Board of Agriculture. The President and the Vice-President, or the President alone, of this Board may be appointed. If the Education Minister should be in the House of Lords, it is provided that the President of the Council will be the President of the Board, and he will be represented by the Vice-President in the House of Commons. If the Minister of Education should be in the House of Commons he will have the office of President, and will have no Vice-President. The Department will be represented in this House by some arrangement such as we have found practical in the case of other Departments. We think that the present time is extremely opportune for such a reorganisation of our Education Department. Next year the Secretary for the Science and Art Department retires under the age rule. The office which he holds is one that has never escaped criticism, and perhaps the strength of Sir John Donnelly's convictions and the energy with which he has supported them has exposed him to even a larger share of criticism than some of his predecessors. I think it only due to Sir John Donnelly to state that the Government has never possessed a more devoted public servant, and that, under conditions extremely difficult, I believe the Department has, under his administration, taken part in the very great development both of scientific and artistic training. But the changed conditions of education, the growth of the Department itself, the growing conviction for a better and a more special technical training for our people—a conviction that has found expression in the Technical Instruction Act—all these have rendered a revision of the scope and character of the Department absolutely necessary at the present time. I believe that that revision will be greatly assisted if we are able to obtain, what we are asking Parliament to give, sanction for the establishment of one central responsible department which should be charged with the supervision of secondary as well as elementary education, and of all the agencies appertaining to both. The Bill, I need hardly say, will not contain the details of the proposed reorganisation. They cannot well be promulgated until Parliament has given its sanction to the principle of the establishment of a central authority. But I may say that the reorganisation will not necessarily be confined to the Department of Science and Art. It would be entirely a mistake to suppose that there is any intention of simply merging the Department of Science and Art into that of Education. The Education Department itself under our plan will require some reorganisation. Some of the duties performed by the Education Department—such as those which relate to training colleges, to training pupil teachers, to the higher-grade schools—are pertaining more to secondary rather than to elementary education; and it may very well be that it will be found expedient to group those functions which are now discharged by the Education Department and others which are now discharged by the Science and Art Department under a Secondary Education Department proper, while a third division may possibly be charged with the supervision of the more technical branches of science and art instruction, and at the same time control and manage the Science and Art Museums which exist both in the metropolis and the provinces. These details of reorganisation have, of course, to be worked out by the departments concerned and by the Treasury after the work which will be undertaken in anticipation of the approval which we hope we may obtain to the proposals we are now making. I do not know whether there are any of your lordships House who are interested in the subject of economy. It is said, I believe, that no one in the House of Commons cares about economy except the Chancellor of the Exchequer and his predecessor. But I do not think that this proposed reorganisation need necessarily lead us, or ought to lead us, to any increased expenditure on administration. It is, of course, impossible to say what this Parliament or future Parliaments may think fit to spend directly on secondary technical, scientific, or artistic education. But, so far as administration is concerned, which is all we are dealing with at present, I see no reason why this arrangement should lead to any increased expenditure. I rather think it will tend to economy. Already by the transfer of training in elementary schools from the Science and Art to the Education Department a very considerable saving has been effected; and in my opinion the system under which grants in aid to science and art teaching are now dispensed is, in consequence of the rapid and unforeseen extension of the system—a system which has been steadily developed from small beginnings indeed—so cumbrous and complicated, and therefore so costly, that I should be very much disappointed if by a more systematic and scientific rearrangement of duties a very considerable economy cannot be brought about. I have said that a great deal of what we proposed to do could be done simply by an administration order to which the sanction of Parliament might be given when the estimates are presented; but, as I have said, we thought it better to embody the main principles in a Bill. But one portion of the duties which we propose to transfer under the Education Department cannot be transferred without legislation. I refer to the supervision of endowed schools under the schemes which have been promoted by the Charity Commissioners. Logic and symmetry may perhaps appear to require that the whole of the powers of the Charity Commissioners, so far as they relate to educational endowments, should be transferred to the Education Department. But the subject of endowments is so delicate, the distinction between charitable and educational objects and charitable trusts, the extent to which the necessities of special cases are to be regarded, the sectarian questions which they involve are all so difficult and controversial in character that we have hesitated to propose to transfer all such questions from a quasi-judicial to a political authority. Under this Bill, therefore, the administration of charitable trusts and the framing of trusts under the Endowed Schools Act will remain untouched, except that an instruction will be given to the Charity Commissioners to frame schemes, so far as they are educational, in consultation with the Education Board, and the Education Board will have power to promote other schemes when required. All these schemes contain a provision with regard to the educational examination of the schools, and the result of that examination is reported to the Charity Commission. They also institute from time to time an administrative inspection of their own, as to the management of the funds of the school and other matters. The educational examination and the administrative inspection, so far as it relates to educational matters, will be transferred to the new Department. In other respects the present powers of the Charity Commissioners will not be interfered with by the Bill. But for the first time a most important part of our educational system will be brought under the cognisances, and to a certain extent under the guidance, of the responsible Minister of Education. The Royal Commission laid considerable stress on the constitution of an educational council with consultative and certain administrative powers. We have

been unable to accept those recommendations as a whole. For the purpose of forming and maintaining a registry of teachers a separate and more or less independent council was necessary. A Bill for that purpose was introduced some time ago, which will be reintroduced to-day. It provides a council for this purpose only, some of whose members will be nominated by the Crown, some by the Universities, and ultimately it will contain members directly representative of the registered teachers themselves. But we have not seen our way to give to this council or to any other council statutory powers. We recognise, however, that the advice of educational experts may be of great value to the Board of Education. We have taken power to authorise the President of the Board of Education to appoint an educational committee to advise the Board on such matters as may be referred to it. Such a committee in all probability will be largely founded upon the registration council. In our opinion it would only tend to hamper the responsibility of a Minister if a consultative council were appointed by statute and endowed with statutory powers; in our opinion the Minister must be responsible for the choice of his advisers as well as the action which he takes upon that advice. While it is desirable, almost necessary, that the registration council should have a fixed and permanent character, we thought it desirable to reserve complete discretion to the Minister as to the choice of his advisers. I have endeavoured to explain what these Bills contain. It may appear to be a somewhat rash act to submit proposals of this character to be exposed to discussion and criticism during the long months of a comparatively unoccupied recess. It may be so, but for my part I can only say that I welcome the fullest discussion and criticism. I welcome discussion on a subject in which, in my opinion, too little interest has been hitherto felt by the general public as distinguished from professional experts, and I only trust that these proposals may receive very full discussion and criticism. I have no doubt that they will be condemned by some on account of their incompleteness; I have admitted that they are incomplete, and incomplete on a vital and essential point, but I have endeavoured to show that we have not been insensible to the importance or the urgency of that portion of the question, which we propose at present to postpone. If we have postponed it, it is because we are convinced that the constitution, preliminarily or concurrently, of a strong central authority is necessary for the equally important, perhaps more important, object—the creation of strong local authorities also. If the discussion which follows the introduction of this measure shows that we have over-rated the difficulties which I think still exist in the constitution of satisfactory local authorities, it may still be possible in another session to enlarge the scope of this Bill. But, however that may be, we may feel confident that these limited proposals, standing even alone, will be an important step in the direction of placing our national education upon a sounder and more satisfactory basis.

NOTES.

PROF. E. RAY LANKESTER has been appointed to succeed Sir William Flower as Director of the Natural History Museum at South Kensington.

THE fourth International Congress of Physiologists will assemble at Cambridge on Monday, August 22, and will hold its meetings each morning and afternoon from Tuesday, 23rd, to Friday, 26th, inclusive. The Congress has for its object the advancement of physiology by affording physiologists of various nationalities an opportunity of personally bringing forward experiments, and of exchanging and discussing their views together, and of becoming personally acquainted one with another. The languages to be recognised as official at the Congress are English, French, and German. Membership is open to (1) representatives of physiology in the persons of professors and their assistants; (2) members of physiological and similar purely scientific societies, as for example, American Physiological Society; the Physiological Society, England; Société de Biologie, Paris; Physiologische Gesellschaft, Berlin; (3) ladies and gentlemen who are proposed by a National Committee. Members will be afforded all possible facilities for experimental demonstrations, as well as for the exhibition of preparations and of scientific apparatus. In connection with the Congress there will be an exhibition of physiological apparatus. Those who attend the Congress, and all directors of physiological institutes, as well as instrument-makers recommended by the above, are invited to send exhibits. The exhibition will remain open from Monday, the 22nd, to Saturday, August 27, inclusive. A large number of British, American and Continental physiologists have notified their intention to be present. The organising Committee of the Congress is constituted as follows:—M. Foster, President; M. Blix, H. P. Bowditch, A. Dastre, P. Heger, H. Kronecker, W. Kühne, A. Mosso, W. Wedensky, with L. Fredericq, P. Grützner and C. S. Sherrington, Secretaries. Further information concerning the local arrangements for the Congress can be obtained from Dr. L. E. Shore, St. John's College, Cambridge.

THE Government of the Congo Independent State has, it is stated, just sanctioned an important measure for the advancement of scientific knowledge on the Congo. The despatch, last spring, of the expedition under Lieut. Lemaire was a commencement in this direction, but, whereas his explorations will be chiefly in the Tanganyika region, the new measure will apply to the whole of the State. Twenty posts which are to form the centres of observation, and also the bases for the collection of flora, fauna, and mineralogical specimens, have been decided upon, and are now being carefully organised under the supervision of the proper officers at Brussels. As soon as the posts are in working order, a publication will be issued at Brussels for the purpose of recording the results of these experiments. It will be issued every six weeks, under the title of "Scientific Annals."

MR. W. HARCOURT-BATH has recently returned to England with a large collection of insects obtained in the Himalayas of Sikkim and Thibet, many of which were procured at great altitudes among the snow.

A REMARKABLY fine specimen of the gigantic centipede (*Scolopendra gigas*) may be now seen in the Zoological Society's Insect House. It is not, perhaps, quite full grown, but measures about eight inches in length. It is fed principally on small mice, which it devours with alacrity. This specimen was captured in Trinidad, and forwarded to the Society by Mr. R. R. Mole, of Port-o-Spain.

THE expedition sent out to the Galapagos Islands, at the suggestion of the Hon. Walter Rothschild, last year brought home a fine series of living tortoises, which have been recently deposited in the Zoological Society's Gardens. There are in all fifty-two specimens belonging to the group of large land tortoises namely thirty-three of *Testudo vicina* from the south part of Albemarle Island, and nineteen of *Testudo ephippium* from Duncan Island. These have been placed in the old Tortoise House in the North Garden, and feed greedily on cabbages. The interesting account of the giant tortoises of the Galapagos, given by Darwin in his "Naturalists' Journal," will be in every one's recollection.

THE Committee appointed by the Board of Trade a year ago, to consider and advise upon the means of obtaining and publishing information as to opportunities for the introduction and development of British home trades in the various districts in which we have official representatives, have adopted their report. As to the means of obtaining further commercial information, it is suggested that the most economical course would be to send out experts periodically to make inquiries and to report upon the progress and the direction of trade. The Committee recommend the establishment of an office whose function it shall be to meet the constantly-increasing demand for prompt and accurate information on commercial matters, so

far as it can be met by Government action. Amongst the duties of this new office would be: (1) To collect and focus existing information upon any subjects of commercial interest, whether derived from official or from unofficial sources, and whether relating to British Colonies or dependencies or to foreign countries. (2) To reply to inquiries which can be answered by a short note or by word of mouth, or by reference to published commercial data and statistics. (3) To direct inquirers who want special information to the proper quarter—*e.g.* to the Commercial Department of the Foreign Office, the office of a particular Colony, Chamber of Commerce, the Imperial Institute, and so forth. The proposed office would also bring together all the information contained in the diplomatic and Consular reports bearing upon particular industries and the state of the market for particular classes of goods. By these means it is believed that a wider knowledge of the conditions of the industries and markets abroad would be secured than exists at present.

THE *Engineer* reports that on July 27 a series of experiments in aerial research were conducted in the grounds of Shaw House, near Newbury. The experiments were carried out under the direction of the Rev. J. M. Bacon, Dr. R. Lachlan, Mr. J. N. Maskelyne, and others, with the advice and assistance of Lord Kelvin, Lord Rayleigh, and other men of science. The balloon was in charge of Mr. Percival Spencer and his brother, and was filled with 40,000 cubic feet of gas. The main object of the experiments was to discover in what measure the intensity of sound is influenced by altitude, by the presence of clouds, &c. The weather proved favourable for the observations, and the ascent was successfully made at twenty minutes past five o'clock, the balloon drifting steadily in a north-westerly direction. As soon as the balloon had had a fair start the series of experiments commenced. The first experiment in acoustics was with the voice, followed by five tests with musical instruments, these being succeeded by the discharge of rifles and blasts of the siren from an engine. Then came a rifle volley, followed by a roll of musketry, succeeded in turn by discharges of cotton-powder, four ounces being used in each charge. After this came three further discharges of cotton-powder, with eight ounces in each charge. When the balloon had travelled a considerable distance there were two explosions of cotton-powder with double charges, the final experiment being a comparison between a discharge of four ounces of gunpowder and four ounces of cotton-powder. The aeronauts had with them a receiving instrument, and by noting the altitude and the sounds which reached them, took the angular distance. The balloon descended at ten minutes to seven o'clock at North Denford. All the experiments proved highly successful.

THE attention of the Belfast Corporation Public Health Committee has been recently called to the fact that many cases of typhoid fever had been traced to the eating of shellfish gathered on the banks of Belfast Lough, which are saturated with sewage matter, and it was decided to call public attention to the circumstance in order that people may be apprised of the danger of eating shellfish taken from such an unsavoury locality.

THE Treasurer of Guy's Hospital has received an anonymous donation of 6000 dollars from a gentleman who listened to the speech delivered by Mr. Balfour on the recent occasion of the distribution of prizes in the medical school, with the request that the Governors would use the sum for the purpose of endowment of medical research. This generous response to Mr. Balfour's appeal is most praiseworthy, and the example set by the donor will, we hope, be emulated by many other men of means acting with the same public spirit.

As has already been announced in these columns, the seventieth meeting of the Society of German Naturalists and Physicians, which is to be held at Düsseldorf in September, will be preceded by an exhibition of "historical-ethnographical medicine," to be opened immediately. The *Athenæum* states that the exhibits will include an exact reproduction of the oldest Egyptian medical papyrus—the Veterinär-papyrus of Kahun, twelfth dynasty—showing the veterinary operations of four thousand years ago. Some of the "finds" of the Imperial German Archæological Institute in Athens will be on view, which demonstrate that the original "god of the physicians" in Athens was Amynos, who was afterwards displaced from that honour, and Asklepios adopted in his stead. Dr. Sudhoff has organised a special department as a "Paracelsus Exhibition."

IN connection with the meeting of the British Medical Association, the University of Edinburgh has conferred the honorary degree of LL.D. on the following medical men:—Dr. Henry Bowditch, professor of physiology, Harvard University; Sir William Broadbent, Bart., F.R.S.; Dr. Lauder Brunton, F.R.S.; Dr. E. Doyen, Paris; Dr. David Ferrier, F.R.S., professor of neurology, King's College, London; Dr. Joseph Forster, professor of hygiene, University of Strassburg; M. le Comte de Franqueville, Member of the Institute of France; Dr. Karl Gerhardt, professor of clinical medicine, University of Berlin; Mr. Jonathan Hutchinson, F.R.S.; Dr. Theodor Kocher, professor of surgery, University of Berne; Dr. August Martin, professor of gynæcology, University of Berlin; Dr. Johann Mikulicz, professor of surgery, University of Breslau; Dr. Ottavio Morisani, professor of midwifery, University of Naples; Dr. William Osler, professor of medicine, University of Baltimore; Dr. William Playfair, professor of obstetric medicine, King's College, London; Dr. Roddick, professor of surgery, University of Montreal, President of British Medical Association, 1897; Dr. Siegmund Rosentein, professor of clinical medicine, University of Leyden; Dr. Hermann Snellen, professor of ophthalmology, University of Utrecht; and Sir Richard Thorne Thorne, K.C.B., F.R.S., chief medical officer, Local Government Board, London.

UNDER the auspices of the Essex Field Club, a meeting of the scientific (Natural History) societies of Norfolk, Suffolk and Essex was recently held at Witham, to take steps for the establishment of an annual conference or congress of these societies. Mr. David Howard occupied the chair, and the discussion was opened by Mr. W. Cole, who read a short paper advocating such an annual assembly, and pointing out how much work might be done conjointly which would be difficult for any one society to accomplish alone. He also advocated, as a possible result of such conferences, the publication of one really good natural history journal for the whole of the "East Anglian" societies. Prof. Meldola, Mr. J. Southwell (Norfolk), Mr. H. Miller (Suffolk), Mr. W. Whitaker, Dr. Vincent (Suffolk), Prof. Boulger (Essex), Mr. J. C. Shenstone (Essex), and the Chairman, strongly supported the proposal. A resolution was unanimously passed that, in the opinion of the meeting, the establishment of an annual congress of the East Anglian societies was much to be desired, and that steps be taken to form a Committee to promote such a congress next year. The large meeting subsequently visited, under the leadership of Prof. Boulger and the Rev. A. Shears, Black Notley, Ray's birth-place and burial-place, and his home at "Dewlands" for twenty years preceding his death. The party was afterwards entertained by the Mayor of Colchester at his beautiful seat at Stisted.

THE report of Dr. T. Oliver, of Newcastle, on a visit of inspection made by him to three French match manufactories, has just been issued as a Parliamentary paper. The report gives particulars as to the works themselves, the number of workpeople employed, the kinds of matches made, an account

of the health of those engaged, the precautions taken to guard against sickness, and regulations as to those who are sick, and concludes with the following impressions and deductions: (1) Until recently the match-makers in certain of the French factories suffered severely from phosphorus poisoning; that at the present time there is apparently a reduction in the severer forms of the illness. (2) That the reduction in the amount of illness is attributable to greater care exercised in the selection of the workpeople; raising the age of their admission into the factory; medical examination on entrance; subsequent close supervision; repeated dental examination; personal cleanliness on the part of the workers; early suspension on the appearance of symptoms of ill-health; improved methods of manufacture. (3) That the French Government, aware of the dangers of match-making, is furthering by all possible means new methods of manufacture, and, with this object in view, retains in its service chemists and inventors who are continually making experiments. (4) That the Government has to some extent already succeeded in manufacturing a match capable of striking anywhere, yet free from white phosphorus, but that until now the manufacture of this match is not an industry.

PARTICULARS are given in the *Times* as to a process employed for making wood incombustible, or at any rate incapable of sustaining and conveying flame. The process may be said roughly to consist of removing the natural juices of the wood and replacing them with certain substances which not only make it fireproof, but also have antiseptic properties that prevent decay. The operation is effected in retorts or cylinders. The wood having been run in on trollies, the air-tight door is closed and the contents subjected to heat and the action of a high vacuum. This treatment is continued till the volatile and fermentable constituents have been withdrawn, the time required to attain this result varying with the character of the wood. The next step is to fill the cylinder with the fireproofing solution, the exact composition of which is kept secret, and force it into the wood under hydraulic pressure, the amount of which again differs for different woods, but may reach 150 lb. to the square inch or more. When thoroughly impregnated with the salts the timber is taken out of the cylinders, restacked on the trollies, and put into the drying-kiln—a room through which hot air is continually circulated by powerful fans, and which is fitted with apparatus to condense the vapours given off by the wood. Here it remains till it is thoroughly dried—in the case of a load of average thickness about a month. It is then ready for delivery and use.

WE are glad to learn that efforts are being made to secure for the Maidstone Museum and Public Library the collection of prehistoric flint implements formed during the past thirty-four years by Mr. Benjamin Harrison, and illustrating important periods in the early history of man in Great Britain and elsewhere. It is proposed to select from the specimens in Mr. Harrison's collection the type series chosen from the chalk plateau implements by Sir Joseph Prestwich to illustrate his monographs upon the subject of plateau or eolithic implements, and other type implements which have been figured and described by other writers; a series to show variety of form and the probable uses to which these implements have been put; a collection of paleolithic implements from gravels in the West Kent district; and type series of neolithic implements found in Kent. No more suitable home could be found for these implements than the Maidstone Museum, situated as it is in the county town, and also in the immediate vicinity of the district in which they were discovered. An appeal for subscriptions to purchase the collection, signed by the Mayor of Maidstone, has been issued by the Museum Committee. The public spirit of the municipality in the cause of science, as shown by the efforts being made to acquire Mr. Harrison's collection, is as gratifying as it is rare. Nearly 100*l.* have been raised so far, and there should be no difficulty in increasing this to the amount required. Subscriptions may be sent to the Town Clerk of Maidstone, or to the Harrison Collection Fund, Kentish Bank, Maidstone.

IN the U.S. *Weather Review* or March, Mr. R. de C. Ward describes an interesting formation of small cumulus clouds over a fire, observed by him at the Harvard College Observatory at Arequipa, Peru. Behind the western flank of Mount Charchani, and about fifteen miles away, a column of smoke was rising from a considerable fire of brushwood, at a probable height of about 14,000 feet above sea-level. While looking at the smoke he noticed the formation of a small cumulus cloud directly over it, and from 3000 to 4000 feet above it, the sky being almost clear and the wind nearly calm at the time. The cloud soon disappeared, and was succeeded by another, which again disappeared within five minutes. Eight distinct cloudlets were seen thus to form and dissolve within the space of half an hour, at the end of which time the smoke had disappeared. Although the smoke column was small, the conditions were evidently favourable for cloud formation. Cumulus clouds over fires were described by Espy in his Fourth Meteorological Report; another case was also noted by Mr. Ward in *Science* of January 8, 1897.

AN interesting installation of electric transmission of water power has, says *Engineering*, recently been completed by the utilisation of the River Etsch for the benefit of the towns of Bozen and Meran. The sources of the Etsch are at a great height above the Reschen lake, which is situated some 5200 feet above the level of the sea. At the place where the installation in question has been erected, the fall of the river is 630 feet over a distance of about a mile and a half. So far 6000 horse-power have been utilised, and a similar quantity can be made available at the second fall. The power will be used for electric light, at an extremely cheap rate for industrial purposes, probably electric railways, &c. The course into which the water is conveyed has a length of about 1000 feet; a tunnel has been made through the rocks of 1730 feet in length, and at the end of this is a reservoir, with a capacity of 1335 cubic metres. From here the power conduit, 12 feet in diameter, has been blasted almost vertically in the rock; it ends in a chamber, from whence two steel tubes, about 5 feet in diameter, lead to the turbines. The tubes are for a length of 110 feet inserted in the rock and laid in concrete. From each tube three outlets lead the water to turbines, which are after the Portial Girard system, and of 1000 horse-power each at 320 revolutions, the consumption of water being 1·4 cubic metre per second, with a utilised fall of about 230 feet. The dynamos are direct-coupled with the turbines, and generate currents of 10,000 and 3600 volts. The connection with Bozen has a length of twenty-two miles, and the one to Meran of three miles. They are overhead, supported by 33-feet high poles, and with a tension of respectively 10,000 and 3600 volts. On entering Meran the current is conveyed through two cables to the distributing station, from whence it, by means of underground high-tension network, is conveyed to the transformers and reduced to 115 volts. The same is the case at Bozen, where the current, however, first is reduced from 10,000 to 3600 volts.

THE formulæ relating to recurring series have long been studied, but there has always been a certain incompleteness about their synthetic treatment. This want is now to a certain extent supplied by a paper, communicated by Dr. Carlo Pietracola to the *Atti* of the Naples Academy, of which a brief abstract appears in their *Rendiconto*. Dr. Pietracola deals with the part of the theory regarding the formal relations

between the general terms of recurring series and the elements which define them. This subject he treats by a new method, involving a generalisation of the isobaric algorithm, and a number of interesting applications form a noteworthy feature of the paper.

A METHOD of determining simultaneously the electric and thermic conductivities of metals at different temperatures is described by Signor Paolo Straneo in the *Atti dei Lincei*, vii. 11. The principal object of the experiments was to ascertain how the thermic conductivity of a substance varied with the temperature. As regards the internal conductivity, the variations were found to be too small to be determinable to a sufficient degree of precision by existing methods. The coefficient of surface conductivity increases with the temperature, and the dispersivity not only increases with the absolute temperature, like the coefficient of specific heat, but is at least a quadratic function of the difference of temperature between the body and the surrounding air.

THE so-called chromatolysis, supposed by Cavara to exist normally in the nuclei of plants, is discussed in the *Atti dei Lincei* by Dr. B. Longo, who enunciates the following conclusions: (1) The phenonomen of chromatolysis does not exist in the normal vegetable nucleus; (2) the nucleoli consist of one unique substance, and not of a central one representing the nucleolus proper of Cavara, and a peripheric one representing the chromatin; (3) the nucleolus proper of Cavara is nothing but a vacuole; (4) the nucleoli are either perfectly homogeneous or vacuolate, but never alveolate; (5) in the present state of science we are ignorant of the true function of nucleoli.

PROF. G. MERCALLI has recently prepared an important memoir on the earthquakes of southern Calabria and the district around Messina (*Mem. della Soc. Ital. delle Scienze*, ser. iii. vol. xi.). The first part contains a catalogue of all the shocks felt in this region from 1169 to the present day. In the second, a special study is made of the more important seismic series, and especially of that which commenced on February 5, 1783. Of this series alone (1783-86), the author adds notices of about 500 shocks to the 1186 already chronicled by Vivenzio and Pignatari. The most interesting part is, perhaps, the third, which deals with the recent series of earthquakes beginning on November 16, 1894, the origin of which Prof. Mercalli traces to two centres, one in the sea of Palmi, the other beneath the western slope of Aspromonte, between S. Cristina and Delianova. Among the general conclusions formulated are the following:—The Calabro-Messinese earthquakes, as a rule, occur in long series. The great destruction caused by those of 1783 was due not only to the violence of the shocks, but especially to their long duration (two minutes and more), and to the nature of the surface rock-formations. All the great earthquakes of the district are independent of the volcanic foci of Etna and the Aeolian islands, there being about eighteen different seismic centres. With regard to the causes of the earthquakes, the author considers tectonic dislocations insufficient, and would prefer either masses of water passing instantaneously into the state of vapour, laccolitic or plutonic displacements and injections, or subterranean rock-falls. On account of their position and supposed origin, he proposes to apply the term *inter-volcanic* to the Calabro-Messinese earthquakes.

THE Report of Mr. J. C. Willis, director of the Royal Botanic Gardens, Ceylon, on the condition of the Gardens, and the work accomplished during 1897, records a number of interesting points. The appointment of Mr. E. Ernest Green as Honorary Government Entomologist is noteworthy. As to the work of the Gardens, a fair amount of ground was laid out during the year in experimental plots of economic plants, chiefly at Peradeniya. An attempt was made to bring the department more into touch with the public by issuing periodical circulars dealing with horticultural, agricultural, and botanical subjects. Each circular deals with one subject only. Three were published during the latte half of 1897, one being introductory, the others dealing with the cacao disease. Copies are sent free to all Government officers, to planters' associations and similar bodies, and to botanic gardens and similar institutions abroad. Much attention was given during the year to the cacao canker. During the early part of the year an extended investigation of the diseased areas was made, and the disease was found to be common in nearly all parts of the Central and Uva Provinces. The disease was found to be due to the attack of a fungus, whose exact nature is at present unknown, but which almost certainly belongs to the class of fungi which cause the various cankers of stems and roots. The interest taken in the cultivation of Para rubber received a very great impetus during the year, and the demand for seed was enormously larger than the supply. The total crop of seeds from mature trees in the Gardens was rather over 100,000 seeds, of which 88,500 were sold to planters in Ceylon. The cultivation of camphor trees is also full of promise. It is reported that camphor plants continue to grow well at Hakgala, some of them being nine feet high. Of the plants distributed in 1895, some of those in Galle District have grown to a height of twelve feet. In the laboratory attached to the museum, researches were carried on during 1897 by several European investigators. The work of the Gardens has thus been for the advancement of pure as well as economic botany.

A LARGE amount of work is being done in the various American botanical laboratories on the embryology of flowering plants, and interesting results have in several cases been obtained. Among the more recent contributions are one on the Pontederiaceæ (*Pontederia* and *Eichchornia*), by Wilson R. Smith; the results being very similar to those with other Monocotyledons of a low type, such as *Naias* and *Zannichellia*; and one on *Euphorbic corollata*, by Florence May Lyon. The embryo of this plant is characterised by the extremely long synergids, and the very temporary character of the antipodals. The work was in both instances done in the Hull Botanical Laboratory. We have also received Part i. of the second series of the Minnesota Botanical Studies; and three publications from the U.S. Department of Agriculture: a Preliminary Report of the Soils of Florida, by Milton Whitney; and Nutrition Investigations at the University of Tennessee and in Pittsburg respectively, by Dr. Charles E. Wait and Prof. Isabel Bevier.

THE special correspondent of the *Lancet* in Calcutta writes: "A very diplomatic compromise between what ought to be done and the wishes and prejudices of the natives has been effected in Calcutta by the establishment of licensed family hospitals for plague cases. The sanitary measures hitherto adopted elsewhere are not adapted to the Indian people, and consequently the regulations about plague have been evaded in every possible way. The establishment of this system, therefore, has gained the confidence of the people. Besides the public hospitals and the ward hospitals there are numerous private hospitals, so that all the communities are now well provided for. In addition to this, houses possessing anything like suitable accommodation for the isolation of a case of plague are allowed to have one or more rooms set apart for the purpose. By these concessions every case of plague ought to come under observation. The plague scare has greatly subsided, and inoculation is coming slowly into favour among all classes."

THE current number of the *Journal* of the Society of Arts contains the first of Dr. D. Morris's Cantor lectures on "Sources of Commercial India-rubber."

WE learn from the *Kew Bulletin* that a Flora of Simla and the surrounding district is being prepared by Sir Henry Collett, and is expected to comprise about 1500 species of flowering plants. The illustrations are contributed by Miss Smith.

JUDGING from the Report for 1896-97, which has just reached us, the Felsted School Scientific Society is doing good work by creating an interest in science among the members of the rising generation. During the session under review a number of interesting papers and lectures were delivered, among the number being a lecture by Mr. George Murray, F.R.S, on "A Journey to the Tropics," and a paper by Mr. C. Hose, Resident of Baram, Sarawak, entitled "A Visit to Celebes."

SURGEON-GENERAL STERNBERG, of the U.S. Army, contributes an article on "The Sanitary Regeneration of Havana" to the August number of the *Century Magazine*, which should be read by all who take an interest in sanitary matters. The writer of the article considers it practicable to put the city of Havana in such a sanitary condition that it would be exempt from its ever-recurring scourge of yellow fever, but that the undertaking would be of considerable magnitude, involve the expenditure of large sums of money, and require much time for its accomplishment.

THE additions to the Zoological Society's Gardens during the past week include a Pig-tailed Monkey (*Macacus nemestrius*, ♀) from Java, presented by Mr. C. R. Johnson; two Squirrel Monkeys (*Chrysothrix sciurea*) from Guiana, presented by Mr. C. E. Günther; a Common Rat Kangaroo (*Potorous tridactylus*, ♂) from Australia, presented by Major Fleming; a White-crested Jay Thrush (*Garrulax leucolophus*), a White-throated Jay Thrush (*Garrulax albogularis*) from India, presented by Mr. Henry Fulljames; a Rook (*Corvus frugilegus*), British, presented by Mr. Mack; a Leopard Tortoise (*Testudo pardalis*), a Bell's Cinixys (*Cinixys belliana*), a Home's Cinixys (*Cinixys homeana*) from Kavitando, near Victoria Nyanza, presented by Captain E. M. Woodward; a Common Chamæleon (*Chamæleon vulgaris*) from North Africa, presented by Mr. W. Cooper; a Humboldt's Saki (*Pithecia monachus*) from the Amazons; a Vinaceous Amazon (*Chrysotis vinacea*) from Brazil, an Orange-winged Amazon (*Chrysotis amazonica*) from South America, a Festive Amazon (*Chrysotis festiva*) from Guiana; five Gazelles (*Gazella dorcas*) from North Africa, two Magpies (*Pica caudata*), British, deposited; four Cambayan Turtle Doves (*Turtur senegalensis*), a Spotted Pigeon (*Columba maculosa*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

AUGUST METEORS.—In consequence of the brightness of the moon during the earlier portion of this month, only the more brilliant members of the Perseid swarm of meteors are likely to be observed. These meteors originate, as their name indicates, from a point situated in the constellation of Perseus near the star η, which lies in the north-eastern part of the heavens, and is rather low down during the earlier portion of the evening. As the maximum is usually attained on the 10th of the month, the moon should not prove such a disturbing factor; and if the night be fine, observers should make a point of recording their observations in a manner which has been described by Mr. Denning. It is only in this way that observations can be properly discussed and made to serve a useful end. Mr. Denning has recently (*Knowledge*, August 1) published an ephemeris of the position of the radiant point, and below we give an abstract which may prove useful for the present return.

August.	R.A.	Decln.	August.	R.A.	Decln.
4	38	+56	10	45	+57
5	39	56	11	46	57
6	40	56	12	47	57
7	41	57	13	49	58
8	42	57	14	50	58
9	44	+57	15	51	+58

We may mention again that the maximum occurs on the night of the 10th.

WOLF'S COMET.—This comet is gradually decreasing its northern declination, but is increasing slowly in brightness. Its ephemeris for the present week is as follows (*Astr. Nach.*, 3506):—

12*h*. *Berlin M.T.*

1898.	R.A. h. m. s.	Decl. ° ′	Br.
August 4 ...	4 37 7 ..	+17 45 ...	2·4
5 ...	39 48 ...	36·8	
6 ...	42 28 ...	27·7 ...	2·4
7 ...	45 7 ...	18·3	
8 ...	47 46 ...	8·7 ...	2·4
9 ...	50 23 ...	16 58 8	
10 ...	52 59 ...	48·8 ...	2·4
11 ..	55 34 ...	38·4	
12 ...	4 58 8 ...	+16 27·9 ...	2·4

Between the above dates, the sun's apparent right ascension at apparent noon lies between 8h. 58m. and 9h. 29m. G.M.T.

THE VARIABLE *o* CETI.—This variable star has always afforded plenty of interest to the observer, and according to the most recent observations much attention must still be paid until we are able to understand all the intricacies which are connected with it In the current number of the *Astr. Nachr.* (3506) Herr W. Stratonoff gives a short account of his observations, which extend over the years 1896–98 ending January 24, and these show that there are peculiarities which need further study. According to these observations the maximum (3·60 mag.) in 1897 occurred about January 5, which indicated that the time of computed maximum was about sixty-three days too early. The following maximum in 1897 took place on about November 23, the magnitude of the star amounting to less than on the former occasion, namely 3·06. This maximum occurred fourteen days later than the calculated time. The interval between the two amounts to 322 days, which is smaller by nine days than what is generally computed to this star. Herr Stratonoff further points out that after the chief maximum a secondary maximum occurs, twenty-seven days later; this is very interesting, as such a maximum takes place in the well-known variable η Aquilæ. Herr Stratonoff's observations were all made with the naked eye, with the exception of those included in October 22–25, when he used an opera-glass. He attempted, by photographic means, to determine the variations of the star by making equal exposures on different nights, and examining the diameters of the images formed; but he ultimately found that the method was not so accurate as the one, namely Argelander's, that he had employed.

In the same number of the *Astr. Nachr.* Dr. A. A. Nijland communicates a short paper on the same variable, and shows that, according to his observations, the maximum in 1897 occurred sharply on November 26. This determination may be perhaps considered more accurate than that of Herr Stratonoff, whose observations at the time of maximum were less numerous than those of Dr. Nijland. Even in this case the computed time was far too early, amounting to fifty-seven days. In Dr. Nijland's curve the secondary maximum of Herr Stratonoff is also indicated, although the former observer draws his curve through the mean of the observed points, looking upon the variation of intensity as within errors of observation. Assuming that the maximum fell according to Chandler, on January 11, 1897, then the last observed period amounts to about 319 days, which does not differ very much from that found by Herr Stratonoff, as mentioned above. The light curves reproduced in both the papers referred to are well worth perusal, and will perhaps lead other observers to follow the fluctuations of this interesting variable.

THE RED SPOT ON JUPITER, AND ITS SUSPECTED IDENTITY WITH PREVIOUS MARKINGS.

THE outlines of the red spot are still faintly distinguishable on a night of good definition. With a 10-inch reflector and power of 312, I have obtained the following estimated transits :—

Date 1898	Spot on central meridian h. m.	Longitude
March 22 ...	10 43 ...	23·6
April 15 ...	10 26 ...	22·6
,, 17 ...	12 6 ...	23·6
,, 18 ...	8 0 ...	25·2
,, 22 ...	11 16 ...	24·9
May 14 ...	9 25 ...	24·1
June 7 ...	9 20 ..	25·9

At the present time the spot follows the zero meridian (System II.) of Mr. Crommelin's ephemerides in *Monthly Notices* by 26 degrees, which is equivalent to 43 minutes.

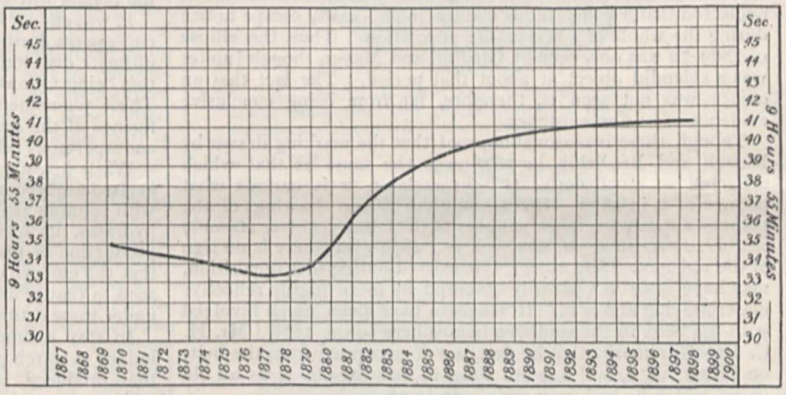
During recent observations the spot has not appeared to be quite centrally placed within the concavity in the great southern belt. Its position is slightly on the following side.

Now that this singular marking has been watched for a period of twenty years, the time may be opportune for referring to the question whether it can be physically identified with the large spot seen at intervals by Cassini, Hooke and Maraldi about two centuries ago, and with more modern observations of somewhat similar formations by Key in June 1843, by Dawes in 1857, by Lassell and Huggins in 1858 and 1859, by Gledhill and Mayer in 1869, 1870 and 1871, by Rosse and Copeland in 1873, and by Russell and Bredichin in 1876. In some instances the features alluded to exhibited a very suggestive resemblance to the red spot, and were, moreover, situated in, or nearly in, the same latitude.

This question of identity, when the details come to be considered, presents so many difficulties that, though the affirmative view has much in its support, it scarcely admits of definitive settlement in respect to the more ancient observations. For our knowledge of the older spots we have to depend upon drawings of the planet; and it is notorious that delineations by different observers are rarely consistent as to the form of an object, or accurate as to its position on the disc. Before the apparition of the red spot in 1878, the great utility of taking the times when the markings passed the central meridian of Jupiter had not been sufficiently recognised, and such observations had been rarely attempted.

Apart from the approximate character of former materials, the extremely variable motion of the Jovian features presents a serious impediment when we attempt to demonstrate the absolute identity of any of them. Were the observed velocities equable, and the spots permanent markings on the real surface, like those discerned on Mars, the matter would be simplified, and we should possess a well-assured base for investigation. It would be easy to determine whether a modern spot occupied the same longitude as one of its prototypes visible at a distant period. Thus, the Kaiser Sea, as we see it to-day on Mars, can be unmistakably identified as one of the principal lineaments drawn by Huygens in 1659 and subsequent years. But the visible markings on Jupiter appear to be quite of another character. They are atmospheric details which display vagaries inducing great changes of appearance and displacements in longitude, so that we can only speak with confidence of individual markings which have been retained continually under telescopic scrutiny. It is true that a break of a few months in such observations need not, in particular cases, be fatal to the identification of markings. There must necessarily occur such breaks during the interval when Jupiter is near conjunction with the sun; but notwithstanding this, there has been no difficulty whatever in recognising the red spot at every reappearance of the planet since 1878. When, however, there occur breaks of two or three years in observations of a supposed identical feature, doubts are at once introduced by the lack of connecting links to bridge over the intervals. This is the case affecting the various features which are suspected to have been early representations of the modern red spot; there are many links wanting in the chain of evidence necessary to prove their identity.

I have been carefully comparing the various observations of apparently analogous markings in the southern hemisphere of Jupiter since 1857, with the view of associating them if possible and discovering what rates and changes of motion influenced them. The result of the examination has tended to strengthen the idea that Gledhill's ellipse of 1869–70, Lord Rosse's and Dr. Copeland's red spot of 1873, and Russell's and Bredichin's oval spot of 1876 were really one and the same object. I believe that all these observations are to be satisfactorily accounted for on the theory of identity. Certainly there are some small differences due to the approximate character of the materials available for discussion. The times of passage of the objects across the central meridian have in most cases to be estimated from their positions as drawn either west or east of it. But it must happen that, in getting transits from such rough data, our resulting values will be sometimes erroneous to the extent of 15 or 20 minutes, and occasionally perhaps it will amount to 30 minutes. Even the latter quantity is not, however, always a very serious item, for when the rotation of a spot has to be derived from, say, observations extending over two years, it only introduces an error of 1 second in the resulting period.



There is little doubt that the red spot before its remarkable intensification of colour, and prior to freeing itself from the obscuring material which apparently veiled it in 1877, had been increasing its velocity of rotation. We know that after 1878 it gradually slackened. When Gledhill first observed the spot in the autumn of 1869, its period of rotation appears to have been about 9h. 55m. 35s. Slightly increasing in velocity, the rate up to the close of 1872, when Lord Rosse and Dr. Copeland redetected the spot by means of the six-foot reflector, was 9h. 55m. 34·5s. It had been seen in the interim by several others. Mr. Gledhill saw the ellipse resting on, and actually in contact with, the great southern equatorial belt on December 1, 1871, and on January 5, 6 and 11–12 it was seen by Messrs. E. B. Knobel, H. Pratt and J. Birmingham respectively (*Astronomical Register*, January and February 1872, and *English Mechanic*, September 13, 1872). Several others, including Dr. F. Terby, appear to have recognised it at about this period. During the interval from Rosse and Copeland's observations in the winter and spring of 1873, to Russell and Bredichin's in the summer of 1876, the mean period of the spot was 9h. 55m. 34s., and between June 1876 and Dennett's observation of July 27, 1878, it had further decreased to about 9h. 55m. 33·5s. Subsequently to this the motion of the spot has slackened until, now, twenty years after Dennett's observation, its period is 9h. 55m. 41·5s., or 9 seconds more. The variation of motion since 1869 can perhaps be graphically represented by a diagram.

The slackening of its motion is still evident, but it is very slight as compared with that which took place in the years from 1879 to 1884.

Taking the whole period from Gledhill's first observation on November 14, 1869, when the spot was central at about 10h. 50m., to one obtained at Bristol on June 7 last, at 9h. 20m., we shall find the interval covered 10,431 days 22 hours and 30 minutes, and that 25,218 rotations were performed with a mean period of 9h. 55m. 37·7s.

In addition to the variation exhibited in the diagram, there have been some minor changes in the motion of the spot. These could, however, only be satisfactorily worked out from the most accurate observations and by determining the rotation periods for short intervals.

As to the question whether the red spot is identical with markings seen in 1857, 1858 and 1859, the matter is open to doubt, for there seems to be a great lack of corroborative observations between 1860 and 1869. The objects delineated by several skilled observers about forty years ago were somewhat similar in position and form to the red spot of recent years, and afford strong presumptive evidence of identity. We have had the spot continuously before us for twenty years, and there can be no doubt that its existence can be traced back to 1869. We ought to be able to go back another ten years and affiliate it with the elliptical markings which were drawn by Dawes, Huggins and others in the region immediately south of the great equatorial belt in 1857, 1858 and 1859, but there is an absence of suitable observations along the interval, and though it is easy to infer that the various objects were identical the fact cannot be demonstrated.

Had observations been more numerous, we should perhaps be able to put our hands on a complete series of records of the red spot extending back for a very long period. It must be remembered that some years ago the planet was so much neglected that a conspicuous feature might easily escape notice during the whole of a favourable apparition. Thus the ellipse of 1869–70 was only seen by Gledhill and Mayer, though Jupiter was a splendid object at about that period. The fact that an object was not seen is, therefore, far from being conclusive evidence of its non-existence.

Though there is reasonable proof that the marking drawn by Russell and Bredichin in 1876 was the same as that which attracted so much notice two years later, it is curious what became of it in 1877. Bredichin gives fifteen drawings of the planet's appearance in the summer of the latter year (see *Annales de l'Observatoire de Moscou*, vol. iv., 1878), but there is no sign of the red spot. The object, if it existed during that opposition, may have been temporarily obscured by more highly reflective material lying above it. It seems to have been much involved with the belts in the southern hemisphere before 1878. Mr. H. C. Russell remarks that he first saw it separated from the belts on July 8, 1878, and was not long in recognising it as an old friend which he had frequently seen in 1876.

Many of the markings on Jupiter are probably formed by materials evolved from the actual surface of the planet, which afterwards become floating masses in the outer region of the atmosphere. Their longitudes do not probably long coincide with that of the original seat of disturbance, for they will fail to keep pace with the exceedingly rapid motion of the sphere, and must exhibit a retardation similar to that so well pronounced in the case of the red spot. The latter has proved itself a very special object with a durableness which does not seem to have characterised other markings. There were "new red spots" in 1886 and 1891, but they did not last long. The majority of the Jovian markings appear to be somewhat transient and irregular in their apparitions, and certain zones of the planet would seem favourable to the production of markings having an individuality of aspect.

The true rotation period of the actual sphere of Jupiter still awaits accurate determination. An occasion might, however, present itself for this element to receive satisfactory investigation. If the spots are really due to eruptions from the planet, and if these should be sustained over periods sufficiently long for the purpose intended, then a string of spots might be formed along a zone, and the time taken to complete the circumference might give data for ascertaining the true rotation period if the retardation of the markings on arriving in the outer atmosphere were allowed for. Thus, in 1880–81 I watched the formation of a complete girdle of spots in about ninety days; and had the distension taken place always on the preceding side, the materials would have been obtained for finding the correct period, for the observed rotation of the spots was 9h. 48m. But the objects appeared to extend themselves both east and west, though the spreading out on the following side may have been due to an increase in the slackening motion, rather than to the formation of new spots. Phenomena of this character obviously offer important features for discussion. Whenever an outbreak of spots takes place, it becomes necessary to learn the direction and rate of its longitudinal distension; for such inquiries may usefully increase our knowledge of the physical condition of Jupiter, and supply us with a more precise value for the rotation period. Our previous acquaintance with this element depends upon atmospheric phenomena, and must be to some extent in error, for the markings display proper motions differing among themselves to the extent of nearly eight minutes, and in nearly every case the rate of velocity appears to vary in an irregular manner but generally lengthening with the time

W. F. DENNING.

THE GERMINATION OF HORDEUM VULGARE.[1]

THE work described in this paper is a continuation of a previous research by Mr. Horace T. Brown and Dr. G. H. Morris published in 1890 (*Jour. Chem. Soc.*, vol. lvii. p. 458), dealing with the respective influences of embryo and endosperm in the alteration of the reserve-starch and cellulose for the requirements of the young plant during germination of seeds of the *Gramineæ*. The seeds of various species were examined, but the main results were obtained with *Hordeum vulgare*; the observations made in this later work are also almost entirely confined to this species, and there can be but little doubt that the results will be found applicable to the *Gramineæ* generally.

It was shown in the earlier paper that the first changes in the endosperm during incipient germination are disintegration and ultimate dissolution of the membranes of the amyliferous cells, this being followed by erosion of the contained starch-granules. These phenomena suggested that the action is due to the influence of the embryo, and not to any autonomous action of the endospermous cells themselves.

While investigating this point, it was found that a carefully excised embryo can exist independently of the seed, if supplied with suitable artificial nutriment in the form of certain carbohydrates, its own proteids yielding sufficient nitrogen for the production of plantlets of considerable size. It was also found that the embryo can be transferred from the endosperm of one seed to that of another, and that healthy plantlets are produced under these artificial conditions.

In this manner it was shown that an excised embryo can induce in starch-granules an action alike in kind and degree to that produced by an embryo growing *in situ* on its natural endosperm, as in normal germination. It was found that the columnar epithele of the scutellum can secrete a very active amylohydrolytic enzyme, and project this into the endosperm or any artificial nutriment in intimate contact with itself. This embryonic activity was, however, recognised not to exclude the possibility that the endospermous cells might participate in the dissolution of their own reserve-materials. To ascertain how far such co-operation might exist, degermed seeds were studied when placed in conditions allowing rapid removal of any products of change. The same end was also obtained by grafting a living embryo from one grain on to the endosperm of another, that had been so treated, so as to destroy presumably all potential vitality of the endospermous cells. Since living embryos induced in these supposititiously dead endosperms all normal changes of depletion, and since no autonomonous changes were observed in the degermed endosperms not attributable at that time to adventitious micro-organisms, the idea of residual vitality in the endosperm as a condition of its depletion seemed superfluous.

Since 1890, Grüss, Hansteen, and others, have confirmed the conclusions formed in 1890, that the embryo can secrete enzymes, but Pfeffer, Hansteen, Grüss, and Puriewitsch have strongly contested the view that the endosperm has no autonomous power of self-depletion. These latter observers state that the amyliferous cells of the endosperm have distinct power of digesting their own reserves, this function being quite independent of any induced action of the embryo, and due to residual vitality.

The present work is the result of a re-examination of the

[1] "On the Depletion of the Endosperm of *Hordeum vulgare* during Germination." By Horace T. Brown, F.R.S., and F. Escombe. (Read before the Royal Society on March 3.)

mutual dependence of embryo and endosperm in *Hordeum vulgare*. In it the proportionate shares taken in the endospermous depletion are evaluated for (1) the embryo, (2) the amyliferous part of the endosperm, (3) the so-called "aleurone-layer" (*Kleberschicht*). The possibility of some of the changes being due to enzymes pre-existent in the seeds is considered, as also of any action being due to micro-organisms in experiments with degermed endosperms. The conclusions are drawn from results given by very many experiments in widely-varied conditions.

Great difficulty was found in the just appreciation of the effects of micro-organisms, for, although their influence on intact seeds is minimal, yet their action on the endosperm bared through degermation produces changes in the cells hardly distinguishable from such as would be induced by the cells themselves, on the assumption that they had living contents.

No antiseptic reagent could be found with such differential action as to inhibit, or materially retard, the growth of micro-organisms, while not hindering normal development of the seedling. But extreme refinements for avoiding air-sown organisms are useless, since complete initial sterilisation of the exterior of the grain cannot be ensured. Differentiation of autonomous action of the tissues from that of extraneous organisms was much aided through study of the action of similar organisms on undoubtedly dead tissue.

To ascertain the self-depletive power of endosperms from which the embryo had been removed, a method was adopted almost identical with that described in the paper of 1890 (*loc. cit.*). The endosperms were placed with their proximal ends downward in small holes in a very thin mica-raft, which was then floated on water so as to just submerge the endospermous surfaces laid bare through degermation, every facility being thus given for outward diffusion of products of change. This method is preferable to Hansteen's plan of affixing the grains to plaster-columns standing in water. In these conditions slow changes undoubtedly occur in the degermed seeds, these being due neither to influence of micro-organisms, nor to enzymes pre-existent in the grains. The changes are very much slower than those of normal germination, but are of the same order, and are undoubtedly due to autonomous action of some part of the endosperm.

There is firstly a tendency for the "aleurone-layer" to separate from the underlying amyliferous cells through cytohydrolysis of the membranes of the latter. This action commences on the dorsal side of the grain near the apex of the scutellum, extends gradually in well-defined directions, and invades slowly the more deeply-seated parts of the endosperm, producing a partially-mealy consistence of the cell-contents. This cytohydrolysis is followed after some days by a more or less partial erosion of the starch-granules underlying immediately the "aleurone-cells." This erosion is, however, very different from that effected by the embryo through the enzyme secreted by its columnar epithele. The difference between these two modes of erosion is clearly shown in the accompanying prints.

These changes in the degermed seeds are without doubt self-induced, since it is impossible to produce them in endosperms that have been demonstrably killed through submersion in chloroform-water for twenty-four hours. It is also certain that the action is initiated by the "aleurone-layer," and not by any autonomous action of the amyliferous cells, since no such changes can be induced in this portion after deprivation of its "aleurone-layer."

Although the statement made in 1890 that the amyliferous cells possess no self-depletive power, is true, the one affirming that the endosperm as a whole is passive during germination requires correction, since the "aleurone-layer" shares with the embryo in preparing the reserve materials for the seedling.

As an active agent in *amylohydrolysis*, the "aleurone-layer" seems to play a subordinate part to the embryo; its principal function appears to be *cytohydrolytic*. Certainly an embryo grafted on an endosperm, the "aleurone-layer" of which has been killed, cannot induce an action comparable in intensity with that produced through joint action of a living embryo and a living "aleurone-layer." This is not due to deficiency in amylohydrolytic power of the embryo, but to the fact that the embryo has relatively small cytohydrolytic power, so that the action of its diastase, owing to the low diffusibility of the latter, is not effective as long as the membranes of the amyliferous cells are undestroyed.

The view put forward in 1890, that the *whole* endosperm is passive during germination, was mainly founded on experiments in which living embryos had been "grafted" on endosperms previously soaked for several months in strong alcohol, a treatment then believed to ensure complete loss of potential vitality of the "aleurone-layer." Such treatment is now known to be insufficient to destroy with certainty even the potential life of the embryo, for barley-seeds have been germinated that had been continuously soaked in strong alcohol for many weeks, and there is reason to believe that the "aleurone-layer" is even more resistant to adverse conditions than the embryo.

The conclusion that the amyliferous cells are incapable of initiating any changes in themselves as deduced from physiological experiments, is strongly supported by cytological observations. A method is described in the paper by which

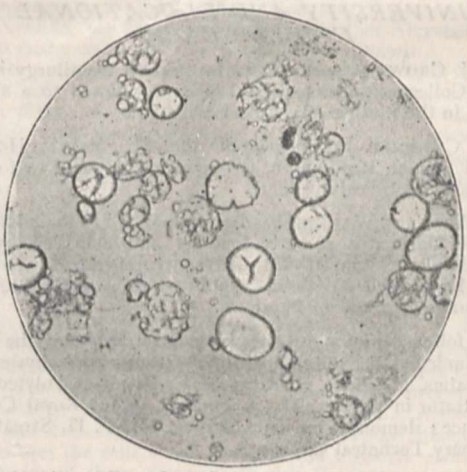


FIG. 1.—Sub-scutellar erosion of starch produced by the embryo. Here the action commences with general *pitting* of the granule. These pits enlarge, and thus break up the granule.

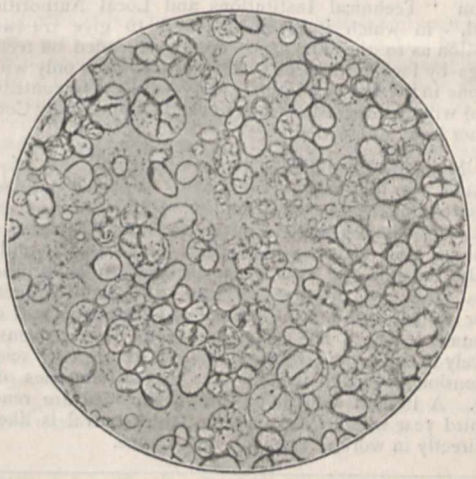


FIG. 2.—"Sub-aleuronic" erosion. Here no preliminary pits are formed, but large *rifts* are produced, and the granule undergoes concentric or irregular dissolution.

these cells can be cleared of their closely-packed starch granules, so that the nuclei can be readily discerned. During development of the amyliferous cells of the endosperm their nuclei become extremely deformed, owing to the increasing pressure of the starch-granules, and are very often disintegrated. It is difficult to believe that cells in this condition can functionate, even if there were no confirmatory evidence such as is afforded by the physiological experiments described.

It is very probable that the "aleurone-layer" possesses a function additional to that exercised during germination, but which can hardly fail to be very important. Its cells, which undoubtedly contain living elements, constitute the outermost peripheral layer of an otherwise *dead* endosperm, and this would

be much more liable to attack by any micro-organisms of the soil which succeeded in penetrating the seed-envelopes, if the protective sheath of living cells were not present. It is remarkable that the "aleurone-layer" is much more fully developed over those parts of the seed that may be regarded as dead, becoming very much more attenuated where in proximity to the embryo, the cells of which owing to their vitality do not require an equal amount of protection.

The authors express, finally, their great thanks to Mr. W. T. Thiselton-Dyer and to Dr. D. H. Scott for the opportunities afforded them in the prosecution of this research at the Jodrell Laboratory, Kew.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. J. CROWTHER, at present lecturer in metallurgy in the Owens College, Manchester, has been appointed to a similar position in the Swansea Technical School.

DR. CHEADLE has presented the St. Mary's Hospital Medical School, Paddington, with the sum of 500*l.*, to found a gold medal in clinical medicine.

DR. WALLACE WALKER has been appointed to the additional chair of Chemistry recently founded and endowed by Mr. W. C. McDonald in M'Gill University, Montreal; and Mr. Ernest Rutherford has been appointed to succeed Prof. H. Callendar in the chair of Physics.

THE following appointments have been made at the West Ham Municipal Technical Institute:—Lecturer in physics and mathematics, Mr. S. G. Starling, of the Battersea Polytechnic; demonstrator in physics, Mr. J. Tomkin, of the Royal College of Science; demonstrator in chemistry, Mr. F. H. Streatfeild, of Finsbury Technical College.

THE *Record of Technical and Secondary Education* for July contains illustrated accounts of the Royal Technical Institute, Salford, and the Leith School of Navigation, and an important article on "Technical Institutions and Local Authorities in England," in which it is endeavoured to give trustworthy information as to the amount of money expended on technical buildings by local authorities. The article deals only with the work done in the county boroughs, but a subsequent contribution will deal with the operations in connection with County Councils and other local authorities.

HER Majesty's Commissioners for the Exhibition of 1851 have made the following appointments to Science Research Scholarships, for the year 1898, on the recommendation of the authorities of the respective Universities and Colleges. The scholarships are of the value of 150*l.* a year, and are ordinarily tenable for two years (subject to a satisfactory report at the end of the first year) in any University at home or abroad, or in some other institution approved of by the Commissioners. The scholars are to devote themselves exclusively to study and research in some branch of science, the extension of which is important to the industries of the country. A limited number of the scholarships are renewed for a third year where it appears that the renewal is likely to result directly in work of scientific importance.

	Nominating institution.	Scholar
1	University of Glasgow	James Francis Bottomley
2	University of Aberdeen	Alexander Findlay
3	Mason University College, Birmingham	A. H. Reginald Buller
4	Yorkshire College, Leeds	Harry Thornton Calvert
5	University College, Liverpool	Ernest Brown
6	University College, London	Louis Napoleon George Filon
7	Owens College, Manchester	James Henry Smith
8	Durham College of Science, Newcastle-upon-Tyne	Arthur William Ashton
9	University College, Nottingham	Austin Henry Peake
10	Royal College of Science for Ireland	Robert L. Wills
11	Queen's College, Galway	Hugh Ryan
12	University of Toronto	William Gabb Smeaton
13	Dalhousie University, Halifax, Nova Scotia	Ebenezer Henry Archibald

The following scholarships, granted in 1897, have been continued for a second year on receipt of a satisfactory report of work done during the first year:—

	Nominating institution	Scholar	Places of study
1	University of Edinburgh	Longfield Smith	University of Leipzig; to proceed to University of Heidelberg
2	University of Glasgow	James Muir	Engineering Laboratory, University of Cambridge
3	University of St. Andrews	Harry McDonald Kyle	Gatty Marine Laboratory, St. Andrews, and Laboratoire Arago, Banyuls-sur-mer; to proceed to Marine Laboratory, Heligoland
4	University College, Dundee	Sydney A. Kay	Högskola, Stockholm; to proceed to University of Leipzig
5	Mason College, Birmingham	Gilbert Arden Shakespear	Cavendish Laboratory, University of Cambridge
6	University College, Bristol	Chas. Henry G. Sprankling	Owens College
7	Yorkshire College, Leeds	Harold Albert Wilson	Cavendish Laboratory, University of Cambridge
8	University College, Liverpool	Wm. Augustus Caspari	University of Jena; to proceed to University of Leipzig
9	University College, London	Percy Williams	École de Pharmacie, Paris; to proceed to Prof. Van 't Hoff's Laboratory, Wilmersdorf, Berlin
10	Owens College, Manchester	J. H. Grindley	Owens College (*permitted under special circumstances*)
11	Durham College of Science, Newcastle-upon-Tyne	Robert Railton Hallaway	Universities of Bonn and Heidelberg
12	University College of South Wales and Monmouthshire, Cardiff	Maria Dawson	Botanical Laboratories, University of Cambridge
13	Queen's College, Belfast	W. A. Osborne	University of Tübingen
14	McGill University, Montreal	Jas. Lester Willis Gill	First year, McGill College (*by special permission*); second year, Harvard University
15	Queen's University, Kingston, Ontario	Frederick J. Pope	Columbia University, New York
16	University of Sydney	Tom Percival Strickland	MacDonald Engineering Laboratories, McGill University
17	University of Melbourne	W. Rosenhain	Engineering Laboratory, University of Cambridge

NOTE.—The Report of the Scholar from University College, Nottingham, is not yet due.

The following scholarships, granted in 1896, have been exceptionally renewed for a third year:—

	Nominating institution	Scholar	Places of study
1	Mason College, Birmingham	Thomas Slater Price	University of Leipzig; to proceed to University of Stockholm
2	Yorkshire College, Leeds	Harry Medforth Dawson	Laboratory of Prof. Van 't Hoff, Wilmersdorf, Berlin
3	University College, London	Joseph Ernest Petavel	Davy-Faraday Laboratory
4	University College, Nottingham	George Blackford Bryan	Cavendish Laboratory, Cambridge
5	Dalhousie University, Halifax, Nova Scotia	Douglas McIntosh	Cornell University; to proceed to University of Leipzig

THE Holt Fellowships in Physiology and Pathology established in connection with University College, Liverpool, by the late Mr. George Holt in 1886 for a period of ten years, and renewed for a further period by Mrs. and Miss Holt, have been awarded to the following gentlemen respectively: Mr. A. Hope Simpson, provisionally upon his attaining full qualifications within a period of three months, and Mr. K. Nelson. The Robert Gee Fellowship in Anatomy, of the value of 100*l.*, has been awarded to Mr. F. Lovegrove.

SCIENTIFIC SERIALS.

American Journal of Science, July.—The origin and significance of spines; a study in evolution, by C. E. Beecher. The importance of spines lies not in what they are, but in what they represent. They are simply prickles, thorns, spines or horns. They represent a stage of evolution, a degree of differentiation in the organism, a ratio of its adaptability to its environment, a result of selective forces, and a measure of vital power. Tracing the various groups of forms through their geological development, it is noticed that each group began its history in small, smooth, or unornamented species. As these developed, the spinose forms became more abundant until after the culmination of the group is reached, when this type either became extinct or was continued in smaller or less specialised forms.—Electrical discharge from the point of view of the kinetic theory of matter, by J. E. Moore. When gaseous matter moves in a stream in any definite direction, the pressure of the gas in that direction is increased by an amount proportional to the square of the velocity of translation The author proves experimentally that the pressure in the direction of discharge is greater than in either of the directions at right angles, by an amount depending upon the velocity of the discharge stream.—Further separations of aluminium by hydrochloric acid, by F. S. Havens. Describes the separation of aluminium from zinc by the action of hydrochloric acid gas in aqueous ethereal solution. Also the separation of the same metal from copper, mercury and bismuth.—On the origin of the corundum associated with the peridotites in North Carolina, by J. H. Pratt. The corundum was held in solution by the molten mass of the dunite when it was introduced into the rock, and separated out among the first minerals when the mass began to cool.—The winter condition of the reserve food substances in the stems of certain deciduous trees, by E. M. Wilcox. Material of the *Liriodendron* collected in October was found to have an abundance of starch in the cells of the cortex, but none in the cells of the medullary sheath, and but few grains in the cells of the wood parenchyma and medullary rays. The cells immediately below the growing point of the stem contained no starch at this time. November and December showed a gradual increase in the amount of the starch in the medullary sheath, but a marked decrease in the amount present in the cortex. At the end of February starch began to appear again in the cortex, but more especially in the cells beneath the growing point.

Annalen der Physik und Chemie, No. 6.—The spectra of iodine, by H. Konen. The author investigates all the different spectra of iodine obtainable by the use of arcs, vacuum tubes, heated vessels, sparks, and fluorescence. He uses the photographic method and an excellent concave grating, and succeeds in cataloguing some 360 lines, extending from 3030 to 5800.—The Leidenfrost drop, by J. Stark. By inserting a drop in the spheroidal state, the hot metallic plate, and a telephone in an electric circuit, the author shows that the drop performs oscillations with respect to the layer of vapour which prevents its evaporation. In the final stages the plate is intermittently wetted. The oscillations are due to differences of surface tension between the hot and cold portions of the drop.—The electromotive behaviour of chromium, by W. Hittorf. Chromium has a different electric behaviour, accordingly as it is in the state to form the monoxide, the sesquioxide, or the peroxide. At ordinary temperatures, and in solutions from which it does not disengage hydrogen, it behaves like a noble metal. But at high temperatures it reduces all the other metals except zinc from their fused salts, and forms its own lowest combination. Fresh surfaces of the metal are in the active state.—The Weston standard cell, by P. Kohnstamm and E. Cohen. The E.M.F. of the cadmium cell shows certain irregularities below 15 degrees, which are due to the fact that the constitution of the cadmium sulphate undergoes some change at that temperature. This change does not affect the water of crystallisation, but corresponds to the change undergone by sulphur at 95 degrees. At temperatures between 15 and 70 degrees the Weston cell is superior to the Clark standard.—On thermophones, by F. Braun. The momentary expansions and contractions produced in a strip of brass or a bolometer by a variable current may be used for the transmission of sound. For this purpose the bolometer is put in circuit with three or four accumulators and a microphone. The effect may be greatly increased by increasing the steady current.—Electric discharge in rarefied gases, by W. Wien. From experiments on the electrostatic deflection of kathode rays, the author calculates their velocity as one-third that of light. Goldstein's canal rays are the prolongation backwards of the kathode rays, and like them are subject to magnetic and electrostatic deflection.—Polarisation of Röntgen rays, by L. Graetz. Polarised X-rays cannot be produced even by using a fluorescent body as an anti-kathode, although such bodies are known to emit polarised light.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 16.—"The Stomodæum, Mesenterial Filaments, and Endoderm of *Xenia*." By J. H. Ashworth, B.Sc., Demonstrator in Zoology, Owens College, Manchester. Communicated by Prof. Hickson, F.R.S.

The Xeniidæ are distinguished from all other Alcyonaria by their soft fleshy consistency and non-retractile polyps.

The stomodæum of each polyp is moderately long (1·8–2·2 mm.), and has a well-marked ventral groove or siphonoglyphe, the cells of the lower third of which bear long flagella. Among the cells forming the remainder of the wall of the stomodæum are numerous "goblet cells," which have not hitherto been noticed in the stomodæum of the Alcyonaria. These cells generally appear empty, having discharged their secretion, which, in some cases, can be seen issuing from the cell into the cavity of the stomodæum. These secreting cells occur chiefly in the middle and lower portions of the stomodæum, and are most abundant on the lateral walls near the siphonoglyphe.

These "goblet cells" of the stomodæum are the only secreting cells connected with the digestive cavity, as the six thick ventral and lateral mesenterial filaments, which bear the gland cells in other Alcyonaria, are absent in all polyps of this *Xenia*. The two dorsal mesenterial filaments are present and have a similar course and structure to those of *Alcyonium*. Wilson and Hickson have shown that the ventral mesenterial filaments bear the cells which produce the digestive secretion. The absence of these filaments in this *Xenia* is probably correlated with the presence of gland cells in the stomodæum, which from their position and structure appear to perform some digestive function.

The siphonozooids which occur in Pennatulids and some other Alcyonaria are the only recorded examples of polyps in which the ventral and lateral mesenterial filaments are absent. According to Wilson, these siphonozooids derive their food supply from the autozooids or feeding polyps, and therefore do not require cells to produce a digestive secretion.

The endoderm cells which line the cœlentera and the cavities of the tentacles contain numerous small vacuoles which give the protoplasm a reticulate appearance. Among the ordinary endoderm cells are numerous cells, the inner or free end of which is produced into a long pseudopodium, which is from four to eight times as long as the basal portion of the cell. The pseudopodia, which appear to be flexible, may attain a length of ·12 mm. They are not vacuolated, their protoplasm being homogeneous or very finely granular. The basal part of the cell from which the pseudopodium arises has the reticulate protoplasm of an ordinary endoderm cell, and the nucleus of the cell is situated in this portion. These pseudopodia-bearing cells are very numerous and occur in all parts of the endoderm, lining the cœlentera and the cavities of the tentacles.

EDINBURGH.

Royal Society, July 18.—Lord McLaren in the chair. In a note on the electrolysis of ethyl potassium diethoxysuccinate, Prof. Crum Brown and Dr. H. W. Bolam showed that the electrolytic synthesis of dibasic acids applies to the unsymmetrical diethoxysuccinic acid

$$COOH—C(OEt)_2—CH_2—COOH,$$

although it does not apply to monoethoxysuccinic acid

$$COOH—CH(OEt)—CH_2—COOH.$$

—Mr. W. W. Taylor communicated a note on the freezing point of aqueous solutions of sodium mellitate. The work was undertaken at Prof. Crum Brown's suggestion to test Van t' Hoff's theory of the depression of the freezing point of solutions of electrolytes. The molecular depressions obtained experimentally for solutions of different concentration were from 4 to 6 times the normal molecular depression, 1·87. According to the theory the greatest possible depression is 7 times the normal.—Sir John Murray, K.C.B., presented two papers—one on the deposits collected by the s.s. *Britannia* in the Western

Atlantic in 1897, and the other on some of the deposits collected by the German ship *Gazelle* in 1874 and 1875. In an appendix to the former paper, Mr. R. G. Peakes compared the mean temperature of the sea-bottom between the Bermudas and the West Indies as determined by thermometric observations with that estimated from the resistance of the telegraph cable. The values were respectively 36°·57 and 33°·3 F., a serious discrepancy, which seemed to be difficult to trace to any fault in the electrical resistance method.—In notes on coral reefs at Port Louis and Grand Port, Mauritius, Mr. W. Shield gave an account of twelve borings at these places, one of which at Port Louis reached a depth of 68 feet. The character of the material brought up from each boring was described in detail, but no general result was indicated.—Dr. James Burgess, in a note on finding log sines and log tangents of small arcs, gave formulæ which were much simpler and more accurate than those hitherto published. For example, the log sine of an arc of x minutes and h seconds was given by the expression

$$\log \text{ sine } x' + \log (x'' + h'') - \log x'' - \cdot 12\ x^\circ\ h'',$$

where x'' is the x minutes expressed in seconds and x° the same expressed in degrees.—Prof. Tait gave a generalisation of what is known as Josephus' problem, and showed how by a simple arithmetic process the problem could be extended to huge numbers. Thus he found that if every third man were removed from a ring of 8,968,992 until only one was left, that one would be the first.—Prof. Tait also communicated some recent experimental results on the compressibility of sugar solutions, which was found to be not much less than that of water, whereas the compressibility of brines is notably less. The results accord with the general principle that the greater the change of volume on dissolving the less the compressibility.—The Chairman read a short review of the work of the session.

PARIS.

Academy of Sciences, July 25.—M. Wolf in the chair.—On the numerical calculation of the coefficients in the development of the function of perturbation, by M. O. Callandreau.—Thermogenesis in tetanus, by MM. d'Arsonval and Charrin. Experiments upon rabbits show that disturbances, of an oscillatory character, in the production of animal heat make their appearance at an early stage of incubation, and increase in strength until the crisis of the disease is reached.—Note upon animal heat, by M. Émile Blanchard. Some observations on the temperature of insects, more especially of those which are remarkable for their rapid movements.—On a theorem of M. Poincaré, by M. S. Zaremba.—On the absorption of the light emitted by a body placed in a magnetic field, by M. Auguste Righi.—Electrical resistance at the contact of two discs of the same metal, by M. Edouard Branly. Two smooth, plane discs of zinc or copper, when pressed together, offer practically no resistance to an electric current under any circumstances. In the case of aluminium, iron and bismuth, however, the resistance, although small when the discs are simply pressed together, is greatly increased when they are forcibly brought together by falling from a height. The author is unable to offer any explanation of these phenomena.—On the diffusion of kathode rays, by M. P. Villard. The phenomena attributed by Prof. S. P. Thompson to *parakathode rays* appear to be really caused by diffusion of kathode rays.—Measurement of the velocity of the electrified particles during discharge under the influence of ultra-violet light, by M. H. Buisson. The velocity found varied from 25 to 135 centimetres per second, according to the difference of potential between the plates of the condenser, and was independent of the intensity of the light employed.—On the determination of arsenic in antimony and other metals, by M. O. Ducru. The author recommends the process of distillation with hydrochloric acid and ferric chloride, the arsenic in the distillate being afterwards precipitated by hydrogen sulphide.—On the composition of phosphorescent sulphides of strontium, by M. José Rodriguez Mourelo. The specimens of sulphide of strontium employed in the author's previous researches contained as impurities, varying in amount according to the method of preparation, strontium sulphate, sulphide and sulphate of barium, calcium sulphide, sodium sulphide, sodium chloride, and traces of aluminium and iron. Pure monosulphide of strontium is not phosphorescent.—Detection and estimation of methyl alcohol in ethyl alcohol, by M. A. Trillat. The process described depends upon the formation of methylal, when methy alcohol is oxidised with potassium bichromate and sulphuric acid, and the conversion of this substance, by condensation with dimethylaniline, into tetramethyldiamidodiphenylmethane. This compound, when oxidised with peroxide of lead in acetic acid solution, gives an intense blue coloration, the depth of which is proportional to the amount of methyl alcohol originally present in the liquid under examination.—On the aloins, by M. E. Léger. A number of substitution derivatives of barbaloin and of isobarbaloin are described, and the conviction is expressed that these are the only aloins which exist in the various aloes of commerce.—Study of the phosphoric acid dissolved by the water of the soil, by M. Th. Schloesing fils. The dissolved phosphoric acid appears to be independent of the amount of water in the soil.—On the composition and alimentary value of millet, by M. Ballard. This grain is rich in nitrogen and fat; it resembles maize in composition, and forms a more complete food than wheat.—Contributions to the study of the function of the nucleolus, by M. Antoine Pizon.—On the different phases in the development of a new species of *Sarcina*, by M. E. Roze. The new species, for which the name *Sarcina evolveus* is suggested, was observed upon the macerated tubercles of *Boussingaultia baselloides*.—On a silicified *Lepidodendron* from Brazil, by M. R. Zeiller.—Production of acute meningoencephalo-myelitis in the dog by the bacillus of septicæmia of the guinea-pig.—On the polar vortex, by M. A. Poincaré. This paper deals with the movements of the atmosphere in the polar regions.—On the adherence of the copper washes used in combating the cryptogamic diseases of the vine, by MM. G. M. Guillon and G. Gouirand. For the destruction of the parasites of the vine, the use of a large quantity of cupric sulphate is of less importance than the close adherence of the salt to the surface of all the organs of the plant. This adherence is sought to be effected by the addition of such substances as molasses, soap, gelatine, lime and other alkalies, to the solution of cupric sulphate. The present paper gives the results of a number of experiments in which glass plates were sprinkled with the various washes, dried in the sun, exposed for a certain time to the action of rain, and the amount of copper left determined. Lime and gelatine appear to be the most effective fixing agents.

CONTENTS.