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WHAT CONSUMPTIVES OUGHT TO KNOW.

(1) *Advice to Consumptives, Home Treatment, After-Care and Prevention.* By Dr. Noel Dean Bardswell. Foreword by Dr. C. T. Williams. Pp. xv+144. (London: A. and C. Black, 1910.) Price 1*s.* 6*d.* net.

(2) *Consumption, its Prevention and Home Treatment. A Guide for the Use of Patients.* By Dr. H. Hyslop Thomson. Pp. 75. (London: Henry Frowde, and Hodder and Stoughton, 1910.) Price 2*s.* net.

(3) *Open Air at Home: Practical Experience of the Continuation of Sanatorium Treatment.* By Stanley H. Bates. With introduction by Sir James Crichton-Browne, F.R.S. Pp. 62. (Bristol: John Wright and Sons, Ltd.; London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd., 1910.) Price 2*s.* 6*d.* net.

(4) *The Expectation of Life of the Consumptive after Sanatorium Treatment.* By Dr. Noel Dean Bardswell. Pp. v+130. (Edinburgh, Glasgow, and London: Henry Frowde, and Hodder and Stoughton, 1910.) Price 3*s.* 6*d.* net.

ONE of the most important features of the modern crusade against consumption is the attempt that has been made by those who are actively engaged in treating patients in sanatoria to make provision for the training of these patients in suitable methods of carrying on home treatment, after-care, and prevention. These skilled men see that it is impossible for most of the patients who have come under their charge to remain in the sanatorium for a sufficient length of time to ensure complete or permanent cure, and they desire to make the sanatorium a school in which the patient may be trained so to live and regulate his work that he may become and remain a useful and productive member of society. No one is better able to give such advice than is Dr. Bardswell, the medical superintendent of the King Edward VII. Sanatorium, and in the little unpretending book (1) now before us we have in few words and practical form just such advice as the consumptive requires.

Dr. Bardswell begins by pointing out the difficulties of laying down general rules for the treatment of individual patients, but shows that when principles are sound the details can gradually be fitted in; the general principles as laid down by Dr. Bardswell are the following:—

"1. Raising the general health of the consumptive to its highest possible pitch, thus restoring his power of resistance and arresting the disease.

"2. Maintaining it there long enough to justify the assumption that the disease is cured."

Dr. Bardswell indicates that although the first part of the process may be effected during a stay of some three to six months in a sanatorium, the second portion of the cure rests with the patient himself, the twelve months following the patient's discharge from the sanatorium being the really critical period of treatment.

Fresh air, without cold or discomfort is his first requirement; open windows, shelters and châlets, half-holidays and holidays in the open, and a change of air whenever possible. Health resorts and sea voyages, if judiciously indulged in, may be very useful, but they are by no means essential, and, indeed, where they involve fatigue may be actually harmful. The chapter on food is extremely practical and very condensed, and those interested in the subject may well peruse it carefully. Dr. Bardswell is of opinion that the consumptive is best without any alcohol at all, though he thinks that when convalescence has been thoroughly established there may be

"no harm in substituting a glass of beer or some light wine for the milk at meals. This is as far as I would go. Spirit in any form and at any time, but especially so between meals, should be absolutely avoided."

In the suggestive chapter on rest and exercise it is laid down that anyone suffering from pulmonary tuberculosis, or who has so suffered, should abstain entirely from any game or sport which entails sustained and severe physical exertion or sudden and violent muscular effort, whilst the ordinary indoor recreations, unless they can be adapted to the open air in fine weather, should certainly be demitted during treatment and convalescence. Smoking, especially before meals, should be avoided except in great moderation. Moreover, if there is any tendency to weakness of the throat smoking is absolutely negatived.

It will be seen that Dr. Bardswell is essentially practical in directing special attention to those points concerning which the consumptive so often requires advice and encouragement. Hints as to clothing, an account of the sanatorium treatment, the principles of which have to be carried out in the patient's own after-life until health is thoroughly established, occupation, emigration, infection, disinfection, are all carefully dealt with. The last couple of pages give in concise and admirable form advice which will be useful not only to consumptives but to those who, without becoming valetudinarians, wish to remain physically and mentally sound and vigorous. The man who lives by the thermometer and with the help of various nostrums will find in this book nothing to encourage him, but the man who believes in good, sound, common-sense and a healthy, active life will derive great encouragement from its perusal.

(2) The reproach sometimes cast at the medical specialist, that he is too theoretical and pays but little attention to the practical details and surroundings of his patient, can certainly not be laid at the door of Dr. Hyslop Thomson, who, in a small compendium, gives a series of very practical hints which may be read with very great advantage by those who are recovering from consumption. This little work is another sample of the book that removes all excuse for ignorance, even amongst the laity, of the more important facts and factors to be noted and observed concerning the cause, course, treatment, and result of tuberculosis. Lowered vitality, inherited susceptibility, exposure to infection, the nature of infection,

are all treated of, and the special and general conditions under which tuberculous infection may be carried, and the conditions of the patients who may most readily be infected by that infective material are all of them laid down. The precautions to be taken against infection, the necessity for home treatment, and for the carrying of it out in a rational and intelligent and persevering fashion are insisted upon strongly. The following quotation might well be written up in large letters wherever men congregate :—

"The education of all consumptives to this view, that in the warfare against tuberculosis, the arrest of the disease, and the prolongation of life depend upon the care with which home treatment is carried out by the patient would materially aid in diminishing the death rate from the disease."

It is, of course, obvious that any such patient, if he be wise, will report himself at intervals to his doctor for examination and advice.

The various rules laid down as to observation of temperature, rest, exercise, diet, and the like, simple and readily followed out, are exceedingly valuable. The concluding paragraph of the book is perhaps a good type of the advice here given :—

"Too frequently the consumptive spends on useless nostrums money which would be far better employed in purchasing good food and procuring fresh air. All the so-called cures which are advertised for consumption will avail little in checking and curing the disease, compared with an intelligent effort on the part of the patient to carry out the principles and practices of open-air home treatment."

(3) Mr. Stanley H. Bates, in this brochure, gives a very succinct and clear account of his own experience in post-sanatorium treatment of consumption. Mr. Bates defines his purpose as being

"to give, in as clear a manner as possible, practical advice in the home-treatment of consumption drawn from three years' actual experience. It is written for the benefit of those who find themselves placed as I was three years ago, when, after six months at a sanatorium, I was advised to continue the treatment at home; and is an attempt to pass on to them the knowledge I should have been glad of then, but had to learn by experience."

After outlining the advantages of an outdoor sleeping shelter, the author gives a series of most practical details as to site, construction, and ventilation, protection from rain, materials, cost, and general construction and furniture, of an outdoor shelter. It is interesting to note how the ideas of the author gradually developed, and how at very small cost he has been able to evolve an open-air shelter that has practically all the advantages of a sanatorium shelter. He is a good example of the man who fights the disease whole-heartedly, and he certainly has deserved his victory.

"Wage continuous war with it," he says, "allow it no respite, and your victory will be accomplished the sooner. Some amount of moral courage and perseverance will be required for the purpose of your recovery. Energetic measures, however, and a determination to get well without delay, will go far towards rendering it sure and speedy. It is far better to make your recovery complete before returning to your occupation, than to run the risk of having to leave it again for the purpose of a further course of treatment. If your illness has upset your plans, make others; if a change of occupation is necessary, resign yourself to the form of life it will be best for you to follow. You will find more than sufficient compensation in the exuberance of health which you will enjoy as the result of your open-air principles."

This is good philosophy and sound common-sense. Mr. Bates's book should be in the hands of everyone who wishes to obtain the best results possible in his or her own care.

(4) Dr. Bardswell, in a concise abstract of the cases that have come under his observation in King Edward VII. Sanatorium, directs attention to the fact that it is now possible to obtain some indication as to the expectation of life of the consumptive, especially when based on a careful classification of a series of patients, living under favourable conditions, examined before and after treatment. He shows that this double classification is of importance because at the one extreme the patient is observed under what may be looked upon as the most unfavourable conditions, whilst at the other the course of the disease and the condition of the patient may be assumed to be considered in their most favourable aspects. How complicated and varied are the symptoms in cases of tuberculosis may be gathered from the classifications given by Dr. Bardswell, but it is obvious that without the data on which the classifications are based it would be impossible to give any intelligent and trustworthy prognosis, the classification on discharge being as important as is that on admission in so far that it offers additional ground for prognosis.

Marked differences persist at the stage of treatment, at which the cases leave hospital. This is evident from the fact that they are divided into "apparently cured," "arrested," "improved," "unimproved," or "progressive." Examining these cases at later intervals—that is, after periods of from one to five years—Dr. Bardswell gives the results of the open-air treatment of 241 cases discharged between the years 1901 and 1905, taking as the time basis of his report the year 1909, and points out that of these patients there were 62 suffering from incipient phthisis, of whom 46 were still alive, 6 of these dating back to the year 1901, 12 to the year 1902, 14 to the year 1903, 11 to 1904, and 3 to 1905, so that all of them were alive and well for at least four years after they had been discharged, and some of them for nine years. In only one case was the disease active when the patient was discharged, and he is now dead. Of the other cases of incipient phthisis 10 of the 62 were dead and four could not be traced.

Such results are certainly very satisfactory. In cases where the diseases was moderately advanced on admission the results were far less satisfactory. Of 95 treated 47, or 49·4 per cent. against 74 per cent. in the first group were well in 1909, 10 were alive, but were still suffering from the disease, and 35 or 36·8 per cent., against 17·6 in the first group were dead, and three patients had been lost sight of entirely. In the group in which the disease was far

advanced on admission, 84 in number, only 6, or 7·1 per cent., had been cured, that is, were well, in 1909. Only four others were alive, while 74, or 88 per cent., were dead.

It should be noted that Dr. Bardswell deals rather with what may be called the "chances of survival" than with the "expectation of life" as defined by actuaries. In regard to the capacity for work—that is, ability to work or to live an ordinary life—of the patients now described as well, he gives some interesting figures. Here, again, the incipient cases afford by far the greatest percentage of workers. Of those working at the above mentioned dates, it was found that 59 per cent. were able to do full work, 10·2 per cent. could work short hours, 10·2 per cent. had given up work, and 20·4 per cent. had died. From amongst the moderately advanced cases, 32 per cent. were doing full work, 7·3 per cent. were working short hours, and 24·5 per cent. had given up work entirely; 36·6 per cent. were dead. Of the advanced cases only 4 per cent. were working short hours, and 94 per cent. had died. The prospect of any advanced case ever doing a normal amount of work is, therefore, very small indeed; but, as Dr. Bardswell puts it, the "outlook for the moderately advanced cases is very fair and for the incipient cases good."

It is interesting to note that in a commentary on these cases Dr. Bardswell states that there are few morbid conditions that are so rapidly and markedly benefited by appropriate treatment as is tuberculosis, but that this treatment must be prolonged there seems to be little doubt, prolonged considerably beyond what the patient, from his feeling of well-being, usually considers necessary. At the same time, he believes that the patient may remain too long under sanatorium treatment. Some patients lose their self-reliance and become nervous as to their condition, and develop into "sanatorium hypochondriacs." These are usually the patients who do not obey instructions or who do not respond to treatment. Such patients, he believes, should go home or be sent abroad, and be encouraged to "get out of themselves" and find other interests.

Dr. Bardswell is also a great believer in the importance, as factors in success, of the temperament and character of the patient. He says:—

"To the consumptive who possesses earnestness of purpose, common-sense, courage, and patience, cure is much more probable than in one who lacks these characteristics. It has been well said that a fool never gets well of consumption."

Whatever else may be said, it must be admitted that the sanatorium treatment has prolonged by a very considerable span the life of the consumptive patient. Dr. Williams's estimate of the average duration of life of selected cases of consumption in the pre-sanatorium days was eight years. Dr. Noel Bardswell's figures indicate an improvement on this, for he finds that of every one hundred cases of consumption, taking them as they come, and without any attempt at selection, fifty will die within a period of from four to nine years after admission to the sanatorium, but the remaining fifty will be found for the most part to be enjoying good health after the same period. A study of the abstracts of Dr. Bardswell's cases seems to bear out his contention. This work may be commended to the attention, not only of those who expect too much from the sanatorium treatment, but also to those who are prone to belittle it.

EGYPTIAN RELIGION.

The Book of the Dead. By H. M. Tirard. With an introduction by Prof. E. Naville. Pp. 170. (London: S.P.C.K., 1910.) Price 3*s.* 6*d.*

THIS little book will no doubt interest the many amateurs of Egyptology in this country, but it cannot be said to be of any scientific value. For this it is too conventionally "religious" in tone; a cult of "one supreme God" is supposed to have existed amid the chaotic polytheism of Egypt (there is no proof of any such conception before the time of Akhenaten), and the commonplace belief in the immortality of the soul, which is shared by all mankind, is credited to the Egyptians as a special virtue. Also the book is not historical and archæological enough in treatment. We hardly realise from Mrs. Tirard's pages that the Egyptian religion had a long history, and that it was not the same at all periods; nor, to take a concrete instance, are we told by her that the *ushabti* figures, so typical of the interments of the dead, were unknown until half Egyptian history had been accomplished, their place being taken in the earlier ages by those remarkable models of workmen and boatmen which are among the chief treasures of our museums. All the typical prayers from "The Book of the Dead," about the *ushabtis*, the fields of Aalu, and so forth, which we regard as so characteristic of Egyptian religion, were not characteristic of it for half its period of existence.

The interest of the Egyptian spells and charms relating to the souls of the dead, which we call "The Book of the Dead," is to the anthropologist very great, as he gains from it most interesting views of the original savage state of the African ancestors of the Egyptians. But a strictly scientific book on these spells is yet to seek. A critical survey of the material would separate the early magical incantation from the later prayers and hymns of the civilised age. The pious conservatism of the Egyptians preserved the childish gabble of the primitive age side by side with the later prayers. Both are habitually jumbled up together in books on the Ancient Egyptian religious writings, and to the primitive magical gibberish is ascribed a hidden and recondite meaning (on the principle *omne ignotum pro magnifico*) which it never possessed. It never was more than the "patter" of the savage medicine-man. He was the spiritual ancestor, no doubt, of the cultured priests who wrote the hymn to Amen quoted by Mrs. Tirard (p. 157); but this is very far removed above the average calibre of "The Book of the Dead," of which it is no part, and seekers after real religious feeling in Ancient Egypt will go to these hymns and psalms, which have nothing to do with the tomb, its ghosts, and magical paraphernalia, the "clotted absurdities" to which Mrs. Tirard has devoted such careful and painstaking labour, which, however, has, we fear, hardly

been critical enough to be of any value to the anthropologist.

Prof. Naville is quite justified in congratulating (on the introduction which he prefixes to the volume) Mrs. Tirard on the extent of her knowledge of the Egyptian religious writings. It is her uncritical treatment of her own knowledge that we regret. There are few actual mistakes in matters of fact in the book, the most serious perhaps being the statement that the word *makheru*, "justified," is never used of the living, only of the dead; this is incorrect, as instances of *makheru* being used of the living are known. In a matter of faith rather than of reason, we do not share her belief that the "Prince of Wales's Feathers" are derived from the Egyptian feather symbolical of "Truth," or rather, "Right." Where are the intermediate stages between the old Egyptian feather-emblem and the day when the Black Prince did *not* take the three ostrich plumes from the helmet of the slain King of Bohemia? For we know that at Poitiers the blind king's crest was an eagle's wing, and that the picturesque legend of the origin of the Prince of Wales's Feathers has no basis in fact.

In her citations, Mrs. Tirard usually follows the masterly translation of Prof. Naville.

ANATOMY OF SEDGES.

Anatomy of the British Carices. By F. C. Crawford. Pp. xiv+124+xx plates. (Edinburgh: Oliver and Boyd, printed for private circulation, 1910.) Price 7*s.* 6*d.* net.

FRANCIS CRAWFORD was an enthusiastic worker in pursuits that attracted him; a remarkable man in that, after success in business enabled him to retire at forty-five, he could crowd so much acquisition of natural history knowledge and collections into the remaining twelve years of his life. Botanist, ornithologist, geologist—an all too brief biographical sketch of the author precedes the introduction by Prof. Balfour, who, as his lifelong friend, gives in a few touches fuller insight into the lovable character of the man. His sudden death, soon after the MS. was in the printer's hands, in February, 1908, deprived the work of the author's revision; and Prof. Balfour, who edited it, deemed it best, in spite of its unconventional phraseology, to let the book go forth "as Frank Crawford wrote it."

Crawford had no laboratory training, and, taking to botanical work late in life, could not readily acquire the use of its technical terms, or always consent to their fitness. "If people can't understand plain terms," he used to say, when his vernacular expressions were criticised, "so much the worse for them." This accounts for the frequent blend of scientific and homely phrases. The section of a midrib (p. 49) is described as a "round knob with a blunt point"; the stem of *C. remota* (p. 37) is "roundish and difficult to define, very bumpy"; the section of a leaf of *C. hirta* is "long, narrow, twisting about"; and in another species the "vascular bundles . . . don't reach to the epidermis." But these quaintnesses would not puzzle any reader.

What is a more troublesome deviation from usage will be found in the abbreviations and technical terms that need explaining, being relegated to casual footnotes. What is the meaning of the sentence on p. 8, "The bundle of *vulpina* var. *nemorosa* is in the median plane, but the patch of sch. does not reach to the apex, there is therefore a point of par."? The reader looks in vain for a list of abbreviations; it is in footnotes on pp. 2, 7, that to the two used here and constantly further on he finds a clue. The terms "involute" and "revolute" bear the meaning of incurved and recurved (p. 4), while "lumen" is not explained at all.

Such minor flaws detract, however, but little from the real value of an admirable book, which has the great merit of being pioneer work, at least in regard to this genus. The field botanist will be grateful for the inside details of stem, leaf, and rhizome, of which for the most part he has been woefully ignorant. All these details are set forth in the clearest style, in type that leaves nothing to be desired.

By Prof. Balfour's advice, Crawford tells us in his introduction, he collected, with the help of the Rev. E. S. Marshall and some others, fresh material to work on in preference to dried herbarium specimens. He first photographed a flower portion, and put other portions in spirit for winter work. From these he took sections of the stem, leaf, rhizome, and root, and prepared photomicrographs of the best, magnifying about 40 diameters. Little or nothing was obtained from dissecting the flowers; these are therefore not touched on in the "Anatomy." Many sections of the other parts were selected to figure, and with drawings of highly magnified stomata, &c., occupy twenty plates. These are done with a clearness of definition and a fidelity of detail that reflect great credit on both photographer and engraver.

The description of the figures in the plates, p. 115, is concise and accurate enough, but the numbers of the plates might have been added for convenience of reference, and as the species in this list of figures are in no order, and several occur again and again, the index should have embraced these pages as well as the rest.

In the special anatomy, as Crawford terms his descriptive account of the species, which forms the body of the work, each part of the plant in section (below the inflorescence) is given in detached paragraphs. *C. chordorrhiza*, Ehrh., is a capital example, being fully illustrated as well as minutely described. Crawford discovered in this species remarkable divergences between its aërial and underground rhizomes. There is no doubt where this came from, as there is but one British locality. The same with *C. trinervis*, which he collected at Ormesby by the present writer's direction. But the locality is a *desideratum* in almost every case, and might be supplied from the labelled specimens or photographs, which have been deposited at the Royal Botanic Garden, Edinburgh.

Most interesting is the success attained in differentiating more thoroughly the triad so perplexing to novices, *C. laevigata*, Sm., *binervis* and *distans*; in confirming on the whole the suspected origin of several hybrids, and in testing the claims of some varieties. Among these last the evidence does not

support the alleged distinction between *C. vulpina* and its var. *nemorosa*, *C. canescens*, and its var. *robustior*, *C. diandra* and its var. *Ehrhartiana*; shows some difference between *C. Goodenowii* and var. *juncella*, much more between *C. binervis*, Sm., and var. *Sadleri*, Linton, which are farther apart than has been supposed.

This posthumous work, which throws more light on the *Carices* than most of us expected, owes its inception and completion to its distinguished editor, but it is a fine memorial of the persevering toil and ability of its lamented author, which must find its way into the hands of every botanist who pretends to a knowledge of the genus. EDWARD F. LINTON.

TABLES OF SYMMETRIC FUNCTIONS.

The Symmetric Function Tables of the Fifteenthic, including an Historical Summary of Symmetric Functions as Relating to Symmetric Function Tables. By Prof. F. F. Decker. Pp. 16+tables. (Washington, D.C.: Carnegie Institution, 1910.)

THE publication of this paper is an example of the excellent work that is being done by the Carnegie Institution of Washington, over a wide field of science, under the fostering care of Dr. R. S. Woodward.

The formation of Symmetric Function Tables dates from the first decade of the nineteenth century, when Meyer Hirsch gave them up to and including the 10ic. These tables give the expression of a symmetric function of the quantities, a_1, a_2, . . . a_{10}, in terms of the elementary symmetric functions thereof, p_1, p_2 . . . p_{10}, where

$$(x-a_1)(x-a_2)\ldots(x-a_{10})=x^{10}-p_1x^9+\ldots+p_{10}.$$

According to modern notation and nomenclature a function

$$\Sigma a_1^{\pi_1}a_2^{\pi_2}\ldots a_{10}^{\pi_{10}} \text{ or } (\pi_1\pi_2\ldots\pi_{10})$$

is thus expressed in terms of quantities

$$p_s=\Sigma a_1a_2\ldots a_s \text{ or } (1^s),$$

the exponents of the quantities, a under the sign of summation being merely assembled in a bracket.

Ex. gr. $(2^2)=(1^2)^2-2(1)(1^3)+2(1^4)$,

and it will be observed that each term on the eight involves four units, and each is said to be a separation of (1^4). Mr. Decker's tables, like the earlier ones to which he refers, express all the functions $(\pi_1\pi_2\ldots)$, where $\Sigma\pi=15$ in terms of separations of (1^{15}), and a reader of his historical summary might suppose that nothing further had been done in the way of tables of symmetric functions. The facts are quite otherwise, for several remarkable extensions have been made to which Mr. Decker makes no reference whatever. So far back as 1888, in the *American Journal of Mathematics*, an analogous theory was shown to exist in regard to the separations of any partition whatever, and a complete set of tables, direct and inverse, up to weight six inclusive, was given in the *Journal*; a law of symmetry corresponding to the Cayley-Betti law and several other laws of symmetry were established. For example, one row for weight six and the separable partition (321) is :—

$$2(51)=(3)(21)+(2)(31)-(1)(32)-(321).$$

It was also shown that the weight might be zero or negative, and the separable partitions involve zero and negative parts without interference with the construction of the tables or with their fundamental properties.

Further, also in the Phil. Trans., R.S., 1890, the tables and properties were extended to the symmetric functions of several systems of quantities and specimen tables were given. It is necessary to say so much, as otherwise a reader might be grievously misled.

The historical summary in regard to a single system of quantities and the separations of (1^n) is well given by Mr. Decker. He is in error in ascribing formulas for calculating the constituents in each of the first four lines or columns to Roe; the first of these is nothing more than Waring's law, extended by the law of symmetry; the others are readily obtainable from it, and have long been in use by calculators.

The chief use of the formation of tables of these functions has been that the construction has led to the discovery of new theorems which have been of use in other departments of mathematics; in particular, remarkable differential operators were thus brought to light which have been successful in opening up problems of the magic square description, which had defied analysts from Euler to Cayley. Also the theory of non-unitary symmetric functions was shown to involve that of the covariants of binary quantics.

It is disappointing to find that Mr. Decker's laborious work with the 15ic has not resulted in the discovery of theorems of wide application; this is not surprising, because it is fairly certain that previous workers have taken the principal plums out of this particular orchard; but, this being so, there does not appear to be any sufficient reason for continuing this series of tables.

Mr. Decker's table is beautifully produced, and he seems, while detecting errors or misprints in the lower tables, to have carried out a good system of checks to ensure freedom from error in his own.

P. A. M.

WORKSHOP MATHEMATICS.

Shop Problems in Mathematics. By W. E. Breckenridge, S. F. Mersereau, and C. F. Moore. Pp. vii+280. (Boston and London: Ginn and Co.) Price 4*s.* 6*d.*

THE authors' aims in producing this book have been to impart to the student information in regard to the more important points in shop work, such as the names of the parts of machines used in wood and metal working, together with the materials employed, and also to give a thorough training in the mathematical operations that are useful in shop practice and science. In carrying out these ideas, about two-thirds of the space available are occupied in calculations applied to timber, house building, machines, pattern-making, and foundry work, forgings, screws, and screw-cutting, and the gas engine. The latter part of the book is taken up with a review of calculation with short methods.

The book is decidedly American in its arrangement,

treatment, and nomenclature, and is evidently designed for the use of students in manual training high schools. One of the objects, we are told, is to correlate the work of the mathematical classroom with that of the departments of mechanic arts and science. For example, a student is beginning to handle boards in the shop and at the same time is commencing the study of algebra; it is advised that he be assigned some problems on board measure, together with a review of work in fractions. It is, without doubt, advisable to have a general working arrangement between the mathematical classroom and the applied science departments, but the arrangement, in our opinion, may be, and often is, carried too far. There is a danger, if the connection be too intimate, of the student specialising on his own account by giving his earnest attention to those portions of the mathematical work which are adapted to fit the trade he intends following, and giving scant attention to the other portions. It is rarely the case that books of the nature before us succeed in becoming an integral part of an effective educational system, despite the fact that they may be, as this one is, clearly written, full of useful information, and well arranged.

There are a few slips; thus on p. 107 appears an exercise on the work done while punching a hole. It is impossible to work this problem without an autographic record of the operation, although no hint of this is given. Many teachers in trade schools in this country will be glad to inform themselves of American methods through the medium of this book, despite the fact that they may find difficulty in placing it in their pupils' hands owing to the nomenclature, to which reference has been made.

SPECTROSCOPY.

Handbuch der Spectroscopie. By Prof. H. Kayser. Fünfter Band. Pp. vi+853+Täfel ii. (Leipzig: S. Hirzel, 1910.) Price 48 marks.

AS is well known, Prof. Kayser planned to finish his great handbook in four volumes, but owing to the mass of the material dealing with absorption the third volume was divided into two. The same trouble has arisen over the fourth volume on the original scheme, and the present volume contains only the spectra of the elements, arranged in alphabetical order, down to and including nitrogen. The sixth volume, which is to appear shortly, will contain the spectra of the remaining elements, and will conclude the physical spectroscopy.

As Prof. Kayser points out in his introduction, it would have been very satisfactory to include under each individual element a complete account of the work that has been carried out on its spectra under varying conditions of illumination. This would have entailed, however, the expansion of the book by several volumes, and therefore the details that are given have been limited. In the case of the fifty elements dealt with in the present volume, tables of the wave-lengths of the lines in the arc and spark spectra are given, and there also appears an account of the work that has been carried out upon these spectra of each element. Although this has of necessity to be brief, yet Prof. Kayser has dealt with the various investigations in a critical manner. In one or two cases is this especially to be remarked, and the article on the spectra of carbon stands out particularly as a fine critical review of the many contributions to the literature of the subject.

One great difficulty faces anyone who attempts to collate the various measurements of the spectra of substances, and that is the question of the standards upon which these measurements are based. As is well known, for the eight years between 1885 and 1893, the standard generally employed was that of Ångström's map as corrected by Thalén; this was superseded by Rowland's normal solar spectrum, which differed from the previous one in an irregular manner. Later it was shown by Prof. Kayser himself that the coincidence method used by Rowland with his concave gratings is not to be depended upon, and this was borne out by Fabry and Perot, who proved by their celebrated series of interference measurements that the Rowland scale is also irregular in its accuracy. As a result of the discussion held at the meeting of the International Union for Solar Research, a new standard has been set up by Fabry and Buisson, based upon the interferential comparison of a number of equidistant lines with the Michelson cadmium standard. This, however, is too recent to have had very much influence on comparative measurements. As a result of the fact that the three standards are not capable of accurate comparison, it is easy to see that very great accuracy cannot at present be claimed for many of the published spectroscopic measurements. Prof. Kayser remarks that the accuracy cannot be depended upon to within 0·1 tenth-metre.

Another difficulty that is met with in collating emission spectra is the relative intensity of the lines. It is manifest that it is next to impossible to standardise these intensities, for they vary so much with the method of excitation and also with the sensibility curve of the photographic plate. Different experimenters, moreover, have used different scales to which the intensities are referred. The values given therefore can only be taken as a general guide to the brightness of the lines, and cannot be considered of much value in comparing the spectra of different elements.

There is no doubt that this volume is a very worthy follower of the first four in the series, and must prove an indispensable addition to the library of everyone interested in emission spectra. Above all, it shows the directions in which work, and that most important work, still remains to be done. E. C. C. B.

OUR BOOK SHELF.

Subconscious Phenomena. By Hugo Münsterberg, and others. Pp. 141. (London: Rebman, Ltd., n.d.) Price 5*s.* net.

FOR the purpose of arriving at some unanimity, if possible, on subjects regarding which there exists a certain amount of diversity of opinion it has recently become the fashion among psychologists to write a *symposium* in which each contributor gives expression to his views. The present work, produced under the editorship of Dr. Morton Prince, is of this nature and

from it we learn what Münsterberg, Ribot, Jastrow, Prince, Janet and Bernard Hart mean by the subconscious. That such a work serves a useful purpose may be gathered from the fact that, as the master of the symposium states in his introduction, there are six recognised meanings of "the subconscious":—

(1) That portion of consciousness which for the moment is outside the field of attention.

(2) Split-off or dissociated ideas, such as automatic writing.

(3) A subliminal, secondary, subconscious "self" constituted and elaborated from such dissociated ideas.

(4) A combination of dissociated and forgotten ideas.

(5) The subliminal reservoir of consciousness from which ideas are drawn into phenomenal consciousness.

(6) Certain neural processes unaccompanied by any mentation whatsoever.

Most of the writers take the view that subconscious phenomena are physiological and not psychical processes, the underlying reason in all being that they are not memories, ideas or anything else of which mentation is composed.

Janet, of course, limits the subconscious to such abnormal states as are encountered in hysteria and psychasthenia, and Bernard Hart considers that the marginal elements of phenomenal consciousness (the *subconscious* of Stout), dissociated portions of phenomenal consciousness (the *co-conscious* of Morton Prince and the *subconscious* of Janet) and the non-phenomenal conceptual *unconscious* of Freud all form part of the material of psychology and not of physiology. It need scarcely be said that a symposium by such writers is above criticism; they criticise each other.

Mikroskopische Untersuchungen über die Übereinstimmung in der Struktur und dem Wachstume der Tiere und Pflanzen. By Dr. T. Schwann. Edited by F. Hunseler. Pp. 242+iv Taf. (Leipzig: W. Engelmann, 1910.) Price 3.60 marks.

AT a time when the accumulation of the facts of animal and plant structure threatened to prevent a clear conception of their true value, this famous memoir by a distinguished pupil of Johannes Müller converted histology into a rational branch of science. Schwann, who effected this profound change, based his method on development. He pointed out that "there is a common principle of development for all the elementary parts of the organism," and in so doing founded (with Schleiden) the cell-theory upon which modern physiology and pathology are based. The cellular nature of animals and plants had already been demonstrated, but there was no general hypothesis to "colligate" the facts. This Schwann supplied. He not only confirmed facts of cellular structure, but, in a refreshingly broad way, and moving with the ease of genius amongst a multiplicity of data that would have bewildered a lesser mind, he brought forward the evidence for the origin of the tissues and enunciated clearly his views on the nature of life.

To Schwann the organism is a beehive, as Huxley said in his famous essay on this very treatise. Its activities are the expression of the myriads of cell-changes, each independent of all the rest. To Schwann, and almost against his better judgment, the organism was, indeed, the product of its cells, and its cell the result of the crystallising of a "cytoblastema." Though in some ways we have outgrown this essay, its influence will probably always be felt, and when histology, as to-day, has become incapable of large views from the overburdening load of descriptive data, we realise the need of another Schwann; let us be thankful for the physiologist who by his developmental hypothesis put the subject-matter into a definite problem and offered a feasible answer.

Determinación de la Latitud por la Observación de Distancias Cenitales de la Estrella Polar. By C. Puente. Pp. 227. (Madrid: Observatorio Astronomics de Madrid, 1910.)

THIS is a monograph on the method of determining the latitude of a place from observations of the zenith distances of Polaris, at a known time. There is nothing new in this method, which proceeds on the ordinary lines of developing the latitude in a series of ascending powers of the polar distance, but the author has put the discussion out with great clearness and considered very carefully the terms that must be taken into account, according to the degree of approximation needed, as well as the most suitable formulæ for use when Polaris is near the upper or lower culmination. The methods of observing by means of theodolites, the instrumental adjustments, and the precautions necessary to be taken to ensure accuracy are detailed with very great care, the instructions being evidently intended for those who have had little practice. Numerous examples are worked out by different methods, and we have the ordinary curiosity of a latitude determined to the hundredth of a second when the microscopes read only to half seconds, and the time is observed no nearer than a second. Some of the results are so accordant that the ordinary observer must despair of attaining a similar accuracy. The greater portion of the book contains auxiliary tables for accelerating the reduction. Some of these have been extended from Albrecht's "Formeln und Hilfstafeln für geographische Ortsbestimmungen." and are available only within the limits of the Iberian Peninsula.—The more important of the tables include values of $\frac{2\sin^2\frac{1}{2}t}{\sin 1''}$, $\log\frac{2\sin^4\frac{1}{2}t}{\sin 1''}$, also $\frac{\cos\phi\cos\delta}{\sin(\delta\pm\phi)}$ where t, ϕ, and δ have the ordinary signification.

Calculus Made Easy. Being a very simplest Introduction to those beautiful Methods of Reckoning which are generally called by the terrifying names of the Differential Calculus and the Integral Calculus. By F.R.S. Pp. viii+178. (London: Macmillan and Co., Ltd., 1910.) Price 2s. net.

THE author of this little book writes as if it were the first of its kind, and in encouraging his readers he continually jeers at the professional mathematician in what might be regarded as reckless nursery language. In spite of such faults, we have no doubt that the book will be useful to schoolboys who need the ideas of the calculus in their study of physical science. The young engineer or the clever schoolboy will think it illogical and slipshod to leave $(dx)^2$ *out of consideration, as it is inconsiderable* in comparison with the other terms of $(x+dx)^2$, and he will say that there is only a pretence in the proof of the differentiation of x^n; he will probably look upon the introduction of the expansion of $(1+1/n)^n$ when n is indefinitely great, as not quite playing the nursery game.

Einführung in die Biologie. Ein Hilfsbuch für höhere Lehranstalten und für den Selbstunterricht. By Dr. W. Schoenichen. Pp. viii+215. (Leipzig: Quelle and Meyer, 1910.) Price 2.60 marks.

IT is difficult to understand to whom this little book is intended to appeal. It might almost be described as a scrap-book of illustrations, borrowed mostly from other text-books, and strung together with a minimum of letterpress. The subject-matter is treated from the point of view of physiology rather than that of comparative anatomy, but there is a short section dealing with cells and tissues, and some extremely

inadequate descriptions of certain animal types. The geological history of the vegetable kingdom is dealt with in about half a page of text, but an entire page is devoted to "Lamarckismus und Darwinismus." This being so, it seems a piece of reckless extravagance to have devoted several pages of the section on movement to organisms which do not move. The appetite of the German public for small doses of extremely condensed elementary biology seems to be insatiable. We should like to know to what extent information conveyed in this way is capable of assimilation. It seems as if a considerable amount of previous biological training would be necessary, even for the intelligent reading of such a book as this. It may perhaps be of some use in supplying new points of view to those to whom the actual facts are already more or less familiar.

Heaton's Annual. The Commercial Handbook of Canada and Boards of Trade Register, 1911. Edited by E. Heaton and J. B. Robinson. Pp. 540. (Toronto: Heaton's Agency; London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd.) Price 5*s*.

THE information about Canada which a business-man requires is here arranged in logical sequence. All matter under the head of general information is official, having been collected from the latest Blue Books. The Boards of Trade Register contains descriptions of towns, with notes of opportunities offering for manufacturers, investors, and individuals. Altogether this is a useful work of reference.

Flowers of the Field. By the late Rev. C. A. Johns. Thirty-third edition, entirely revised by G. S. Boulger. Pp. 611+64 coloured plates. (London: Society for Promoting Christian Knowledge, 1911.) Price 7*s*. 6*d*.

NOTHING need be said about the interest and usefulness of a book which has reached its thirty-third edition. In its revised form this popular manual will probably enter on a new lease of life, for it would be difficult to find a more convenient volume for the student of field botany.

The British Isles: Geographical Diagrams and Land Forms, with Questions, Statistics, and Tables. By H. J. Snape. Pp. 64. (London: A. and C. Black, 1911.) Price 1*s*. 6*d*.

MOST teachers expect to find in the text-book of geography they place in the hands of their pupils maps, pictures, and statistics of the kind Mr. Snape has brought together here. In schools where it is difficult to use a magic-lantern, the pictures especially should prove useful. The book is likely to save teachers time and trouble.

Familiar Wild Flowers. Figured and described by F. Edward Hulme. Pp. xviii+184. (London: Cassell and Co., Ltd., 1910.) Price 3*s*. 6*d*.

THIS series of volumes—of which the present is the ninth—with their striking coloured plates, are already widely known and deservedly popular. It is easy with the aid of these books to decide the species and genus of common wild flowers, and to discover the part they may have taken in folk-lore and other literature. We understand this is the concluding volume of the series.

Junior Experimental Science. By W. M. Hooton. Pp. lviii+277. (London: W. B. Clive, 1910.) Price 2*s*. 6*d*.

THIS is the second edition of a book which on its first appearance was reviewed in NATURE for May 16, 1907 (vol. xxvi., p. 51). There do not appear to be any important changes in the volume.

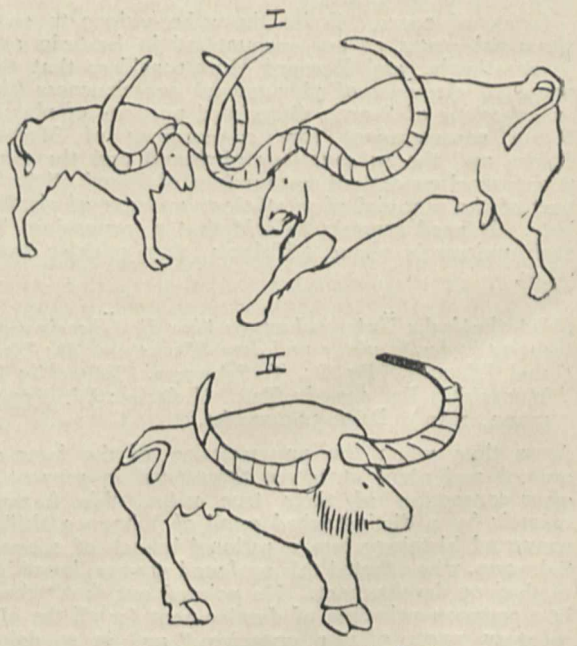
LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Extinct Buffalo of Algeria as Drawn by Prehistoric Man.

ONE of my objects in making a tour recently into south-western Algeria and the adjoining region of the Moroccan Sahara was to see the engravings on the rock surfaces, which have lately attracted much attention amongst French men of science, especially those who are more or less connected with the University of Algiers. Quite a number of the sites of these remarkable rock drawings (such as Tiout and Zenaga) can be reached by the long railway which the State has constructed from Oran on the north to Figuig and the Wed Gir in the extreme south of Morocco.

These pictures on the rocks have been mainly studied and illustrated by M. Gautier (Mission Sahara: Le



Prehistoric drawings of *Bos* (*bubalus*) *antiquus* in South-western Algeria. I. On rock-surface at Ennfous in the Aflou district, east of Géryville. II. At Ksar al Ahmar, near Géryville.

Sahara Algérien), and by M. G. B. Flamand, through the Lyons Society of Anthropology. M. Flamand's great work on the subject, however, is not yet completed for publication.

The chief features of interest in these prehistoric drawings will certainly be to zoologists the huge buffalo with enormous horns, which is perhaps the animal most frequently illustrated. I have copied a number of these either from the stones or the photographs of the stones, which may be seen at the University of Algiers or in the Algiers Archæological Museum, and give two of them here.

Of course, the great interest of these drawings is that they come as a valuable supplement to the palæontological discoveries made in the Quaternary and late Tertiary deposits of Algeria. The principal person connected with the discovery and illustration of the vanished fauna of Algeria was the late Prof. A. Pomel, whose works were mostly published between 1893 and 1908. Amongst the discoveries of himself or his predecessors were the remains of a gigantic buffalo—*Bos* (*bubalus*) *antiquus*—a creature

with a superficial resemblance to the Arni buffalo of India, but larger in size and possessing horns exceeding those of the Arni in length, while in its skeleton it evinces a greater relationship to the Cape buffalo. Of course, the fossil remains only give us in their most perfect examples the more or less complete bony core of these horns. We owe to the art of primitive man a better idea of what this armature looked like as a living animal. In full-grown males the horns were marked with annular corrugations, not unlike those still to be seen on the horns of Asiatic buffaloes (there are traces of them also in some of the modern types of Central Africa). There was no considerable development of horn boss on the forehead, and the horns seem to have been flat rather than round. They were set on the skull in such a way that they were not so much directed backwards, as in the Indian buffaloes of to-day, but branched out from the head almost at right angles to the median line of the nose, and in very extravagant developments looked like the figure 3 laid on its side. In some of the drawings there is the indication of the buffalo having developed a considerable fringe of hair along the angle of the lower jaw, in some examples almost a throat mane.

When did this large buffalo become extinct? Some of the authorities I consulted thought not more than two or three thousand years ago. They stated that amongst the engraved rock surfaces that have been photographed there are drawings of this buffalo bearing a pack-saddle. In any case, the drawings I saw myself represented it as being hunted by some form of white man (presumably of Libyan race) wearing a skin garment round the loins and armed with a bow and arrow, or with a spear and javelin, these weapons being either Neolithic or actually within the age of metal.

So far as I know, there is no mention of this buffalo existing in North Africa to be found in any of the Roman writers.

In addition to the buffaloes in these prehistoric drawings, the African elephant is the most striking feature. He is unmistakably delineated with widespread ears, but seldom or never with very big tusks. The fore-foot of these elephants is sometimes girt about by what seems to be a circlet of converging spikes (unless this type of elephant developed bristles on his feet). This recalls in appearance the kind of antelope or buffalo snare which is still in use in Ethiopia and East Central Africa. Other beasts illustrated on the rock incisions of Africa north of the Sahara Desert are the lion, leopard, Mhorr gazelle, Loder's gazelle, and domestic goats and sheep.

Among the remainder of the vanished fauna of Algeria which was apparently coeval with man, but is not to be identified in any prehistoric drawing, was a species of elephant closely allied to that of India, besides the *Elephas antiquus* of Pleistocene Europe. In addition to the buffalo, there was a large wild ox (*Bos opisthonomus*) allied to the aurochs of Europe, and a third form, *Bos ibericus*, apparently nearly related to the Indian zebu, and, if so, in all probability the parent of the modern domestic ox of negro Africa, as well as of types preserved for us in the art of ancient Egypt and of Crete. There was also an eland very like the elands of to-day, and what Prof. Pomel called a nilghai (*Boselaphus rayi*), with longer, more circular horns than those of the existing species; also a gnu, apparently related to the blue gnu of tropical Africa. There were two forms of hippopotamus, one the existing species, and the other a more primitive type with six incisors. Somewhat earlier, perhaps, in period of time was *Cervus pachygenys*, a remarkable form of deer with an exceedingly thick lower jaw, which developed on the outer aspect of its phalanges almost a boss of bone, the purpose or advantage of which does not seem to be very clear. Prof. Pomel also believed that he found in the recent deposits in Algeria a type of Palla antelope, besides an indigenous species of wild camel. As to the modern African elephant, it must have swarmed in Algeria down to the time of the Romans, say two thousand years ago. Its remains are discovered in nearly every watercourse in the northern littoral. The fossil remains on which the late Prof. Pomel's treatises were based can be seen (on application) at the museum of the University of Algiers.

H. H. JOHNSTON.

The Transference of Names in Zoology.

A LETTER on the above subject addressed to NATURE of January 26 by my friend, Dr. Calman, has appeared also in the American journal *Science*. This appeal to the Old World and the New evidently invites discussion. The letter apparently has in mind the man in the street and the natural history specialist, each of whom is to be protected from "moral and intellectual damage," which some applications of the law of priority might inflict upon him.

So far as the general public is concerned, two things should be borne in mind, first, that for popular books on natural history the publisher thinks one Latin name as bad as another, or a great deal worse, and, secondly, that the casual inquirer, when told the technical denomination of an animal, straightway forgetteth what has been told him, be it right or wrong, time-honoured or brand-new. Some handy little names might be kept in stock to gratify these incurious curious persons, as, for example, *Metoponanaphrissontes*, probably applicable to quite a crowd of creatures from annelids to monkeys. Tears seem to mingle with the ink when Dr. Calman tells us that "at present, a writer who mentions Trichechus may be referring either to the walrus or the manatee." Yet what sort of a writer could have the ingenuity to leave it an open question which of the two animals he was discussing? "The great possibility of confusion" to which Dr. Calman refers appears to me to be simply a nightmare, by which he himself is one of the last men in the world to be terrified.

Incidentally, I would beg Dr. Calman and others not to be scared into using Carcinides (Rathbun, 1897) as the generic name of the common shore-crab, assigned to Carcinus by Leach in 1814. It is quite true that Latreille in 1796 named a genus Carcinus in the Amphipoda, but this ought to be considered a *nomen nudum*, since no species was designated as belonging to the genus, and in the course of 115 years no one has fitted the definition to any amphipod in particular.

The conclusion of Dr. Calman's letter reopens a controversy which I will now make one more effort to close.

No crustacean, perhaps, is better known than the common lobster. May I earnestly ask leave here to set forth in full the credentials of its proper scientific name?

1758. *Cancer gammarus*, Linn., Systema Naturæ, tenth edition, p. 631.

1758. *Astacus verus*, Borlase, Natural History of Cornwall, p. 274.

1777. *Astacus gammarus*, Pennant, British Zoology, vol. iv., p. 9.

1791. *Cancer* (*Astacus*) *gammarus*, Herbst, Krabben und Krebse, vol. ii., part i., p. 42.

1798. *Astacus marinus*, J. C. Fabricius, Suppl. Entom. Systematicæ, p. 406.

1813. *Astacus gammarus*, Leach, Edinburgh Encycl., vol. vii., p. 398.

1815. *Astacus gammarus*, Leach, in Trans. Linn. Soc., vol. ii., p. 344.

1819. *Astacus gammarus*, Leach, in Samouelle's Entomologist's Comp., p. 95.

1831. *Astacus marinus*, Latreille, Cours d'Entomologie, p. 379.

1836. *Astacus gammarus*, Westwood, in Partington's Brit. Cycl. Nat. Hist., vol. ii., p. 167.

1838. *Astacus gammarus*, Westwood, The Entomologist's Text-book, p. 101.

1844. *Astacus marinus*, O. G. Costa, *Atti R. Acc. Sci.*, vol. 5, part ii., p. 72.

1850. *Astacus gammarus*, White, Catal. Brit. Crust., p. 35. With the imprimatur of John Edward Gray.

1857. *Astacus gammarus*, White, Popular History of Brit. Crust., p. 101.

1875. *Astacus gammarus*, Sowerby, Malac. Podoph. Brit., text to pl. 35.

1893. *Astacus gammarus*, Stebbing, Hist. Crust., Internat. Sci. Ser., vol. lxxiv., p. 203.

1897. *Astacus gammarus*, A. O. Walker, Rep. Brit. Assoc. (1906), p. 437.

1897. *Astacus gammarus*, Stebbing, Ann. Nat. Hist., ser. 6, vol. xix., pp. 120, 355.

1900. *Astacus gammarus*, Stebbing, South African Crust., part i., p. 34

1901. *Astacus gammarus*, T. Scott, Brit. Assoc. Handbook Nat. Hist., Glasgow, p. 330.
1906. *Astacus gammarus*, T. Scott, Proc. Roy. Phys. Soc. Edin., vol. xvi., No. 4, p. 116.
1906. *Astacus gammarus*, Stebbing, Victoria Hist. Cornwall, Crustaceans, p. 269.

We have now to consider the significance of these references. There is general agreement at present that the marine lobster and the river crayfish must stand under separate generic names. The question is, Which of the two has a right to that name Astacus, which for many years they enjoyed in common? Miss M. J. Rathbun argues that this was determined in 1810 by Latreille, who in his "Consid. gén. sur les classes des Crustacés," &c., gives a "Table des genres avec l'indication de l'espèce qui leur sert de type," citing for Astacus only *Astacus fluviatilis*. How little Latreille intended by this choice of an illustrative species to strip the lobster of its ancestral title may be inferred from his remark in 1803 that the *astakos* of Aristotle is evidently the marine lobster, and from the fact that still in 1831 he retains lobster and crayfish together in the same genus. Suppose, however, that in such matters a man's intentions are of no consequence, and that only his actions count, the same rule will apply in the case of Borlase, who in 1758 mentions only one species of Astacus, and that the common lobster, thanks to the fact that the river crayfish was not, and seemingly still is not, found in the county of Cornwall. But really the man to whom the restriction of Astacus is due was not Borlase, nor yet Latreille, but William Elford Leach, who in 1815 detached from it Nephrops for the Norway lobster, and in 1819 Potamobius for the river crayfish.

There is talk about lists of *nomina conservanda*. Lists of *exempla vitanda* would be much more to the purpose. Here is a specimen. Leach having previously restricted Astacus to the lobster, Milne Edwards in 1837 unlawfully transfers that name to the crayfish already named Potamobius, and endows the lobster with the new name Homarus, of which it was in no need. In 1852 Dana (U.S. Expl. Exp., vol. xiii., p. 532) follows suit, although acknowledging that "Leach has undoubted priority," but for various fanciful reasons setting that claim aside. He informs us that "in some recent English works the name Potamobius has been substituted for Astacus, and Astacus for Homarus," just as if it were the English works that had committed the crime of substitution, and he winds up his argument by saying, "There seem, therefore, to be reasons enough for rejecting Leach's names, if it is of no weight that they remained for thirty years unrecognised by British authors." Yet John Obadiah Westwood was a British author.

Then Huxley in 1881 ("The Crayfish," third edition, p. 13) tells us that Astacus was retained for both lobster and crayfish until Milne Edwards (in 1837) called the lobster Homarus. "At the present time, therefore," he continues, "while the recognised technical name of the crayfish is *Astacus fluviatilis*, that of the lobster is *Homarus vulgaris*," though he admits that by *astakos* the Greeks, ancient and modern, mean the lobster and not the crayfish, and Huxley himself, while ignoring Leach's Potamobius, accepts and defines (pp. 252, 256) a family Potamobiidæ. In 1888 Spence Bate (*Challenger* Macrura, p. 192) follows in the wake of Dana, with some additional statements, of which my references will supply a sufficient refutation. Thus these distinguished men bolster up one another in wrong-doing, and feebly lament the supposed necessity of doing wrong. At a time when British natural history was at a very low ebb, and natural history at the British Museum had little to be proud of, Leach suddenly threw lustre alike on that institution and on the science of his country. Need we be surprised if John Edward Gray and Adam White and James Sowerby felt the honour of Leach bound up with that of the great museum to which they also belonged? They followed the lead of the famous Westwood in vindicating the claims of Leach. For English-speaking carcinologists on either side of the Atlantic now to aid and abet in the transference of Aristotle's Astakos and Leach's Astacus to a different genus will be unscholarly and unpatriotic, as well as a needless breach in the law of priority.

THOMAS R. R. STEBBING.

Tunbridge Wells, February 24.

Time Accuracy in Magnetic Registration.

SOME contributions by Dr. Bauer and Mr. Faris in the last volume of *Terrestrial Magnetism* have given rise to a number of letters in this journal concerning the starting times of magnetic disturbances and the accuracy in the determination of time on magnetograms. Mr. Walker (No. 2147, p. 236) points out that the accuracy is augmented by interrupting both curve and base line. This is evident; the beams of light reflected by the various mirrors of the variometers towards the horizontal cylindric lens have, in general, different inclinations, the spots of light on the paper have different heights, so that the interruptions in different traces do not lie on a line perpendicular to the base line. Dr. Krogness (No. 2145, p. 171) desires rapid registering with automatic time marks upon the curve itself, in order to solve the question of simultaneity or non-simultaneity of the abrupt beginnings of magnetic storms for different parts of the globe.

For a number of years, an arrangement answering Dr. Krogness's wishes has been applied at the Meteorological Institute at De Bilt (Netherlands); the method was described for the first time in the Annuary B. for 1905, and recently in *Terrestrial Magnetism* (vol. xv., p. 31, 1910) in a communication concerning the magnetic storm of September 25, 1909. By means of a contact clock, the circuit of a battery is closed for two seconds every minute; the current illuminates a little glow lamp, the filament of which is straight and placed vertically. This filament takes the place of the illuminated slit in the usual arrangement of an Adie magnetograph; its image, about $\frac{1}{2}$ mm. wide, would be formed in the plane of the paper. Just in front of the paper, however, a screen with narrow, horizontal slit is mounted; accordingly, only the light admitted through the slit falls on the paper, and we get a little line or spot about $\frac{1}{2}$ mm. long and $\frac{1}{8}$ mm. wide. Every minute such a spot is formed; an hour corresponding to 15 mm. of base line, the recorded curve consists of a series of points with a mutual distance of $\frac{1}{4}$ mm. Another contact lights the glow lamp every twenty minutes for four seconds; this contact falls between two minute-contacts, and is convenient in reading the time. The correction and the rate of the contact clock, and consequently the times of the contacts, are exactly known; the moments of the twenty-minute contacts are om., 20m., and 40m. Greenwich mean time.

On quiet or moderately disturbed days the trace looks at first sight as a continuous curve; at times of larger disturbances the points are further apart. With the usual arrangement, in strongly disturbed parts the trace becomes very faint, or is sometimes altogether lost; this drawback may be avoided by taking a wide slit, but then many details in quiet or less disturbed parts of the curve are lost. The new method of registration enables the variations to be followed exactly from minute to minute in all circumstances; it must be granted, however, that some details, *e.g.* rapid oscillations of small period, are not exactly reproduced by this method.

The contacts being given once every minute, the beginning of a disturbance, which, as a rule, falls between two contacts, is known with an accuracy of $\frac{1}{2}$ minute; the uncertainty may be reduced, however, to $\frac{1}{3}$, $\frac{1}{4}$, or $1/2n$ minute by giving the contacts 2, 3, or n times a minute; there is no objection against doing so, only the velocity of registration should be taken greater 2, 3, or n times respectively.

It is evident that the method described shows some analogy with that for seismic registration; here too a time mark is given generally once a minute by a contact clock. These clocks being kept for sale, among others, by the manufacturers of seismographs, the arrangement of magnetic registration in the manner applied at De Bilt is a rather easy matter. For the solution of various problems recently advanced—simultaneity or non-simultaneity of the abrupt beginnings of magnetic storms for different elements, direction and velocity of propagation, and character of disturbances, &c.—the providing of a number of stations, spread over the globe in an appropriate manner, with registering apparatus of the kind described, would undoubtedly yield important data and results.

G. VAN DIJK.

Meteorological Institute, De Bilt, February 21.

Reflections in Water.

IN the coloured photographs from Egypt, printed in *The Illustrated London News* on February 25, one picture has white clouds and blue sky with their reflection in still water. The image has the appearance of being stronger than the original. The fact is that the blue sky has much more polarised light than the clouds: the cross-polarisation by reflection at the water darkens the sky and scarcely alters the clouds. At the various incidences, by which the different points of the sky reach us, the conditions are altered. Thus the reflected scene is one of greater variety and stronger contrasts. The effect is not due to anything in the photographic process; I was surprised to see such a correct presentation of what I have sometimes observed.

No one could surpass the late Lord Tennyson in his love for noting various moods of nature, but perhaps the habit is more frequent with great masters of language in France than with us. Pierre Loti abounds with such passages as "Avec cette sonorité particulière que les cloches prennent pendant les nuits tranquilles des printemps." Rostand devotes the opening verses of "Chantecler" to the varied powers of sunlight: the sinking sun, for instance, which chooses

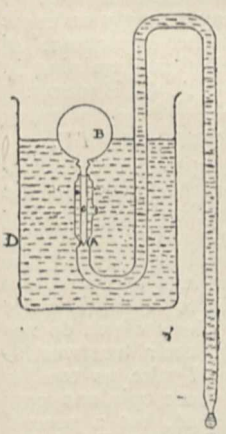
L'humble vitre d'une fenêtre
Pour lancer son dernier adieu.

There are two marked forms in which we often see this. Sometimes it is difficult to believe that there is not a fierce red fire raging in a distant house. At other times, with a higher and a whiter sun, a house on the hill may reflect the sun to us, surrounded with brilliant coloured halos. I suppose that dust upon the window diffracts the light, as do the dust plates of Fraunhofer.

The College, Winchester. W. B. CROFT.

A Self-regulating Siphon.

IN a large number of laboratory experiments it is necessary to keep a continuous flow of water through a vessel in which the level must remain constant. Some sort of self-regulating siphon is a great convenience for this purpose, and that here described is both simple in construction and very efficient in use.



The **U**-tube, bent out of ordinary quarter-inch quill tubing, as shown in the sketch, is narrowed at the point A, and the small piece of glass rod, C, is drawn out so as to fit this constriction. The bulb B, sealed on to the top of this rod, floats on the surface of the water. The **U**-tube must be so fixed that when the water is at the desired level the rod just fits into A, and so closes the exit. If the level of water in the vessel D rises at all, the bulb is raised, and the excess of water flows out through the siphon.

W. H. TAIT.

King Edward VI.'s High School, Birmingham.

The Plumage Bill.

THE statement has been widely circulated by a section of the Chamber of Commerce interested in the feather trade that the aigrettes or ospreys which are now worn are, for the most part, the moulted plumes collected after the breeding season. Long ago Prof. Alfred Newton exposed this statement. He emphatically stated that "cast" feathers do not find their way into the market, and added, "I should doubt whether cast feathers have any real value at all in the plume trade," his belief being that no one concerned in it would look at them. Again, Mr. W. H. Hudson wrote:—"Each bird produces only a small number of these valued feathers, and when he sheds them he does not shed them all together in some spot where a feather-hunter will be sure to find them. He drops them one by one at odd times, some falling in the water where he fishes, some among the trees and rushes where he roosts, and some are shed when he is on the wing going from place to place."

Sir E. Ray Lankester, Mr. W. P. Pycraft, and Mr. James Buckland testify to the truth of the foregoing. Sir E. Ray Lankester says:—"It is always the parent bird, slain at the breeding season, which supplies 'ospreys' for women's hats and bonnets. . . . I am quite tired of assuring the public of the facts of the matter."

In introducing his Bill to prohibit the sale, hire, or exchange of the aigrette and other plumes, Mr. Percy Alden stated that last year some thousands of ounces of these plumes were offered for sale at Mincing Lane. It is estimated that this amount represents the breeding plumes of about 20,000 parent birds, the fledglings of which were probably left to die of starvation. Legislation is the only means of coping with this insensate massacre. JOSEPH COLLINSON.

York House, Portugal Street, W.C., February 28.

Edward Blyth and the Theory of Natural Selection.

WITH reference to Mr. H. M. Vickers's letter in NATURE of February 16, I may perhaps mention that the Edward Blyth who edited Gilbert White's "Selborne" in 1836, a reissue of which was made in 1858, dated his "advertisement," or preface, from "Lower Tooting, November, 1836." Blyth's bird notes to this edition are extensive, but the other portions of the book are very free from annotation. EDWARD A. MARTIN.

285 Holmesdale Road, South Norwood, S.E.

Cat Playing with Shadow.

CAN any correspondent of NATURE recall a case of a cat playing with a shadow?

I know of a cat—a blue Persian—which appears to wait until the morning sun throws the shadow of a cage-bird on the wall of a room, and then seems to play at catching the shadow of the bird as it moves about.

H. S. G.

22 Kensington Park Gardens, W.

THE A-KAMBA OF BRITISH EAST AFRICA.[1]

MR. HOBLEY has again put ethnologists in his debt by giving another series of observations on certain tribes of British East Africa. His monograph on "Eastern Uganda: an Ethnological Survey," published by the Royal Anthropological Institute in 1902 was followed in 1903 by a valuable paper, "Anthropological Studies in Kavirondo and Nandi," in the *Journal* of the Institute. In the present volume he deals mainly with the A-Kamba, who inhabit a large area south and south-east of Mount Kenia, and about whom we have hitherto had extremely little information, with the exception of a capital general and comparative ethnographical account by J. M. Hildebrandt in the *Zeitschrift für Ethnologie*, Bd. x., 1878, p. 347. A small book containing vocabularies of the Kamba and Kikuyu languages, compiled by Mrs. Hinde, was published by the Cambridge University Press in 1904, but no details are given about either people.

The A-Kamba are probably the purest representatives of the Bantu stock in British East Africa; they are a sturdy people, the males being about 5 feet 6 inches in height. The average cephalic index of ten men is 78·6, while that of two skulls is 74. The nose is platyrhine. Two general types of head are noticeable, one "with very wide massive jaws, curved sides, and tapering towards the forehead, a very coarse negroid type, and the other is, comparatively speaking, a more intellectual type, with a wider fore-

[1] "Ethnology of A-Kamba and other East African Tribes." By C. W. Hobley, C.M.G. Pp. xvi+174. (Cambridge: University Press, 1910.) Price 7*s*. 6*d*. net.

head and narrower in the region of the jaws; the chiefs generally belong to the latter type. It appears to be impossible to discover any reason for this variation." Periodically numbers of the younger people are seized by a peculiar form of hysteria (resembling the so-called arctic hysteria), and the sight of a hat or cap, or sometimes of a dog, causes the patient to fall into convulsions, until the obnoxious object is removed from sight. The numerical proportion of the sexes is equal, and polygyny is fast dying out. The A-Kamba are the only people in East Africa who chip the upper incisor teeth to a point; filing or chipping the teeth is generally supposed to be associated with cannibalism, but so far as can be ascertained no such custom exists or has existed among the A-Kamba. The ornaments, clothing, implements, arts and crafts of the people are succinctly described, but the most valuable portion of the book is that dealing with the social and religious aspects of native life. The birth, marriage, and death customs are recorded, but those connected with puberty are of greater interest. Circumcision is performed when the child is about four or five years old; this is only a small affair, but more important is an initiation ceremony, which lasts for several days, at which several hundred young people are often present; the boys and girls are divided into batches of ten or fifteen, with a fully initiated youth or girl in charge of each batch. It is the duty of these tutors to teach their pupils their duties in life; they also cut pictographs on sticks, the meaning of which the neophytes have to discover. Some two months later the youths only undergo a ceremony of a very secret character in the woods; in the darkness of the night a weird booming roar is heard, and the youths sit and shudder with fright. This is said to be caused by a fearsome beast, which on the third day is supposed to be killed and its flesh eaten by the novitiates. Very little is known about this ceremony, which is evidently one of great antiquity and interest.

The second part of the book contains some valuable notes upon a few other tribes; of especial importance are the notes on the social organisation of the Masai, among whom a geographical grouping is replacing the older clan grouping; the marks branded on the cattle correspond to the latter, while the designs on the shields have a territorial significance. Mr. Hobley directs attention to the promising field for research, not only in the ethnology but in the archæology of British East Africa. His little book, which is extremely well illustrated, serves to emphasise how much more there is to be done; for example, he has discovered a new small pastoral tribe, the Mogogodo, on the foothills on the north side of Kenia, who possess a remarkable language, and features that remind one of certain ancient Egyptians. In a prefatory note, Prof. Ridgeway strongly endorses the remarks of Mr. Hobley on the importance of Government officials having a preliminary training in anthropology.

A. C. HADDON.

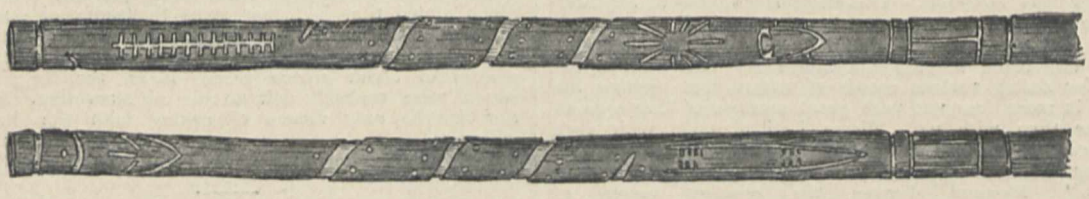


FIG. 1.—Pictographs cut on a stick representing a star; moon; arrow; black, red-legged millipede; python, the dots represent the spots on the reptile's skin; spider; tortoise; lizard; wooden jar for carrying honey. From "Ethnology of A-Kamba and other East African Tribes."

FIG. 2.—Matungi, chief of the Mogogodo tribe. From "Ethnology of A-Kamba and other East African Tribes."

THE TOKYO IMPERIAL UNIVERSITY.

THE peoples of the West for a long time had the impression that while the Japanese had great artistic ability and could imitate the productions of other countries, they had little or no originality. Notwithstanding all that they have accomplished during the past forty years or so, both in the arts of peace and war, that impression still prevails to a considerable extent, and we frequently hear opinions which do not do justice to their general ability, their trustworthiness, or their originality. It would take us too far afield if we attempted to disprove those opinions from what the Japanese have accomplished, but a perusal of the reports of the Minister of State for Education and of the calendar of Tokyo Imperial University shows that the developments which have taken place in Japan in recent times are not the superficial veneers which some people would have us believe they are, but, on the contrary, that they have been made on a solid foundation of education.

The annual report of the Minister of State for Education is a most interesting document, and shows that during the time which we have mentioned every department of education which is necessary to train men and women for all the duties of a modern State has been very fully developed. Elementary schools are to be found in every part of the country, and secondary schools have been established in the more important centres of population, while a great variety of special and technical schools, fit for all the functions required under the new conditions, which are the result of the adoption of Western science and habits of life.

At the head of all these educational institutions stand the Universities of Tokyo and Kyoto, the calendar of the former of which has just come to hand, and a perusal of it will be useful to all who are interested in education in this country, as in some respects it shows a width of view and a completeness of arrangement which are not always observable in universities in this country. The University of Tokyo began in a very small way, and its development is sketched in the interesting historical summary which serves as an introduction to the calendar. At a comparatively early stage it had four departments of study, namely, those of law, science, literature, and medicine, and in 1886 the Kobu-Daigakko or Imperial College of Engineering, became a college in the university. Readers of NATURE of between thirty and forty years ago will remember this as the college associated with the names of Dr. Henry Dyer and Dr. Edward Divers, its first and second principals, and of Profs. Ayrton, Perry, Milne, and other graduates of British universities.

The university now consists of six colleges and one university hall. The colleges are those of law, medicine, engineering, literature, science, and agriculture. The College of Law includes the two courses of law and politics, with thirty-four professorial chairs. The College of Medicine includes the two courses of medicine and pharmacy, with thirty-one professorial chairs. In connection with this college there is a course of State medicine. The College of Engineering includes the nine courses of civil engineering, mechanical engineering, naval architecture, technology of arms, electrical engineering, architecture, applied chemistry, technology of explosives, and mining and metallurgy, with thirty-two professorial chairs. The College of Literature includes the three courses of philosophy, history, and literature, with twenty-four professorial chairs. The College of Science includes the nine courses of mathematics, astronomy, theoretical physics, practical physics, chemistry, zoology, botany, geology, and mineralogy, with twenty-five professorial chairs. The College of Agriculture includes the four courses of agriculture, agricultural, chemistry, forestry, and veterinary medicine, with thirty professorial chairs. For the training of practical farmers, subsidiary courses of agriculture, forestry, and veterinary medicine are provided in connection with the College of Agriculture.

The university is well equipped with all the appliances required for the practical teaching of the various subjects. It has a very good library, containing a large number of all the more modern books required in university study. Hospitals are connected with the College of Medicine. An Institute of Historical Compilation is a part of the College of Literature connected with the College of Science are the Tokyo Astronomical Observatory, the Botanical Garden, the Seismological Observatory, and the Marine Laboratory. Forests, experimental farms, veterinary hospitals, and the Institute for the Training of Agricultural School Teachers are connected with the College of Agriculture. There are many laboratories and museums in connection with the Colleges of Medicine, Engineering, Science, and Agriculture.

The total number of students is between five and six thousand, and of graduates in one year nearly nine hundred. The record of the occupations of the graduates after they have left the university shows that they have taken up practical work connected with the special department which they had selected as students. A large proportion become Government officials, lawyers, engineers, medical practitioners, and teachers. There are two private institutions in Tokyo of university rank, the Keïo Gijiku and the Waseda Universities, each of which has a large number of students, the majority of whom enter private services, as distinguished from the students of the Imperial University, a large proportion of whom become Government officials.

That the students of the university do not simply absorb Western learning and apply it to practical purposes is shown by the long list of papers which is printed at the end of the calendar, giving the contents of the *Journals* of the Medical, Engineering, Science, and Agricultural Colleges, and the bulletins of the Engineering and Agricultural Colleges. Those who have had the opportunity of perusing these publications will admit that they will bear very favourable comparison with those of similar publications in any other country, and those who have the pleasure of knowing the professors personally will admit that they are men of ability, learning, and character, of whom any learned institution in the world would have no reason to be ashamed.

A survey of the results of education on the affairs of the nation shows convincingly and conclusively the intimate relation that exists between the provision made by a nation for the higher education of its people and the position taken by that nation in the ceaseless competition between the great countries of the world. After a searching comparison between the facilities for university education in this country, on one hand, and in the United States and Germany on the other, Sir Norman Lockyer was justified in saying in his presidential address at the British Association meeting at Southport :—

"But even more wonderful than these examples is the 'intellectual effort' made by Japan, not after a war, but to prepare for one. The question is, Shall we wait for a disaster and then imitate Prussia and France, or shall we follow Japan and thoroughly prepare by 'intellectual effort' for the industrial struggle which lies before us?"

H. D.

FIFTH MIGRATION REPORT OF THE BRITISH ORNITHOLOGISTS CLUB.[1]

WE have before us the fifth annual report of the migration committee of the British Ornithologists Club, containing the data with regard to the arrival and dispersal within England and Wales of our common migratory birds during the autumn of 1908 and the spring and early summer of 1909, scheduled and tabulated as in former years. The report, which is longer than any of its predecessors, summarises a vast number of observations sent in by numerous voluntary observers, and by the keepers of the coastwise lighthouses and lightships. These data, compiled with an infinitude of labour and care, will always retain their value as a contribution to our knowledge of the movements of the species dealt with within the narrow limits of the area of reference. Even such apparently dry details—composed solely of names and figures—present (among those, for instance, sent in from the lonely sea-girt stations dotting our shores from The Hanois to St. Abbs Head) an interesting and fascinating picture of that wild, inexplicable rush of our feathered friends in a commingled horde fleeing as from judgment to come, which every autumn blindly compels to the southward, but to what latitudes we know not yet for certain.

The dates of the movements of the scheduled birds tabulated on the maps afford us again the satisfaction of following the sure and happy return of our

[1] Bulletin of the British Ornithologists Club. Edited by W. R. Ogilvie-Grant. Vol. xxvi., Report on the Immigrations of Summer Residents in the Spring of 1909; also Notes on the Migratory Movements and Records received from Lighthouses and Light-vessels during the Autumn of 1908. By the Committee appointed by the British Ornithologists Club. (London: Witherby and Co., 1910.)

summer songsters as they hasten hard after the northing sun. The tale each map is intended to tell is made evident on its face by a system of signs, but they are intelligible, however, only to those acquainted with the earlier reports. As the student may not always have these at hand, it would be advantageous and would save some "language," if the editor would, as already suggested in NATURE of May 26, have the interpretation of the hieroglyphical brackets inserted in the preface or cause explanatory legends to be attached to each map; for the signs have not invariably the same meaning in all of them, while occasionally new signs are introduced without explanation, such as the hexagons and octagons which are used in the present report.

There is considerable inconsistency also in the plottings of the observations. In some schedules the earliest arrivals, even if solitary, are entered, but not invariably: in others, movements mentioned in the chronological summary, which appear to us to be of importance, are ignored for no obvious reason. In the diary of the swallow, for instance, the summary includes a large number of records for May, yet the whole of them (with the exception of those for "2," "7–14," and "3," on the south coast), although numerous and apparently as important as those of March and April, are entirely unscheduled. So far, also, as appears from the map, there was in 1909 only a single swallow immigration, yet the summary alludes to several, and in previous years as many as five are separately mapped. In the section entitled "Unscheduled Birds," sixty-six birds are recorded, and are listed in many cases with fuller details than those given for the scheduled species. It would be an advantage to those studying the evidence, we think, if, in future reports, both scheduled and unscheduled birds were incorporated in one list, the latter in less prominent type, if need be. There is as much to be learned from the one set as from the other. It would, likewise, be important and very interesting to have lighthouse records for the arriving as well as for the departing bird-streams, and to know if the spring flocks are composed of as mixed assemblages of species as those of the autumn. It would be worth trying also to ascertain whether, if this be not the case on arrival, it be so as they start from their winter quarters.

Those who have followed this inquiry will remember that the reports which the committee have presented during the last five years are but fuller continuations of the investigations carried on for so many years by a British Association committee. The present committee, in their second report, hoped "that in a few years results of considerable value may be obtained." Many ornithologists are of opinion that if these elaborate and costly compilations are ever to contribute to the solution of the migration mystery some results ought by now to be showing on the surface. Yet if we search through the four last reports, we fail to discover any fact of real significance which is not to be found in the first. The dates of the arrival and departure of our migrants are seen to vary slightly from year to year; the wave may be larger or smaller, and the species which make their port of entry in one year east of the Isle of Wight may choose one to west of it in other years. But of what importance is this information to the problem? Five years ago it was believed that the methods adopted by the committee would probably provide material for valuable generalisations. Year after year passes, and our disappointment grows that we seem no "forarder" in our quest. It is becoming daily clearer that the area of observation is far too limited, for the land-patch of England and Wales is no more to the wide area covered by migrants than Trafalgar Square is to the county of Middlesex. The complex problems—the cause of the impulse, whether it originates within or outside the birds, and whether it affects all species, though in different degrees: how the young birds (if in autumn they really—which is very questionable—precede their parents into uncharted space) find their way, and other such questions, cannot be solved by tabulating the momentary vision of a passing bird in association with local meteorological or other conditions which it encounters by chance *en route*, except over a wider area than these reports deal with, and by taking many other influences into consideration.

We firmly believe that no contributions of real value to this inquiry can be attained, if they ever are to be attained, except by the united international action of ornithological societies in marking vast numbers of parents as well as nestlings in their breeding localities, of "the thousands" also of those that are temporarily dazed at lighthouses, and of northern species while in winter quarters in various regions of Africa, and of southern Asia and America. Only thus are we likely to discover what awakens the migratory impulse at a particular date, whether meteorological changes, deficiency of food supply, decrease of sun-heat and light, or other external causes, or whether none of these have any influence, and perhaps solely an inherited periodical brain-storm impels them to the road. Only by the capture of birds, numerously marked at their nesting-places in northern and in their winter quarters in southern latitudes, can their routes, out and home, be plotted and dated with any approach to exactitude. Such an inquiry must needs be protracted even with united world-wide interaction; but it seems more hopeful than any other. Moreover, it is urgent, and ought to be commenced at once. The mystery of migration may, nevertheless, elude the best efforts of our generation towards its solution.

JOHAN GADOLIN.[1]

JOHAN GADOLIN, one of the most distinguished of Finnish men of science, occupies a well-defined position in the history of chemistry. He was a pupil of Bergman, a friend of Scheele, and the forerunner of Berzelius. He served as a connecting link, as it were, in the new departure of the science as initiated by the workers at Upsala, and as so splendidly furthered by the secretary of the Stockholm Academy. Gadolin's scientific activity was, in fact, concentrated within the two decades which elapsed between the death of Scheele and the coming of Berzelius, and his labours worthily upheld the traditions of the Scandinavian school.

Gadolin came of a family which had long been associated with learning and scholarship in Finland. He was born June 5, 1760, at Åbo, then the capital of Finland, and the seat of its university. His father, Jacob Gadolin, was formerly professor of physic, afterwards of theology, and ultimately Bishop of Abo. His maternal grandfather, Johan Browallius, a contemporary and friend of Linné, had also served as professor of physic, and, like his son-in-law, was likewise made a bishop. After passing through the High School of his native town, the young Gadolin attended the lectures of Pehr Adrian Gadd, the first to hold a chair of chemistry in the Finnish University. Attracted by the fame of Torbern Bergman, then one of the foremost leaders of chemical science in northern Europe, he passed over to Upsala, where he remained four years. During that time he became known to Scheele, and was on terms of intimate

[1] Johan Gadolin, 1760–1852. In Memoriam. Wissenschaftliche Abhandlugen Johan Gadolins in Auswahl. Herausgegeben von Edv. Hjelt und Robt. Tigerstedt. Pp. cii+287. (Leipzig: S. Hirzel, n.d.) Price 12 marks.

friendship with him during the few short years of life that were left to him.

Gadolin was the most distinguished of Bergman's pupils. Under him he began the metallurgical and mineralogical inquiries with which his name is associated. At Upsala, too, he commenced his work on specific heat, which he subsequently published at Abo in 1784. On the death of Bergman, he was a candidate for the chair at Upsala, but Afzelius was chosen, whereupon Gadolin returned to Finland, and in 1785 was made professor extraordinarius at the University of Åbo. The duties of his office left him, however, ample leisure, part of which he occupied in travel in Germany, Holland, and England. He established a literary connection with Lorenz Crell, which led to frequent communications to the *Annalen* which Crell edited. Whilst in London he published a memoir on the analysis of iron ores by wet methods, in which he gave the first suggestion of a method of volumetric analysis, and in conjunction with Crawford he undertook a series of determinations of the latent and specific heat of ice. Passing over to Ireland, he made the acquaintance of Kirwan, with whom he subsequently corresponded on mineralogical matters.

Gadolin was early attracted to the work of the French School of Chemistry, and made known the new doctrine to northern Europe. On his return to Åbo in 1789 he adopted the new chemistry as a feature of his teaching. In 1797, on Gadd's death, he became ordinary professor of chemistry, holding the chair until 1822, when he retired. Phlogistonism died hard in Sweden, but Gadolin's handbook, which he published in the Swedish language in 1798, did much to kill it. The most fruitful period of Gadolin's scientific activity is comprised between the years 1788 and 1803.

It was Gadolin who first made known the existence of a new earth in a black mineral from Ytterby, in Sweden, which Ekeberg subsequently termed *Yttria-earth*, the first discovered member of that numerous group of bodies we term the rare earths. The mineral itself became known as Gadolinite. A hundred years later Marignac and Lecoq de Boisbaudran found a new element in Samarskite, which they named *Gadolinium*, in honour of the discoverer of the first of this series of substances.

The great fire of 1827, which practically destroyed Åbo, and with it the university buildings and the whole of his mineral collections, terminated Gadolin's scientific career. The site of the university was moved to Helsingfors, and Gadolin retired to the country, where he died on August 15, 1852, at the age of ninety-two.

In the handsome quarto volume before us Prof. Hjelt and his collaborator have put together a very complete account of Gadolin's career and of his services to science. This is followed by copious extracts from his correspondence, some details of his courses of university lectures, and a selection of his more important memoirs, and the whole concludes with a list of his contemporaries, more particularly of those associated with him as academic colleagues, co-workers in science, or as literary correspondents. The chapter on Gadolin's scientific activity contains an admirable critical account of his relation to his period and of the part he played in connection with the downfall of phlogistonism. It also contains a full and discriminating analysis of his more important memoirs, viz., on specific heat, on iron analysis, and on his detection of the first member of the series of rare earths. The short acount of his system of teaching is largely made up of extracts from the manuscripts of his lectures. They are especially rich in historical references and throw interesting sidelights on his period. T. E. T.

NOTES.

We notice with deep regret the announcement of the death, in his fifty-ninth year, of Prof. J. H. van 't Hoff, honorary professor of general chemistry in the University of Berlin, on February 1, at Steglitz, near Berlin.

The nineteenth "James Forrest" lecture of the Institution of Civil Engineers will be delivered on Wednesday, June 28, by Dr. F. H. Hatch, his subject being "The Past, Present, and Future of Mining in the Transvaal."

The president of the Royal Society and the members of the General Board of the National Physical Laboratory will meet at the laboratory on Friday, March 17, for the annual visitation, when the various departments will be on view.

Prof. H. E. Armstrong, F.R.S., has been nominated the delegate of the Royal Institution at the celebration of the centenary of the Royal Frederick University of Christiania, and Sir James Crichton-Browne, F.R.S., as delegate at the celebration of the 500th anniversary of the University of St. Andrews.

Lieut.-Colonel David Prain, F.R.S., director of the Royal Botanic Gardens, Kew, has been elected a member of the Athenæum Club under the provisions of the rule which empowers the annual election by the committee of a certain number of persons "of distinguished eminence in science, literature, the arts, or for public services."

It is announced in the *Revue scientifique* that M. Fauvel has offered 30,000 francs for the construction of an annexe to the laboratory of the National Museum of Natural History in Paris.

The death is announced, at sixty-eight years of age, of Mr. John Sime, C.I.E., late Director of Public Instruction in the Punjab and Under-Secretary to the Punjab Government in the Education Department.

We regret to notice that Mr. E. E. Wilson, formerly an assistant in the radiography department of the London Hospital, died on March 2 as the result of disease contracted by frequent exposure to Röntgen rays.

The Easter excursion of the Geologists' Association will be to St. David's district, South Wales, and will extend from April 13 to April 22. The excursion directors are Mr. J. F. N. Green and Prof. O. T. Jones, and the excursion secretary Mr. A. L. Leach, Giltar, Shrewsbury Lane, Plumstead, S.E.

A conference of members of the Museums Association and others interested in museums will be held at Belle Vue and Bankfield Museums on Saturday, April 8, for the purpose of discussing subjects of interest to those concerned in the work of museums, art galleries, and kindred institutions. Anyone proposing to attend the conference should communicate with Mr. H. Ling Roth, Briarfield, Shibden, Halifax.

Dr. John W. Harshberger, assistant professor of botany in the University of Pennsylvania, has just returned from an expedition in the Everglades of southern Florida, during which he collected several plants previously unknown to science. The Everglades themselves, he reports, are fast passing away through continual drainage, and their vegetation is likely soon to become extinct.

We learn from *Science* that the U.S. Senate has passed the Weeks Bill providing for the establishment of a forest reserve in the Appalachian Mountains. The Bill is applicable from Maine to the Gulf of Mexico, on the eastern

seaboard. The Bill gives the consent of Congress to the States to enter into an agreement among themselves for the purpose of conserving the forests and water supply of each, and grants 40,000*l.* to enable the Secretary of Agriculture to cooperate with such States in giving fire protection. In addition, the Bill appropriates 200,000*l.* for one year, and not more than 400,000*l.* for each year thereafter, until 1915, for surveys, examinations, and acquirement of lands located at the headwaters of streams which are being or may be developed for navigable purposes.

A FLIGHT from Paris to the crest of the Puy de Dôme was accomplished by M. Eugène Renaux on a Maurice Farman biplane with a passenger on March 7. The distance is 210 miles, and the journey was made to the crest of the Puy de Dôme, 4000 feet high, in 5h. 11m., after one landing. This is the fourth noteworthy aëroplane flight of the present year, the others being:—January 30, Mr. McCurdy, the Canadian aviator, flew over-sea from Key West (Florida) to within ten miles of Havana, in the island of Cuba; February 1 and February 2, Captain Bellanger flew from Paris to Pau, *via* Bordeaux, a distance of nearly 500 miles; March 5, Lieut. Bague flew 140 miles over-sea from Nice almost to the Italian coast. Referring to these flights, *The Morning Post* says:—"These flying achievements, viewed in regard to the lengthy periods over which they were sustained, the precision with which they were executed, and the fact that in each case the aviator had a definite goal which he succeeded—or all but succeeded—in reaching, place the art of aviation in a position, as concerns its practical usefulness, which it would have been all but impossible to have foreseen only a year ago."

THE following are among the lecture arrangements at the Royal Institution after Easter:—Prof. F. W. Mott, two lectures on the brain and the hand; Prof. W. W. Watts, two lectures on (1) the ancient volcano of Charnwood Forest (Leicestershire), (2) Charnwood Forest and its fossil landscape; Prof. R. W. Wood, three lectures on the optical properties of metallic vapours; Dr. W. N. Shaw, two lectures on air and the flying machine: (1) the structure of the atmosphere and the texture of air currents, (2) conditions of safety for floaters and fliers; Mr. T. Thorne-Baker, two lectures on (1) changes effected by light, (2) practical progress in wireless telegraphy; Mr. W. P. Pycraft, two lectures on phases of bird life: (1) flight, (2) migration. The Friday evening meetings will be resumed on April 28, when a discourse will be given by Prof. W. M. Flinders Petrie on the revolutions of civilisation. Succeeding discourses will probably be given by Prof. Martin O. Forster, Prof. W. Stirling, Prof. R. W. Wood, Prof. Gilbert Murray, Commendatore G. Marconi, and Prof. Svante Arrhenius, among others.

THE first Universal Races Congress will be held on July 26–29 in the central building of the University of London. The object of the congress will be to discuss, in the light of modern knowledge and the modern conscience, the general relations subsisting between the peoples of the West and those of the East, between so-called white and so-called coloured peoples, with the view of encouraging between them a fuller understanding, the most friendly feelings, and a heartier cooperation. The following is the programme for the eight half-day sessions:—(1) fundamental considerations—meaning of race, tribe, nation; (2–3) general conditions of progress; (3*a*) peaceful contact between civilisations; (4) special problems in inter-racial economics; (5–6) the modern conscience in relation to racial questions; (7–8) positive suggestions for promoting inter-racial friendliness. It is proposed to hold in connection with the congress an exhibition of books, documents, photographs of the highest human types, skulls, charts, &c. The exhibition is under the direction of Dr. A. C. Haddon, F.R.S., and promises to be of wide interest. A prospectus will be sent free of charge on application to the honorary secretary of the congress, Mr. G. Spiller, 63 South Hill Park, Hampstead, London.

MR. L. PEARSALL SMITH writes to *The Times* to suggest that another term, such as "halcyon"—used as a substitute—should be adopted in the place of "anti-cyclone," as this word is said not to convey the connotation of calm and pleasant weather conditions. "While popular speech," he remarks, "has been able to adopt 'cyclone,' it has found, as we might expect from its form, 'anti-cyclone' unsuited for its purpose." The unfortunate thing is that popular speech, as expressed in the daily Press, calls a storm or any unusual atmospheric disturbance a cyclone, whereas it is nothing of the kind. What Mr. Smith proposes, therefore, is that the exact terms of meteorological science shall be modified to adapt them to the indefinite and often incorrect expressions of popular language. For the sake of the preservation of precision in scientific nomenclature, it is worth while to give in this connection a quotation from a publication of the U.S. Weather Bureau, issued many years ago:—"The terms 'cyclone' and 'anti-cyclone' do not describe phenomena that can be observed by one observer at a single station; they should, therefore, not be used in the description of local phenomena; they represent generalisations based upon the charting and study of winds and clouds observed at many stations, and should only be used when the nature of the rotation of the wind has been clearly demonstrated or can be safely inferred."

A SUMMARY of the temperature, rainfall, and bright sunshine in the United Kingdom for the past winter is given by the Meteorological Office in its last issue of the Weekly Weather Report. The mean temperature was slightly in excess of the average over the entire kingdom, but the difference was nowhere large. At Greenwich the mean for the three winter months, December to February, was 1·7° below the normal, but December is the only month where the departure from the average was considerable, amounting to an excess of 5°. The Midland counties is the only district in which the sheltered thermometer touched 60°, whilst the minima in the several districts fell below 20° everywhere except in the Channel Islands. The aggregate winter rainfall was deficient except in the north and west of Scotland and in the east and north-west of England. The greatest deficiency is 2·64 inches in the south of Ireland, and 2·22 inches in the Channel Islands. The largest aggregate rainfall for the three months is 17·37 inches in the north of Scotland, and the least 4·30 inches in the north-east of England. There was an excess of rain during the winter at Greenwich, due entirely to the heavy rains in December. The rainy days were in fair agreement with the average, the maximum number being 73 in the north of Scotland, and the minimum 46 in the north-east of England. The duration of bright sunshine was generally in fair agreement with the average over the whole kingdom, the records for England showing a slight excess. The maximum duration of sunshine is 209 hours in the Channel Islands, the minimum 103 in the north of Scotland.

WE learn from the Wellington (N.Z.) *Evening Post* of December 7, 1910, that the New Zealand Government has voted 50*l.* or 100*l.* towards the cost of explosives for rain-

making experiments to be made at Oamaru and adjacent drought-stricken parts. It has been shown that such experiments are a useless expenditure of money, and (as stated in the article) have been condemned by the best meteorologists of Europe and America. *Symons's Meteorological Magazine* (July–September, 1908) contains a careful report by Mr. D. C. Bates, who was ordered to watch and report upon rain-making experiments previously carried out in the same district. He states that "the explosions had apparently no more effect on the vast expanse of the air than would the striking of a match in a room." In a lecture printed in *Popular Science Monthly* for January last, Prof. C. Abbe, one of our leading authorities on meteorology, states, in connection with laboratory experiments on the formation of clouds and rain:—"I think you will see that the firing of cannon or dynamite in order to make a great noise is not likely to form rain, and, in fact, cannot possibly bring it down." And further, with reference to the cannon used in Italy to send vortex rings of air into the clouds, he says:—"We have no evidence that they ever reach them, or that they could have any effect if they did so. . . . I regret to think of so many thousands of farmers wasting time and money on this delusion"; and with these opinions we entirely concur. The situation was saved in the present instance by rain having fallen before the explosions took place.

THE thirty-third annual general meeting of the Institute of Chemistry was held on March 1. Dr. George Beilby, F.R.S., the president, occupied the chair, and delivered an address, in which, after referring to the losses of the institute by death, mentioning especially Prof. Campbell Brown, Mr. Michael Carteighe, and Mr. Oscar Guttman, he dealt with the progress and work of the institute. The membership continues steadily to increase, notwithstanding the high standard of the examinations, while the position of the institute as an organisation existing for public service never stood so high as at the present time. The council has under consideration the institution of a series of lectures, the object of which will be to bridge over the gap between academic training and practice. Without depreciating the value of a broad scientific education, it is realised that students entirely trained in an academic atmosphere miss some of the advantages of the old system of private pupilage in the laboratories of practising fellows or in works. This loss is met in some instances by students preparing for the final examination in such laboratories, but there is a need for a means of introducing something analogous to the clinical instruction afforded to medical students. It is proposed, therefore, to ask fellows having expert knowledge to give lectures which will give students an insight into the actual work of the chemist, whether engaged in the application of his science to commerce and industry or to the scientific control of the affairs of daily life. Prof. R. Meldola, in moving a vote of thanks to the president for his address, said it would give him much pleasure to see the institute take an active part in the education of chemists, and he cordially supported the new departure as to the institution of the proposed lectures, which will make the student realise more fully the value of the practical side of his subject.

IN *The Times* of March 4 there appeared a further article upon the subject of the spread of plague. Dealing, first, with the disease amongst rodents in East Anglia, the writer refers to the rat investigation recently carried out at Ipswich under the auspices of the Local Government Board. This inquiry lasted for about six weeks, during the course of which about 6000 animals were examined. These rats were not drawn from the area already known to be infected, but from a fairly extensive tract of country on its outskirts. No report has yet appeared, but it is believed that few, if any, plague-rats were found. This result, although apparently reassuring, does not affect the main question. The investigation was carried out during the off-plague season, and at the time when fewest rat-fleas are found. Similar inquiries carried out in India and elsewhere show that it is dangerous to conclude that plague has disappeared from an infected area because no plague-rats are found. It is thereafter desirable that the investigations should be repeated in autumn, and at intervals during the next two or three years. In the meantime, the campaign of rat extermination should be prosecuted with undiminished vigour. Reference is made to the proposal of the War Office to hold extensive manœuvres in Essex. While the possibility of infection among the troops must be considered remote, yet it cannot be said that the establishment of large standing camps is altogether free from risk. Turning next to the question of plague manifestations in other parts of the world, the writer of the article gives some important particulars concerning the occurrence of the pneumonic form of the disease during recent years. These show that a relatively large proportion of such cases occur in temperate climates. Very little is at present known about pneumonic plague, and there are often difficulties in its diagnosis. It is not unlikely that much valuable information may be obtained by a study of the present outburst in Manchuria. No explanation can be afforded for the mysterious disappearance of plague at the beginning of the eighteenth century, or for its equally mysterious reawakening in the Chinese province of Yunnan in the 'seventies of last century. Since the year 1896 it has caused a terrible loss of life in India, and spasmodic cases have occurred in every continent. It has been argued that the Manchurian outbreak suggests an increasing intensity in the violence of plague infection, the consequences of which will presently be universally manifest. Whether or not this be the case, there is ample justification for the statement that the outlook is not hopeful in places where the rodents are infected. Where infection exists there is always danger. Panic would be unwise, but no one acquainted with the history of plague can regard the present situation with indifference.

DR. J. MAES contributes to the February number of *Man* an account of certain remarkable fetish images of the Wazimba tribe, which have recently been acquired by the Congo Museum at Terveuren. Those illustrated are rude male and female figures, one of which guards children, a second watches young girls and presides over accouchements, a third guards the house, and a fourth protects people from nightmare. The treatment consists in making the patient, to the accompaniment of magical formulæ, drink an infusion of manioc leaves, which are first laid on the head of the fetish.

IN *Man* for February Mr. M. W. H. Beach describes, largely from hearsay, the strange Punan tribe in Borneo, a people well deserving further study. They are said to wear bark clothing, to have no houses or property, and to wander about the forest and sleep in trees. Intercourse with them is carried on by the methods of silent barter. They have the curious habit of leaping three or four yards at a time instead of walking, and their speed is marvellous. They kill game with the *sumpitan*, or blow-pipe, not by the usual method of blowing into the mouth, but by striking the end which contains the dart with the curved palms of their hands.

THE Journal of the Royal Society of Arts for February 10 contains a report of a lecture, by Capt. A. J. N. Tre-

mearne, on the Kagoro, a naked, head-hunting West African tribe occupying a mountain ridge running from the Bauchi into the Nassarawa province of northern Nigeria. They are notorious head-hunters, and there is a curious analogy between the objects and methods of the practice among them and the Nagas of Assam. Among both races it is a mark of social evolution, a young man showing his fitness for marriage by producing a head. Further than this, it appears, as in the case of the Meriah sacrifice of the Khonds or Kandhs, to be a means of promoting the fertility of the soil, a fowl in Nigeria being now the surrogate of the human victim which was not long since sacrificed by the Indian tribes.

PARTS v. and vi. of the Treasury of Human Inheritance (London: Dulau and Co., Ltd., 1911), issued by the Galton Laboratory for National Eugenics, consists of a monograph on the subject of hæmophilia, by Drs. W. Bullock and Paul Fildes. The authors are to be congratulated on the very thorough manner in which they have performed a task the magnitude of which can be realised when it is stated that the literature list contains full references to and descriptions of 949 separate works. Two hundred and thirty-five pedigrees are diagrammatically represented, and such available clinical notes are provided for each person said to have suffered from the disease as would enable a medical man to form an opinion as to the validity of the diagnosis. Many of these pedigrees deal with a very large number of individuals; thus that of the Tenua families includes eight generations and about 400 persons. Enough has been said to show that a rich mine of material has been opened up, and we hope that it will be worked by the experts in heredity. If they desire fuller information on any point or doubt the accuracy of what is contained in this volume, the excellent bibliography will make reference to the original sources easy for them.

IN an article on natural hair-balls in *The Field* of February 25, Mr. Lydekker records the fact—apparently not referred to in any book on reptiles or general natural history—that the stomachs of South American alligators (caimans) not infrequently contain large balls of hairs, derived, doubtless, from mammals which formed their prey. The evidence rests on the testimony of Mr. J. S. da Costa, who brought home a specimen—now in the Museum of the Royal College of Surgeons—and who states that, in the belief of the natives, such accumulations eventually lead to the death of the reptiles. A hair-ball composed mainly of tenrec-hair, brought to England from Madagascar by Mr. A. Dobrée, may indicate that Old World crocodiles are afflicted in the same manner, although this cannot at present be regarded as certain.

BREEDERS should be much interested in an article, by Mr. R. Bunsow, in the second number of the new serial *The Mendel Journal*, on the inheritance of coat-colour in thoroughbred horses. Taking up the subject from the established fact that bays (including browns) may be either pure as regards the power of transmitting their colour, or impure, when they may give rise to chestnuts, the author states that bays, as being capable of producing offspring of a colour different from their own, are a dominant type (D), while chestnuts, which lack this capacity, are recessive (R). Chestnut horses, as having but one kind of sexual cells, may accordingly all be symbolised as RR, whereas bays may be classed either as DD or DR, according to whether they are pure or whether they contain an admixture of chestnut cells. Now if a DD stallion be mated with an RR mare, all the foals will be DR bays. On the other hand, the foals of an RR mare by a DR stallion will, in the long run, consist of bays and chestnuts in nearly equal numbers. When chestnuts are bred together, their offspring should be all chestnuts (RR), but if chestnuts be crossed with bays, the foals may be either all bays or half chestnuts (RR) and half bays (DR), the former case, as mentioned above, being due to the fact that the parent bays were DD, and the latter to their being DR. Certain exceptions to these conditions occurring in the Stud-book are shown to be due to incorrect registration of colour, and it is probable that the same is the case with the rest. As regards greys, it is asserted that one of the parents must be of this colour.

A SUMMARY, by Mr. A. B. E. Hillas, of reports received relative to the movements of eel-fry during the year ending September 30, 1909, has been received from the Irish Department of Agriculture and Fisheries (Fisheries, Ireland, Sci. Invest., 1910, vi.). This summary, which is a continuation of that of the previous year, presents the substance of replies given to four questions, widely circulated among those likely to be able to give information of the movements of eel-fry in the various river systems. The information at present available is not sufficient to permit the author to state with certainty whether the successive immigrations of fry form parts of one continuous annual series or are divisible into two or more seasonal runs; the facts reported from Wexford seem to support the latter view, whereas in the Coleraine district there was a run from March to June, which was practically continuous from April 21.

A LIST of wild flowers recorded from Barmouth and the neighbourhood is published by Mr. James Kynoch, Brighton. The most interesting part is the list of plants, including cryptogams as well as phanerogams, compiled by the Rev. T. Salwey, and published in 1863, in which localities in the county of Merioneth outside the Barmouth district are given.

PROCEEDING from the appearance of a variant *Œnothera rubricalyx*, distinguished from its progenitor *Œnothera rubrinervis* by increased red coloration in parts of the plant, Dr. R. R. Gates communicates to the *American Naturalist* (April, 1910) an article in which he discusses the bearing of what is regarded as an instance of quantitative colour inheritance, concluding that in many cases the difference between Mendelian hybrids must be simply quantitative, involving a difference either in the amount of certain material substances or in the energy content of certain constituents.

CONTINUING his revisions of fungal species in the *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften*, Vienna (vol. cxix., part v.), Prof. F. von Höhnel discusses a number of Ascomycetes, and presents a scheme for classifying the Microthyriaceæ. To the same number Miss J. Menz contributes a paper on the morphology of the genus Allium, in which the taxonomic value of the leaf bundles is considered, and a relationship between the Allioideæ and Amaryllidoideæ is suggested, primarily owing to the development of mucilage canals and cells containing raphides.

A FIRST contribution to the flora of Siam, published in the *Kew Bulletin* (No. 1), is jointly provided by Dr. A. F. G. Kerr, who collected the plants and has written an introductory sketch of the vegetation on Doi Sootep, a mountain in northern Siam, and by Mr. W. G. Craib, who is responsible for the identifications. Different types of forest are associated with *Pentacme siamensis*, *Dipterocarpus tuberculatus*, species of Quercus and Castanopsis,

Pinus Khasya, and *Quercus Junghuhnii*. In several of the associations, epiphytes, chiefly orchids and ferns, are a characteristic feature; *Dischidia Rafflesiana*, *Agapetes Hosseana*, and *Rhododendron Veitchianum* are notable epiphytes. Mr. Craib's list, which is confined to the Polypetalæ, contains a number of species new to science, and a type of a new genus, Pittosporopsis, in the family Icacinaceæ. A very large preponderance of species in the family Leguminosæ is due partly to the number of genera and partly to the variety of species in the genera Desmodium, Crotalaria, Cassia, and Bauhinia.

IN the *Cairo Scientific Journal* for January, Mr. W. Cartwright has an article on the control of the cotton aphis, thus adding one more to the many useful communications relating to cotton cultivation which have appeared in that journal during the past four years, during which but little has been done officially to promote research in this important field.

IN a recent paper (*Bull. de l'Acad. Imp. de Sci. de St. Pétersbourg*, 1911, No. 2) Prince Galitzin discusses the records obtained at Pulkowa of the great earthquake of January 3–4. He finds that the epicentre was situated in lat. 43° 14′ N., long. 78° 24′ E., an estimate which agrees closely with that obtained from the records at Eskdalemuir of lat. 42° N., long. 77° E. Both points lie close to Lake Issyl-kul, and to the epicentral area of the great Vyernyi earthquake of June 9, 1887.

THE seismological bulletins of the observatory at Zikawei for November and December, 1910, consist of registers obtained from Omori and Weichert pendulums. The former weighs about 15 kilos., and the latter about 1200. In December the heavier of these instruments gave twenty-three records, whilst the lighter only gave eighteen. Three out of the twenty-three seem to be peculiar to Zikawei, whilst the remaining twenty were also recorded in Great Britain, and probably at most stations in the world.

A POPULAR article by a resident at Innsbruck, the capital of Tyrol, on the Föhn wind as it strikes an observer, appears in *Symons's Meteorological Magazine* for February. This blows at times with considerable force, sweeping northwards from the Brenner Valley as a warm, dry wind, raising clouds of dust in its track. If it is summer, the atmosphere becomes stiflingly hot, if winter, the keen, frosty air turns mild and close; and it sometimes exerts a depressing influence on the nervous system. From twenty-five years' observations supplied by Dr. H. v. Ficker, Innsbruck has an annual average of forty-three days of Föhn; it is most frequent in spring (seventeen days) and autumn (eleven days). It generally lasts one or two days; twice in the above period it lasted eight days. On vegetation it has its advantages, *e.g.* Innsbruck owes its crops of maize to it, and some floral types from the inter-Glacial period still survive in the Inn Valley. Its attacks are mild compared with those in certain Swiss valleys, where it sometimes uproots trees by its fury.

IN the Australian Monthly Weather Report for March, 1910, Mr. H. A. Hunt gives a very interesting account of a hurricane of exceptional severity that visited the Fiji group of islands on the 24th and 25th of that month. The storm was a remarkable one, and its track can be followed for some 2500 miles from Fiji to New Caledonia, Norfolk Island, and the North Island of New Zealand, where it arrived on the morning of the 30th. The harbour master at Suva states that its approach was quite unexpected; the heat was excessive, but the barometer gave scarcely any warning. At midnight it was falling; at 2h. a.m. it stood at 29·00 in., and the easterly wind was increasing, with heavy rain. At 3h. a.m. it was blowing with hurricane force, and sheets of iron were flying from all directions between E. and N.E.; at 4h. a.m. the barometer had fallen to 28·50 in., and then began to rise. At Levuka there was a calm of about ten minutes as the votex passed over the town, with a complete change of direction, but at Suva the wind simply backed from E. to N.N.E. as the barometer rose. The isobaric charts show that the storm followed the usual track, moving in a W.S.W. direction until caught in the easterly atmospheric drift of mid-latitudes, when it curved to the south-east.

IN the January number of the *American Journal of Science* appears a communication by Dr. L. A. Bauer on gravity determinations at sea, in which he discusses the results obtained by Dr. Hecker in 1901, 1904, and 1909, and indicates the direction in which efforts are being made to attain more satisfactory results during the cruise of *Carnegie*, starting from Cape Town about April, 1911. In spite of the most elaborate precautions which were taken in Hecker's trips, trouble was experienced with the boiling-point thermometers employed to determine the atmospheric pressure in order to compare it with the height of the mercurial column, which, under the same conditions, changes with variations of gravity. Experimental work with boiling-point thermometers was carried out on the *Carnegie* in 1909–10, and the results showed that it would be worth while to attempt gravity work on board of her. The methods and reductions hitherto employed are discussed, and the view is expressed that some error may attach to the results obtained by the boiling-point thermometers, and that in the method of reduction local gravity anomalies observed during a cruise partake of the nature of accidental errors. On the *Carnegie* it is proposed to make both shore and harbour observations, especially at places where pendulum observations have already been made; frequent zero determinations of the thermometers, and comparisons of the barometers with shore standards, wherever available, are to be employed to determine the various errors. The necessary refinement of the barometric work remains as the chief difficulty, and the hope is expressed that, in view of the great importance of the subject, a method superior to the present may be discovered whereby the boiling-point thermometer may be eliminated.

IN an original memoir in the January number of *Le Radium*, M. G. Sagnac, of Paris, shows that in order that the time occupied by two beams of light in describing in opposite directions the contour of an area of considerable magnitude may be the same, it is necessary and sufficient if the vector which defines the relative velocity of the æther with respect to the optical system is irrotational throughout the area enclosed by the contour. In order to test whether the æther in the immediate neighbourhood of the earth possesses this property, M. Sagnac divided a beam of light into two portions, which he sent in opposite directions round a circuit consisting of a horizontal length of about 30 metres, an equal vertical length, and a third sloping one joining the two former. The two beams after traversing the circuit interfere, and the bands are observed in a telescope allowing a determination of displacement of 1/1000 of the width of a band. The plane of the circuit being east and west, observations of the bands were taken at various hours of the day and night, but no displacements were observed equivalent to a change in the relative motion of æther and matter of 1 millimetre per second for an elevation of 1 metre. Any relative

motion that exists must, therefore, be practically irrotational.

THE Journal of the Franklin Institute for February contains a report on recent progress in the chemistry of the terpenes and camphors, by J. S. Hepburn. Similar reports dealing with the sugars and the proteins have appeared in the two preceding years. The present report is based upon Wallach's recently published volume on the "Terpenes and Camphor," and in the space of twenty-five pages gives an excellent summary, which is likely to be of service to those who are unable to make use of the German original.

MR. A. E. PORTER finds that a number of ferments, including pepsin, trypsin, and rennet, are rendered inactive by being kept in contact with artificial membranes, especially with collodion ones. Most ferments which have thus been inactivated have at the same time acquired inhibitive properties. The inactivation of ferments by membranes is not due to simple absorption, for there is no evidence of saturation of the membrane; on the contrary, its inactivating power appears to improve with repeated use. Although the inhibitive power of the inactivated ferments may be due in part to substances preformed in the solution, inhibition is still present after removal of these substances, suggesting that the ferment itself is changed by contact with a membrane into a substance having an inhibiting power on itself (*Quart. Journ. Experiment. Physiol.*, iii., No. 4, December, 1910, p. 375).

THE important discoveries of MM. Paul Sabatier and Senderens on the catalytic action of finely divided metals, notably nickel and copper, have recently been extended to a study of the catalytic action of various metallic oxides. In the current number of the *Comptes rendus* MM. Paul Sabatier and A. Mailhe give an account of a new synthetic method, based on the catalytic effect of titanium oxide, which would appear to possess many practical applications. They show that if a column of titanium dioxide is maintained at a temperature of 280°–300° C., and a mixture of the vapours of a primary alcohol and a fatty acid (other than formic acid) is led over it, the corresponding ester is formed. The same limit is here reached instantaneously as was found by Berthelot after prolonged contact. An excess of either constituent favours the limit of combination of the other. Following this method, the methyl, ethyl, propyl, butyl, isobutyl, and isoamyl esters of acetic, propionic, butyric, isobutyric, isovaleric, and caproic acids have been prepared. Esters of benzyl alcohol have also been readily obtained by this method. The inverse action—the direct hydrolysis of esters by water—is also easily effected, and the use of titanium dioxide reduces any secondary reactions to a negligible amount.

AN article on ferro-concrete beams with single reinforcement appears in *Engineering* for March 3, from the pen of Dr. W. C. Unwin. The object of the article is to put the equations of the ordinary theory into the most convenient form for calculation. The ordinary theory is known to be only roughly approximate, but the assumptions made are believed to be generally on the side of safety. The formulæ, however, are still in some cases very complicated, as given in books, due to the attempt to obtain formal exactness from a mathematical point of view. But the data used in solving problems are themselves only approximate; for instance, the selected value of the coefficient of elasticity of concrete, which itself varies with the stress, and the neglect of the tensile stress in the concrete. Hence it would appear that, for practical purposes, a sacrifice of mathematical exactness in the form of the equations is justifiable, if the errors are small within a practical range. In fact, some of the equations are only used in designing by making assumptions and proceeding by trial and error, or by the use of tables and curves based more or less on experience. Both rectangular and T sections are dealt with in the article, and examples are given of the use in practice of the simplified formulæ deduced.

A COPY has been received of the first number of the *Irish Review*, a monthly magazine of Irish literature, art, and science. Science is represented only by an article on economics by Mr. George W. Moore, in which he deals with the problem of rural life. The magazine is published in Dublin, and may be obtained in London from Messrs. Simpkin, Marshall, Hamilton, Kent and Co. The price is 6*d*. net.

THE annual report for 1910 of the Philosophical Institute of Canterbury, New Zealand, shows that the condition of the institute continues to be satisfactory both as regards the number of members and the active interest displayed in those branches of science which constitute its object. The special lines of research outlined in last year's report have been developed, and some have already given good results. These lines of inquiry are:—observations on the Arthur's Pass tunnel; a survey of the Canterbury lakes; and an examination of the Christchurch artesian system. This is quite apart from the original work which has been carried on by individual members of the institute. A subcommittee has also been considering the question of the more adequate protection of the native fauna. Ten meetings of the institute were held during the year, at which the average attendance was sixty-four. At these meetings twenty-seven papers embodying the results of original research were read. These are classified as follows:—botany, four; zoology, seven; geology, five; chemistry, six; physics, two; mathematics, one; miscellaneous, two.

OUR ASTRONOMICAL COLUMN.

THE BRILLIANT METEOR OF FEBRUARY 19.—Mr. W. F. Denning writes:—"A very good observation of this object comes from Mr. Felix de Roy, of Antwerp, who describes the apparent path as from 27°+34° to 11°+60°, and onwards to the north-east. He gives the duration as twelve seconds, but this only relates to a portion of the flight. To him the meteor disappeared in a cloud.

"At Putney the object was seen by Mr. F. E. Baxandall, who gives the duration as fifteen seconds, but I do not know whether the newspaper account of his observations includes the course of the meteor. The radiant point appears to have been at 46°−15° in Eridanus, and the heights 70 to 49 miles along a path 590 miles long, and probably this does not include the whole extent of the visible luminous trajectory. Its motion seems to have passed from over the English Channel between Brest and Plymouth to Oldenburg, in Hanover. From Stowmarket the meteor was seen to rise from the south-west horizon, and at Antwerp it was low in the north-east when it disappeared. The meteor may therefore have sailed along in a nearly horizontal flight much further, but it was rising, not falling, to the earth when last seen.

"This meteor, though of such an extended course, is not beyond precedent, for according to the computations of the late Prof. Herschel the fireball of August 18, 1783, had a path of 1000 to 1200 miles; that of September 5, 1868, was watched along 880 miles; while that of July 20, 1860, was traced more than 1000 miles. It will be important to secure observations of the meteor of February 19 from Cornwall or the north-west coast of France, and from Holland and Hanover or that region."

HALLEY'S COMET.—Dr. Ebell publishes a bi-daily ephemeris for Halley's comet, extending to April 30, in No. 4476 of the *Astronomische Nachrichten*. Although the comet is not likely to be observed with ordinary instru-

ments, it is interesting to note that its present position is 10h. 30·2m., −13° 48·2′, roughly about one-third of the distance from υ towards λ Hydræ; it is travelling north and west, towards Sextans, and its distance from the earth is about 330 million miles. Prof. Barnard's observation, of January 8, gives a correction to Dr. Ebell's ephemeris of +12s., −0·5′, and the ephemeris shows that by April 30 the comet should be about one magnitude fainter than when Prof. Barnard saw it.

THE ANGULAR SPEED OF ROTATION OF A LONG-ENDURING PROMINENCE.—From the study of the Kodaikánal spectroheliograms of a prominence which endured, in more or less the same form, for eighty-two days, Mr. Evershed arrives at some important conclusions, which he publishes in No. 1, vol. xxxiii., of the *Astrophysical Journal*. When first photographed, the prominence was on the western limb, was 55″ high, and covered from +2° to −14° in latitude. Its seventh, and last, "limb" appearance was on April 28, when it was 80″ high, and extended over latitudes −7° to −23°; on each occasion, after the first, it was seen for three successive days on the limb. Not only was this object photographed on the limb, it is also seen as an absorption marking on a number of "disc" photographs taken, and is shown as such on the four magnificent photographs reproduced.

Measures of the photographs show that the dark mass of calcium (and hydrogen) vapour near the equator had, during February, a speed 5 per cent. greater than the general surface of the photosphere, and, during the March apparition, a speed 11 per cent. greater. They also indicate that the two apparitions really represent two distinct masses of gas emanating from a common origin in solar longitude 75°. The general aspect and behaviour of the prominence suggest that it was continuously renewed by glowing gas emanating from numerous photospheric orifices.

The enormous activity attending such phenomena is indicated by the fact that, on March 25, the prominence extended over at least 36° of latitude, or was 250,000 miles long, yet twenty-four hours later the whole object had completely vanished.

Radial-velocity measures made when the prominence was on the limb, on March 17 and 18, showed that the prominence, at a considerable height, was moving at a speed 34 per cent. greater than the normal chromosphere, and they suggest that the acceleration of velocity with height, discovered by Adams, may be continued beyond the limits of the chromosphere. The measures were made, with a radial slit set across the limb at the equator, on the Hα line, and the difference measured was that between the absorption line, representing the normal chromospheric line, and the bright prominence line.

CONJUNCTIONS OF MAJOR PLANETS AND STARS IN 1911.—According to Prof. Banachiewicz, in No. 4465 of the *Astronomische Nachrichten*, there will be three near conjunctions with Mars and one occultation by Jupiter this year.

On May 3, at 11h. (G.M.T.), Mars will be in conjunction with and 18″ S. of B.D. −10° 5892, a star of magnitude 7·5; on May 10, at 12·6h., the planet will pass 0·8′ S. of the sixth-magnitude, fundamental star h Aquarii, and on August 9, at 11·7h., it will pass within 15·5″ of the star AG. Lpz. I. 898 (mag. 8·5); it is possible that the unknown proper motion of the star may make this an occultation.

The star B.D. −12° 4042 (mag. 6·5) will be occulted by Jupiter on August 13 at 0·2h. G.M.T., and the phenomenon will be observable in Australia and eastern Asia.

ASTROPHYSICS IN THE UNITED STATES.—The *Revue générale des Sciences* for February 15 (No. 3) contains a very interesting illustrated article, by M. Bosler, in which the author summarises the recent progress of astrophysical methods in the United States. M. Bosler includes the methods employed at Harvard in the systematic study of the stars and their spectral classification, the radial-velocity and other researches at Mount Hamilton, the multifarious observations made at the Yerkes Observatory, and the great progress in methods, instruments, and knowledge which has taken place at Mount Wilson since the solar observatory was founded on its elevated site. The article is freely illustrated with photographs, and gives an excellent idea of the great advances made in our knowledge of the universe under the favourable financial and climatic conditions which obtain in the States.

STUDIES OF ALGOL VARIABLES.—The Journal of the College of Science, Imperial University of Tokio, for January 18, contains a paper, in English, by Mr. Naozo Ichinohe, in which the author discusses a large number of variable stars of the algol type. After giving a brief historical account, Mr. Ichinohe defines an algol variable, and then gives a list of ninety-three stars which conform to his definitions. He then discusses the periods, densities, distribution, magnitudes, spectra, &c., and, with a number of tables, makes up a useful epitome of our knowledge concerning this type of star.

THE SPECTROSCOPIC BINARY u HERCULIS.—In 1848, the star u Herculis was suspected by Schmidt to vary; but its light-changes were puzzling, and it was not until 1869 that he concluded it to be a variable, with a period of about forty days, which at minimum suffered rapid changes. Frost and Adams, in 1903, showed the star to be a spectroscopic binary.

In No. 9, vol. ii., of the Publications of the Allegheny observatory, Dr. Baker discusses the radial velocities of this star, determined from spectrograms taken with the Mellon spectrograph, and finds it to be an eclipsing variable of the β Lyræ type, with a period of 2·051 days, and a secondary minimum about a day later. The presence of this secondary minimum, and the presence of the fainter spectrum on the plates, afford a unique opportunity of ascertaining the relative densities of the two stars and other data bearing on the question of double-star evolution. Dr. Baker finds that the diameter of either star is nearly six times that of the sun; that the brighter star (visual mag. = 5·0) is 7·5 as massive, but only one twenty-seventh as dense as the sun, while the fainter star (mag. 6·0) is 2·9 times as massive and one-seventieth as dense; that the centre of gravity of the system lies well within the surface of the brighter star, its mean distance from the centre of each body being 2,900,000 and 7,300,000 km., respectively, and that the surface brightness of the massive star is 2·5 times that of the other, although the spectra are practically identical. If the parallax were accurately known, it would be possible to determine, for this case, whether helium stars, such as these two are, or solar stars, have the greater surface brightness; assuming the parallax to be 0·02″ or greater, it would appear that the surface brightness of the fainter star, at least, is less than that of our sun.

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TECHNOLOGY.

Cassell and Co., Ltd.—Hardening and Tempering Steel, a Workshop Guide to the Heat Treatment of all Steels, including High-speed, edited by B. E. Jones, illustrated; Electric Primary Batteries, edited by B. E. Jones, illustrated; Electric Accumulators, edited by B. E. Jones, illustrated; Cyclopædia of Photography, edited by B. E. Jones, in parts, illustrated. *J. and A. Churchill.*—The Principles of Aëroplane Construction, with Calculations and Formulæ, R. Kennedy, illustrated. *Constable and Co., Ltd.*—The Static Transformer, H. M. Hobart, illustrated; Handbook of Testing, C. A. Smith, part i., Materials, part ii., Prime Movers; Applied Thermodynamics for Engineers, W. D. Ennis, illustrated; Electric Furnaces and their Industrial Applications, J. Wright, new edition, illustrated; Arc Lamps and Accessory Apparatus, J. H. Johnson; Motors, Secondary Batteries, &c., S. K. Broadfoot; Electrical Mining Installations, P. W. Freudemacher; Building in London, H. Cubitt; Gas Engines, Capt. H. Riall Sankey, W. J. Marshall, illustrated; Wood Pulp, Charles F. Cross, E. J. Bevan, and R. W. Sindall, illustrated. *Gauthier-Villars (Paris).*—Systèmes cinématiques, *Crosby Lockwood and Son.*—Three-phase Transmission, a Practical Treatise on the Economic Conditions governing the Transmission of Electric Energy by Underground and Overhead Conductors, W. Brew, illustrated; Aërial or Wire Rope-ways, their Construction and Management, A. J. Wallis-Tayler, illustrated; The Modern Motor Car and its Mechanism, a Practical Handbook on the Management and Maintenance of the Car, for the use of Owners and Drivers, W. G. Duncan, illustrated; Short Specifications of Materials, Labour, and Goods, for Works connected with Building, J. Cubitt; Crushing and Grinding Machinery Practice, a Handbook on the Machinery used in Crushing and Grinding Operations on all classes of materials, T. G. Marlow, illustrated; Drying Processes and Patents, T. G. Marlow, describing the various Drying Processes as applied to Sundry Materials, also a Classified Summary of the Patents connected with Drying Processes and Apparatus; A Handbook on the Gas Engine, a Practical Treatise on the Design, Construction, and Running of Internal Combustion Engines, H. Haeder, translated from the German, with the addition of numerous useful tables and other matter by W. M. Huskisson, illustrated; Sewerage Systems, their Design and Construction, a Practical Treatise upon the principles of the Design, Construction and Maintenance of Town Sewerage Systems, with examples of existing works, H. S. Watson, with Legal Notes by E. B. Herbert, illustrated; Reinforced Concrete Design Simplified, Diagrams, Tables, and other data for designing and checking accurately and speedily, J. C. Gammon, with an introduction by H. K. Dyson; Technical Terms, English-German, German-English: a Pocket Glossary, suitable for the Engineering, Manufacturing, and Mining Industries, J. G. Horner, in collaboration with A. Schlomann. *Longmans and Co.*—A Practical Guide to Iron and Steel Analysis, for Students and others, W. Macfarlane; The Principles of Electro-deposition: a Laboratory Guide to Electro-plating, S. Field, illustrated. *Methuen and Co., Ltd.*—Rubber, Dr. P. Schidrowitz, illustrated. *Scott, Greenwood and Son.*—Spirit Varnishes and Spirit Varnish Materials, J. G. McIntosh, being vol. iii. of The Manufacture of Varnishes, illustrated; Casein: its Preparation and Technical Utilisation, translated from the German of R. Scherer, new English edition, revised and enlarged, illustrated; Lubricating Oils, Fats and Greases, their Origin, Preparation, Properties, Uses, and Analysis, a Handbook for Oil Manufacturers, Refiners and Merchants, and the Oil and Fat Industry in General, G. H. Hurst, illustrated, new edition; Edible Fats and Oils, their Composition, Manufacture, and Analysis, W. H. Simmons and C. A. Mitchell; Chemical Manures, translated from the French of J. Fritsch, illustrated; Chemical Works, their Design, Erection, and Equipment, S. S. Dyson and S. S. Clarkson, illustrated; Foods and Drugs, E. J. Parry and C. H. Bennett, vol. i., Chemistry and Analysis of Foods and Drugs, vol. ii., Law Relating to Foods and Drugs; Yarn and Warp Sizing in all its Branches, C. Kretschmar, translated from the German by C. Salter, illustrated; Dressings and Finishings for Textile Fabrics and their Application, Description of all the Materials used in Dressing Textiles: their Special Properties, the Preparation of Dressings and their Employment in Finishing Linen, Cotton, Woollen, and Silk Fabrics, Fireproof and Waterproof Dressings, together with the principal Machinery Employed, F. Polleyn, translated from the third German edition by C. Salter, illustrated. *E. and F. N. Spon, Ltd.*—Workshop Receipts, vol, iv., Rainwater Separators to Wire Ropes, new edition, illustrated. *Whittaker and Co.*—Electric Wiring Diagrams, W. P. Maycock; Colour in Woven Design, Prof. R. Beaumont, new and revised edition. *John Wiley and Sons (New York).*—How to Enamel, being a Treatise on the Practical Enamelling of Jewellery with Hard Enamel, illustrated; Metallurgy, a Brief Outline of the Modern Processes for Extracting the More Important Metals, W. Borchers, translated by W. T. Hall and C. R. Hayward; High-efficiency Electrical Illuminants and Illumination, R. W. Hutchinson, jun., illustrated; The Analysis of Non-ferrous Alloys, W. B. Price and R. K. Meade.

MISCELLANEOUS.

A. and C. Black.—A new edition of The Grammar of Science, Prof. Karl Pearson, F.R.S. *Dulau and Co., Ltd.*—A Monograph on Albinism in Man, Prof. Karl Pearson, F.R.S., E. Nettleship, and C. H. Usher, parts ii. and iii., illustrated. *Macmillan and Co., Ltd.*—The Psychology of Education, Prof. J. Welton; Ancient Hunters and their Modern Representatives, Prof. W. J. Sollas, F.R.S., illustrated. *Methuen and Co., Ltd.*—Body and Mind: a History and Defence of Animism, W. McDougall, illustrated. *John Murray.*—The Excavation of Gezer, 1902–5 and 1907–9, Prof. R. A. S. Macalister, illustrated. *The Oxford University Press.*—Excavations in Nubia, 1909–10, Prof. J. Garstang, F. Ll. Griffith, and Prof. A. H. Sayce. *Kegan Paul and Co., Ltd.*—Practical Archæology, Prof. Garstang; The Modern Science of Language, H. C. Wyld. *Rebman, Ltd.*—The Mechanism of Life, being the only authorised translation of Prof. S. Leduc's "Théorie Physico-Chimique de la Vie et Générations Spontanées," by Dr. D. Butcher; The Individual and Society: or, Psychology and Sociology, Prof. J. M. Baldwin. *Swan Sonnenschein and Co., Ltd.*—Physiological Psychology, Prof. W. Wundt, a translation of the fifth and wholly rewritten German edition by Prof. E. B. Titchener, in 3 vols., vol. ii., illustrated; The Adolescent, J. W. Slaughter; Scientific Romances, the late C. H. Hinton, reissues of "The Persian King," "Casting out Self," "A Plane World."

CANADIAN MINERAL STATISTICS.[1]

THE report before us contains a number of short articles on various points of special interest to those engaged in mining operations in Canada, and should prove of decided value to them, though it must be admitted that in the majority of cases the interest is mainly local. A short note refers to accidents in Canadian mines caused by explosives, and shows that the high accident death-rate is due to the absence of protective legislation in Canada. The following is given as the death-rate per 1000 miners in various parts of Canada:—

	per 1000
British Columbia, Coal Mines, 1899–1908 ...	9·21
Nova Scotia, Coal Mines, 1899–1908	2·67
British Columbia, Metal Mines, 1908	5·93
Ontario, Copper and Nickel Mines, 1907 ...	2·19
Ontario, Silver and Iron Mines, 1907	7·36

These figures afford convincing evidence of the need of a complete mining code, properly administered, seeing that there is nothing in the mining conditions of Canada to which so formidable a death-rate can fairly be ascribed.

[1] Canada, Department of Mines. Summary Report of the Mines Branch for the Calendar Year ending December 31, 1909. Pp. 31. No. 26a. (Ottawa, 1910.) Price 10 cents.

A summary of the mineral production of Canada for 1909 is given, some of the more interesting items of which are as follows :—

Metallic.

Copper	54,061,106 lbs.
Gold ... ... about	£2,000,000 sterling
Pig iron from Canadian ore ...	149,444 tons
Iron ore exports	21,956 ,,
Lead	45,857,424 lbs.
Nickel	26,282,991 ,,
Cobalt	?
Silver	27,878,590 ounces
Zinc	?

(In addition, there were produced 607,718 tons of pig iron from imported [Newfoundland] ore.)

Non-metallic.

Coal	10,411,955 tons
Asbestos	63,349 ,,
Asbestic and asbestic sand ...	23,951 ,,
Petroleum	420,755 barrels
Pyrites	57,038 tons

In addition to products of less importance, a number of structural materials and clay products are also included in the returns. These returns have been modelled upon the mineral statistics of the United States, and thus copy faithfully all the mistakes of the latter, the principle having apparently been to get hold of a system that shall show the largest possible money value, irrespective of the consideration whether this is a true or a fictitious one. Thus the ores, or, as they are called in the returns, the metallic minerals, are valued by the amount of metal they contain, on the assumption that the whole of this metal can be extracted, and that its extraction and manufacture cost nothing; to get the grand total of the value of the mineral products, the total value of the coal mined is added to that of the metals thus calculated, though, of course, the manufactured value of a metal is made up in part, and often in large part, of the value of the coal used in smelting it; hence any coal used for smelting is valued twice over, and the same is true of the coal used in burning bricks, tiles, lime, &c. The values assigned are therefore so misleading that it appears better not to quote them. It is also surely incorrect to class arsenic, chromite, ochres, and pyrites amongst the *non-metallic* minerals. Although there are thus serious grounds for finding fault with the principles adopted in compiling the returns of mineral statistics, the work is, as usual, done thoroughly well, and gives evidence that the organisation of the Canadian Department of Mines has been put upon a highly systematic basis. H. L.

SCIENTIFIC RESEARCH IN AUSTRALASIA.[1]

THE Transactions and Proceedings of the New Zealand Institute form a very remarkable series of volumes, the contents of which deserve to be better known and appreciated in the mother country than would appear to be the case. They contain, amongst other things, the results of nearly half a century of investigation by New Zealand naturalists of the unique fauna and flora of their country, and local geologists and ethnologists have also contributed a large share to the imposing edifice of fact and theory which is gradually being built up. A generation of teachers, which included in its ranks such men as F. W. Hutton and T. J. Parker, could hardly fail to stimulate research—if stimulation were needed in a country where everything cries out for investigation.

The remarkable organisation of the New Zealand Institute, with its constituent societies in all the important centres of population, and the no less remarkable facilities for university education at the four university colleges, have no doubt also contributed largely to the result. Opportunities for original work have been abundant, and good use has been made of them. Much, of course, remains to be done in the future, and it will be very many years before New Zealand biologists have to seek "fresh fields and pastures new." In the meantime, the hope may be expressed that the New Zealand University may soon be able to see its way to an increase in the number of its science professors, accompanied by that necessary division of labour which has long been urgently called for. The professors themselves would then have more liberty for research work, and this is a matter of vital importance.

We believe there has never yet been a professorship of either botany or zoology, pure and simple, in New Zealand, and the botanical teaching has generally been in the hands of professors who have themselves specialised mainly in zoology. This fact makes the results attained all the more remarkable. The New Zealand University has always wisely insisted upon a course of general biology as the necessary foundation for both zoology and botany, and the fatal divorce which has taken place between the two subjects in the old country has thus to a large extent been avoided. We should be sorry to see this admirable arrangement upset, but surely some means could be devised whereby existing chairs could be divided without sacrificing the general biological training.

The forty-second volume of the Transactions and Proceedings of the New Zealand Institute marks a distinct advance upon its predecessors in the character of the illustrations, which in previous volumes have often left much to be desired. More care will have to be taken, however, in supervising the printing of the coloured plates. In the copy before us the registration of plate xxxi. is nearly an eighth of an inch out, producing a grotesque dislocation. One of the most interesting papers in the volume is "A Comparative Study of the Anatomy of Six New Zealand Species of Lycopodium," by J. E. Holloway, a pupil of Prof. A. P. W. Thomas; and Miss B. D. Cross has a well-illustrated paper on some New Zealand halophytes, treated mainly from the œcological point of view, in which the influence of Dr. Cockayne's work is clearly recognisable. Mr. Aston's "Botanical Notes made on a Journey across the Tararuas" deserves special mention on account of the beauty of the photographic illustrations.

Another noteworthy paper is that by Dr. C. Coleridge Farr and Mr. D. C. H. Florance, "On the Radio-activity of the Artesian-water System of Christchurch, New Zealand, and the Evidence of its Effect on Fish-life." The water from all the wells tested was found to contain a considerable amount of radium emanation, and when it first emerges from the well it has a very disastrous effect upon young fish and developing eggs. Experiments made in the fish-hatchery of the Canterbury Acclimatisation Society showed that the number of eggs dying increased in direct proportion to the amount of radium emanation present in the water.

We have also received two volumes of collected papers from the science laboratories of the University of Melbourne, published during the years 1906–9. We learn from Prof. Osborne's preface to the first volume that in March, 1908, the Government of Victoria made a grant of 1000*l.* to the University for the payment of scholarships in scientific research, and that in the two following years this sum was doubled. The result has been a marked increase in the amount of research by post-graduate students in science subjects.

The volumes before us contain numerous papers emanating from the departments of anatomy, biology, botany, chemistry, engineering, geology, natural philosophy, and physiology. These have been collected from very various publications and bound up together, and though they have been sorted out into two categories according to size, the resulting volumes are necessarily somewhat clumsy and awkward to handle. Unfortunately, also, they do not contain nearly all the papers published by members of the scientific departments of the university during the period selected, but they should serve to impress the supporters of the university with the large amount of valuable research work which is being done. As the different papers do not appear in these volumes for the first time, but were all originally published elsewhere, it is perhaps undesirable to attempt to notice them individually in this place. They form a highly interesting record of what is being done in the way of scientific research in the Melbourne University, and show a great amount of activity on the part of both teaching staff and students. A. D.

[1] (1) Transactions and Proceedings of the New Zealand Institute, vol. xlii. (for 1909).
(2) Collected Papers from the Science Laboratories of the University of Melbourne. 2 vols. (1906–9.)

THE MANUFACTURE OF VARIETIES OF COMMON SALT.

GREAT interest has been aroused among salt manufacturers by the announcement of the discovery of a new process capable of producing every variety of commercial salt in one plant and with great economy of fuel. The inventor is Mr. James Hodgkinson, of the firm of James Hodgkinson, Ltd., Pendleton, Manchester, makers of mechanical stokers. It is said that the patent rights for America have been sold to an American syndicate for 1,000,000*l.*, and to the Canadian Pacific Railway Company for Canada.

Up to the present time, salt has been manufactured by a process scarcely different from that used during the Roman occupation, namely, boiling down the brine in shallow open pans heated by coal fires. It is true that in 1839 Reynolds introduced the use of closed pans, in which the steam was passed from the first pan to the others, and a considerable economy in fuel effected, one ton of coal yielding four tons of salt, as against two tons in the case of open pans, which, however, still continued in use.

The chief features in the Hodgkinson process are the introduction of mechanical stokers for the fires, and the working of a plant consisting of seven pans, three closed and four open, heated by one fire. The quality and size of the salt crystals largely depend on the temperature, which can be so regulated in the new process as to produce every kind required.

The first pan is covered, and produces, by crystallisation alone, a table salt so fine that no grinding is required. From this pan proceed waste gases, which pass underneath and heat all the remaining pans, while the steam passes over to the succeeding pans and assists the precipitation of the salt. The second and third pans are also covered, and produce a slightly coarser variety, known as "dairy" salt. In the succeeding pans, all of which are open, the gases are at a lower temperature, and coarser salt in larger crystals is obtained. This is known as "fishery" salt, and is used in fish-curing. It should be added that there is an automatic flow of brine into the pans, and an automatic discharge of the salt produced.

The process, first successfully tried at Northwich, then extended to Port Sunlight and St. Helens, has resulted in such complete consumption of smoke that several large chimneys have been dispensed with. The success of the process must be assured if the hopes of the inventor are realised in practice. He claims that four or five times as much salt can be produced in a given time as compared with the old process, and that three tons of coal will be saved out of every four.

ARCHÆOLOGICAL RESEARCH IN ARKANSAS.[1]

MR. CLARENCE B. MOORE has issued another of his valuable memoirs on the prehistoric pottery of the United States. His last season's field work was on the St. Francis, Little, White, and Black rivers in Arkansas. Like all his other memoirs, this one is illustrated with maps and very numerous beautiful illustrations, many in colours, and all of large size, so that every detail is visible. Mr. Moore is still in the collecting stage of his work; generalisations we may expect at a future time. The principal sites along the St. Francis, although, as a rule, having mounds in connection with them, are in reality great dwelling-sites which have increased in height gradually through long periods of occupancy, and the aborigines, burying where they lived, have formed in course of time great cemeteries, all of which he believes to be pre-Columbian, since no object was found in any way indicating intercourse with Europeans excepting a bone comb, which, "though the shape is undoubtedly copied from a European model, the decoration points to Indian workmanship"; he asserts it is prehistoric.

The St. Francis valley has yielded more examples of its ware than has any equal area in the United States, and has been largely exploited by irresponsible collectors. The earthenware is shell-tempered. Quantity rather than quality seems to have been the aim of its makers, for the ware is often insufficiently fired, and the vessels are frequently thick and lop-sided. A high polish is almost absent. A very large proportion of the vessels are undecorated or with trivial decoration. Incised decoration is scarcely ever seen, the inferior surface of most of the ware being unsuited to incised decoration of excellent quality, even had it been attempted. Practically none of the vessels obtained by him are of types new to the pottery of the Middle Mississippi valley. The types of pottery have been well described by Prof. W. H. Holmes in his "Aboriginal Pottery of the Eastern United States" (20th Ann. Rep. Bur. Am. Eth). The most noteworthy find was a ceremonial "spear-head" of sheet-copper. Several vessels in the form of heads with fairly well-modelled faces were obtained, and some in the form of human figures. One burial of a very young infant had near by it a small bowl in which, upright, was a little effigy bottle.

Unlike the St. Francis river sites, which are on high ground, the sites on the White river and its upper reaches, the Black river, are on low, overflow ground, where archæological research is not likely to be rewarded; indeed, with a few trifling exceptions, no aboriginal objects had previously been obtained from this district. With one exception, no site of interest was found along the White river, and but three vessels of earthenware were encountered along the stream. Along the Black river, while some vessels were found, not one was of a character to warrant its transportation home. Although burials were fairly numerous, they were almost invariably unaccompanied by artifacts, a remarkable fact considering the custom of lavishing deposits upon the dead as practised by aborigines of neighbouring regions. The best find was a narrow, well-made ceremonial axe-head of green quartzite, 212 mm. in length.

A. C. HADDON.

[1] Journal of the Academy of Natural Sciences of Philadelphia. 2nd series, vol. xiv., part 2: "Antiquities of the St. Francis, White, and Black Rivers, Arkansas," by C. B. Moore, pp. 255-364 (Philadelphia, 1910).

THE COEFFICIENT OF SKIN FRICTION IN AIR AT MODERATELY HIGH VELOCITIES.

THE object of this study is to find a coefficient of turbulent friction readily applicable to the design of aërodynamic appliances such as aëroplanes and windmills.

It is assumed throughout that:—

(1) The surfaces on which the friction occurs are of reasonably smooth finish, and present no marked head resistance due to irregularities of surface.

(2) The velocities of the air relative to the surface are well above the critical values at which pure viscous shearing resistance is superseded by the generation of momentum in the contacting film or fluid, so that the skin resistance varies as the square of the velocity.

(3) The length of the surface in the direction of motion bears so small a relation to the dimensions perpendicular thereto that the diminution of the coefficient with the length is inappreciable.

The study is divided into two parts:—

(*a*) An analysis of the various methods of determining the skin-friction coefficient already known, with a tabular record of the numerical results already attained or thereby deducible, leading up to the most probable value of the said coefficient.

[(*b*) An experimental study made with the purpose of confirming the accuracy or otherwise of the said probable value. This is now in progress, the apparatus (an epicyclic differential dynamometer) being made. As this will not be ready for some considerable time, it may be useful to publish the comparative analysis beforehand.]

Symbols Employed.

British engineer's units—Pounds, feet, seconds. Force in lbs. wt.

f. Coefficient of skin friction.

C = about 0·7, being the coefficient of normal pressure on unit square surface, with unit velocity, and unit mass of air.

ρ. Mass of unit volume of air at normal temperature. About 0·08 pound per cubic foot.

A_1. Area subject to skin friction.

A_2. Area of mid-section or normal surface of a dirigible.

k. Ratio of skin friction on a dirigible to normal resistance on an area equal to the cross-section.

c. Coefficient of oblique air pressure (Lanchester). The value of this depends on the aspect ratio of the surface. From Duchemin's rule for square surfaces it is 2; Eiffel gives a value of 3; Lanchester gives hypothetical values between 2 and 3.

ξ. Ratio of skin friction on a double surface to the normal resistance of the plane of the same single-surface area.

β. Angle of incidence (Radians).

V. Relative velocity of air to surface.

l. Length of surface in the direction of flow.

A.

I.—*Frictional Resistance deduced from the Head, or Total Resistance of Dirigible Balloons.*

The resistance of a well-shaped dirigible is, like that of a ship, almost entirely due to skin friction. The aërodynamic resistance of cars, rigging, &c., is almost negligible in ratio to the skin friction, certainly not exceeding 30 per cent. thereof.

If, then, the area of the skin is A_1, and that of the maximum cross-section is A_2, and k is the ratio of the skin friction to the aërodynamic resistance of a normal surface with the same shape as the mid-section, this definition of k may be written :—

$$\frac{fA_1}{C\rho A_2} = k \quad \ldots \ldots \ldots \quad (1)$$

The coefficient k has been measured for several dirigibles, and forms the basis of this computation.

Name	Length	D'ameter	A_1	A_2	k	f
Renard and Krebs	50·42 m.	8·4 m.	1330 sq.m.	55·4	0·4	0·000033
			(Espitallier, Genie Civil, 1902)			
Z ppelin III. ...	128	11 66	48000	100	0·45	0·000025
			(Moedebeck's Pocket Book)			
Lebaudy	58	10·3	2000	80	0·31	0·000030
			(Ditto.)			
Spherical Conoid.	6D	D	$6\pi D^2$	$\frac{1}{4}\pi D^2$	0·16	0·000014
			(Moleswor,h's Pocket Book [1])			
Total						0·000102
Mean va'ue						0·000025
Deduct 30 per cent. for other resistance ...						0·000008
						0·000001

The value 0·000025, seeing that it certainly includes some aërodynamic resistance due to imperfect form of envelope and the resistance of car and rigging, should be regarded as the absolute maximum.

II.—*Frictional Resistance deduced from the Efficiency of a Plane Aërofoil.*

According to Turnbull (*Physical Review*, March, 1907), the lift-to-drift ratio is a maximum for planes of an aspect ratio of two, when the angle of incidence is 3½ degrees, and it has then a value of 5·1 (3½ degrees = 0·06 radian).

Employing Lanchester's notation, this ratio (also called by Turnbull the "efficiency")

$$= \frac{C\rho AV^2\beta}{\xi C\rho AV^2 + C\rho AV^2\beta^2}$$

$$= \frac{c\beta}{\xi + c\beta^2}$$

c, according to Lanchester (compare Dines, Eiffel, and Rateau), is about 2·5, so that $\xi = 0{\cdot}020$ for the double surface and $f = \xi C\rho = 0{\cdot}000032$ for the double surface, or for the single surface 0·000015.

III.—*Frictional Resistance in Air deduced by Comparison with that of Water.*

The investigations of Froude have led to a fairly accurate knowledge of the frictional resistance of water, and it has been thought by many that a simple ratio exists between this and that of air in similar circumstances.

Froude's coefficients are between 0·003 and 0·005, the total resistance varying with a power of the velocity from 1·83 to 2·0 when there is considerable turbulence. It is probable that the lower density of air renders it more easily subject to turbulent conditions, so that there can be little doubt as to the approximate truth of the velocity squared hypothesis.

(*a*) Assuming that the friction is purely dependent on the density, since the density of water is about 800 times that of air, f may be $= 0{\cdot}004/800 = 0{\cdot}0000052$.

(*b*) Assuming that the friction varies as the density, and also as the square root of the kinematic viscosities, an assumption consonant with hydrodynamic theory,

f = sq. root of $12 \times 0{\cdot}004/800 = 0{\cdot}000017$.

IV.—*Zahm's Investigations.*

Prof. Zahm, by experimenting in a wind tunnel on boards, obtained a formula as follows :—

$$f = 0{\cdot}000008\ l^{-0{\cdot}07}\ V^{1{\cdot}85}$$

for smooth surfaces and no vibration, increasing up to $f = 0{\cdot}00001$ (total resistance varies with V^2) for turbulent conditions and buckram-covered surfaces.

V.—*Lanchester's Investigations.*

Index of velocity variation = 2.

Mr. F. W. Lanchester, experimenting with gliding models, and also with an aërodynamic balance (similar to that designed by Ritter von Loessl), obtained various results.

Nature of surface	Method	Coefficient
Mica	Gliding angle of models of variable area	0·000017
,, ...	Gliding angle of model ..	0·000016
Varnished cedar	,, ,, ...	0·000019
Polished ,,	Ballasted aëroplane ...	0·000005
,, ,,	Aërodynamic balance ...	0·000008
Glass paper ...	,, ,, ...	0·000013
	6)	0·000078
Mean value for moderately smooth surfaces		0·000013

VI.—*Collected Results.*

I. From the resistance of dirigibles ...	0·000017
II. Turnbull's observations	0·000015
III. Hydrodynamic theory and Froude's observations of water	0·000017
IV. Zahm's observations	0·000010
V. Lanchester's observations	0·000013
5)	0·000072
General mean	0·000014

HERBERT CHATLEY.

[1] This result is apparently after Pole's figures, but the resistance seems to have been under-estimated.

BIOLOGY OF THE EEL-FISHES, ESPECIALLY OF THE CONGER.

DURING the Atlantic and Mediterranean cruises of the Danish research steamer *Thor*, in the winter of 1908–9 and summer of 1910, a very large material has been collected of the larvæ of the eel-fishes (Leptocephali). These belong to at least twelve different forms, and several of them can be referred to their parent species.

The material is specially rich in a few of the forms, and this permits of important conclusions being drawn with regard to the biology of these species. At the same time, it has yielded valuable information regarding the occurrence of the very youngest stages (pre-Leptocephali)—information which has long been desired and sought after; and, lastly, it has aided us in the determination of the *age* of the older Leptocephali, a question which the hitherto available information has been quite unable to settle.

The species of eel which is of the greatest practical interest in Great Britain is the Conger, and of this we have now a very large and complete material. Several hundred specimens have been taken—in all stages, from a length of only 9 mm. up to ca. 160 mm.

The larvæ are not difficult to determine, in part from the number of myomeres, which in ten specimens I have found to vary between 153 and 159, thus quite the same as in the adult Conger; below 35 mm. the most posterior

myomeres cannot be counted with certainty, but the pigmentation is sufficiently characteristic.

In the accompanying table (Fig. 1) I give a graphic summary of the Conger larvæ taken on the two cruises of the *Thor*. Without further explanation, it will be evident from this table that the *youngest stages*, of 1–4 cm. in length, have *only* been taken on the summer cruise, the older intermediate stages, of 5–9 cm., *only* on the winter cruise, whilst the full-grown Leptocephali, of

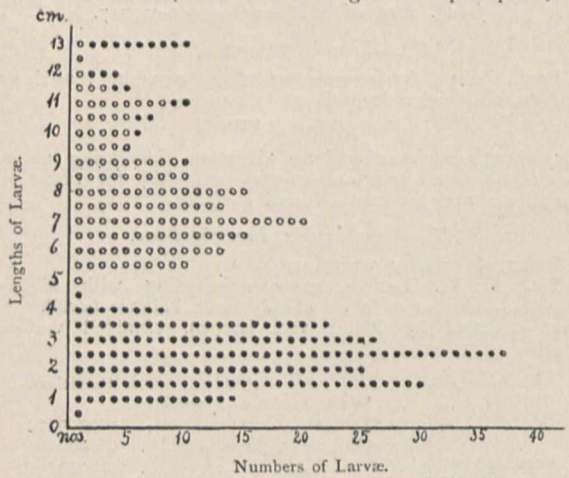

FIG. 1.—Conger larvæ. { • Summer cruise (vi, vii, viii). o Winter cruise (xii, i, ii).

ca. 12–13 cm. in length, were taken on both cruises, though mainly in the summer. From the sharp distinction between the youngest specimens taken on the summer cruise and the larger of the winter cruise, we are obliged to conclude that *the spawning of the Conger takes place mainly, if not exclusively, at a certain definite time of year, namely, in spring and summer.* We may further conclude from the material that the larval group of about 7 cm. is about half a year old, and that most of the larvæ of 12–13 cm., some of which are in process of transformation, are about one year old.

All the larvæ recorded in the table were taken in the Mediterranean or in the Atlantic off the Straits of Gibraltar. In earlier years (1905–8), when the *Thor* was working in the northern parts of the Atlantic, west of the British Isles, we also found several Conger larvæ during the period May to September, but these were all older stages, more than 12 and up to 16 cm. in length. The observations made on our last two cruises in the Mediterranean throw a new light on these older discoveries, for we now know that it is extremely easy to take the earliest Conger larvæ in the upper layers, when we know just *where* to find them. We may, in fact, conclude, with a high degree of probability, that the Conger does not spawn in the region examined by the *Thor* to the west of the British Isles, but further south in the Atlantic (Fig. 2, off the Straits of Gibraltar).

A more detailed account of the distribution of the different developmental stages will be given later, but on the accompanying chart I endeavour to summarise the occurrence of the youngest specimens, from 1–4 cm. long, all of which were taken on the summer cruise. It will be seen from this chart that *these earliest developmental stages were mainly taken over very great depths*, outside the 2000-metre line (or near this), but not in the many hauls which were made in the shallower waters. It appears, further, that the largest hauls (including newly hatched larvæ) were made at the deepest places the *Thor* had visited, namely, over depths of more than 3000 metres or about 3000 metres, in the Levant, the Ionian and Tyrrhenian Seas, as also in the deep basin between Sardinia and the Balearic Isles, where we have taken twenty to sixty larvæ in quite short hauls with pelagic apparatus.

These discoveries show that, when the time for reproduction arrives, *the Conger seeks out from the coasts to great depths, where it spawns mainly in the deepest and most central parts of the basins.*

In an earlier paper (1906) I suggested that the youngest larval stages of the eels might be bathypelagic, that is to say, living at great depths below the surface. Perhaps our most important discovery now is that *the earliest pre-leptocephalous stages of the Conger, as well as of the other four to five species the earliest larvae of which I know, really belong to the upper layers.* This can be seen from the hauls at any of our stations where such eel larvæ were taken in quantities. Our practice at each station was to make a series of hauls at varying depths, the length of wire out being 25, 100, 300, 1000, and 2000 metres, and the large quantities of the fry and eggs were always taken in the first, but few, or none at all, in the others. As the depth fished in could not have exceeded 15 metres, we must conclude that the youngest stages and the eggs belong normally to the uppermost layers of water. The older stages (Leptocephali), on the other hand, are also found in greater depths, 100–200 metres below the surface, as I have already shown in my earlier papers, and the life-history of the eel larvæ is thus no exception to the general rule applying to fishes with pelagic eggs, namely, that the earliest stages are passed at or near the surface, and that as development proceeds the larvæ sink down into greater depths.

The renowned Straits of Messina have also become famous in connection with our present subject as the first place where eel larvæ were found. So far as I know, the eel larvæ have never before been discovered in any quantity in the open waters of the Mediterranean, and this is the reason, I believe, why the reputation which the Straits of Messina obtained through the discovery of the

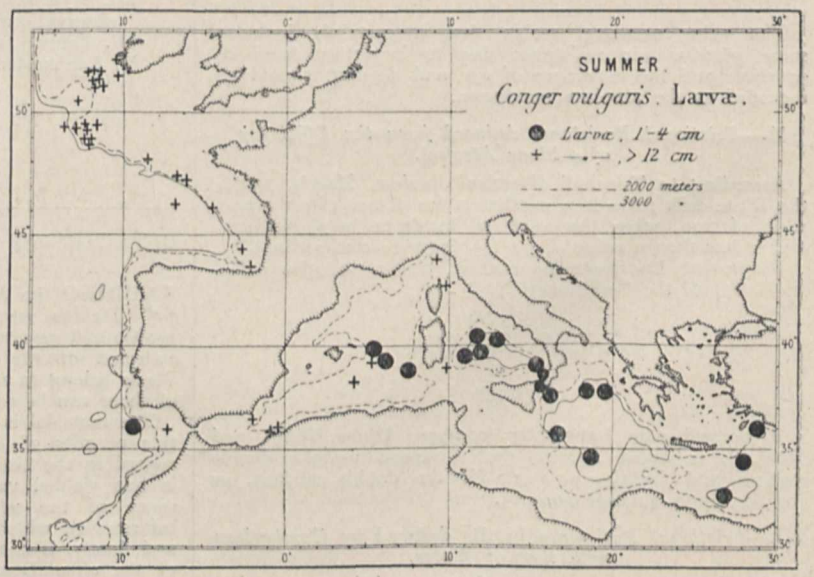

FIG. 2.—Chart of the Mediterranean and Atlantic, showing where the Conger larvæ were taken.

Leptocephali there was, to a great extent, undeserved; in any case, the theories which the Italian observers founded on this discovery regarding the bathypelagic or demersal mode of life of the pre-Leptocephali and Leptocephali cannot be maintained. The conditions in the Straits where deep-sea forms and surface forms occur together at the surface are exceptional and abnormal, and the phenomena, biological and physical, we find there are not at all indi-

cative of the ordinary course of events. The pre-Leptocephali and the Leptocephali are just as much pelagic animals as, for example, the larvæ of the cod or haddock, and occur in the upper layers not exclusively in the Messina Straits, but everywhere in the various deep basins of the Mediterranean, as well as in the Atlantic.

With regard to the actual spawning of the eels, it is still undecided whether this takes place on the bottom or bathypelagically in great depths of the ocean. In our 1906 cruise we found the Leptocephali of the common eel in great numbers far out in the Atlantic over depths of 4000–5000 metres. Further, the largest quantity of muræenoid eggs I have taken were found near the surface in the middle of the Tyrrhenian Sea over about 3500 metres. There is the possibility, therefore, that the eels seek out to these great depths in order to spawn bathypelagically, irrespective of the bottom, but unfortunately it will be very difficult to decide this question one way or the other.

Our present knowledge of the life-cycle of the eels may be summarised as follows.[1]

The eel-fishes spawn in great depths, how far from the surface we do not yet know. The eggs occur pelagically in the surface layers, and there give rise to the pre-leptocephalous stages, which also belong normally to the uppermost layers over great depths. Their whole organisation also shows that the pre-Leptocephali, as well as the Leptocephali, are true pelagic organisms. The Leptocephali likewise belong to the upper layers (high up at night, lower down in the day time), but there is the difference that during their prolonged existence they spread over greater distances and are also found over shallower waters than the pre-Leptocephali.

The first stages in the transformation also proceed pelagically, but thereafter the different species behave differently. Whilst some species during transformation go deeper down in the sea (*e.g.* Synaphobranchus), others (*e.g.* Conger and the common eel) undergo most of their metamorphosis in the upper layers. In their later life the former live in great depths, the latter in shallower water near the coast, and even in fresh water. When the time for reproduction arrives, all descend again into the oceanic depths whence they came, spawn but once, so far as we know, and never return. JOHS. SCHMIDT.

Copenhagen, February 8.

REPORT OF THE CARNEGIE FOUNDATION.

THE fifth annual report of the president of the Carnegie Foundation for the Advancement of Teaching covers the year ending September 30, 1910. The report is divided into two parts. Part i. pertains to the current business of the year; part ii. is a discussion of the relation of the college and the secondary school.

The report shows that the trustees had in hand at the end of the year funds amounting to 2,222,811*l.*, consisting of the original gift of 2,000,000*l.* par value of 5 per cent. bonds and 200,000*l.* accumulated surplus. The income for the year was 108,776*l.* During the year sixty-four retiring allowances were granted, of which forty-six were in accepted institutions and eighteen in institutions not on the accepted list.

In the first part of the report the president of the foundation follows up the bulletin on medical education by a paper on the relation of the university to the medical school, in which he directs attention to the responsibility attaching to any college or university which undertakes medical education.

The second part of the report is a careful attempt to state the existing causes of friction between the secondary school and the college, and the loss of educational efficiency in the present methods of bringing pupils from the school to the college. The complaint of the college against the secondary school, and the complaint of the secondary school against the college, are set forth.

An extremely interesting part of the report is a statement of the observations of Oxford tutors upon the preparation of the Rhodes scholars. The strong points in the American youth's preparation are readily seen by these trained teachers, and the weaknesses which they find point directly to the superficiality and diffusion of the work done in the American secondary school and college.

The president of the foundation urges that this whole question be approached by secondary-school men and college men in a spirit of cooperation. Neither the certificate method of admission nor the piecemeal examination method have in his opinion solved the problem. He urges that the college must find a solution which will test better than the certificate or the piecemeal examination the fundamental qualities of the student, and which will at the same time leave to the high school a larger measure of freedom. He recommends a combination of certificate and examinations, the latter of a simple and elementary character, but calling for a high quality of performance, without which the candidate will not be admitted. For example, under this plan the boy who cannot write good idiomatic English would not be admitted to college at all, but would be sent back to the secondary school. The entrance requirements recently adopted at Harvard are quite in line with these recommendations. The president of the foundation urges a cooperation between the secondary school and the college, not as unrelated institutions, but as two parts of a common system of education. He argues that the interest of the great mass of high-school students must not be sacrificed to the interest of the minority who are looking toward college. He insists on a larger measure of freedom for the secondary school, but, on the other hand, he argues that the interest of the boy who goes to college and of the boy who goes from the high school into business are alike conserved by learning a few things well, not by learning many things superficially. The boy who has obtained such intellectual discipline is a fit candidate for college, whether he has studied one set of subjects or another; without this intellectual discipline he is unfit alike for college or business. It is therefore, in the opinion of the president of the foundation, the plain duty of the college, at the present stage of American educational development, to articulate intimately with the four-year high school and to leave to the secondary school the largest freedom so that it may educate boys, not coach them, but at the same time to require of the candidates for admission tests which rest upon high performance in the elementary studies and which mean mastery of the fundamentals. In such a programme lies the hope of scholarly betterment and of civic efficiency both for college and high school.

[1] Four species of Leptocephali, one of Tilurus, and first and foremost the two Conger species (*C. vulgaris* and *C. mystax*) form the basis of this summary.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The legacy of 20,000*l.* bequeathed by the late Mr. John Feeney has been applied to the endowment of the chair of metallurgy, which is henceforth to be known as the "Feeney Chair of Metallurgy."

The Huxley lecture for this year is to be delivered by Prof. Henri Bergson, lecturer in philosophy at the University of Paris.

In addressing the Court of Governors at the annual meeting, the Vice-Chancellor referred with satisfaction to the recent grant of an additional halfpenny rate by the City Council, "which they all acknowledged had been generous." The principal (Sir Oliver Lodge) in his speech, which followed that of the Vice-Chancellor, defended the University against the charge of extravagance which had been brought against it in some quarters. He pointed out that "in this country we are behind in educational matters, and have been excessively economical when we ought to have been lavish in outlay." He stated that certain departments are better equipped in other modern universities in England, and that it must not be assumed that what Birmingham had done was "to be regarded as something out of the way and extraordinary." He also expressed the opinion that "it was highly important that universities, whatever aid they received, should not become appendages of State departments of the Civil Service. All our modern universities were experiments started by the nation in higher education, and no Government office or official was competent to control the highest education in the country. The only reasonable way was to trust the institutions and the experts called

together to manage them, because there were no better men, and though they made mistakes, it was better that such mistakes should be made individually than all over the country."

CAMBRIDGE.—The council of Trinity College has resolved to offer to the University the sum of 1000*l.* in the present year, to be invested for maintenance of buildings. The offer is made in the hope of expediting the erection of one or both of the proposed new buildings for physiology and experimental psychology.

The general board of studies will shortly proceed to appoint a university lecturer in moral science in succession to Dr. Keynes. The appointment will date from October 1. Candidates are requested to state the subject or subjects on which they are prepared to lecture. They are also requested to send their applications, with such testimonials as they think fit, to the Vice-Chancellor on or before Monday, April 24.

The Allen scholarship has been awarded to Mr. Hugh F. R. Smith, of St. John's College.

The next combined examination for sixty-eight entrance scholarships and a large number of exhibitions, at Pembroke, Gonville and Caius, King's, Jesus, Christ's, St. John's, and Emmanuel Colleges, will be held on Tuesday, December 5, and following days. Mathematics, classics, and natural sciences will be the subjects of examination at all the above-mentioned colleges. Most of the colleges allow candidates who intend to study mechanical sciences to compete for scholarships and exhibitions by taking the papers set in mathematics or natural sciences.

IT is announced in *The Pioneer Mail* that his Highness the Nawab of Rampur has contributed a lakh and a half to the funds for the proposed Mahomedan University. At a meeting in Calcutta on February 14 last, his Highness the Aga Khan stated that the whole amount of money required is likely to be subscribed before the end of the present month, by which date it is expected the fund will exceed twenty lakhs.

THE London County Council has issued a full report of the proceedings at the conference of teachers held under its auspices on January 5–7 this year. A descriptive account of the meetings of the conference was given in these columns on January 12 last (vol. lxxxv., p. 353), and it will be sufficient to point out that this official publication contains a verbatim report of the papers read and the discussions which took place. Copies of the report may be obtained from Messrs. P. S. King and Son, 2 and 4 Great Smith Street, London, S.W., price 1*s.* 6*d.*

WE learn from *Science* that Dr. and Mrs. Robert W. Long, of Indianapolis, have given 40,000*l.* to the medical department of Indiana State University; that by the will of Mrs. Emily H. Moir, of New York City, Barnard College received 2000*l.*; and that Illinois College, at Jacksonville, Ill., received recently 1000*l.* from Mr. Edward F. Goltra, of St. Louis. This contribution is towards a new endowment of 30,000*l.* which the college is raising. Mr. Andrew Carnegie has contributed one-half of the amount; friends and old students have thus far contributed about 13,000*l.*

THE Education Committee of the County Council of the West Riding of Yorkshire has issued a pamphlet giving detailed information of the conditions under which it awards scholarships and exhibitions. Provision is made for every grade of education, and facilities are offered to make it easy for the ambitious boy or girl to proceed on the educational journey from the elementary school to the university or technical college, so far as his or her ability permits. The needs of both men and women have been borne in mind. County major scholarships of the estimated value of from 60*l.* to 65*l.* are tenable at universities or university colleges, and county art scholarships of the value of 60*l.* per annum are tenable at the Royal College of Art. There are in addition county technological scholarships, scholarships for women, coal-mining exhibitions, agricultural exhibitions, exhibitions for the blind, and travelling scholarships. The capacity-catching net is certainly thrown very wide in the West Riding, and there should be very few Yorkshire students of talent unable to proceed with their education through lack of means.

THE Department of Agriculture and Technical Instruction for Ireland will, as in previous years, conduct courses of instruction for teachers during the coming summer. Among the courses arranged may be mentioned those in experimental science and laboratory arts; in domestic economy; in hygiene, sick-nursing, and housewifery; in manual training in wood and metal; in practical mathematics and mechanics; and in rural science. All the courses mentioned will be held in Dublin. Teachers who attend the courses of instruction regularly and punctually will, as a rule, be allowed a sum of 3*l.* 10*s.* towards their expenses while living at the centre, and those who travel more than twenty miles to the centre of instruction will be allowed, in addition, third-class railway fare for one return journey. Teachers desiring to take advantage of the courses must fill up and return the appropriate form of application not later than March 31 to the offices of the Department, Upper Merrion Street, Dublin.

COPIES of the report of the librarian of Congress and the report of the superintendent of the library building and grounds for the fiscal year ending June 30 last have been received from Washington. The reports, which are bound together, make a volume of 305 pages. The grants for the administration of the library proper and the copyright office in connection therewith amount for the present year to upwards of 98,000*l.* The report shows that there was a marked increase in the size of the library during the year under review; 90,473 books were added, 6822 maps and charts, and 17,215 prints, in addition to the pieces of music and volumes on music. A very interesting description is provided respecting the accessions to the division of manuscripts, of which, the report says, a numerical estimate is not feasible. We notice that the total number of visitors to the library building during the year was 768,911, being a daily average for 363 days of 2118.

A GIFT of 60,000*l.* by Mrs. Russell Sage to Cornell University is announced in *Science*. From the same source we learn that an increase in the income and in the building fund of the University of Wisconsin on the basis of a growth of 23 per cent. in the number of students in the last two years and of the constantly growing demand on the part of the people of the State for expert assistance from the University, is provided for in a Bill introduced in the State legislature. It provides for changing the present two-sevenths of a mill tax on the assessed valuation of all property of the State for maintaining the University to three-eighths of a mill. This will increase the general University income approximately from 125,000*l.* a year to 200,000*l.* a year. For new academic buildings and permanent improvements, the proposed legislation appropriates 60,000*l.* a year, of which 10,000*l.* annually is set aside for the purchase of books, furniture, apparatus, and equipment. The remaining 50,000*l.* a year is to be used for the construction of academic buildings, in the order of their greatest need, and for the enlargement and repair of present buildings. The regents of the University of Michigan, too, have applied to the legislature for a grant of 50,000*l.* for a science building. The need for more adequate accommodations for the natural sciences has been felt for a number of years, and was the subject of a memorial to the regents by the departments of botany, zoology, geology, mineralogy, and forestry in 1907.

THE distribution of prizes and certificates to students of the Battersea Polytechnic was held on Tuesday, February 28. The principal, Dr. Rawson, in presenting his report, stated that he thought in every respect the report was a satisfactory one, there having been a considerable increase in the student hours, these, on the whole, being the best criterion of the progress of an institution. The examination successes included nine passes for the final B.Sc., five being in honours; seven students passed the intermediate B.Sc., and three the engineering intermediate examination. The principal added that the work of the Day Technical College, both in quantity and quality, was steadily rising, and that a full four-year course was in operation. A very gratifying feature was the demand which was being experienced for their students, in almost all cases positions having been found for all three-year students by the end of the session. Dr. T. J. Macnamara,

M.P., in addressing the students, said that the English people are rapidly coming to see that in the markets of the world the schoolmaster is the agent in advance. Our great past, glorious as it was, may be something of a handicap if we slavishly follow the paths that led to our being a great people. The governing forces of the universe are changing with a rapidly increasing momentum. Brawn put us where we were, but, under present conditions, will not keep us there. Nowadays a nation, to maintain its place, must have brain as well as brawn.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 2.—Sir Archibald Geikie, K.C.B., president, in the chair.—Prof. C. S. **Sherrington** and Miss S. C. **Sowton**: Reversal of the reflex effect of an afferent nerve by altering the character of the electrical stimulus applied.—Dr. H. E. **Roaf**: Carbon dioxide output during decerebrate rigidity (preliminary communication). The object of this research is to determine the amount of energy required to maintain muscular rigidity in decerebrate cats. As an indication of the energy production, the carbon dioxide output was measured. The animals were maintained under constant conditions. The experiments were divided into two periods of two hours each. During the first period the carbon dioxide production of the decerebrate cats was measured, and during the second the carbon dioxide production, after abolishing the rigidity, was estimated. The results show that abolishing the rigidity by curare does not alter the carbon dioxide output, and hence there does not seem to be any more energy used to maintain the rigid condition than when the muscles are flaccid. Decapitation abolishes the rigidity, and at the same time lowers the carbon dioxide output. The cause of this lowering of the carbon dioxide output is being investigated.—Dr. Arthur **Harden** and W. J. **Young**: The alcoholic ferment of yeast-juice. Part vi.—The influence of arsenates and arsenites on the fermentation of the sugars by yeast-juice. The results of the investigation may be summarised as follows:—(1) When a suitable amount of arsenate is added to a fermenting mixture of yeast-juice and a sugar, it causes a large acceleration in the rate of production of carbon dioxide and alcohol. This enhanced rate differs from that produced by phosphate, inasmuch as it continues long after a chemical equivalent of carbon dioxide has been evolved. The arsenate, moreover, is found in the free state throughout the fermentation. (2) The rate attained increases rapidly with addition of arsenate until *optimum* concentration is reached, after which it decreases, at first rapidly and then more slowly. (3) The total fermentation produced depends on the particular concentration of arsenate employed, and may be either higher or lower than that given in the absence of arsenate. As the high rate produced by a suitable quantity of arsenate persists for a long time, very considerable increases in the total fermentation may be observed. (4) Glucose and mannose are similarly affected by yeast-juice in presence of arsenate, whereas fructose is much more rapidly fermented than these two sugars, and the optimum concentration of arsenate in its presence is greater. (5) The increased rate of fermentation of sugars in presence of arsenate is due to an acceleration of the rate of action of the hexosephosphatase of the juice, whereby an increased supply of phosphate is afforded. The action is therefore essentially different from that of phosphate, and it has been found that arsenate cannot replace phosphate in the fundamental reaction of alcoholic fermentation. (6) Arsenate also causes a considerable increase in the rate of autofermentation of yeast-juice and in the rate of fermentation of glycogen. This is mainly due to acceleration of the rate of action of the diastatic enzyme of yeast-juice (glycogenase). (7) The action of arsenites is similar to that of arsenates, but is much less marked. (8) Both arsenate and arsenite cause total inhibition of the fermentation when they are present in a high concentration, but the nature of this effect has not been ascertained.—Colonel Sir David **Bruce** and Captains A. E. **Hamerton** and H. R. **Bateman** (Sleeping Sickness Commission of the Royal Society, Uganda, 1908–10): Experiments to ascertain if certain Tabanidæ act as the carriers of *Trypanosoma pecorum*. In the latter part of 1909 the commission noted that an outbreak of cattle trypanosomiasis due to *Trypanosoma pecorum* at Mpumu, Uganda, coincided with the appearance of swarms of *Tabanus secedens* in certain places where the cattle went to graze. In 1910 the following researches were commenced to ascertain if *Tabanus secedens* might be the carrier of this trypanosome. An investigation of the biting flies occurring where the cattle became naturally infected showed twelve species of Tabanus, five species of Hæmatopota, two species of Chrysops, *Glossina palpalis*, and a new species of Rhinomyza. Before this investigation, it was thought that some five or six species comprised all biting flies inhabiting the locality. *Glossina palpalis* was found inhabiting an inland stream having no connection with Victoria Nyanza, and situated six miles from the lake shore. Tabanidæ appear suddenly in great numbers in certain localities for a few months only, then as suddenly disappear. Hæmatopota was found in open swampy places and forests. Chrysops and Rhinomyza were comparatively scanty; found about fords of streams in the forests. The three species *Tabanus secedens*, *T. fuscomarginatus*, and *T. thoracinus*, were the most common of the Tabanidæ. Their eggs or larvæ were never found, and only wild flies were experimented with. The flies would not live in cages. Transmission experiments were carried out in a fly-proof kraal built amidst the natural surroundings. Sick and healthy calves were daily placed together in a compartment of the kraal in which the above-named species were set free, the experiments being performed with only one species of fly at a time. The flies only lived a few days, but were frequently observed to bite the cattle. A control calf was kept in a compartment of the kraal, to which no flies had access. Large numbers of flies of the above-named species were used, but no normal calf contracted the disease. Two series of dissections were made. First, of the wild flies, obtained near the laboratory, the same day they were caught; secondly, of wild flies, introduced into the fly compartment of the kraal, after they had had the opportunity of biting the infected calf therein. In the first series 138 *Tabanus secedens* and 49 *T. thoracinus* were dissected. Of the former, 5 per cent. showed a heavy infection of flagellates in the hind-gut, rectum, and proctodæum only; of the latter, flagellates were found in hind-gut, rectum, and proctodæum of 25·5 per cent. Inoculation of these parasites into white rats failed to cause disease. In the second series, liberated in the fly compartment of the kraal, 50 *T. secedens*, 24 *T. thoracinus*, and 37 *T. fuscomarginatus* were dissected. Two *T. secedens* were infected with flagellates, and one *T. thoracinus*. None of the *T. fuscomarginatus* were infected. Inoculation of these parasites into white rats also failed to cause disease.—H. M. **Leake**: Experimental studies in Indian cottons.

Geological Society, February 17.—Prof. W. W. Watts, F.R.S., president, in the chair.—Annual general meeting.—Prof. W. W. **Watts**: Presidential address. The consideration of geology as geographical evolution. The main factors of the geographical evolution of an area were considered to be the alternation of upward and downward movement. Each geographical cycle, passing from the period of maximum depression through uplift into terrestrial conditions, and then back again towards depression and submergence, would be expressed in the geological record by a corresponding set of deposits consisting of "thalassic," "shoreward," "terrestrial," "estuarine," and "thalassic" deposits, following each other in this order. Each of these phases was considered in some detail, and attention was directed to difficulties in interpretation and correlation, and to the principles according to which the depositional phenomena should be translated into terms of geography. Despite the fact that several cycles of geography and deposition had swept over Britain, there had been comparatively little repetition of phase in the deposits, and two or three examples were taken to illustrate cases of correspondence and non-correspondence of deposits formed during similar stages in the succeeding cycles. The careful and minute study of existing geographical conditions was strongly advocated as the key to the interpretation of the geological record, and it was

urged that the utmost possible use should be made of palæogeographical maps, both as a means of expressing ascertained fact and as affording a focus for new critical investigation. The association of the phases of earth-movement with igneous activity was next briefly treated, as also the connection of movement with rock-structure and existing physiography. Finally, geographical evolution was examined as the spur to organic evolution, and it was urged upon palæontologists that they should endeavour to ascertain to what extent periods of slow or rapid evolution corresponded with epochs of physical change.

February 22. Prof. W. W. Watts, F.R.S., president, in the chair.—R. H. **Rastall**: The geology of the districts of Worcester, Robertson, and Ashton (Cape Colony). After a brief description of the physiography of the district and the general sequence of the rocks composing it, in which the incompleteness of the stratigraphical record is especially noted, a detailed account is given of the structure and characters of the Malmesbury rocks of Worcester and the region near that town. These are shown to include a lower and an upper sedimentary series, predominantly gritty and slaty respectively, and evidently of great thickness, probably more than 20,000 feet. The upper division is pierced by granitic dykes, which have been subsequently crushed and foliated, forming "phyllite gneiss." Certain bands of limestone are metamorphosed by them to pure white marble. The distribution and characters of the rocks of the Cape and Karroo systems are only dealt with, in so far as they throw light on the principal subject of the paper, but a fairly full description is given of the occurrences of Enon Conglomerate, which is shown to occupy a series of isolated basins arranged along an east-and-west line, and to lie with a strong discordance upon all the older rocks. After a careful discussion of all the available evidence, it is concluded that the Worcester-Swellendam Fault, which has a maximum throw of probably 10,000 feet, is in great part of post-Cretaceous age, although there are indications of earlier movement along the same line of fracture. From a study of the dominant trend-lines of south-western Cape Colony, it is concluded that the district in question is situated at or near the central line of the syntaxis of two great sets of folds at right angles, which have assumed a fan-shaped arrangement in plan, and that the great fault is a line of fracture and subsidence running transversely across these lines of folding.—Baron Ferencz **Nopcsa**, jun.: Geology of northern Albania. The author had examined the greater part of the province of Skutari in western Turkey, and recognised three distinct structural units, namely, the north Albanian platform, the folded Čukali, and the eruptive region of Merdita. In the first region Mesozoic limestone of all periods predominates, in the second region Mesozoic radiolarian chert is found, while in the third region Mesozoic clastic rocks, volcanic tuffs, and eruptive masses are abundant. The first and third units are not folded, but are, at least in part, overthrusts from the north and south respectively above the second (intermediate) unit, which is strongly folded. In northern Albania Upper Carboniferous and Permian rocks are also distinguishable, and there is an Eocene flysch.

Zoological Society, February 21.—Dr. A. Smith Woodward, F.R.S., vice-president, in the chair.—R. **Lydekker**: *Tragelaphus buxtoni*, an antelope obtained by Mr. Ivor Buxton in Abyssinia.—E. G. **Boulenger**: Varieties of the spotted salamander (*Salamandra maculosa*). One of the principal results of the author's study was to lay greater stress on the disposition of the spots than on their actual form, size, or colour, and to define two principal forms in Central Europe, which had not previously been separated with sufficient precision, notwithstanding their well-marked geographical distribution. The author further dealt with some of the experiments of Dr. Kammerer, of Vienna, and the conclusions arrived at by him with regard to coloration in relation to environment.—G. A. **Boulenger**: A collection of fishes from the Lake Ngami basin, Bechuanaland, made by Mr. R. B. Woosnam.—Dr. F. D. **Welch**: Gibbons of the genus Hylobates, and on a Siamang gibbon, recently living in the society's gardens, with notes on skins in the British Museum (Natural History).

MANCHESTER.

Literary and Philosophical Society, February 21.—Mr. Francis Jones, president, in the chair.—Dr. Alfred **Holt**: The boric acids. Experiments were described on (1) the rate at which orthoboric acid loses water when heated to different temperatures; (2) the changes in the vapour density of orthoboric acid on heating; (3) the freezing points of solutions of ortho-, meta-, and pyroboric acid; and (4) melting points of mixtures of orthoboric acid and boric anhydride. From these experiments the following conclusions were drawn:—(1) metaboric acid is probably a definite compound; (2) no evidence is found for the existence of boric acids containing less water than the meta acid; (3) only orthoboric acid exists in solution, and it is present in simple molecules; (4) metaboric acid cannot be regarded as an equimolecular mixture of orthoboric acid and boric anhydride; (5) fused mixtures of orthoboric acid and boric anhydride, in which the molecular ratio of the latter to the former compound exceeds 4 : 1, can exist in a vitreous metastable and crystalline stable form.—J. E. **Myers** and Dr. A. **Holt**: The hydration of metaphosphoric acid. Experiments were described by which it was shown that pyrophosphoric acid is formed as an intermediate compound in the hydration of metaphosphoric acid. It was further shown that the hydration did not take place according to any simple scheme, and a method of estimating meta acid in a solution of all three varieties by means of barium chloride was described. From the depression of the freezing point of aqueous solutions of various varieties of pyro and meta acids, it appears that, when these acids are prepared by dehydration of orthophosphoric acid, there occurs association of the molecules, but when prepared by decomposition of the lead salts by hydrogen sulphide, simple molecules result. The peculiar "crackling" phenomenon which accompanies the solution of one form of meta acid was shown.

DUBLIN.

Royal Irish Academy, February 11.—Dr. F. A. Tarleton, president, in the chair.—W. M'Fadden **Orr**: Extension of Fourier's and the Bessel-Fourier theorem. The author shows by application to some illustrative physical problems how certain defects as to uniqueness and differentiability in the expansions of the former paper (Proc. Roy. Irish Acad., vol. xxvii., A, 11) may be remedied. These problems include the motion of the system consisting of a stretched elastic string and a number of elastically connected particles at each end, in extension of a simple case considered by Lord Rayleigh ("Theory of Sound," § 135), the analogous problem involving the motion of a circular or annular membrane, and analogous problems in heat conduction. The expansions are also extended so as to apply to the same vibrating systems when subject throughout to viscous forces, in which case the displacement of the string satisfies the equation

$$d^2\phi/dt^2 = c^2 d^2\phi/dx^2 - f d\phi/dt + g d^3\phi/dx^2 dt.$$

—A. W. **Conway**: The application of quaternions to some recent developments of electrical theory. Two examples of quaternion treatment are given for the purpose of showing the superiority of this method over vectors, by considering two cases in which the latter would lead to great complication. The subjects taken are Poincaré's Fredholm solutions for Hertzian waves, and Einstein's and Minkowsky's formulæ of relativity.—Rev. M. F. **Egan**: The linear complex and a certain class of twisted curves: on twisted curves such that the degree of any cycle of the curve is equal to its class. Relations between such curves and null-systems in three-space.

February 27.—Dr. F. A. Tarleton, president, in the chair.—R. Lloyd **Praeger**: Clare Island survey: report of progress during 1910. During the second year's field-work on Clare Island and its neighbourhood great advances have been made. About fifty workers visited the district during the year, for periods ranging from one to three weeks. Simultaneously with this report, the first instalment of the results of the survey are presented to the academy. It is intended to finish the field-work during the present year. In connection with the Clare Island survey, the following papers were read:—N. **Colgan**: Marine mollusca. The author gives a very full account of the marine mollusca collected during the years 1909 and

1910 in the various dredgings and shore collectings made in the Clew Bay area. The list includes 246 species, and of these no fewer than 133 were taken in a single haul of the dredge. Amongst the species enumerated are two nudibranchs, here for the first time recorded as Irish, *Thecacera pennigera* and *Actaeonia cocksii*. New records are also given for many rare species, the most interesting being *Circulus striatus* (*Trochus duminyi*), which was twice dredged in the bay.—J. N. **Halbert**: Water mites. At least four species previously unknown to science, and ten others new to the British Islands, are recorded.—H. Wallis **Kew**: False scorpions.—James **Wilson**: Agriculture and its history. The initial purpose of this paper is to determine the approximate dates at which agricultural plants and animals, not native to the island, might have been introduced. To do this, it is necessary to consider the history of agriculture first of all in Ireland, and then in Great Britain and the neighbouring Continent, in order to trace the immigration of their plants and animals westwards. The paper becomes, therefore, a concise historical note on British and Irish agriculture, with special regard to such data as bear upon its initial purpose.—N. **Colgan**: Irish names of animals and plants. The writer has collected on Clare Island and about Clew Bay current Gaelic names for about 120 species of native plants and animals. The dialectic variants found in use in other parts of Ireland are appended to those collected in the Clew Bay area, and supplementary notes are added on the folk-lore found in association with certain of the animals and plants referred to.

PARIS.

Academy of Sciences, February 20.—M. Armand Gautier in the chair.—J. **Carpentier**: Remarks on a modified pattern of the spherometer due to M. Nugues.—M. Eugène Tisserand was elected a member of the section of free academicians, in the place of the late M. J. Tannery.—Carl **Störmer**: The structure of the solar corona. Calculations have been made for a series of trajectories of electrified corpuscles, emanating normally from the solar surface, and assuming that the magnetic field of the sun is identical with that of an elementary magnet placed at the centre with its axis along the axis of rotation. The results of these calculations are shown graphically, and compared with the form of the corona at the time of minimum sun-spot frequency.—Maurice **Gevrey**: Partial differential equations of the parabolic type.—A. **Buhl**: The geometrical application of the formula of Stokes.—Ed. **Sarasin** and Th. **Tommasina**: The action of slight elevations of temperature on induced radio-activity. From the experiments described, it is concluded that even small elevations of temperature act on metals which have been rendered radio-active, causing an immediate and temporary increase in their loss of activity.—F. **Leprince-Ringuet**: The law of transmission of heat between a fluid in motion and a metallic surface.—Paul **Lebeau**: Uranyl nitrate and the nature of its ethereal solution. The uranyl salt forms a compound with the ether used for its solution, and there is a slight heat evolution. This compound can be crystallised out by cooling the solution with a mixture of solid carbon dioxide and acetone.—V. **Auger** and M. **Gabillon**: A new method for the estimation of sulphuric acid and sulphates. The sulphate is distilled with a mixture of potassium iodide, phosphoric, pyrophosphoric, and phosphorous acids. The sulphur is given off quantitatively in the form of sulphuretted hydrogen, the latter being absorbed and estimated in the usual manner. The method fails with barium sulphate.—G. **Darzens**: Condensation of halogen derivatives with ββ-dimethylglycidic ester. Dimethylglycidic ester, treated with zinc and an alkyl iodide, gives substituted lactic acids of the general formula $Me_2.CH.CR(OH).CO_2H$, and from these, by dehydration, a series of unsaturated acids can be obtained.—E. E. **Blaise** and L. **Picard**: The action of the chlorides of the α-alkoxylacids on the mixed organo-derivatives of zinc.—A. **Guilliermond**: The reproduction of *Debaryomyces globosus* and on some phenomena of retrogradation of sexuality observed in yeasts. These yeasts form one of the best examples known of a group in the course of evolution towards parthenogenesis.—Mlle. G. **Promsy**: The influence of acidity on germination.—M. **Mazé**: The excretion of mineral and organic substances by roots and stomata.—R. **Legendre** and H. **Piéron**: Experimental contribution to the physiology of sleep. The authors' experiments lead them to the conclusion that there exists in the cerebral plasma, blood, and especially in the cephalo-rachidian fluid of dogs suffering from insomnia, a substance possessing a hypnotoxic property. This disappears when heated to 65° C., and causes an overpowering demand for sleep.—M. **Piettre**: Muscular autolysis of pathological origin.—Paul **Hallez**: A non-parasitic Bdelloura of the Antarctic seas.—Jean **Effront**: The Bulgarian ferment. A comparison of total and volatile acids produced by the action of seven Bulgarian ferments of different origin shows that the bacterium isolated by Bertrand is clearly differentiated from the rest. This ferment produces more total acid and less volatile acids than any of the others.—H. **Bierry**: The digestive ferments of manninotriose and its derivatives.—J. L. **Dantan**: Fecondation in *Paracentrotus lividus* and *Psammechinus miliaris*.—Raphael **Dubois**: The disease affecting crayfish in the lake of Nantua. The malady is shown to have been caused by a yeast, *Rhabdomyces Duboisii*.—Jules **Amar**: The expenditure of energy in walking. The energy expenditure depends on several factors, speed, rhythm, displacement of the centre of gravity, oscillations of the body, &c., and follows no simple law. The effect of carrying a load has been studied, and also the most economical speed for walking.—Léon **Bertrand**: The prolongation of the North Pyrenees sheets in the western Pyrenees.

February 27th.—M. Armand Gautier in the chair.—A. **Chauveau**: The phenomena of visual inhibition which may accompany the re-association of the two retinal images dissociated by the prisms of the stereoscope. Some experiments on stereoscopic vision with most interesting results are described in detail. The inhibiting action of one eye on the other is most strikingly shown in one experiment. When the left eye is cut off by a screen all the details of the figure are clearly seen with the right eye; on removing the screen all the details of the figure disappear.—A. **Laveran** and A. **Thiroux**: The identification of the pathogenic trypanosomes. An examination of the method proposed by Levaditi and Mutermilch, and based on the attachment of the trypanosomes to leucocytes. It has been found that although the method yields useful indications, it cannot be relied upon for an absolute diagnosis.—E. L. **Bouvier**: Observations in the Pycnogonomorphs and principally on *Pentapycnon Geayi*.—Paul **Sabatier** and A. **Mailhe**: Direct esterification and saponification by catalysis (see p. 54).—Jean **Chazy**: The determination of uniform functions in the neighbourhood of points where they cut.—S. **Bernstein**: The approximation of continued functions by polynomials.—C. **Cailler**: The linear pentaseries of solid bodies.—M. **d'Ocagne**: The nomographic determination of the path pursued by a ship in the course of varied movement.—M. **Bertin**: Observations on the preceding note.—Jean **Becquerel**: The duration of the phosphorescence of the uranyl salts. The duration of the phosphorescent emission is independent of the temperature (down to −193° C.) for uranyl sulphate and nitrate, whilst uranyl acetate, tartrate, oxalate, and other organic salts follow the ordinary rule, and the phosphorescence is of longer duration at the lower temperatures.—Henri **Abraham**: Relays and electric servo-motors.—M. **Ferrié**: The measurement of the lengths of Hertzian waves. Various types of wave meters are indicated and full particulars given of the method of calibration of one of them.—L. **Gay**: Mixtures of acetic acid with normal liquids.—Eugène **Fouard**: A practical method for the preparation of semi-permeable membranes applicable to the measurement of molecular weights. The method is based on the use of a collodion membrane, prepared according to the description of E. Roux and Salimbeni; this is permeable to a true solution but impermeable to the ultra-microscopic particles of a colloid. If such a collodion tube containing a tannic acid solution is placed in a gelatine solution, the membrane is modified in such a manner that whilst remaining freely permeable to water, it becomes impermeable to substances such as sugar in solution, and thus fulfils the condition of a semi-permeable membrane. Such a cell can be used to prove that two solutions are isotonic with much greater accuracy than is obtained by the method of de Vries.—

Daniel **Berthelot** and Henry **Gaudechon**: Nitrification by the ultra-violet rays. An aqueous solution of ammonia under the action of ultra-violet light forms some nitrite. A solution of ammonium nitrate under similar conditions gives off oxygen mixed with nitrogen and nitrite is formed. The effects of ultra-violet light are generally similar to those of ferments.—Emile **André**: The combination of amines with acetylenic ketones. The preparation of β-substituted ethylenic aminoketones.—Charles **Moureu** and Amand **Valeur**: Isosparteine, a case of stereoisomerism of nitrogen.—Henri **Coupin**: The comparative toxicity of plant essences on higher plants. The action of the essential oils from a large number of plants has been studied from the point of view of their action on wheat germs. The great majority prove to have clearly toxic effects.—G. **Gastine**: The use of saponins for the preparation of insectidal emulsions and liquids for the destruction of insects and cryptogams. The addition of saponin to such liquids is shown to be distinctly advantageous.—Henri **Bierry**, Victor **Henri**, and Albert **Ranc**: The action of ultra-violet light on glycerol.—J. **Renaut**: Mitochondria of the globular cells of the hyaline cartilage of mammals.—Ph. **Négris**: The existence of the trias at Mt. Ktypas (Messapion) and the importance of the gap between the Trias and the Cretaceous in Greece.

DIARY OF SOCIETIES.

THURSDAY, MARCH 9.

ROYAL SOCIETY, at 4.30.—(1) The Absorption Spectra of Lithium and Cæsium; (2) Dispersion in Vapours of the Alkali Metals: Prof. P. V. Bevan.—On the Ionic Solubility-product: J. Kendall.—Note on the Electrical Waves occurring in Nature: Dr. W. H. Eccles and H. M. Airey.—The Action of Animal Extracts on Milk Secretion: Prof. E. A. Schäfer, F.R.S., and K. Mackenzie.

MATHEMATICAL SOCIETY, at 5.30.—On the Reduction and Classification of Binary Cubic Forms which have a Negative Determinant: G. B. Mathews.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Laying and Maintenance of Transmission Cables: C. Vernier.

SOCIETY OF DYERS AND COLOURISTS, at 8.—The Fading of Dyestuffs: J. W. Lovibond.

FRIDAY, MARCH 10.

ROYAL INSTITUTION, at 9.—Recent Advances in Turbines: Hon. C. A. Parsons, F.R.S.

ROYAL ASTRONOMICAL SOCIETY, at 5.—On the bearing of the Principle of Relativity in Gravitational Astronomy: W. de Sitter.—The long-period Variable *RT* Cygni: A. N. Brown.—On a New Family of Periodic Orbits in the Problem of Three Bodies: E. W. Brown.—On the Determination of the Places of Reference Stars and Fundamental Stars by Photographic Methods: H. H. Turner.—On the Oscillating Orbits about the Triangular Equilibrium Points in the Problem of Three Bodies: E. W. Brown.—On the Problem of Distribution in Globular Star Clusters: H. C. Plummer.—Measures of Double Stars: Royal Observatory, Edinburgh.

MALACOLOGICAL SOCIETY, at 8.—On the Recent Species of Vulsella; on a New Species of Phasianella: E. A. Smith.—On the Value of the Gasteropod Apex in Classification: T. Iredale.—*Valvata Woodwardi*, n.sp., and *Sphærium Bulleni*, n.sp., from the Forest Bed (Cromerian) of West Runton, Norfolk: A. S. Kennard.

PHYSICAL SOCIETY, at 8.—Demonstration of the Working of the Gyro Compass: G. K. B. Elphinstone.—Note on an Electrical Trevelyan Rocker: Dr. W. H. Eccles.—Notes on the Tilted Gold-leaf Electroscope: Dr. G. W. C. Kaye.

SATURDAY, MARCH 11.

ROYAL INSTITUTION, at 3.—Radiant Energy and Matter: Sir J. J. Thomson, F.R.S.

MONDAY, MARCH 13.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—A Pioneer Journey in the Purcell Range, British Columbia: Dr. T. G. Longstaff.

ROYAL SOCIETY OF ARTS, at 8.—Applications of Electric Heating: Prof. J. A. Fleming, F.R.S.

TUESDAY, MARCH 14.

ROYAL INSTITUTION, at 3.—Crystalline Structure: Mineral, Chemical, Liquid: Dr. A. E. H. Tutton, F.R.S.

ILLUMINATING ENGINEERING SOCIETY, at 8.—*Resumed discussion* on School Lighting.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Electrification of a Portion of the Suburban System of the London, Brighton and South Coast Railway: P. Dawson.

FARADAY SOCIETY, at 8.—Some Properties of Aluminium Anode-films: G. E. Bairsto and R. Mercer.—The Weight of a "Normal" Litre of Hydrogen Chloride and the Atomic Weight of Chlorine: F. P. Burt and Dr. R. W. Whytlaw-Gray.—A Physico-chemical Study of Mercury-sodium Alloys or Sodium Amalgams: E. Vanstone.—On Surface Effects between Mercury and certain Solutions, and an Electro-chemical Method of Estimating Dissolved Oxygen: Dr. S. W. J. Smith and W. F. Higgins.

WEDNESDAY, MARCH 15.

ROYAL SOCIETY OF ARTS, at 4.30.—The Adulteration of Food: Colonel C. E. Cassal.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—What can we learn from Rainfall Records?: Prof. H. H. Turner, F.R.S.

ENTOMOLOGICAL SOCIETY, at 8.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Some Photomicrographs illustrating the Morphology of the Organisms concerned in the Production of Acute Intestinal Toxæmia in Infants: Dr. Ralph Vincent.—Anomalies in Objective Screw Threads: F. W. Watson Baker.—(1) On some New Objectives and Eye-pieces by R. Winkel of Göttenberg; (2) An Objective Mount with an Iris on the Variable Microscope: W. Nelson.

THURSDAY, MARCH 16.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Gametogenesis of the Gallfly, *Neuroterus lenticularis*. Part II.: L. Doncaster.—The Action of the Venom of *Echis carinatus*: Sir T. R. Fraser, F.R.S., and Dr. J. A. Gunn.—Further Researches on the Development of *Trypanosoma gambiense* in *Glossina palpalis*: Colonel Sir D. Bruce, F.R.S., and others.—Spontaneous Cancer in Mice: Dr. M. Haaland.

ROYAL INSTITUTION, at 3.—Giants and Pygmies: Prof. A. Keith.

LINNEAN SOCIETY, at 8.—On the Brown Seaweeds of the Salt Marsh: Miss S. M. Baker.

ROYAL SOCIETY OF ARTS, at 4.30.—Education in India: C. H. A. Hill.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Presidential Address: E. B. Ellington.

FRIDAY, MARCH 17.

ROYAL INSTITUTION, at 9.—Water Supply: J. H. Balfour-Browne.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Production of Water-gas: Alwyne Meade.

SATURDAY, MARCH 18.

ROYAL INSTITUTION, at 3.—Radiant Energy and Matter: Sir J. J. Thomson, F.R.S.

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