THURSDAY, OCTOBER 21, 1909.

THE SPECIES QUESTION RE-OPENED.

The Making of Species. By Douglas Dewar and Frank Finn. Pp. xix+400; 15 illustrations. (London: John Lane, 1909.) Price 7*s*. 6*d*.

IF this work fails to bring about that revolution in biological science which its announcement led us to expect, it is not for lack of confidence on the part of the authors or their publisher. We were informed (by advertisement) that with the exception of a certain well-known treatise by de Vries this book was "the most important contribution to biological science which has appeared since Darwin's 'Origin of Species.'" We were further told that "the authors have no difficulty in demolishing some of the theories which are most cherished by biologists of to-day—notably those of mimicry and recognition markings in birds," and that "the facts which they have brought together undermine the whole of the massive superstructure which Neo-Darwinians have erected on the foundation of the theory of natural selection." A few extracts from the preface will suffice to reveal the tone which pervades this latest attack upon the theory of natural selection:—

"We fear that this book will come as a rude shock to many scientific men. . . . We are endeavouring to save biology in England from committing suicide, to save it from the hands of those into which it has fallen. . . . The Wallaceians (*sic*) continue on their course and give to the world a spurious Darwinism . . . we were both of opinion that biology is in an unhealthy condition, especially in England, and that the science sorely needs some fresh impetus."

After such a flourish of trumpets we naturally turn eagerly to the text for the "fresh impetus," but fail to find inspiration. There are many gibes aimed at and epithets attached to "Wallaceians" and "Neo-Darwinians," and there are some very remarkable perversions of the history of organic evolution. The authors set out, in fact, with an attempt to explain the reasons why the "Origin of Species" was accorded a "rapturous welcome . . . by the more progressive biologists," and how

"the man in the street was able to comprehend the theory of natural selection. This was greatly in its favour. Men are usually well disposed towards doctrines which they can readily understand."

Those who are familiar with the history of the publication of Darwin's great work and the difficulty which he experienced in making even the expert naturalists of his time fully grasp the principles of the selection theory will wonder from what source the authors have derived their information. As another example of historical perversion, attention may be directed to the statement (p. 198)

"that all the opposition to the theory of protective colouration comes from those who observe nature first hand, while the warmest supporters of the theory are cabinet naturalists and museum zoologists."

From this the reader will infer that the founders of that theory, Bates and Wallace, Trimen, Belt, Fritz Müller and Weismann, were not, in the judgment of the authors, observers of nature at first hand.

Within the limits of an ordinary review in these columns it is impossible to discuss in any detail the large body of evidence which the authors bring together in order to "demolish" those whom they dub "Neo-Darwinians," "Wallaceians," or even, when their scorn reaches its highest pitch, "Neo-Wallaceians." The general drift of the work is purely destructive, and its main object is apparently to disprove the all-sufficiency of natural selection. There is nothing very novel in this position, and by attributing to the followers of Darwin and Wallace a highly exaggerated and super-exalted doctrine, which no Darwinian has ever upheld, such refutation is naturally a very simple matter. The authors appear to imagine, for example, that somebody holds the belief that the theory of natural selection has been seriously held "to explain all the varied phenomena of nature" (p 28). Of course, the very obvious and flagrant cases of adaptational colouring coming under the designations "protective resemblance" and "mimicry," which have generally been looked upon as reasonably explicable on Darwinian principles, come in for a large share of attention, and here is the verdict with respect to these theories:—

"We have examined these mighty images of gold, silver, and brass and iron, and found that there is much clay in the feet. We shall devote this chapter to lifting the hem of the garment of sanctity that envelops each of these images, and so expose to view the clay that lies concealed" (p. 172).

It must be left to the reader, whose flesh has been made to creep by this preliminary threat, to find out how far the authors have succeeded in damaging the evidence which has been accumulated by the joint labours of some of the most acute observers of nature ("at first hand"!) since Darwin gave us the key to the explanation of the phenomena in question, half a century ago. Prof. Poulton, as one of the most prominent of recent workers in this field, comes in for much castigation. The methods of demolition adopted by the authors have been made quite familiar by anti-Darwinians ever since the publication of Mivart's "Genesis of Species." Cases of convergent characters which are non-mimetic are marshalled against the selection theory of mimicry, the facts of mimicry are altogether denied or said to be much exaggerated, and cases of obvious adaptation, such as Kallima, are said (virtually) to be too good to be true, or, in other words, that the imitation is elaborated to an unnecessary extent.

It will naturally be asked whether this great array of objections and difficulties is a purely destructive attack, or whether it is a prelude to some great constructive generalisation. The reader who looks for new light will, we fear, be disappointed, judging from the following specimen of an "explanation" of the mimicry of butterflies by diurnal moths:—

"When two species adopt the same method of obtaining food, it not infrequently happens that a professional likeness springs up between them" (p. 250).

In so far as there is any positive declaration to be found in the volume the authors may be classified with the "mutationists." They are at great pains, in fact, to define their precise position as members of that school "of which Bateson, de Vries, Kellog, and T. H. Morgan appear to be adherents" (p. 26). They state further that, "like Darwin," they "welcome all factors which appear to be capable of effecting evolution" (p. 27). What these factors are beyond natural selection (to which they assign some value) it is not quite easy to gather from the present work. Isolation, correlation, variation, and heredity have been considered very seriously by all evolutionists from Darwin down to the present time, and it cannot be said that Messrs. Dewar and Finn have shed any new light on these subjects. They tell us (p. 387) that species are made by

"the inherent properties of protoplasm and the laws of variation and heredity. These determine the nature of the organism; natural selection and the like factors merely decide for each particular organism whether it shall survive and give rise to a species."

This will seem to the reader who is not a "mutationist" to be very like pure Darwinism with a dash of "inherent properties of protoplasm" thrown in. The introduction of "biological molecules," which are defined (pp. 157–9) as the units of which the germ cell is composed, may be considered as the substitution of a vague conception for the very definite mechanism which has been introduced into the theories of heredity associated with the names of Darwin, Herbert Spencer, Weismann, Mendel, and others. One example of the use of this conception will suffice to show its vagueness:—

"Thus the phenomena of 'mimicry' and 'reversion' are, we believe, due to the fact that in the fertilised egg of both the pattern and its copy a similar arrangement of biological molecules obtains. If we regard the sexual act as resembling in many respects a chemical synthesis, the phenomenon need not surprise us" (p. 293).

The reasons for associating mimicry with reversion and sexual reproduction are not very obvious, even from the authors' own point of view. Dealing with the first set of phenomena only, if the "explanation" means that in a mimic and its model the similarity of colour and pattern is due to an identity either of physical structure or chemical constitution, or of both, it is untrue in fact. If it means that the resemblance has arisen because the units (*i.e.* "biological molecules") of which the ovum is in each case composed give rise to a similarity of colour and pattern on development, this appears to be a mere paraphrase of the description of the facts and no explanation at all.

It is to be regretted that Messrs. Dewar and Finn have made this aggressive incursion into the domain of biological theory. They are favourably known as popular writers on Indian ornithology and other natural-history subjects. Although in the present volume none of the objections brought against natural selection are new in principle, it must be placed to the credit of the authors that, unlike so many of the earlier critics of Darwin's work, they are able to give a certain number of illustrations derived from personal observation and experience. But the work as a whole will not add to their reputation; with the majority of readers it will probably have the reverse effect. If the general object of the book is simply to emphasise the point that the theory given to science by Darwin and Wallace need not arrest further research in the domain of bionomics, there will be a very general unanimity among workers of all schools as to the soundness of their contention. But if the authors attribute any neglect, real or imaginary, of the study of bionomics to the direct influence of the teachings of Darwin and Wallace and their followers, they are inverting the truth. No greater stimulus was ever given to research in this domain than that given by the theory of natural selection. Any neglect with which English biologists can be charged is due to their ignoring and not to their acceptance of the teachings of the founders of that theory. R. MELDOLA.

THE GEOGRAPHICAL DISTRIBUTION OF LEPIDOPTERA.

Die geographische Verbreitung der Schmetterlinge. By Dr. Arnold Pagenstecher. Pp ix+451. (Jena: G. Fischer, 1909.) Price 11 marks.

THE author of this work is one of the older German entomologists, who has been working for many years in the formation of a collection of Lepidoptera, and has published many valuable lists and monographs of the species found in various limited regions. He has now utilised his materials in a work which cannot fail to be interesting, not only to entomologists, but also to all naturalists who direct their attention to the numerous problems connected with the present geographical distribution of animals over the surface of the globe.

Dr. Pagenstecher remarks that the geographical distribution of Lepidoptera, like that of plants, is closely connected with certain physical and organic factors. The most important physical factors are (1) soil; (2) temperature and light; (3) moisture; (4) atmospheric conditions. The first portion of this work is therefore devoted to general observations on the geographical conditions of the continents, and the influence of mountains, desert or fruitful plains, the neighbourhood of rivers and seas, continental and oceanic islands, &c., on distribution. The influence of temperature, moisture, atmosphere, &c., is then briefly described; then vegetation, carnivorous habits, commensalism, &c. This is followed by sections on the distribution of Lepidoptera as affected by altitude, notes on migration, cosmopolitan species, and seasondimorphism and local variation. After this, the organic (physiological) factors of the subject are discussed, with special reference to former geological and climatic conditions, and some reference to fossil Lepidoptera. After some remarks on structure, and on the enemies of Lepidoptera, the section concludes with a summary of the Macro-lepidoptera of Central Europe (1626 species, according to Lampert), and a table of the species of Papilio found in the more important districts of the world.

The second section of the work is devoted to the

regions and subregions of the world as defined by Wallace, Sclater, and others, with some reference to the views of other zoologists and botanists on the subject. After this, the various regions and districts of the world are discussed, first with regard to their climatic conditions, and secondly with reference to the species of Lepidoptera known to inhabit them, of which, in many instances, very full lists are given. This portion of the work contains an enormous amount of valuable detail, and much scattered information is brought together which it would be very difficult to utilise in its original form. This portion of the work is the most extensive, but cannot here be discussed in detail.

The concluding section deals with the geographical distribution of Lepidoptera under their families and genera, and this also is very completely set forth. The book is illustrated by two outline maps, one (facing p. 62) indicating the regions and subregions of the world, as mapped out by Wallace and Sclater, and the other (facing p. 217) representing the Malay Archipelago from the Nicobars and Malacca to the Philippines, New Guinea, and North Australia.

Dr. Pagenstecher has not indulged in much theorising, but his book forms a great quarry from which philosophical speculators will be able to extract a vast amount of material. It is not a book that either systematic lepidopterists or philosophical naturalists can afford to ignore, and they will have reason to be very grateful to the author for the conscientious care that he has devoted to this most laborious and useful book. W. F. K.

AGRICULTURAL FERTILISERS.

Fertilisers and Manures. By A. D. Hall, F.R.S. Pp. xvi+384. (London: John Murray, 1909.) Price 5*s.* net.

MR. HALL has again succeeded in producing a work which will appeal with equal force to the practical and to the scientific agriculturist, and will do much to overcome that innate prejudice of the ordinary practical farmer against science by showing him the enormous influence science has had in determining a rational system of manuring, and in giving him the knowledge of a variety of substances of use to him in his business of food production, as well as in securing for him a safeguard against adulteration by unscrupulous traders. In the history and evolution of the practice of keeping up the crop-producing power of the soil Mr. Hall examines critically the various theories of manuring adduced from time to time, and the experiments upon which they are based, and the study of merely this part of the work will be of supreme importance to the practical man and to the student in showing how experiments may be misconstrued and conclusions of the most erroneous description drawn.

The recommendations as to the manuring of farm crops are tempered with sound advice, and the impossibility of prescribing more than a generally suitable method of manuring without a careful study of soil and climatic conditions extending over some years is well demonstrated. Mr. Hall gives some timely warnings as to deductions from field experiments, of which there has been such a plethora in recent years, with their unscientific methods both of carrying out and of deduction. The importance of taking into account the experimental error, which is estimated at ±10 per cent., and of neglecting results within these limits should be taken to heart by all who carry on these so-called "experiments."

The chapter on farmyard manure is eminently practical and useful, and recent work on such subjects as root excretions, effect of fertilisers on tilth, and on residual values of manures, brings the book well up to date. It is sought to distinguish between manures and fertilisers, the former designating more or less complete plant foods, the latter those materials which supply one element in the plant food, nitrogen, potash, or phosphoric acid. The perversion of the meaning of the word manure from its original significance, hand work, is no less curious than the use of the word tillage to mean artificial manures, which use still persists in the eastern Midlands. The part of the work relating to lime is worthy of serious attention from all agriculturists, as it is probable that the lack of carbonate of lime in a soil is more often than any other cause an explanation of the comparative infertility or absence of satisfactory results from manuring. A chapter on the valuation and purchase of fertilisers puts this important method of calculation simply and accurately, and a concise statement of the Fertilisers and Feeding Stuffs Act will be useful to all users of manures.

Mr. Hall's remarks on the soil-inoculation question supplement and strengthen the advice he gave in his work on the soil, and the experiments on the new nitrogenous fertilisers, cyanamide and nitrate of lime, show the values of these fertilisers in terms of their competitors, nitrate of soda and sulphate of ammonia. The Rothamsted experiments are, of course, freely drawn upon to provide data, and in the hands of the present director of that station these results are being endowed with fresh life and excellently practical applications. The tables of results are concise and well arranged, so that the reader is not faced with an immense array of figures and tables, and bewildered without being enlightened. To sum up, this is a sound and scientific book which should be in the hands of every practical agriculturist as well as in those of the student, the teacher, and the manufacturer. M. J. R. D.

THE NATURE OF ATTENTION.

Attention. By Prof. W. B. Pillsbury. Pp. x+346. (London: Swan Sonnenschein and Co., Ltd., 1908.) Price 10*s.* 6*d.* net.

IN 1906 Prof. Pillsbury published a book on attention in the "Bibliothèque internationale de Psychologie expérimentale." This work, with substantial additions, now appears in English as the latest volume of Prof. Muirhead's Library of Philosophy. It may be welcomed as a useful member of the series,

though it can hardly compare in importance with some of its brilliant predecessors.

Prof. Pillsbury, like his former teacher, Prof. Titchener, in a still more recent book, defines attention as "an increased clearness and prominence of some one idea, sensation, or object." His first thirteen chapters are devoted to the illustration of this description from general psychological processes; to an analysis of the part played by attention in the phenomena of perception and ideation, of memory, action, reason, emotion, and the self; and to a study of the conditions which determine the incidence of attention. With regard to the latter, he contends for a simplification of current classifications. The "forms" of attention generally recognised are distinguished either by the presence of elements (such as strain sensations) which are extraneous to the sensation-process or else by the nature of the objects to which attention is directed. There is really only one kind of attention, though the conditions of its emergence are two-fold. These are: objective conditions which consist in characteristics of the stimulus, such as its intensity, extent and duration; and subjective conditions, such as the momentary mood and past experiences of the individual. Finally, it must be noted that these conditions never or rarely appear in entire separation.

The later chapters are mainly given to theories of attention, grouped as physiological theories, theories that treat attention as a phase of mental activity, and theories that seek in some particular feature or accompaniment of the attention-process the cause of the predominant "clearness" of certain sensations and ideas. As a critic of preceding theories Prof. Pillsbury's best work is his interesting and useful treatment of apperception. His own theory is a physiological one, and assumes "localisation" of the activity of attention in the so-called anterior association centre of Flechsig. By a kind of "drainage," for which there is experimental evidence, the discharge through a given neuronic system may be heightened by the coexistence of less energetic discharges in connected systems, or depressed by a still more energetic discharge in such a system. The association centre provides lines of irradiation along which reinforcement and inhibition may in this way spread from one sensory centre to another. By such a concept Prof. Pillsbury believes that the determination of attention, both by strong stimuli and by past experience, can be explained in accordance with the postulate of psychophysical parallelism, and without the hypothesis of an unverifiable agent "that stands behind consciousness."

The book ends with a chapter on pedagogical applications. The author attacks the doctrine that makes "interest the measure of what shall be taught" to a child. He argues for the use of "social pressure," and the appeal to duty in education. "They are just as important as the conditions which we ordinarily call interest in governing attention, and it is quite as justifiable to make use of them in practice." This warning of a psychologist against making education "soft" is not untimely, although (owing to the lamentable ambiguity of the word "interest") he is condemning a theory of teaching which no responsible pedagogical writer—at least in this country—would dream of defending.

In addition to a good index the book contains a bibliography of the subject for which the student will be grateful.

TABLES FOR MATHEMATICIANS AND PHYSICISTS.

(1) *Five-figure Logarithmic and other Tables.* By Frank Castle. Pp. 58. (London: Macmillan and Co., Ltd., 1909.) Price 1*s*.

(2) *Taschenbuch für Mathematiker und Physiker.* 1 Jahrgang, 1909. By Felix Auerbach. Pp. xliv+450. (Leipzig: B. G. Teubner, 1909.) Price 6 marks.

(1) MR. CASTLE is well known as the author of a series of elementary text-books on mathematics. He now gives us a new set of five-figure mathematical tables. So many tables of this sort have appeared of late years that innovation in this field is rather difficult. Mr. Castle's tables are very similar in contents to Dale's five-figure tables, with the advanced functions cut out. One happy alteration is that, in the early part of the table of logarithms, mean differences are calculated for every five entries instead of for every ten. This renders possible the use of mean differences in all parts of the table without loss of accuracy. Another good point is a table of degrees and circular functions for equal intervals of radian measure; this should be most valuable for advanced work.

On the other hand, there seems a needless amount of repetition in printing. Thus the table of sines is printed separate from the table of cosines, although the one table is merely the other read backwards. The same holds of tangents and cotangents, secants and cosecants. It may be argued that this makes the tables easier to handle for readers with little theoretical knowledge, but it seems doubtful whether it will not encourage rather than check the common fault of *adding*, instead of *subtracting*, differences for the cosine, cotangent, and cosecant.

A more serious defect is the omission, from the table of cube roots, of the cube roots of numbers from 100 to 1000. This means that the present tables cannot be used to find rapidly the cube root of, say, 0·3.

(2) A pocket-book of reference for mathematicians and physicists will strike most mathematical readers, at all events in this country, as a novelty. Such a pocket-book was recently brought out in Germany by Dr. Felix Auerbach, working in collaboration with Drs. Knopf, Liebmann, and Wölffing. Facing the title-page is a portrait of Lord Kelvin, and the volume opens with a notice of his life and work.

It is intended that this shall be an annual publication. For this reason, Dr. Auerbach tells us in his preface, many matters have been only lightly touched upon, or even omitted altogether, in the hope that further details concerning them may be included in a later issue.

As it is, the initiated reader must be amazed at the amount of useful information which has been compressed into 450 small octavo pages. In every branch and sub-branch of mathematics all the fundamental definitions, theorems, and formulæ have been given, sufficient explanation being added to make the whole intelligible to the average mathematician. A similar plan has been adopted for the physical and astronomical parts, numerous tables of constants being given, as well as descriptions of apparatus. At the end of the book is a useful list of mathematical and physical books and periodicals.

We have noticed a few errata, *e.g.* p. 44, the first theorem of the mean is incorrectly stated, and p. 46, $\int_0^\infty \frac{\sin bx}{x}\,dx$ is equal to $\pi/2$ only if $b>0$. These, however, are slight blemishes, inevitable in a first issue. In conclusion, we wish the "Taschenbuch" all the success it undoubtedly deserves.

OUR BOOK SHELF.

An Introduction to the Science of Radio-activity. By C. W. Raffety. Pp. xii+208. (London: Longmans, Green and Co., 1909.) Price 4*s.* 6*d.* net.

THE aim of this book is to present a concise and popular account of the properties of the radio-active elements and of the theoretical conceptions which are involved in the study of radio-active phenomena. With this object in view, the treatment throughout is purely descriptive, and no attempt is made to develop the mathematical side of the subject. Nevertheless, the author has succeeded in describing and discussing most clearly the various phenomena of radio-activity.

The book is divided into three parts. The first part is descriptive, and, after a general note on the radio-active elements, is devoted to the consideration of the nature of the various radiations emitted by radio-active bodies. The characteristics of the α, β, and γ radiations are carefully explained.

In the second part of the book the author deals with the subject of radio-active transformations, and describes in detail the various disintegration products produced from thorium, uranium, and radium. Chapter iv. in this section contains an account of the theory of atomic structure from the electron point of view. The evidence drawn from various phenomena shows large variations in the number of electrons associated in the atom. The author gives the numbers calculated from experiments on kathode rays. The third part of the book is devoted to kathode, canal, and X-rays, and gives experimental details which should enable an amateur to carry out successfully a number of experiments with a small amount of apparatus. A feature of the book is the appendix, in which the author has collected and tabulated the physical constants of the α, β, and γ rays, the products of decay of the radio-active elements, with their rates of decay, and the absorption coefficients of the radiations emitted by the radio-active bodies.

Altogether the book can be heartily recommended to mathematical, as well as non-mathematical, readers who desire an acquaintance with the subject of radio-activity.

British Mountain Climbs. By George D. Abraham. Pp. xvi+448. (London: Mills and Boon, Ltd., 1909.) Price 7*s.* 6*d.* net.

MR. ABRAHAM here provides the lover of British mountaineering with a conveniently small and concise guide to the British rock-climbs. The climbs are grouped around the most convenient centres, and detailed instructions as to how to perform the various expeditions safely are given. The book is provided with eighteen illustrations and twenty-one outline drawings, showing the principal routes. It is written in a bright, interesting style, and is sure to become a favourite among mountaineers who are willing to learn from it the beauties and difficulties of climbing at home.

The Pond and other Stories. By Carl Ewald. Translated from the Danish by Alexander Teixeira de Mattos. Pp. 320. (London: Everett and Co., 1909.) Price 6*s.* net.

THIS series of eleven stories deals with animal and plant life in a way dear to children. The birds and beasts talk to one another, and incidentally supply the reader with many familiar facts of nature-study. Each story is provided with a good illustration, and the easy colloquial English of the translator will be understood by the young children for whom the book is evidently intended.

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.*]

Magnetic Storms.

DR. CHREE contends that magnetic observations have now reached a high pitch of perfection, and that their discussion is not lightly to be undertaken by outsiders. That is no doubt so, and there must be many features about magnetic storms which are known only to experts. But when we find experts in doubt on such a fundamental matter as whether the cause of those storms is to be found in the sun or in the earth, it appears to be worth while to emphasise some comparatively simple and fundamental considerations which may possibly have become rather covered up by a mass of information.

The simple points that I venture to emphasise, with all due deference to specialists, are:—

(1) That by reason of the high temperature and convulsions of the sun it is almost bound to emit electric projectiles.

(2) That when the visible sign of a solar eruption is aimed at the earth, magnetic storms are often felt, while they are not so frequently experienced from eruptions the emissions of which may be reasonably supposed likely to miss the earth.

(3) That, taking into account the varying aspect of places on the earth to a solar beam, such a stream of particles is well qualified to produce changes in all the magnetic elements during the course of a day—even though deflection by magnetic lines, and the effect of currents induced in the conducting layer of the upper atmosphere, were ignored. (I do not say that the details of a storm fit so greatly simplified a theory.)

(4) That a great beam of this kind is not likely to be uniform, but may be supposed to contain rays of special intensity, the passage of which will cause well-marked and rapid reversals, such as are observed.

(Of course, I never thought that the recent storm was over in fifteen minutes; it was common knowledge that it lasted for hours. I must have expressed myself badly if I conveyed such an idea.)

(5) That detection, in storm-recurrence, of any periodicity which corresponds at all closely with the period of the sun's relative axial rotation—such as is maintained by Mr. Maunder and apparently *half* admitted by Dr. Schuster—would surely be conclusive as to something solar in origin.

(6) And, especially, that simple calculations from known laboratory data show that the magnitude of the effect observed is not unreasonably great to attribute to local solar radio-active emissions.

Hesitation as to the truth of this last proposition was,

I understand, Dr. Chree's basis for his most anxious doubts; and the object of my letter was to try to remove at least this form of doubt from the minds of astronomers and responsible magneticians.

One more quite minor point I may take the opportunity of mentioning, though it is connected rather with a letter of Dr. Chree's in the *Times* than with his letter in NATURE.

(7) Disturbance of terrestrial rainfall—say an increase for a short period due to influx of cosmic nuclei—need not be supposed to modify the usual local *distribution* of rain, but only to increase its amount in the customary localities.

This I only venture to say very tentatively, and with no dogmatism at all. It is clear that the total rainfall all over the earth during a long period cannot exceed what the sun can evaporate in approximately the same period, and therefore depends more on the sun's total activity than on anything else. It is also clear that rain is a local circumstance, and that the conditions which determine whereabouts rain shall fall are mainly local. But I question whether either of these propositions really negatives the idea that cosmic causes may occasionally affect the rainfall during any given month, even in a specified locality. OLIVER LODGE.

Why has the Moon no Atmosphere?

PROCTOR ("The Moon," p. 334) says:—"It has been held, and not without some degree of evidence in favour of the theory, that in our Moon we have a picture of our Earth, as she will be at some far distant date . . . when her oceans and atmosphere have disappeared through the action of the same circumstances (whatever they may be) which have caused the Moon to be airless and oceanless."

The following considerations suggest what the circumstances referred to may have been, and present what seems a possible cause for the absence of an atmosphere.

(1) Apart from all theory, we know that the sun exerts a repulsive force on matter around him. The phenomena of comets' tails show this as clearly as the streamers from a flagstaff show that a wind is blowing. Kepler first suggested the existence of this force. Sir John Herchel, in his essay on comets, said, more than forty years ago, that "they have furnished us with a proof, amounting to demonstration, of the existence of a repulsive force directed . . . *from* the Sun."

(2) Maxwell in 1873 deduced from his electromagnetic theory the pressure of light, which Arrhenius in 1900 applied to explain the formation of comets' tails. Each particle projected from the comet, under the influence of the sun's heat when nearing the sun, being submitted to two opposing forces, viz. gravitation and the pressure of light, he pointed out that since the pressure varied as the surface, while the weight varied as the volume, *i.e.* one compared with the other, varied as the square of a number compared with its cube, then, when the particles were small enough, the repulsive force of the pressure might be many times as great as the force of attraction, and drive away the particles with great velocity.

As a common example of such action, I may remark that we have the case of a wind blowing on a newly macadamised road or on a single stone on the road. While the stones are unbroken the wind cannot move them, but when they are crumbled to powder it sweeps them away in clouds.

(3) In this way the sun exercises a sort of sifting process in space, sweeping away very small particles and drawing the larger ones towards him.

(4) Assuming that the moon had an atmosphere for many ages, the particles would be acted on by the repulsive force of the sun radiating from its centre, and by gravity directed to the centre of gravity of the moon. During the time that the moon retained its atmosphere it is evident that gravity must have been the preponderating force. The atoms, as Dalton called them, were not small enough to allow the pressure of light to prevail over the weight.

(5) But the atmosphere has disappeared, and we have to account for this fact. Can the particles have been in any way reduced in size?

If we are sure that the chemical atoms, as Dalton called them, despite the protests of such men as Davy, Wollaston and Berzelius, cannot be decomposed or disintegrated, then an hypothesis to the contrary must be rejected.

(6) But the recent discoveries in radio-activity are opposed to this. It has been shown that the radio-active elements are disintegrating slowly and gradually from their own internal energy. The process has been going on for indefinite time, although only lately discovered accidentally because of certain radiations. Have we reason to believe that it is limited to these elements? Prof. Rutherford has pointed out that the existence of rayless changes in these elements "indicates the possibility that undetected changes of a similar character may be taking place in the non-radio-active elements" ("Radio-activity," p. 455, 2nd edition). If we suppose that such changes took place at the outer surface of the moon's atmosphere, resulting in particles sufficiently small, then part after part of the atmosphere may have been stripped away until the present condition has been reached.

(7) The same process may be going on now with the earth's atmosphere, notwithstanding the greater force of gravity.

Briefly, if the atmosphere of the moon was ever driven away—the repulsive force of the sun (pressure of light) is the only driving force we know of—the component particles must have been originally too heavy to be driven off, and were therefore in some way reducible; the transformations in the radio-active elements suggest a possible process.

Thus the present condition of the moon is an argument for the disintegration of some of the non-radio-active elements, and the argument is the stronger in proportion to the difficulty of finding a solution otherwise to this old astronomical problem. ALEXANDER JOHNSON.

Montreal, Canada, September 30.

A "Canaan Stone."

CAPTAIN B——, of the Brixham (Devon) trawler fleet, recently showed me what he termed a "Canaan stone." He told me that in the hands of his wife's mother it had effected many miraculous cures of diseases of the eye, and that by its use she had been especially successful in curing cataract. The stone was a polished sphere of agate, translucent, and of a faintly greenish-yellow tint, containing several red-brown patches due to the presence of iron. It was about ¾-inch in diameter, and had been drilled through the centre, as though it had at one time formed part of a necklace. The treatment simply consisted in "striking" (*i.e.* gently rubbing) the eye with the stone. No prayers or incantations were used, but it was essential that different parts of the stone should be used in different diseases, and the part used also varied with the colour of the patient's eyes. The stone was rubbed actually on the conjunctiva, not on the lids. The secret of the exact method of treatment died with the old lady, who is reported to have had quite an extensive ophthalmic practice, and I was appealed to in order that I might explain the secret to the present owners of the stone. Beyond the fact that the stone had been bought by its late owner from a man in Cornwall for 40*l.*, no history was available.

The following extract from the Book of Tobit suggested itself to me as a possible explanation of the origin of the belief in the curative value of the stone:—

"When Tobias and Raphael came to the river Tigris, a fish leaped out of the water and would have devoured him, but the young man laid hold of it and drew it to land. The Angel bade Tobias open the fish, and take the heart, and the liver, and the gall, and put them up safely. . . . And the Angel said . . . As for the gall: it is good to anoint a man that a whiteness in his eyes shall be healed. . . . Tobias met his father at the door, and strake of the gall on his father's eyes . . . and Tobit recovered his sight."

It does not require a great stretch of the imagination to see a resemblance between this translucent, greenish-yellow stone, with its red-brown patches, and the distended gall-bladder of a fish, excised with small portions of liver adherent to its surface. The expression "to strike," for to anoint or rub, is still quite common in Devon. In the country districts a usual treatment for sprains or abrasions

is to "strike them with fasting spittle," *i.e.* to apply saliva when rising in the morning, before any food has been taken. G. HAROLD DREW.

Marine Biological Laboratory, Plymouth.

Orthite in North Wales.

IN March, 1908, an unfamiliar mineral was discovered by Mr. W. G. Fearnsides in a narrow vein which traverses the intrusive granophyric mass of Tan-y-grisiau, near Ffestiniog, and was submitted to me for identification.

It has proved to be the somewhat rare silicate *orthite*, and its occurrence will be of considerable interest to mineralogists both on account of the amount of material available and for the large size of the crystals, which range up to 1½ inches in greatest dimension.

Hitherto orthite, which contains a number of the rarer elements, such as cerium, lanthanum, didymium, yttrium, &c., has not been found in any quantity in Britain, and then only as microscopic crystals and grains. The crystals from Tan-y-grisiau are well-formed, black to dark grey, submetallic tables with bright faces; they are conspicuously tabular, parallel to the form T{100}, and are modified by narrow prism and dome faces.

It is the "unknown and very interesting mineral" to which the attention of those members of the Geologists' Association who took part in the long excursion to North Wales this year was directed.

The exact locality is the north-west face of a quarry at Cefn-bychan, south of Tan-y-grisiau, Blaenau-Ffestiniog, belonging to the Ffestiniog Granite Quarries Co., Ltd.

The physical properties of the orthite are undergoing investigation, the results of which will be published at a later date. HERBERT H. THOMAS.

Geological Survey and Museum, Jermyn Street, S.W.

Drought in South-west Ireland.

WHILST all round us have been reports of wintry weather and unceasing rain during the summer months, we in this small south-westerly area of Ireland have been passing through a period of abnormal drought, in fact a record season, accompanied by high temperature throughout.

I have recorded the annual rainfall here (Bandon) for some years, but I have never had anything approaching a similar experience, and the oldest inhabitant here cannot recall so continued an absence of rain as we have felt this season, that too in a country where the rainfall is generally excessive. I am bound to say, however, that the elements are *now* distinctly making up for lost time, as though in revenge for letting us off so easily before.

I give you the rain-gauge readings for the months June, July, August, and September, which speak for themselves, and may perhaps prove of some interest to your readers.

The readings were taken with a 5-inch Negretti and Zambra gauge, and registered daily:—

June.—Total for month, 1·08 inches. Twenty-five days absolute drought. Highest reading=0·47 inch, on June 24.

July.—Total for month, 1·02 inches. Twenty-three days absolute drought. Highest reading=0·34 inch, on July 10.

August.—Total for month, 0·54 inch. Twenty-five days absolute drought. Highest reading=0·32 inch, on August 1.

September.—Total for month, 0·41 inch. Eighteen days absolute drought. Highest reading=0·08 inch, on September 28. GEO. A. ARMSTRONG.

Ardnacarrig, Bandon, Co. Cork, October 13.

The Meteor in Sunshine, October 6.

THE great daylight meteor of October 6 was observed by many persons in various parts of the country. The particulars to hand are not, however, very definite, and it is scarcely possible to compute the real path of the object. From a comparison of about fifteen descriptions, there seems little doubt that the meteor moved in a direction from south to north over Reading, Thame, and on to a termination near Market Harborough.

The radiant point was in Leo, and it is hoped that more observations of an exact character will be supplied. The sky was clear over a large extent of England, and hundreds of persons saw the meteor, though only a small proportion of that number have reported their observations.

The great daylight meteor of 1900 January 9 was directed from Aquila, that of 1894 February 8 emanated from Hercules. It is seldom that meteors appearing at such times can be suitably observed, as the sky does not afford any reference objects such as is furnished by the stars at night. W. F. DENNING.

An Aurora Display on October 18.

I WITNESSED last night one of the finest displays of the aurora borealis which it has been my good fortune to see in this country. It happened at about 9 p.m., and I was at the time upon one of the highest summits of the Cotteswold Hills, close upon 1000 feet above the sea-level, so that I had an uninterrupted view of the magnificent spectacle. The first I saw of it was several streamers and an indistinct band low down on the northern horizon, with a detached red, cloud-like portion almost due west. These resolved themselves eventually into two bands, the uppermost stretching right across the sky from north-west to north-east, and during the maximum phase of the phenomenon was a truly grand spectacle, with numerous streamers connecting the two bands. The uppermost band finally faded away, leaving the lowermost one still visible but very indistinct, with two or three faint streamers shooting upwards.

I take this opportunity of inquiring what is the most austral or equatorial limit from whence the aurora borealis is visible, or rather has ever been observed? This subject is of particular interest to me from the circumstance that when I was at Darjeeling some years ago I was informed that the phenomenon had been seen from thence, although this well-known hill station is so far south as 27° north latitude. Although it is not impossible for it to be seen from the altitude of Darjeeling (which is 7500 feet above the sea-level), for far away are seen the tops of the Himalayas, I feel convinced that what has been seen from thence, and mistaken for the aurora, is nothing more than the after-glow or reflection from the snow-fields and glaciers upon exceedingly thin masses of aqueous vapour, or rather spicules of snow, floating upwards to 1000 feet or more above the summits of the highest Himalayan peaks. This latter phenomenon I frequently witnessed after sunset, and it certainly possessed the appearance, upon many occasions, of the aurora, hence the mistake, possibly, of unscientific observers. W. HARCOURT-BATH.

October 19.

Jupiter's South Tropical Dark Area.

ALL the transit estimates, numbering fifty-two, of the south tropical dark area on Jupiter, obtained during the apparition of 1908–9, have been reduced to longitude. The area in 1908 December was found to be more than 50° in length at the south equatorial belt. From this date to the close of the observations in 1909 June its dimensions exhibited a gradual increase, and in the latter month it covered considerably more than 90° of longitude. This longitudinal growth was due chiefly to a marked difference in the observed rate of velocity of the two ends of the area. While the preceding end drifted at a pretty normal rate of 15° per month in excess of the adopted zero meridian of System II., the following end exhibited a monthly drift of only 9°. The following part of the area, therefore, was not keeping pace with the preceding portion, and accordingly the object itself became distended in longitude.

The mean rotation period of each end, as well as the middle, of the area would seem to have been as under:—

Number of observations	Number of rotations	Mean daily drift	Mean rotation period
		°	h. m. s.
20 ...	430 ...	−0·4823 ...	9 55 20·8
16 ...	295 ...	−0·3754 ...	9 55 25·3
16 ...	379 ...	−0·2989 ...	9 55 28·3

The above period for the following end is the longest that has been recorded, either for this or any other part of the area, the existence of which became known in 1901 February.

Leeds, October 15. SCRIVEN BOLTON.

FURTHER EXPERIMENTS WITH THE GRAMOPHONE.

IN NATURE of April 15 I described a number of experiments with the gramophone. Since then I have continued to work on this interesting subject, and have at last succeeded in transcribing the vibrations of tones or chords as these are produced by the gramophone; that is to say, during the time that the sounds are given forth. The method is illustrated in the figure accompanying this paper (Fig. 1), and I also give several illustrations of the tracing so obtained. The sounds of the gramophone are carried by a tin tube from the end of the arm of the instrument to which the horn or trumpet-resonator is attached, to a sensitive microphone. The microphone used was made by Herr Müller-Uri, of Brunswick, and was intended to be used in the experiment of the singing-arc flame and also for a loud-speaking telephone. In the circuit of the microphone I have five or six dry cells giving a current of about five volts. In the same circuit is the recorder, which is a very small electromagnet having a marker attached to the keeper.

In early experiments I used a large electromagnet acting on a spring that carried a marker, but such an arrangement only recorded notes or chords, as regards intensity, but without showing the constituent vibrations. It was not quick enough. Accordingly I adopted a small electromagnetic arrangement, like a "Deprez-signal," known to physiologists; but, taking a hint from the use of elasticity in the construction of the reproducer of the gramophone and improved phonograph, I arranged thin india-rubber bands so as to hold the keeper of the tiny electromagnet about one or two millimetres from the small soft iron cores, and so placed that the keeper was kept in equilibrium between two forces, at the distance I have mentioned. I found that with this arrangement, when the gramophone was played, the electromagnetic recorder gave forth the tune with perfect accuracy, and when one touched the keeper it could be felt thrilling on the finger.

The electromagnetic recorder acted like a little telephone. After many contrivances, I found the best method was to place the recorder on the well-known Cambridge platform-stand, which can be moved up or down by a finely cut strong screw (see Fig. 1). On the platform I placed a device of my own, by which I could adjust the marker on the smoked paper with great nicety. On the same platform, as shown in the illustration, I placed an electromagnetic recorder controlled by a 100 vib. tuning fork, so as to register on the tracing 1/100ths of a second. The drum used was an old-fashioned Hawksley drum, well known to physiologists, and it rotated at a speed that gave 12 inches per second. The paper was smoked in the usual way over a camphor flame, and, after the tracing was taken, it was fixed by clear shellac varnish. The tracings shown are from slightly enlarged photographs of a portion of each tracing, and

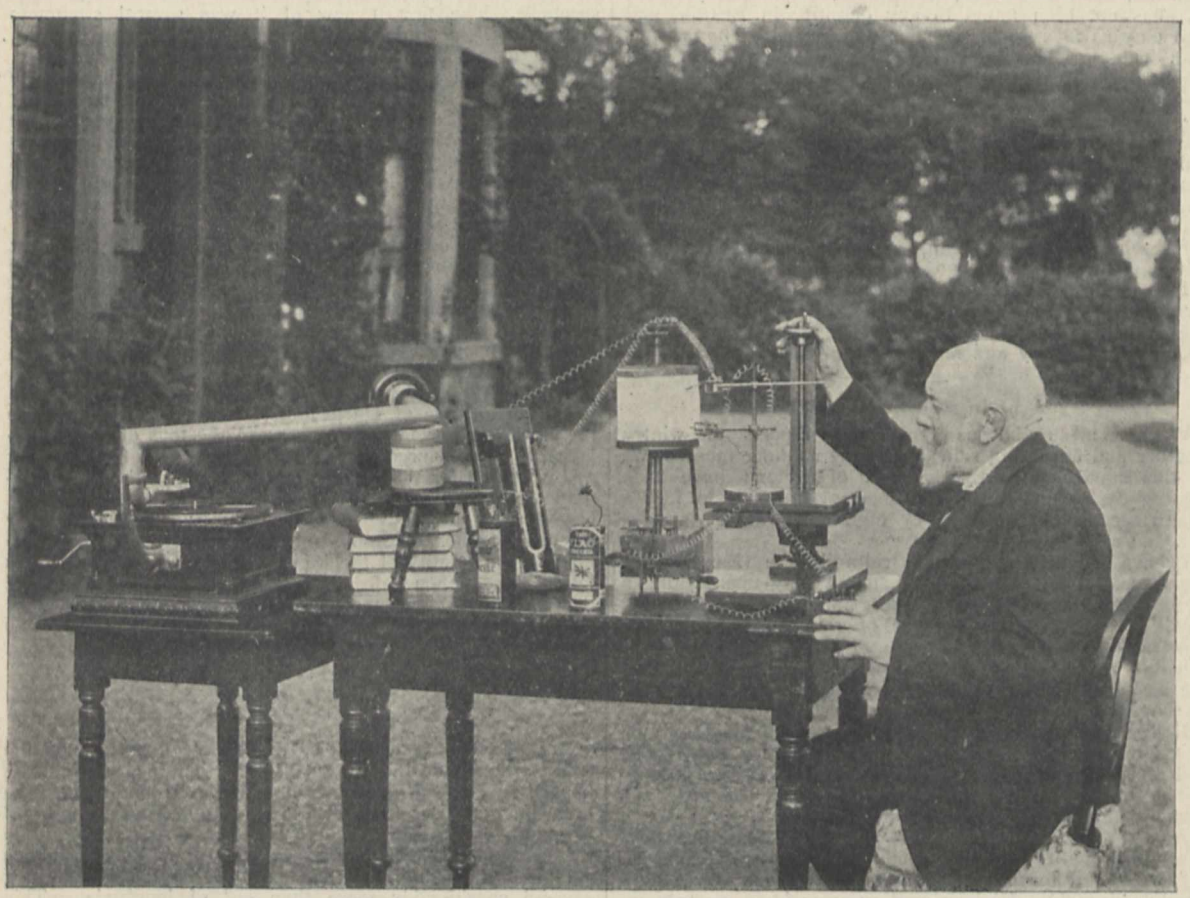


FIG. 1.—Arrangement of apparatus. Gramophone to the left. Observe the tin tube carrying the sound waves to the microphone. The operator is on the right controlling the movable stage. The upper electromagnetic marker adjusted to the cylinder (revolving drum) registers the vibrations of the 1/100th per second tuning fork seen in the middle of the table. The lower electromagnetic marker writes the vibrations of the sound waves as these act on the microphone. While it is registering the lower marker gives forth the sounds played by the gramophone.

the length of each line, from side to side, represents in time 0·3 second. Short descriptions of the tracings are printed below the figures.

The experiment was performed thus:—After carefully adusting the markers on the smoked paper, the cylinder was allowed to rotate until it reached its maximum uniform speed. By closing a key, a time record was taken. Then the gramophone was started; the sound waves acted on the microphone, and the little electromagnetic marker began to sing or play; finally, by having my right hand at the top of the screw, as shown in the figure, I was able slowly to raise the platform, carrying the recorder, so as to describe a long spiral line, about 135 feet in length, from the bottom to the top of the cylinder. On reaching the top, the experiment came to an end. To secure good results, great care had to be taken to secure nicety of adjustment. It must be explained that in the tracings so taken the recorder traverses 12 inches per second. The waves in my tracings are thus compressed laterally. To obtain waves at the speed of the gramophone, I had a wooden cylinder made which was attached to the circular plate of another gramophone, and having a circumference such that the recorder traversed from 21 to 24 inches per second. The two gramophones, one to play, the other to carry the wooden drum, were driven at the same speed. Tracings were thus obtained similar to the indentations or waves on the gramophone record. Trouble arose, however, from the oscillations of the gramophone plate (one of the conditions of the success of the gramophone, in which all the arrangements are more or less mobile), but this difficulty was easily surmounted. Finally, I found that with my arrangement it was not necessary to use the gramophone, as it was easy to record the vibrations of a human voice by causing the singer or speaker to sing or speak direct to the microphone. The arrangement is an excellent phonautograph. About five minutes are occupied in taking a tracing, the average length of which is 135 feet.

An inspection of these tracings shows the wonderful variety of pressures pouring in upon the ear as we listen to music. Three or four or more notes differ-

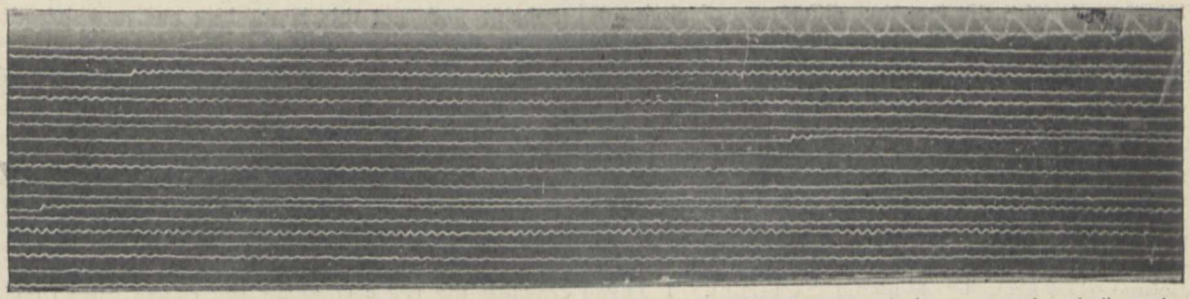


FIG. 2.—Small portion of tracing of the Westminster chimes. The tracing begins at the left-hand corner at the bottom, runs along the line to the right, then is continued in the next line above, again at the lower left-hand corner, and so on. The length of time represented by the length of one line from left to right is about one-third of a second. The tracings of the 1/100th of a second are seen at the top. The tracing is from the portion of the record giving the strokes of twelve o'clock. Near the top little groups of waves indicate the beats, &c., after the last stroke.

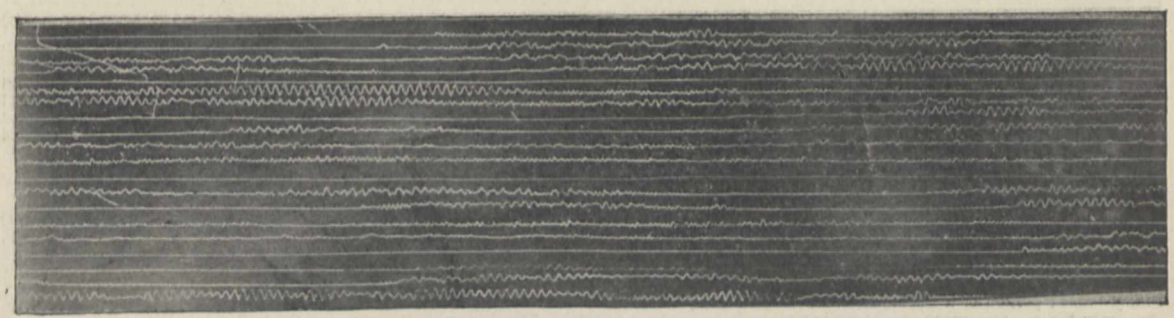


FIG. 3.—Small portion of tracing of a number of male voices singing the "Soldiers' Chorus" from *Faust*. From the La Scala Theatre, Milan. The time relations, &c., are the same as in Fig. 2. Observe the complicated form of the curves.

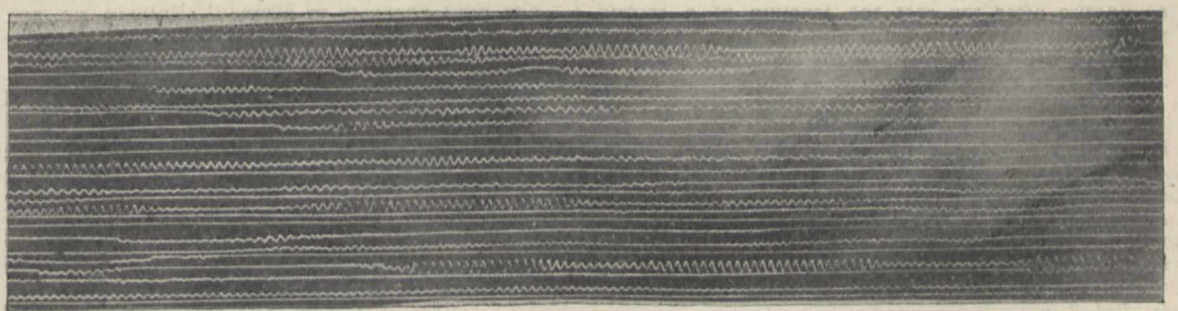


FIG. 4.—Small portion of a tracing giving the vibrations of the voice of Signor Caruso in singing "Spirito Gentile." Time relations, &c., same as in Fig. 2. Observe the crescendo and diminuendo of certain notes, the high pitch of others, and the regularity in form of the waves.

ing in pitch may affect the ear in a second of time. From ten to twenty vibrations, falling on the ear at a certain rate, are sufficient to arouse the sense of pitch of a tone of that frequency. It would seem that with notes of low pitch, within limits, fewer vibrations are required to enable the ear to appreciate pitch, and the opposite holds good with notes of high pitch. This corresponds with the fact that differences of pitch are difficult to detect both in the upper and the lower limits of the scale of audibility, whereas a skilled ear in the middle ranges of the scale can appreciate a difference of one sixty-fourth of a semitone. The tracings also indicate approximately the pitch of any note registered. Suppose three small waves correspond to the wave of the one-hundredth of a second, then the pitch of the note will be about three hundred per second, or (taking the middle *c* at 256) a little below *f*. The highest pitch I have mentioned is *g*″, or more than 1500 vibs. per second, in the "Bell Song," Lakmé (Delebes), by Madame Tetrazzini. I have also observed that the tracings show intervals in which there is a straight line, with no vibrations. If those intervals are very short, then the interval may not be appreciated by the ear, even with the most careful attention. In all the tracings the wave form is compound, not only owing to the existence of overtones, but also because the voice is usually accompanied by an instrument, the piano, or an orchestra. I took one

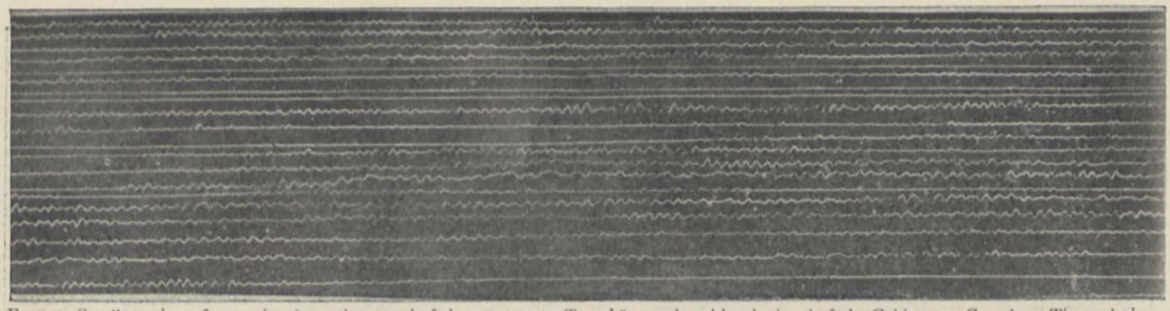


FIG. 5.—Small portion of a tracing from the record of the overture to *Tannhäuser* played by the band of the Coldstream Guards. Time relations, &c., as in Fig. 2. Observe the variations in pitch as indicated by the number of waves in a short period, and the irregularity in form of the waves.

tracing of voice-tones (a bass voice) with no accompaniment.

The most complex waves are those produced by the blending of many voices or by an orchestra (see Figs. 3 and 5). Here again there arises a curious consideration. Suppose that in an orchestral piece all the instruments do not *attack* at the same instant, or if one lingers after the rest the fraction of a second, in both cases the wave form and the tracing picture in general will be affected. If the want of coincidence passes beyond a limit, which it is difficult to define, a musical ear finds the result defective, although one can scarcely tell why. Nothing has excited more in my mind a feeling of wonder at the powers of the ear than the inspection of these tracings. Is there a damping mechanism, or is a damping mechanism necessary? May it not be, after all, that our perceptions of musical tones, as in a musical composition, are the result of different *modes* of stimulating the ends of the cochlear nerves? May not innumerable varieties of pressures act on the nerve-endings, possibly as a whole, and send corresponding impulses to the brain? I confess that in the face of these tracings I find it more difficult to realise an analysis in the cochlea; but if not there, where does it take place? That there is an analysis when we make an effort of attention there can be no doubt.[1]

JOHN G. MCKENDRICK.

[1] I have to thank Prof. Noël Paton, of Glasgow, and Prof. MacWilliam, of Aberdeen, for the loan of some portions of the apparatus.

PEAT IN NORTH AMERICA.

FOR many years peat was looked on as a source of fuel in poor countries only, where communications were undeveloped, and where cottagers extracted it by their personal labour for use in their own household fires. To this day, the economist will probably find that this is the best and most practical treatment of a peat-bog. It becomes idle in such cases to speak of relative calorific values, and to point out that, even under present conditions of transport, coal would form a more effective fuel. Where the right of digging peat over a certain area is included in the rent of a small holding, this peat is dug at odd but suitable times, when the crofter or his family might otherwise have remained idle. The cost of labour thus becomes insignificant, especially where creels are used for transport; and even the horse or ass must be fed, whether or no he is engaged in drawing the red cart along the ridges between cut-away boglands, or down the grooved hillside from the high-level deposit on the plateau.

But from time to time capitalists have turned longing eyes towards these stores of carbonaceous matter, and have sought to get rid of the 80 or 90 per cent. of water in the peat, and to produce a fuel economically capable of transport. Others have proposed to produce gas at the bog itself; while others, often with marked success, have manufactured moss-litter for use as an absorbent bedding for city stables and dairy barns.

The various uses of peat have now attracted attention even on the North American continent. Messrs. E. S. Bastin and C. A. Davis have provided an introductory manual on the subject in their description of "The Peat Deposits of Maine" (Bulletin No. 376 of the United States Geological Survey, 1909, pp. 128). They acknowledge that they have been preceded by Mr. Erik Nyström's treatise on "Peat and Lignite: their Manufacture in Europe," issued a year previously by the Canadian Department of Mines. Messrs. Nyström and Anrep have now also published the results of their "Investigation of the Peat Bogs and Peat Industry of Canada, during the Season 1908–9" (Bulletin No. 1, Department of Mines, Canada, 1909, pp. 25).

The deposits in Maine are at present so little utilised that Messrs. Bastin and Davis direct attention to the various ways in which peat has become profitable elsewhere, and, we must admit, to the various ways in which it has been worked without profit to anyone except the makers of machinery. The buildings and heaps of scrap-iron lying derelict beside the bogs of Europe have not yet served to warn those who are fascinated by some fancy process, put before them under seductive influences in the glamour of a well-lit exhibition. The authors of the United States bulletin have no false enthusiasms, and they lay proper stress

on the really practical results obtained in the manufacture of peat-coke, power-gas, and moss-litter. They point out the agricultural capabilities of decomposed black peat soils in Maine (p. 57), and the use of dried peat as an auxiliary fertiliser in composts with barnyard manure, and they especially urge the introduction of air-dried peat as an absorbent in stables and as a deodoriser. Descriptions of special bogs follow, accompanied by neat maps in the text. These bogs have been tested with an ordinary ship-auger (p. 60), fixed on 21 feet of ½-inch gas-pipe, and an improved form is described, by which, as in many soil-testers, samples can be still more safely collected at any particular depth. The bogs in Maine appear rarely to be 30 feet deep. As is customary in publications of the United States Geological Survey, sufficient explanations are given of technical terms to enable any intelligent citizen to utilise this handy and scientific treatise.

In the case of the Canadian Survey, general principles have been dealt with in the earlier memoir to which we have referred, and the present bulletin describes in considerable detail certain bogs which possess commercial possibilities, and which lie not far from Ottawa. Lines were run across the bogs, usually 1000 feet apart, and drillings were made in each of these lines at intervals of 500 feet. The samples thus collected were often put together in groups, as representing, when combined, certain areas of the bog; but special local features of interest were noted wherever necessary. An ingenious system of lettering on the maps shows the character of the peat at each point, and its relative suitability for moss-litter or for fuel. The Canadian mode of gathering is by breaking up the surface of the bog so as to promote air-drying, and then stripping off this surface-layer. The bog is thus in most cases worked horizontally, and not vertically, as in Europe. The large scale of the maps inserted in the bulletin, and the completeness of the descriptions, remind one of the fine old bog-survey of Ireland published some eighty years ago, which still remains a standard work of reference. The peat industries of Canada, like those of the United States, are still mostly in an experimental stage, and little more can be said of those organised from time to time in Ireland. Meanwhile, in Europe, at any rate, the humble tiller of the soil, with his old-fashioned hand labour, continues quietly to remove the peat, in which he possesses a clean and economic fuel.

G. A. J. C.

AN ANTHROPOLOGICAL SURVEY OF THE SUDAN.

THAT the study of anthropology is of great scientific and practical importance has been acknowledged of late years by various Governments within the Empire. Our readers will remember that the Indian Government assisted Mr. A. R. Brown in his investigation of the Andamanese, and the Ceylon Government two years ago invited Dr. C. G. Seligmann to study the Veddas. The Anglo-Egyptian Administration, as is well known, fully recognises the far-reaching interest which attaches to the natural and human history of Egypt and the Sudan, and directly and indirectly it has done a great deal to extend our knowledge of the meteorology, geology, geography, zoology, botany, and archæology of these regions. In continuance of that enlightened policy, arrangements have been made to organise an ethnographical survey of the Sudan. Those in authority realise that it is impossible to educate or govern a people without some knowledge of their psychology, and no mere facility with their language will suffice without a knowledge of native customs, ceremonies, ideas, and ideals. Especially is it necessary to record the unwritten laws and usages which regulate private and public life and to appreciate the safeguards for personal and social morality which occur in every community. The native conceptions of the relation of the individual to his fellow and of the authority of the head of the local state are very different from those of Europeans, and it would be disastrous suddenly to break up the structure of native society, to weaken authority, or to promulgate revolutionary ideas. It is also recognised by the Sudan Government that failure in the past has been due to lack of scientific knowledge, and they seek to avoid mistakes in the future by acquiring that knowledge upon which a firm and just administration alone can rest.

In the spring of last year the Sudan Government stated that they were prepared to contribute a sum of money sufficient to enable anthropological investigations to be undertaken in the Sudan for at least two years (a part of this sum is set aside for the publication of the results), and Dr. and Mrs. Seligmann were appointed to conduct these investigations. At that time the Seligmanns were still in Ceylon, and as it would take them several months to work up their field-notes, the Sudan expedition was postponed till this year. The Seligmanns leave England on November 2nd, and will proceed with as little delay as possible to investigate the Dinkas and Shilluks in the Upper Nile Province. Probably they will also study the pagan Nubas of Southern Kordofan, and possibly some other tribes as well.

Those who are conversant with recent anthropological literature are fully aware of the competence of Dr. Seligmann to undertake this work. It is significant of the times that Mrs. Seligmann is officially recognised as a co-investigator with her husband. Judging from what Mrs. Seligmann did in Ceylon, there is no doubt that this enlightened new departure of the Sudan Government will be fully justified. During a part of the time that the Seligmanns are in the field they will be accompanied by Dr. W. H. R. Rivers, who will thus be enabled to compare from personal knowledge the systems of kinship and the sociological conditions of Papuans, Melanesians, Polynesians, and Todas with those of various North Sudanese tribes.

Dr. Seligmann hopes to initiate an anthropometrical survey of the Sudan during the work of the following season.

A. C. HADDON.

NORTH SEA FISHERY INVESTIGATIONS.[1]

THE Blue-book before us, which has recently been issued by the North Sea Fisheries Investigation Committee, completes the second report of the Marine Biological Association on the investigations which they have been conducting in the southern part of the North Sea and in the English Channel, in connection with the international investigations of the fisheries of northern Europe.

A memoir by Mr. J. O. Borley describes the experiments which have been made on board the s.s. *Huxley* in order to determine the probability of survival of trawl-caught fish if they are returned to the sea. From the point of view of the fishery legislator this is a matter of considerable importance, since the probable effect of any law regulating the size at which fish might be placed on the market would depend very largely upon whether or not fish below the legal size, which had been caught in the trawl,

[1] North Sea Fisheries Investigation Committee. Second Report (Southern Area) on Fishery and Hydrographical Investigations in the North Sea and Adjacent Waters, 1904–5. Part ii. Pp. v+345; 8 plates. (London: His Majesty's Stationery Office, 1909.) Price 8*s.* 9*d.*

would survive if returned to the sea. The experiments were conducted with both otter- and beam-trawls, and show that fish from long hauls of the trawl are much less likely to survive than those from short hauls, and that the otter-trawl, which is now practically exclusively used by steam trawlers, inflicts much more serious injury on the fish than does the beam-trawl. The effect of exposure of the fish on the deck of the vessel for different periods of time has also been studied.

Dr. W. Wallace writes on the subject of the size and age of plaice at maturity. The method used for determining age has been the examination of the otoliths or ear-stones of the fish, the alternate dark and white rings of which form a record of seasonal growth. The most striking result of Dr. Wallace's work is the determination of the fact that the average size and age of plaice at first maturity varies in different regions. In the central part of the North Sea, around the Dogger Bank, female plaice are, on the average, 16 inches long, and the majority are just six years old when they become mature for the first time. In the southern bight of the North Sea the average size of the females at first maturity is only 13 inches, and the age five years; in the western part of the English Channel the average size is about the same as in the southern North Sea (13 inches), but the average age is four years instead of five, owing to the more rapid growth of the young plaice in the Devon bays. Similar differences are found for the male plaice also, which mature at a smaller size than the females.

The report on records of catches furnished by the captains of Lowestoft sailing-trawlers, which is written by Miss R. M. Lee, shows the value of such records provided by fishermen in supplementing and extending the work done by the scientific steamers. The area worked over by the Lowestoft men corresponds roughly with the southern bight of the North Sea. The analysis of the figures, which Miss Lee has been able to make, indicates that in the northern part of this region plaice occur in maximum quantity by weight during the summer and in minimum quantity during the winter months. In the southern part of the area, on the other hand, the maximum is in winter and the minimum in summer, whilst in the intermediate region there are maxima in spring and autumn. These records, therefore, clearly confirm the southward migration of plaice for the purpose of spawning in winter, which marking experiments in this part of the North Sea had already foreshadowed.

An account of the hydrographical investigations in the English Channel for the years 1904–5 is contributed by Mr. D. J. Matthews, and is illustrated by a series of very valuable plates, which set forth the results in graphic form by means of coloured charts and sections. The importance of these hydrographical investigations in the English Channel in connection with the problems of North Sea fisheries can scarcely be exaggerated, since the Atlantic water which reaches the southern area of the North Sea comes practically exclusively by way of the English Channel. In both the years 1904 and 1905 the salinities in the English Channel reached a maximum in the early months of the year, and fell to a minimum in the summer. The evidence indicates, further, that the movements of the water were more frequent and rapid in 1904 than in 1905. Special attention was given to the conditions prevailing at the mouth of the English Channel, where the two conflicting currents already demonstrated in 1903 were again encountered, a low salinity current flowing southwards from the Irish Channel across the mouth of the English Channel, and a current of high salinity entering the Channel from the south-west.

The volume, as a whole, contains a large mass of data of the greatest importance for the solution of many of the problems dealing with marine life, and more particularly with the natural history of fishes. It must be borne in mind, however, that it is essentially a contribution of data to the much wider and more comprehensive scheme of investigation which is being carried out in connection with the International Council, and not until the whole work which the various countries have done has been brought together and the results duly correlated can the full fruit of these researches be gathered.

DOUBLE-STAR STUDIES.[1]

A COMPLETE record and discussion of the double-star measures made at the Potsdam Observatory by Prof. Lohse, the director, during the period 1899 to 1908 is given in Publication No. 58 of the Observatory. Prof. Lohse employed a refractor made by Schroeder about twenty-five years ago. The objective is eleven inches, and the flint is dark green. It may be described as a good instrument, but not of the highest quality. Nevertheless, we notice that Prof. Lohse was able to secure measures of some difficult pairs, notably δ Equulei, κ Pegasi, and Sirius. The filar micrometer has one fixed and one movable thread. Generally the power employed was 550, but occasionally one of 800 was used. The power ordinarily used with the Greenwich 28-inch refractor is 670, and occasionally 1120. Setting out with a definite programme, he chose a working list of 166 double stars made up of known binaries and others of interest, and during the nine years he was making measures of these systems he collected those made by other observers, and hence was in a position to make a useful discussion of his results.

The present volume is therefore divided into two portions. Part i. contains the measures made at Potsdam, and part ii. their discussion in combination with measures made since the discovery of each pair. Prof. Lohse uses the method of Zwiers to determine his orbits, and discusses altogether thirty. The actual elements arrived at in most cases differ little from previous orbital elements, and do not call for special remark, except, perhaps, in the cases of η Cassiopeiæ and 70 Ophiuchi. The apparent orbit given for η Cassiopeiæ does not seem the most suitable, and brings out a period of 345 years, or 100 years larger than that generally accepted. In the case of 70 Ophiuchi, Prof. Lohse has done a good piece of work in attacking one of the anomalies often found in double-star orbits. It is found that the differences between the computed and observed positions of the companion tend to periodicity. This may be due to some fault in the gravitational theory, to errors due to personality, or to the effect of some disturbing body. The binaries ζ Herculis and 70 Ophiuchi are excellent examples of this, and Prof. Lohse, who favours the personality explanation, has taken great pains to compute the relative areas swept out by the companion to 70 Ophiuchi every six months, and obtains figures in agreement with those deduced by quite independent methods. He is, however, unwilling to admit the reality of the figures, and remarks that by a judicious selection of observations the deviations from the law of equal areas may be reduced. This is the method advocated by Prof. Burnham, but it is not easy to

[1] Publikationen des Astrophysikalischen Observatoriums zu Potsdam, No. 58. Zwanzigsten Bandes, Erstes Stück. Doppelsterne von O. Lohse (Director). Pp. 168. (Potsdam, 1908; in Kommission bei W. Engelmann in Leipzig.)

understand such an attitude in so experienced a computer as Prof. Lohse. However, this only emphasises the thoroughness with which his work has been done. It is a well-planned and complete work, and Prof. Lohse is to be congratulated on making so real a contribution to double-star astronomy.

The following predicted places for 1910·0 for a few of the more interesting binaries may be found useful :—

η Cassiopeiæ	...	...	...	241°·1 and	6″·24
Sirius	...	...	...	89·4 ,,	8·87
Castor	...	...	...	220·5 ,,	5·44
α Centauri	...	...	...	215·3 ,,	19·41

NOTES.

THE third International Congress of Physiotherapy will be held in Paris on March 30 to April 2, 1910. The congress is to be divided into seven sections.

A PRIZE of 160*l.* has been awarded to M. W. Haffkine by the Paris Academy of Medicine for his work on inoculation against cholera.

THE Bradshaw lecture of the Royal College of Physicians of London will be delivered on November 2 by Prof. J. A. Lindsay, who will take as his subject Darwinism and medicine. The FitzPatrick lectures will be delivered by Sir T. Clifford Allbutt, K.C.B., F.R.S., on November 4 and 9. The subject will be Greek medicine in Rome.

THE Société d'Hygiène de l'Enfance of Paris, we learn from the *Lancet*, is offering prizes for essays on the punishments of children. The essays, which must be original, and written in French, German, English, Italian, or Spanish, will be received by the society not later than December 31 next. The papers are to become the property of the society, which reserves the right of selecting from them material for a pamphlet.

ACCORDING to the *Times*, the exhibit of British chemical industries at next year's International Exhibition at Brussels promises to be of great interest and importance. It is stated that the new exhibitions branch of the Board of Trade is already experiencing some difficulty in providing for the requirements of would-be exhibitors, although the area originally allotted to the exhibit has been largely added to.

PRIZES to the value of 1500*l.* are offered by the National Medical Academy of Mexico for work on typhus fever. Of the sum named, 1000*l.* will be awarded to the discoverer of the cause of typhus, or of a curative serum, and 500*l.* to the investigators whose work is judged most useful in helping towards such discovery. The competition is international, but all essays must be written in Spanish. They can be received up to February 28, 1911.

THE annual "Fungus Foray" of the Essex Field Club will be held on Saturday, October 30, at High Beach, Epping Forest, under the direction of Mr. George Massee, of the Kew Museum. Botanists wishing to attend should apply for programmes to Mr. W. Cole, the Essex Museum of Natural History, Romford Road, Stratford, Essex.

THE death is announced of Prof. J. Scott, author of various text-books on farm engineering, and formerly professor of agriculture and rural economy at the Royal Agricultural College, Cirencester.

THE death is reported, in his sixty-third year, of Dr. Irving Stringham, professor of mathematics in the University of California since 1882. He was a graduate of Harvard, and also spent some time in study at European universities. He was the editor of the American edition of C. Smith's "Elementary Algebra," and was the author of a "Uniplanar Algebra."

DR. GEORGE E. POST, whose death was recently reported at the age of seventy, was for many years head of the Medical College established at Beirut, Syria, by the American Presbyterians. He was the author of several medical and scientific text-books in the Arabic language, as well as of a flora of Syria, Palestine, and Egypt in the same tongue. His "Plantæ Postianæ" was written in Latin and French, and published at Geneva. He contributed also to the leading English and American Biblical dictionaries a large number of articles on the flora of Bible lands. In recognition of his work at Beirut Dr. Post received decorations from the Turkish and German Governments.

Science reports the return of the Peabody Museum Expedition, which for the past three years has been exploring the headwaters of the Amazon River in the interior of Peru and Bolivia. The primary object of the expedition was the study of the native tribes of those regions, but, incidentally, collections were made in natural history; meteorological observations were taken, and topographical work was done. A map of the entire region, based on traverses and astronomical observations, was made for the Peruvian Government.

DR. ALLAN KINGHORN has been sent by the Secretary of State for the Colonies to West Africa to investigate sleeping sickness there, with the view of recommending measures for the prevention of the spread of the disease into certain of the British West African colonies. Dr. Kinghorn recently returned from north-east Rhodesia and Central Africa, whence he was sent with Mr. R. E. Montgomery by the Liverpool School of Tropical Medicine to prosecute inquiries into sleeping sickness, and has just completed a report, with Mr. Montgomery, of the Zambezi Sleeping Sickness Expedition.

THE following courses of free public science lectures are announced for delivery in the Manchester Museum :—some forms of vegetation, by Prof. F. E. Weiss, on November 6, 13, and 20; some problems of embryology, by Prof. S. J. Hickson, F.R.S., on January 8, 15, and 22; and the structure of a crystal, by Sir T. H. Holland, K.C.I.E., F.R.S., on February 5, 12, and 19. In addition to the foregoing, Prof. Boyd Dawkins, F.R.S., has begun the delivery of a course of twelve short addresses on geological subjects on Saturday and Sunday afternoons.

WE learn from the *Revue scientifique* that the Institute of France has received a gift of 50,000 francs from M. Patouillard to found two Montyon prizes, one literary and one scientific, of equal value. The latter is to be reserved for some man of science distinguished in electricity chosen by the Paris Academy of Sciences. From the same source we learn that Dr. Von Brunck, formerly director and a member of the committee of management of the "Badische Anilin," has made a gift of 50,000 marks to the Munich Academy on the occasion of the fortieth anniversary of his entry in the industry.

A MEETING was held on October 13 at Christiania to consider plans for the proposed Zeppelin Polar Expedition, at which, the *Times* reports, Prof. Hergesell explained the object of the expedition, which, as at present planned, will last one Arctic summer. It will not be undertaken until the development of the airship has given it an effective scope of 2500 kilometres, or a journey of three

or four days without landing. The pioneer expedition may be expected to take place in two or three years' time. Meanwhile, a ship will proceed next summer to Spitsbergen to make preliminary investigations for the purpose of discovering suitable airship anchorages. During 1911 an airship will make long experimental cruises over the sea from a port on the north coast of Germany. In 1912 two airships will proceed to Spitsbergen and establish a central station, equipped with wireless telegraphy, in Cross Bay. The second airship will remain in reserve.

THE Royal Scottish Museum has recently acquired by purchase the well-known collection of Scottish Carboniferous fossils formed by Mr. James Neilson, Glasgow. This collection contains more than twenty thousand specimens, among which are many type-specimens of lamellibranchs and brachiopods, which have been figured in the publications of the Palæontographical Society and elsewhere. These are remarkable for their wonderfully perfect state of preservation, many of them showing delicate internal structures, such as the spires of Spirifer. The collection also contains Gyracanthus spines, of remarkable size, and other valuable fish fossils, including the unique *Cladodus neilsoni* (Traquair). Some time must elapse before the specimens can be arranged for exhibition, but, in the meantime, facilities will be given, so far as possible, to experts who wish to study the collections.

A REUTER message from Simla states that the Imperial Malaria Conference, which has finished its sittings, has drawn up a series of conclusions and recommendations under the following heads, among others:—(1) The appointment by the Government of India of a scientific investigation committee, to be linked up with special organisations for dealing with malaria in each province, the investigations to be specially directed to (*a*) the distribution of malaria in India; (*b*) the epidemiology and endemiology of the disease; and (*c*) the actions of quinine and other remedies for malaria. (2) Practical measures, including (*a*) the extirpation of anopheles, regarding which further investigation is recommended in order to discover how this can be done at a reasonable cost; (*b*) minor drainage operations, which are recommended when they are certain to be effective; (*c*) the restriction of wet cultivation near towns when the lands cultivated are known to be a source of anopheles; (*d*) the introduction of fish into tanks and other collections of water; and (*e*) the oiling of small collections of water which cannot be filled up. (3) (*a*) On the suggestion of the president of the conference, Sir Herbert Risley, it is recommended that committees of officials and non-officials, directed by the elected members of the new councils, be formed to spread among the people knowledge regarding malaria and the measures which it is possible to take against it; (*b*) it is also recommended that the subject be taught in the schools. (4) Local Governments should be invited to make an annual assignment of funds for malaria investigation and prevention.

THE project of organising and bringing into existence in 1911 a "Scottish Exhibition of National History, Art and Industry" is rapidly taking shape. The object primarily aimed at is to aid, and finally complete, the raising of a fund for the endowment of a chair of Scottish history and literature in Glasgow University; but, according to the *Engineer*, the executive council is considering a scheme of exhibits which takes account of the following:—that there should be a collection of exhibits showing the varied nature of Scotland's industries and of those carried on by Scotsmen in the colonies and abroad, and that in many industries a contrast should be made between the old and the new; that there should be an electricity exhibit, dedicated to the memory of Lord Kelvin; that there should be a shipbuilding and marine engineering exhibit of a historical nature, showing the development of steam navigation in its home on the Clyde; that the river Kelvin should be taken advantage of to represent historic episodes in Scottish life and industry; that the colonies, so largely peopled from Scotland, be invited to tell of the progress of the Scot abroad.

DR. L. A. BAUER informs us that the magnetic survey vessel, the *Carnegie*, arrived at Falmouth on October 14, twelve days after leaving St. John's, Newfoundland. Magnetic observations were secured every day except one. The *Carnegie* will remain at Falmouth until the end of this month. Having completed the harbour observations and the tests ashore of the instrumental constants, the *Carnegie*, under the command of W. J. Peters, who was in charge of the Pacific Ocean vessel, the *Galilee*, from 1906–8, will go to Madeira, returning to New York, *viâ* Bermuda, about March 1 of next year. The September number of *Terrestrial Magnetism and Atmospheric Electricity* contains an account of the launch of the *Carnegie* at Brooklyn in June last, and her departure on this—her first—cruise to Newfoundland, Hudson Straits, and England. There is a further article, by Mr. J. Craig, jun., on the non-magnetic gas engine with which the vessel had to be provided to enable her to continue her voyages when the wind was not strong enough for sailing. It appears that the cheapest power plant would have been a gasoline engine, but that the cost of maintenance would have been greater than for a gas-producer plant, which was finally selected as best. The material used in construction was mainly manganese bronze, a few of the valves being the only parts of steel or nickel-steel. The engine is of the four-cylinder type, and resembles the regular Craig air-starting engine.

THE second Model Engineer Exhibition is now being held at the Royal Horticultural Hall, and will remain open until October 23. The opening ceremony was performed by Sir Hiram Maxim on October 15, and the appropriateness of the selection of this distinguished experimenter in aviation is evident from the very large number of model aëroplanes exhibited. These constitute a special competition class, in which there are more than fifty entries. Many of the designs are original, others are copies of well-known successful types, and we noticed some in which the workmanship was excellent. Considerable variety is shown in the selection of the material for the supporting surfaces; generally fabric is employed, but others having wooden, aluminium, and mica planes are to be seen. There is also a very fine collection of steam and other engines, model yachts, and electro motors. An interesting feature of the exhibition is the completely equipped model engineering workshop in operation. Several firms also show their specialities in machine tools, &c., for model-making. Perhaps the most noteworthy advance in model work recently has been in connection with model motor-boats. At the time of the first exhibition, in 1907, the speed record was 8·76 miles per hour; the present record is above 15 miles per hour, a result which is very creditable to the ability of amateur engineers.

PROF. C. LOMBROSO, professor of criminal anthropology and psychiatry in the University of Turin, died on October 19 at seventy-three years of age. From an interesting notice of his work and career in the *Times* of

October 20 we derive the following particulars as to his work and career. After graduating at Padua he went for some time to Paris and Vienna to continue his studies. At the very outset of his medical work he was attracted by nervous and mental diseases, and while still a student he published two treatises, one on "Insanity in Antiquity" and the other on "The Insanity of Cardan" (the sixteenth-century mathematician). In the latter essay he first advanced the theory of the relation between genius and crime, which was to form the chief purport of his later work. While serving as a surgeon in the army his attention was attracted at Calabria by the diversity of type exhibited by the soldiery, who were drawn from all parts of Italy. He conducted a series of studies, which he endeavoured to make the basis of an anthropological chart of Italy. He measured and examined no fewer than 4000 individuals, and gained an invaluable experience, which stood him in good stead in his subsequent criminological investigations. The removal of his regiment to Pavia, a university town, gave Lombroso an opportunity of continuing his study of nervous diseases at the district asylum, but his military superiors did not look with favour on these scientific labours; difficulties were placed in his way, and Lombroso finally determined to leave the army. Shortly after, he was appointed professor of psychiatry at the University of Pavia at a small salary. He prepared a short inaugural address entitled "Genius and Insanity," in which all the main ideas of his *magnum opus* were outlined. In 1872 he made a discovery which proved to be of considerable scientific and economic importance. He noted the fact that a large number of the inmates of the asylum were suffering from "pellagra," a curious disease, which first affected the skin and afterwards attacked the brain and nervous system. Lombroso discovered that the disorder was to be traced to a poison contained in diseased maize. Upon his appointment to the chair of psychiatry at Turin Lombroso continued his criminological studies. He was the first to apply the anthropometric method to the study of criminology, and his collection of skulls was unique. He showed that the overwhelming majority of criminals suffered from some form or other of nervous disease. These views are embodied in his great work entitled "L'Uomo Delinquente," published in 1889. Lombroso had a somewhat similar theory for the existence of genius, which he declared was a form of larvate epilepsy; this somewhat fantastic thesis was presented in his "L'Uomo di Genio," which has been translated into several languages.

IN Witherby's *British Birds* for October Messrs. W. Davies and F. Coburn record the breeding, during the past season, of the marsh-warbler in Worcestershire. The nest was attached to the stems of cow-parsnip and nettles. Mr. Coburn was of opinion that this was the first record of the breeding of the species, but, as the editor points out, a pair nested in the valley of the Avon in 1892.

THE *Selborne Magazine* for October opens with a short biography, accompanied by a portrait, of Sir Joseph Hooker. In connection with the discovery of fossil bones near Crayford, referred to in the report of the Selbornian excursions, the editor will perhaps permit us to point out that no such species as *Canis domesticus* is known to science, and that none of the bear-skulls found in English Pleistocene deposits belongs to the American *Ursus horribilis*.

AT the conclusion of a paper on the birds of the mountains of the Malay Peninsula, published in vol. ii., No. 4, of the Journal of the Federated Malay States Museums, Mr. H. C. Robinson expresses the opinion that the fauna is of Indo-Malay origin, and that the species have spread in comparatively recent times north-west from the Sunda islands rather than south-east from Burma. Secondly, that the mountain-fauna is composed of a continental and a Sumatran element, and that the connection with the mountain-fauna of Burma is remote. On the other hand, there appears to be evidence of a recent land-connection with Sumatra, and also that the southern portion of the peninsula has been disconnected from the land to the north.

CONSIDERABLE interest attaches to the discovery of large quantities of shells of the pearl-mussel (*Unio margaritifer*) in gravel of apparently Pleistocene age in the Thames near Mortlake. Messrs. J. W. Jackson and A. S. Kennard, who record the fact in the October number of the *Journal of Conchology*, state that "at the close of the Pleistocene period the land stood at a much higher level than it does to-day, and the Thames was then a quick-flowing stream in a deep and narrow gorge. . . . The cause of the extinction of the species is explained by the fact that as the land sank the river became more sluggish, and silt and mud commenced to accumulate. Such conditions would prove highly detrimental to its welfare, and the species soon ceased to exist."

TAKING as his text the apparent fact that a nematode worm effects an entrance into the swim-bladder of rainbow-trout by burrowing through the intestinal wall, and thereby likewise permits the entrance of bacteria, Dr. A. E. Shipley, in the September issue of the *Journal of Economic Biology*, brings forward additional evidence in support of his view that the appendix vermiformis is a functional, and not a decadent, organ, and that appendicitis is probably due to the presence of entozoa. Messrs. Berry and Lack are cited as evidence in support of the contention that the appendix is a functional lymph-gland, and the author expresses his disbelief in the existence of any functionless organs. The remarkable increase of appendicitis in modern times is attributed by him to the practical cessation of the administration, from time to time, of vermifuges, and certainly no other satisfactory explanation of the phenomenon has been given. If this suggestion be substantiated, it tends to prove that our forefathers were not such fools as we often imagine.

THE importance and interest of large and properly classified and arranged collections of photographs—whether these subjects be nature or art—were emphasised by Sir Martin Conway at the Museums' Conference recently held at Maidstone, and his address is published in full in the September number of the *Museums Journal*. Many difficulties must be encountered in forming extensive collections of this nature; but, provided the necessary funds are available, they are not insurmountable, and Sir Martin urges that series of photographs relating to particular subjects ought to be collected by the various museums in the country. If private collectors would also devote themselves to photographs, a system of exchanges could probably be established which would greatly facilitate matters.

THE common fresh-water Hydra was one of the first subjects upon which the experimental zoologist exercised his special genius. More than a century and a half ago Trembley demonstrated the remarkable power of regeneration of lost parts which this little animal possesses, and not a few experimenters have followed in his footsteps. Of late years there has been quite an outburst of activity in this direction, and some highly remarkable results have been obtained. The latest contribution is a paper, by Miss

E. N. Browne, in the August number of the *Journal of Experimental Zoology* (vol. vii., No. 1), dealing with the production of new hydranths by the insertion of small grafts from another individual of the same species. This paper is particularly interesting on account of the ingenuity of the methods employed. In order to determine the exact origin of the regenerating material, the author makes use of Whitney's discovery that the green colour can be entirely removed from *Hydra viridis*, without killing the animal, by keeping it for some weeks in a 0·5 per cent. solution of glycerin. The artificial white hydras thus produced form perfect grafts with ordinary green forms, giving rise to parti-coloured colonies in which the boundaries between the tissues of the green and white components remain clearly defined.

Irish Gardening (October) contains various seasonable articles, notably on the cultivation of seakale and the gloxinia. A very charming bell-shaped ericaceous plant, *Zenobia speciosa*, is recommended for the garden by Mr. C. F. Ball; in the variety *pulverulenta* it attains to the dimensions of a good-sized bush. It requires a peaty soil or the nearest equivalent, and is propagated from seed or by layers.

THE *Country Home* (October) appears in an enlarged form from the offices of the *Sphere* and *Tatler*. The botanical and zoological articles are chiefly utilitarian or popular. The intensive cultivation of asparagus is explained by Mr. L. Terasse, and vegetative propagation forms the subject of an article by Mr. W. M. Webb, while Mr. H. B. Buchanan gives advice on the breeding of pigs.

FOLLOWING up a line of work instituted in the United States of America, the examination of parasitic fungi that attack scale insects has been taken up by the Department of Agriculture for the West Indies. Three species of Ascomycetes, *Sphaerostilbe coccophila*, *Ophionectria coccicola*, and *Myriangium Duriaei* are specified in the *Agricultural News* (September 18) as having been taken on scale insects infesting lime or citrus trees in Dominica, St. Lucia, and other islands, and a fourth fungus is noted, but not identified. It is proposed to experiment with cultures of these fungi on nutrient media which could be distributed to cultivators.

THE most striking point in a description of fungus maladies of the sugar-cane, prepared by Dr. N. A. Cobb, and published in Bulletin No. 6 of the division of pathology and physiology in connection with the Hawaiian Sugar-planters' Association, is the attribution of parasitism to the phalloid fungi *Ithyphallus coralloides* and *Clathrus trilobatus*. The mycelium of Ithyphallus was found attached to cane trash and the roots, while the mycelium of Clathrus passed in among the roots of canes where disease was abundant, so that the author classes them with species of Marasmius as sources of root disease. With the view of identifying the mycelium of these Phalloideæ, a special study was made of their sphæro-crystals.

IN connection with a visit of German systematic botanists, Dr. E. Issler prepared an account of vegetation conditions in the Central Vosges Mountains, which is published in Engler's *Botanische Jahrbücher* (vol. xliii., part iii.). The formations distinguished in the montane region are spruce, beech, mixed fir woods, and the vegetation of the forest streams. It is a curious fact that the beech in many places ascends higher than the conifers, the reason being that the upper tree limit, at the low altitude of 4000 feet, is determined by the wind, which the beech is better able to withstand. In the subalpine region different types of flora are provided by the rocks, meadows, and swamp, and in certain parts there are areas of ling and sphagnum moors. Among the rare plants to be found are *Mulgedium alpinum*, *Rhodiola rosea*, *Luzula spadicea*, two species of Isoetes, and *Subularia aquatica*.

THE *Bio-chemical Journal* for September (iv., No. 8) contains a paper, by Dr. Otto Rosenheim, on the nomenclature of lipoid substances. He proposes to classify them in three main groups, the cholesterins, the cerebrogalactosides, and the phosphatides. Prof. Moore and Drs. Wilson and Hutchinson contribute a paper on the biochemistry of hæmolysis.

PROF. HALLIBURTON, in the *Journal of Hygiene* (vol. ix., No. 2, September), directs attention to the fact that large quantities of flour, both in this country and abroad, are artificially bleached. Some experiments he has performed distinctly indicate that both the starch and the gluten are rendered less digestible by the process of bleaching, though whether the change is sufficient to be serious to children or invalids is a question on which there is at present no evidence.

IN the Bulletin of the Johns Hopkins Hospital for September (xx., No. 222), Dr. Charles White discusses in a suggestive manner the municipal management of tuberculosis. He points out that our struggle must be for an immune race, not for the extermination of the last tubercle bacillus. More and more we see the evidence of protection of *small* doses in healthy resistant bodies. In municipalities the aim should be to get rid of sources of large doses of tubercle bacilli, and to establish resistant bodies by healthy lives, mainly in the children.

AN account of the mathematical work of Sully Prudhomme is given by Prof. H. Poincaré in the *Revue générale des Sciences* for August 15. Sully Prudhomme received a scientific education in his youth, but was prevented by ill-health from attending the École polytechnique. That he nevertheless gave a large amount of attention to mathematics is evidenced by the numerous manuscripts left by him, including the rough drafts of a memoir on geometry. It appears, however, that the manuscripts now in existence cannot be regarded as more than rough drafts of ideas which Prudhomme had further developed and considerably modified after writing them. Prof. Poincaré concludes that it would be undesirable to publish them *in extenso*, and he therefore devotes the concluding portion of his paper to a general account of their salient features.

UNDER the title of "The Gambler's Ruin" (*Annals of Mathematics*, x., 4), Prof. J. L. Coolidge discusses certain problems connected with games of chance which have not hitherto received complete treatment. It is pointed out that while the problem of determining the odds that one player may ruin another has been worked out thoroughly for the case where the amount staked at each turn is the same, the case where the stakes are varied, whether they be limited or unlimited, has been less fully discussed. The author considers the "systems" proposed at Monte Carlo and elsewhere, and gives a deductive proof that no such system can have more than an easily calculable chance of success. He concludes with the quotation from Sir Hiram Maxim's book:—"Je me rends parfaitement compte du désagréable effet que produit sur la majorité de l'humanité, tout ce qui se rapporte, même au plus faible degré, a des calculs ou raisonnements mathématiques."

A SYSTEMATIC study of the influence of the surrounding medium on the lines of the spark spectrum has been undertaken by Dr. H. Finger at the suggestion of Prof.

Konen, of Münster, and his principal results are summarised in No. 17 of the *Verhandlungen der deutschen physikalischen Gesellschaft*. A comparison has been made between the spectra of more than twenty metal electrodes in air and in water, the spark being produced by an induction coil of 40 cm., having a capacity of 0·02 microfarad in parallel with its spark gap. The spectra in air and in water were photographed on the same plate, a concave grating of radius 180 cm. being used. The spectra in water show no air lines, but a large proportion of them show a more or less extended continuous spectrum with the lines of water vapour reversed. Some lines are unchanged, while others are broadened on one or on both sides, lines belonging to the same series being modified in the same sense. No trace of the spectra of salts in solution in the water has in any instance been detected.

PART iii., vol. xvi., of the Proceedings of the Cotteswold Naturalists' Field Club maintains the high standard of style and illustration which distinguishes this publication. A large part is concerned with the record of excursions chiefly to places of geological or antiquarian interest, and is illustrated by no fewer than nine plates of photographic reproductions. Of the papers published, the longest is on "The Lower Severn: Valley, River, and Estuary from the Warwickshire to the Bristol Avon," by Mr. T. S. Ellis. The principal aim of the author is to show that the generally accepted views of river development associated with the name of Prof. W. M. Davis are not applicable to the district with which he deals, and by inference to other districts also. His position is indicated by the following sentence:—"As I believe, we cannot have a right conception of the development of rivers unless we keep our minds free from all idea of original lines of streams or of any principal line as the initial condition. In my view, a river system is evolved not *into*, but *from* a network of streams, formed in the drainage area before any definite line of principal stream has been settled." Accounts are given of places and objects of scientific interest visited during excursions, and among these is a record of an excursion to Shepton Mallet and Vallis Vale, which is well known for its romantic scenery and geological unconformities. The report contains the accompanying illustration, reproduced by permission of the council of the Geological Society, of the classic section showing Oolite resting upon Carboniferous Limestone, which was pictured by Sir H. de la Beche. Short papers by Messrs. L. Richardson and C. Upton, and a report by the Rev. H. J. Riddelsdell, on the progress made in connection with the flora of Gloucestershire, complete the issue.

Le Radium for August contains a very useful table of the principal minerals containing uranium and thorium, prepared by M. B. Szilard, of Madame Curie's laboratory. It occupies seven pages of the periodical, and gives the name, the composition, the percentages of uranium and of thorium, the localities in which the mineral is found, and its crystalline form. In addition, a map of the world, in which the localities are shown, is given.

View of Quarry, showing the Inferior Oolite resting unconformably upon the Carboniferous Limestone in Vallis Vale. Photograph by Prof. S. H. Reynolds.

MR. HAROLD MOORE, of Woolwich Arsenal, read a paper on the Brinell method of determining hardness at the International Association for Testing Materials. We note from an abstract in *Engineering* for October 8 that the author's results show that the thickness of the test specimen has no influence on the result provided that the depth of the impression made by the ball does not exceed one-seventh the thickness of the specimen. A safe rule to be adopted is that the distance of the centre of the impression from the edge of the specimen should not be less than 2·5 times the diameter of the impression. For calculating the hardness number, 30° should be chosen as the standard angle of impression, this giving a diameter of impression equal

to one-half the diameter of the ball. The hardness number then becomes the mean pressure per unit area when the diameter of the impression is one-half the diameter of the ball. In practice it is convenient to employ a known load, and measure the diameter of the impression obtained. The hardness number is then calculated from the formula

$$H=\frac{16PD^{n-2}}{\pi(2d)^n},$$

where P is the load in kilograms, D is the diameter of the ball, d is the diameter of the impression, and n is a coefficient determined by making two impressions with the same ball and different loads, and applying the formula

$$n=\frac{\log P_1-\log P}{\log d_1-\log d}.$$

A REVISED impression of Sir Robert S. Ball's little work "Time and Tide" has just been issued by the Society for Promoting Christian Knowledge.

A CHEAP edition of "Extinct Animals," by Sir E. Ray Lankester, K.C.B., F.R.S., has been published by Messrs. Constable and Co., Ltd. The original edition of the work was reviewed in NATURE of November 2, 1905 (vol. lxxiii., No. 1879).

WE are in receipt of a new catalogue of books and papers (more than 1400 in number) dealing with ornithology which Messrs. John Wheldon and Co., of Great Queen Street, W.C., have for disposal.

THE October classified list of second-hand scientific instruments offered for sale or hire by Mr. Charles Baker, of High Holborn, has reached us. The catalogue, which contains upwards of 1300 items, will be sent free of charge upon request.

MM. A. HERMANN ET FILS, of Paris, have published a translation into French, by Dr. Paul Lemoine, of Prof. James Geikie's "Structural and Field Geology," which was reviewed in these columns on July 6, 1905 (vol. lxxii., p. 223). M. Michel-Lévy has contributed a preface. The price of the French work is 15 francs.

A NEW edition (the eighth) of "Quantitative Chemical Analysis," by Clowes and Coleman, has been published by Messrs. J. and A. Churchill at 10*s.* 6*d.* net. The work has been revised and enlarged, but the size of the page having been increased the thickness of the volume remains as before.

MESSRS. CONSTABLE AND CO., LTD., have sent us a cheap edition of "Time and Clocks," by H. H. Cunynghame, C.B. A review of the first edition appeared in the issue of NATURE for January 17, 1907 (vol. lxxv., No. 1942).

OUR ASTRONOMICAL COLUMN.

MARS.—The advisability of watching Mars closely, at this period of favourable opposition, and seasonal changes on the planet itself, is illustrated by a brief message communicated to the *Astronomische Nachrichten* (No. 4362, p. 303, October 9) by M. Jarry Desloges. Whilst the planet was being observed at 9h. 15m. on October 6, a projection was seen on the terminator in the neighbourhood of Electris. This projection lasted for ten minutes only, whilst a similar one observed by Messrs. Lowell and Slipher, on May 25, 1903, endured for only thirty-one minutes; the latter was ascribed to a cloud of dust some 300 miles in length.

In No. 4361 of the same journal M. Jonckheere announces the discovery, on September 28, of a canal which is probably a new one, and extends from Cyclopum Lucus to Hephæstus; the same observer records a further observation of the new land "Stella" on October 7.

A large number of observations of different features are recorded and illustrated by MM. Quénisset and Antoniadi in the October number of the *Bulletin de la Société astronomique de France*. Numerous canals were observed, the Solis Lacus was seen to be divided, and important changes in the colour and visibility of various regions were closely followed. M. Antoniadi is confirmed in his opinion that these changes are caused by the passage of Martian clouds across the various features, and, from the yellowish tinge which colours the indistinct areas, he confirms the opinion expressed by Prof. W. H. Pickering in 1905, that these Martian clouds are probably yellow.

SOLAR OBSERVATIONS: A NOVEL SPECTROSCOPE.—In order to continue his solar observations, Mr. W. M. Mitchell found it necessary, at the Haverford College Observatory, to devise a large spectroscope which might be used in conjunction with a small equatorial. The telescope at Haverford is of 10 inches aperture and 12 feet 6 inches focal length, and cannot, therefore, carry a large, and consequently heavy, spectroscope of the ordinary type. Acting upon a suggestion from Prof. Hale, he has erected a spectroscope which is mounted upon, and is parallel to, the telescope tube, and finds that the device answers very satisfactorily. The beam from the 10-inch objective is reflected on to the slit of the spectroscope by a 90° prism, and, passing through the slit, is again reflected by a similar prism on to a 3-inch collimating lens of 39 inches focal length. Thence it passes to a grating and back through the 3-inch lens to the eye-piece, the grating and lens being slightly tilted. A negative lens placed between the 10-inch objective and the first reflecting prism gives a larger image, which in Mr. Mitchell's observations was of 3·2 inches diameter. The spectroscope tube is constructed of wood, saturated with hot paraffin before assembling to obviate subsequent warping.

With this instrument Mr. Mitchell gets a resolving power of 70,000 in the third-order spectrum, and was able to observe visually the Zeeman effect in sun-spot lines. An interesting observation on May 11 showed that at one end of a spot "bridge" certain lines were doubled, whilst at the other end, the farthest from the centre of the spot group, the same lines were triple; other lines were double in both regions. A list of lines, recorded as bright in a chromospheric outburst on January 21 7h. to 9h. G.M.T., is also given, and Mr. Mitchell urges the necessity for more laboratory work in connection with chromospheric radiations.

We regret to learn that astronomical observations are to be suspended at the Haverford Observatory, and, consequently, Mr. Mitchell's observations cannot be continued.

THE AURORA OF SEPTEMBER 25.—In No. 4361 of the *Astronomische Nachrichten* (p. 287, October 7) Herr Torvald Köhl records that a fine display of the aurora was observed at Odder, Denmark, on September 21, and adds that a similar display was observed in Stockholm on September 25.

SEPTEMBER METEORS.—The appearance of a magnificent fireball on September 27d. 7h. 20m. is recorded by Herr Köhl, who observed it at the Carina Observatory, Odder, in No. 4361 of the *Astronomische Nachrichten*. Herr Köhl finds from his meteor-catalogue that he observed similar apparitions on September 27–28 in ten different years between 1870 and 1909. He also has records of meteors on December 12–13 for eleven years between 1875 and 1908.

HYDROGEN LAYERS IN THE SOLAR ATMOSPHERE.—In the *Comptes rendus* for September 20 (No. 12, p. 521) MM. Deslandres and d'Azambuja review the work which has been done in separating the various layers of calcium vapour in the sun's atmosphere, and describe the results of similar researches on the hydrogen and iron vapours recently carried out at Meudon.

The image, obtained by using the centre of the Hα line, differs from the Mount Wilson photographs, and shows the details, exactly, of the K_3 calcium images, the same dark filaments and the same bright areas. The authors suggest that the Mount Wilson images were produced by mixtures of the different parts of the Hα line, and that the sinuosities in the edges of the various sections might produce this effect. In the dispersion used at Meudon 1 mm. = 6 Å.

PERCY SLADEN MEMORIAL EXPEDITION IN SOUTH-WEST AFRICA, 1908–9.[1]

II.

IN the latitude of Loanda (8·9° S.), behind a dry, sparsely populated coastal belt about 150 miles wide, lies a mountainous zone, for the most part densely forest-covered

FIG. 1.—A glade in the Bauhinia forest showing a Baobab just before the beginning of leaf-fall

to an elevation of 4000 feet. Within this zone is the historic locality of Golungo Alto, where Welwitsch lived for two years, and in which a large part of his rich collection was obtained. Here he discovered *Gnetum africanum* in 1855.

A few miles to the south-east of Queta, a station on the railway within the forest zone and not far from its eastern edge, is situated the Government experimental plantation (Granja San Luiz), under the energetic direction of Mr. J. Gossweiler, to whom I am indebted for valuable advice and assistance during my residence there from April 1–12. The forests are here very dense and the undergrowth thick and very varied in character. After an unsuccessful search of some days' duration, Gnetum was eventually found on April 7 in a very dense and dark forest on the coffee and rubber estate of Montobello (2600 feet), some thirty miles to the west of Granja San Luiz and ten miles south west from the railway station of Queta. It was very abundant within a strictly limited area and its occurrence is clearly "sporadic," as described by Welwitsch. It may be noted that the native name "N-coco" given by Welwitsch is now applied indifferently to various plants of climbing habit; of Gnetum itself the natives seem to have no special knowledge.

Leaving Loanda on April 16, I arrived on April 21 at Mossamedes, where the third section of the journey commenced. Quite exceptional rains had recently fallen here, as in so many other districts to the south, and the gently rising plains behind the town resembled a waving cornfield rather than a desert. They supported a thick, uniform growth of a tall Aristida (? *A. prodigiosa*, Welw.), among which there flourished a considerable number of small annuals. In sandy places, especially in shallow, dry water-channels, dense crops of the erect plumose awns of Aristida seeds, forced beneath the surface by their hygroscopic movements, were commonly seen. So unusual a supply of food had tempted into the vicinity of the town springbok, gemsbok and other antelopes, while ostriches had reappeared after an absence of many years. Very large Welwitschia plants were found in abundance about eight miles to the south of Mossamedes in the direction of Cape Negro, the locality in which it was discovered by Welwitsch. The plants had coned freely, but almost without exception the cones, severely attacked by a fungus (probably a Cladosporium), were in a state of decomposition—no doubt another consequence of the excessive atmospheric humidity earlier in the season. A large number of young seedlings were found. The Damaraland localities previously referred to, in which no Welwitschia seedlings have been found within recent years, are about forty miles from the sea. But even in these southern latitudes normal seed-reproduction seems to occur on the coast. A recent letter from Dr. Hintrager, Acting Governor of German South-West Africa, contains the interesting statement that "wenige Kilometer nordöstlich von Cape Cross[1] die Welwitschia noch häufig und in fast allen Alterstadien, also auch in jungen Pflanzen vorkommt." It is not improbable that a condition of its seed-germination in nature is a degree of atmospheric humidity which is constantly realised near the sea though now usually absent from desert places inland.

On April 27 I left Mossamedes with the intention of crossing the Huilla plateau and reaching the Cunene River. I was accompanied by Mr. H. G. Mackie, H.B.M. Consul in Angola, to whose kind support the success of this part of the journey was very largely due. The light railway, at present working to the 107th kilometre, leaves Mossamedes in a northerly direction and crosses the broad beds of the periodical rivers Bero and Giroual, in which, near the sea,

FIG. 2.—Cunene marshes opposite Fort Roçadas, looking north.

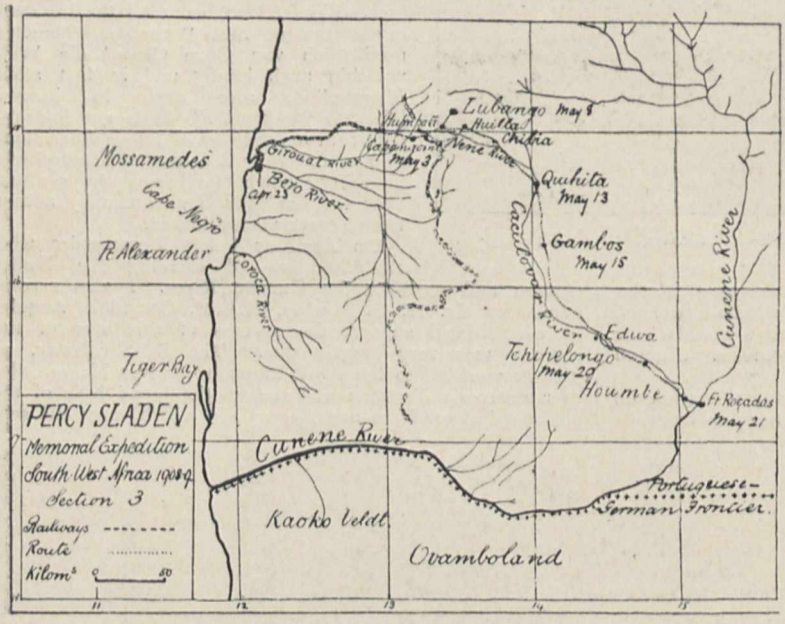
a few tropical and subtropical crops are cultivated. So far inland as the present railhead, the rainfall is small and inconstant and, in normal seasons, the country is practically waterless. At about 80 km., however, the typical desert vegetation mingles with shrubs and a few dwarf trees, which are found in greater luxuriance on the lower

[1] The first article appeared in NATURE of October 14.

[1] Lat. 21·9° S.

slopes of the Chella Range. The railhead is situated in an open forest of stunted trees, among which Acacias, a Bauhinia and the Baobab are prominent, with wide, grass-covered glades. This formation extends to the lower slopes of the Chella Range becoming denser as it ascends until, near the summit, it effects a junction with a Savannah, the characteristic species of which include a number of Proteaceæ and other southern forms. The western face of the Chella Range rises sheer to some 3000 feet from the forest which clothes its base, above which the bedding planes of its grey, lichen-covered sandstone are plainly visible. Except for its great extent, the whole range bears a striking resemblance to Table Mountain as seen from Table Bay. Opposite Capangombe there is a gap, the entrance to a kloof up which winds a steep footpath to the top through an increasingly dense, dripping forest, with a magnificent undergrowth of maiden-hair and other ferns. Near the summit a tall Euphorbia with the habit of *E. grandidens* occurs in great abundance.

Leaving the Boer village of Humpata (6000 feet) on May 10, we approached the Cunene along the now well-known track down the valley of the Caculovar. On descending the eastern slopes, which are less steep than the western, we passed through the same changes of flora, in the reverse order, as those already observed



on the other side. Passing the Huilla Mission—the scene of the botanical labours of Fathers Antunes and Dekindt—we arrived on May 13 at Chibia (4500 feet), where the proteaceous flora thins out and gives place again to the open, dry forest, in which the Bauhinia and Acacias in turn predominate. Henceforward the surface, frequently broken by tumbled heaps of gneiss and ironstone, 50 feet to 500 feet high, slopes gently down to the Cunene. From Gambos (4100 feet) the water-supply, after the end of the rainy season (April), is meagre and its quality bad, and the whole district is fever-stricken. The temperature becomes very high after mid-day, and whirlwinds of great violence spring up very suddenly, and carry columns of dust and other light objects to great heights. Three hours by waggon from Houmbe brought us to the Cunene marshes, which are here confined to the right bank of the river. Owing to the unusually late rains they were still nearly two miles wide, and it was with great difficulty that a crossing to Fort Roçadas on the opposite bank was effected. This stronghold is placed upon the high calcareous cliff forming the left bank of the river. Its neighbourhood, the scene during recent years of many engagements between the Portuguese and the trans-Cunene Ovambo tribes, has become so extremely unhealthy that it will in future be manned entirely by native troops. The country at its foot is thickly studded with small Baobabs and away to the east the open Acacia and Bauhinia forest again prevails, and undoubtedly merges farther south into the thorn-bush of Ovamboland and the Acacia park-formation which extends far to the south of Okahandya and Windhuk.

I take this opportunity of acknowledging the effective support which has been very kindly given to the objects of the expedition by Their Excellencies Sr. Capt. H. de Paiva Couceiro, Acting Governor-General of Angola; Herr Regierungsrath Dr. Hintrager, Acting Governor of German South-West Africa; and the Hon. W. F. Hely-Hutchinson, G.C.M.G., Governor of Cape Colony.

H. H. W. PEARSON.

MODERN METHODS OF ILLUMINATION.[1]

A GREAT change has come over the methods of lighting within the last few years. We have now at our disposal means of lighting which would have seemed incredible a few years ago. Step by step with these developments has taken place the progress of education and the increase of printed matter, with the result that we use our eyes to-day far more than in the past. Our main object, therefore, should be to consider the subject of illumination from the point of view of the impression received through the eye. After emphasising this aspect of illumination, Mr. Gaster proceeds with a summary of recent developments in electric lighting.

Electric Glow-lamps.

It has long been known that a carbon filament glow-lamp could be made to yield more efficient results by bringing it to a higher temperature, *i.e.* running it at a pressure higher than that ordinarily utilised, but such a gain in efficiency has only been found possible at the expense of life and durability.

Within the last few years we have seen the development of lamps with filaments made of other and more refractory materials, such as the Nernst lamp, and the various metallic filaments, such as osmium, iridium, tantalum and tungsten, &c. The two last-named lamps, of course, now play a great *rôle* in electric lighting.

In addition, attempts have been made to improve carbon filaments in the United States by the graphitising process of Mr. Howell, by the aid of which a consumption of 2·5 watts to 3 watts per candle was attained. Another interesting attempt in this direction is the Hopfelt lamp, in which the carbon filament burns in an atmosphere of mercury vapour, with, it is stated, a consumption near 1·5 watts per candle. The Helion lamp, again, is believed to utilise a filament mainly composed of silicon; it is claimed to run for 1000 hours at 1 watt per candle, and even in the open air, without requiring to be enclosed in an evacuated globe; but it has not yet come upon the market. Perhaps the best known metallic filament lamps in use at the present day are those utilising the metal tantalum and those described by various names, but generally believed to contain as the main constituent the metal tungsten. Tungsten lamps are burned at a consumption approaching 1 watt per candle-power, and are generally stated to have a life, under good conditions, of 1000 burning hours. One great difficulty, however, has been the manufacture of lamps of moderate candle-power for high voltages, and capable of being used in any position; very recently, however, lamps having as low a candle-power as 25 or 30, and for pressures extending to 200 volts to 260

[1] Abstract of a series of four Cantor lectures delivered by Mr. Leon Gaster before the Royal Society of Arts and published in the Journal of the Society for August 6, 13, 20, 27; September 3, 10.

volts, have been produced; one company has even professed to manufacture a 200-volt 16-candle-power 25-watt lamp.

Attention may also be directed to the cooperation between the lamp-makers and the electrical supply companies characteristic of the United States, and to the work of the National Electric Lamp Association in that country. A large number of lamp-makers belong to this association, determine standard prices, and support a laboratory for the purpose of carrying out common tests on lamps for their mutual benefit. In addition, the cooperation between lamp-maker and supply company is naturally very beneficial to both parties in pushing the sale of lamps in desired directions.

Electric Arc-lamps and Vapour-lamps.

The most marked development in arc-lamps of late years has been the introduction of flame carbons, that is, carbons such that the light comes from a bridge of incandescent vapour instead of the tips of the electrodes. By this means consumptions so low as 0·2 watt to 0·3 watt per mean spherical candle-power are said to have been obtained. Flame carbons, however, burn away very quickly, and in order to extend their life lamps in which a succession of carbons is automatically used have therefore been introduced. Another development, the enclosed regenerative lamp, involves methods enabling the access of air to the carbons to be restricted, so that a high efficiency, and yet a fairly long life, is obtained. Mention must also be made of the new Blondel flame carbons, yielding a very white light, which have been stated to yield a polar curve of light-distribution specially well adapted for street lighting, and are burned vertically one above the other.

Another direction of progress has been the improvement of small candle-power enclosed arc-lamps, which formerly served to bridge the gap between high candle-power flame arcs and glow-lamps. By securing more complete exclusion of the air from the globe, the Regina Arc Lamp Company claims to manufacture a lamp consuming only 0·8 watt per candle, and lasting for 250 hours without recarboning. High candle-power metallic filament incandescent lamps, which are manufactured up to 1000 candle-power, now also serve to fill this gap.

The chief drawback of mercury-vapour lamps is, of course, the peculiar colour of their light, there being practically no red rays. It has, therefore, been proposed to mix certain salts with the mercury, to use fluorescent materials, &c., in order to improve the spectrum, but few such devices have come to a practical issue. A recent advance has, however, been achieved by Dr. Küch, of Germany, by the use of a tube composed of special quartz-glass, which can stand a very high temperature. By this means a consumption of only 0·27 watt per mean spherical candle-power is said to have been obtained; an incidental advantage is that the luminescence in the tube seems to be partially replaced by temperature radiation, and therefore the light contains a distinct red element, the spectrum broadening out into a more or less continuous band instead of consisting of isolated lines.

In addition, quartz-glass allows ultra-violet light to pass through with special ease, and the lamp is therefore believed to have special uses for the destruction of bacteria, photographic purposes, &c. For ordinary illuminating purposes a special absorbing glass envelope restricting these rays is used. The Moore tube utilises gases in a rarefied condition and subjected to a high-tension alternating discharge. The essential feature of this arrangement is the use of a valve which automatically keeps the condition of the gas within the tube constant.

Gas Lighting.

Great advances have been made in the efficiency of gas burners since the early flat-flame burners yielding only about 3 candle-power per cubic foot. The most recent figure is furnished by the Keith high-pressure light, for which 60 to 70 candles per cubic foot have been found by some observers.

Improvements have been made in the incandescent mantle both in the direction of the colour of the light and through durability. Even so, manufacturers in England have stated that, as a rule, mantles require renewing every 200 hours.

A new departure was introduced some years ago by the Plaissetty soft mantle, and more recently the Cerofrim Company is stated to have made advances in the same direction. For such mantles it is claimed that their softness renders them convenient for package, and that they naturally burn into the shape of the flame, and are thus used under the most efficient conditions. The introduction of the inverted mantle has, of course, also been a great advance, although only two years ago there were many who doubted its commercial possibilities.

At the same time, steady improvements in the design of inverted burners have proceeded. Many types on the market are specially designed to avoid discoloration of the fitting through heat, to secure all the conditions most favourable to complete combustion. Whittaker and Litle in the United States, and, more recently, Lebeis in Germany, have described thermostatical methods of automatically regulating the access of air to the burner, which frequently requires adjustment, as the burner after lighting gradually becomes heated.

Perhaps the greatest advance has been in the direction of *high-pressure* gas lighting, which serves to promote an intimate mixture of gas and air, favouring complete combustion. To this end gas at high pressure may be used, or air at high pressure led into the burner, or a mixture of gas and air at high pressure. In any case, however, special external arrangements are needed with an existing low-pressure installation. Self-contained, highly efficient lamps, which can be run off the ordinary low-pressure supply, have therefore been designed. For instance, the Lucas lamp employs a small fan driven by an electric motor, which receives current from a thermopile near the mantle. In the Chipperfield lamp, a small hot-air engine placed above the burner automatically pumps air under pressure into the burner.

An important field in gas lighting is the use of automatic ignition devices. These may consist of electric sparking apparatus, of clock-work arranged to turn on and off the gas by means of a bye-pass at specified hours, or automatic devices of the same type manipulated by a rise or fall in pressure. Clock-work systems are very trustworthy, but, of course, do not take account of peculiar atmospheric conditions, such as fog. Apparatus of the last type can be controlled from the station, and lamps can be lighted up or extinguished as the engineer desires.

Mention must also be made of the special Norwich system for interior lighting and of the pneumatic methods; these, too, involve the use of the pilot flame.

The subject of street lighting formed the object of study of a deputation to the Continent recently appointed by the Corporation of London, and was subsequently investigated by the lecturer in a visit to Germany. A novelty of considerable interest, with which experiments are being made at Stuttgart, consists in slinging gas lamps on wires spanning the street, just as is done in the case of electric arc-lamps in Cannon Street at present. Lastly, in this section of the subject, the lecturer refers to the recognition of the importance of the heating power of gas, which is now regarded as more vital than its "illuminating power," according to the prescribed tests with flame-burners, for modern methods of lighting, and discusses the suggestion of a calorific standard in the future.

Gas, Oil, Acetylene, and other Self-contained Methods of Lighting.

The simple method of lighting by petroleum lamps, the author points out, should not be neglected. It is used, for instance, in the Church of St. Sophia of Constantinople, where it is preserved on account of its decorative value and because of religious tradition. In addition, petroleum lamps are still used in the country, and give good results when properly handled; in this connection the researches of Mr. Guiselin, who has demonstrated the advisability of keeping the reservoir in oil lamps well filled, are of interest. For instance, the illuminating power was found to be improved by 20 per cent. when 700 cubic centimetres instead of 500 were retained in the reservoir.

Recently many methods of incandescent oil lighting, that is, the use of vaporised fuel with an incandescent mantle, have been devised. The Kitson system and the Empire light are stated to be very efficient for lighthouse work and for the illumination of large outdoor areas in remote

localities. Other types of lamps are the Blanchard, the Petrolite, &c., which are described in detail.

A special account is also given of petrol air-gas lighting, three typical systems, the Machine Gas Syndicate (Cox's system), the Aërogen, and the National Air Gas, being exhibited. This system of lighting has attracted great attention recently for the lighting of private houses in districts where gas or electricity are not available. A mixture of a small percentage of petrol vapour with air is generated outside the building, and passed through pipes to the burner in the usual way.

The method of lighting by alcohol lamps is worth consideration in agricultural districts where petroleum may not be available, but alcohol is readily manufactured. There are also a number of liquid-gas systems in which gas is stored under pressure in liquid form, and has been effectively used for railway-carriage lighting, &c.

Acetylene Lighting.

Mr. Gaster deals briefly with the historical development of acetylene lighting, and describes the modern form of generator and several types of portable acetylene lamps; these are frequently used in mines, for motor-cars, &c.

Acetylene, like petrol-air gas, finds its main application where gas and electricity are not available. A recent development of considerable interest is the method of dissolving acetylene in acetone, which, at a pressure of ten atmospheres, absorbs about 240 times its own volume of acetylene, but liberates it when the pressure is released. Tubes of dissolved acetylene have been widely used for portable lighting, on motor-cars, railway trains, and even in emergencies for interior lighting. Perhaps one of their most successful applications, however, is for the lighting of buoys and beacons in remote localities.

There are several types of ingenious valves which are very effective in saving the consumption of acetylene in the above circumstances. For instance, the Dalen solar valve automatically cuts off the main supply of acetylene in daylight, leaving only the bye-pass burning, and re-kindles it at night.

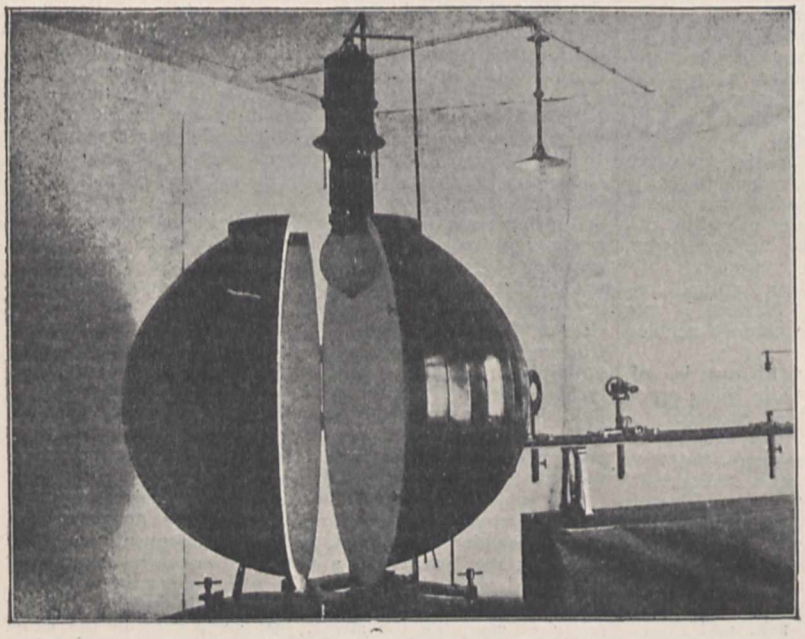
General Problems in Illumination.

In the last of these four lectures Mr. Gaster discusses the question of illumination in general terms. He again directs attention to the increasing brilliancy of modern illumination, and points out that the eye must have developed mainly in compliance with daylight conditions, and therefore we ought not to utilise artificial methods of lighting differing too widely from diffused daylight. The importance of providing for proper access of daylight in the design of buildings, particularly schools, is insisted upon. In this connection, the choice of wall-papers and the scheme of decoration are of considerable importance.

It is pointed out, too, that the intrinsic brilliancy of illumination has gradually increased of recent years. The effect of gazing directly upon such bright sources is very fatiguing and distressing to the eyes, and the author suggests that the time is now ripe for Governmental recommendations on this point.

In order to reduce the intrinsic brilliancy of light sources, suitable shades may be employed, and special reference is made to the Holophane diffusing globes and reflectors, which enable the light to be distributed and concentrated in any desired direction.

Some particulars are given of recent progress in photometry. The line of development of special consequence has been the introduction of so-called illumination photometers, which measure, not the actual intensity of the source, but the actual illumination on the pavements or at the desk at which we read. Sir William Preece so long ago as 1883 emphasised the value of such measurements.



The Ulbricht globe photometer, by the aid of which the mean spherical candle-power of a source can be determined by a single measurement.

Another interesting development is the Globe photometer, an example of which is shown in the accompanying illustration.

Perhaps an exceptionally important development during the last year has been the establishment of the international unit of light between England, France, and the United States, and the recognition of a simple relation connecting this unit with the value in use in Germany. The success of co-operation in this direction in this country is felt to be largely due to the fact that representatives of the gas industry and the gas referees were invited to act with those connected with electricity on the commission studying this subject.

Turning next to some practical examples of illumination, the author insists upon the importance of adequate school lighting, quoting many authorities to show that the eyesight of school children deteriorates during school life; he suggests that tests of the children's condition should be accompanied by the preservation of data relating to the methods of illumination employed in such schools, as this is believed to have a very vital influence on the health of the child.

In the same way the lighting of factories, hospitals, libraries, &c., should receive very careful study, for good illumination is as much a necessity as the provision of adequate sanitation and good ventilation; it is hoped that in the future, conditions of illumination, like the matters referred to above, will become the subject of Government inspection and recommendation. In addition, it is pointed out that even from the point of view of expediency employers would do well to pay attention to this matter, as a relatively small expense involved in securing good lighting is more than counterbalanced by the improvement in the quality and output of work. In hospitals it is obvious that the lighting should be exceptionally perfect, since people in an invalid condition are specially liable to feel the effect of bad methods of lighting.

Libraries, again, are frequented by people engaged in strenuous work and taxing their eyes severely; it is therefore suggested that in this case also no pains should be spared to make the methods of lighting convenient to the workers, and that when great expense is incurred in collecting valuable books and housing them in handsome buildings, the provision for the necessary illumination by the aid of which the books alone can be read should not be grudged.

A subject on which cooperation between different authori-

ties is badly needed is street lighting. It is pointed out that there is room for the establishment of some central testing department where thoroughly trustworthy and impartial tests could be carried out and used for the common benefit of those interested. In particular, it is suggested that it cannot be decided by the mere personal impression of a non-technical body of observers whether the lighting of the street is good or bad. This must be determined by the aid of precise scientific tests, carried out by impartial experts, who have made a thorough study of the subject, and can provide records by which experiences can be checked and subsequently repeated.

Other instances of problems in illumination in which there is great field for scientific treatment are shop-window lighting, stage lighting, and light-house illumination; in the two former fields, in particular, there is ample scope for the ingenuity of those who are up-to-date in their knowledge of the different illuminants, and possess, in addition, the requisite taste.

In the next section of this lecture Mr. Gaster deals with the scientific basis of light production, pointing out how the nature of the radiation from an illuminant depends in general upon its temperature, and indicating some of the possible lines of future development. The figures of authorities in this matter differ very greatly, but it is generally considered that the percentage of energy radiated in the form of light is very small indeed. The problem of light production is complicated by the fact that some invisible kinds of radiation seem to exert a prejudicial effect on the eye. The author describes some experiments showing the nature of the ultra-violet rays, which some authorities consider to be injurious.

In conclusion, Mr. Gaster points out that the problem of illumination is a complex subject which deserves special consideration by itself. There is a need for men who are not connected with any particular illuminant and who are able to take a wide view of the different aspects of the matter, so as to deal with modern problems of lighting. In order to focus interest in this subject and to bring into contact the engineers, architects, oculists, and others interested in illumination, a society has been formed this year which will, it is hoped, gradually lead to the solution of the important questions on which further exact data are felt to be desirable; this is termed the Illuminating Engineering Society. The first president of the society is Prof. S. P. Thompson, and the opening session will commence in November.

ANNUAL METEOROLOGICAL REPORTS.

THE Deutsche Seewarte has issued part xvii. of its over-sea meteorological observations for 1907, containing very carefully prepared summaries, and in some cases individual readings, at some thirty stations. The principal localities include Labrador, Morocco, Shantung, German East Africa, and some islands in the Pacific Ocean; there are also some isolated stations, including one recently established at Babylon. Scientific investigators will be grateful to the Seewarte for references which are given in all cases to the periodicals in which previous observations and results have been published.

The annual report of the Philippine Weather Bureau for 1907, part i., contains hourly readings at the Manila Observatory, together with means deduced therefrom. The tables also show the extreme values recorded, and the departures of the monthly and yearly means from the average. The mean temperature of the year, 79·5°, was practically normal; the absolute extremes were 98·1° in April and 59·0° in January. The rainfall, 72·5 inches, was 3·3 inches below the average; of this amount 64 inches fell from June to October inclusive (the period of the south-west monsoon). An appendix shows the greatest daily and hourly rainfall registered at the observatory in past years; the greatest daily falls were 13·3 inches and 12·1 inches, on September 24 and 25, 1867.

The report of the Liverpool Observatory for the year 1908 has been received from Mr. W. E. Plummer. This useful establishment is maintained by the Mersey Docks and Harbour Board in the interest of shipping, and is well provided with meteorological and astronomical instruments. In addition to the continuous use of the transit instrument for the determination of time, observations of selected stars and of comets visible from the observatory formed the chief astronomical work of the year. A Milne seismograph for the registration of tremors in the earth is kept steadily at work; during the Messina earthquake (December 28) the duration of disturbance was 1h. 41m., and the amplitude (half the complete range of maximum motion) was 15 mm. The meteorological results are very complete, *e.g.* the wind observations show the maximum velocity for each day recorded by Dines's apparatus, the extreme pressure on the square foot by Osler's anemometer, the horizontal motion by Robinson's anemometer, and the number of hours that the wind blew from different points of the compass. The mean temperature of the year (49·2°) was practically normal, and the rainfall (28·9 inches) slightly above the average.

The annual report of the United States Weather Bureau for the fiscal year ended June 30, 1908, shows that the research work at Mount Weather Observatory has been carried on without material curtailment, notwithstanding the destruction by fire of the administration building in October, 1907. Investigation of the upper air by means of kites and captive balloons is made daily (except Sundays), and the data are telegraphed to Washington for the use of the forecast division. The work on solar physics includes the measurement of solar radiation and the degree of absorption by the atmosphere. Considerable discrepancies exist in the values of the solar constant, even computed from observations on the same day at Mount Weather and at Washington; in most cases these are traceable to the unsteadiness of the atmosphere. Great activity exists in the divisions dealing with land and ocean meteorology; the number of climatological stations now exceeds 3700, and more than 1600 vessels cooperated with the Bureau during the year. All data referring to the Indian Ocean are lent to the Indian Meteorological Department, where they are copied and returned. In the forecast division isobaric charts are prepared from daily telegraphic reports from selected stations throughout the northern hemisphere, and forecasts for about a week in advance were published during the last three months of the year. The library now consists of about 28,000 books and pamphlets. In addition, meteorological articles contained in periodicals and transactions are catalogued under both author and subject; this bibliography is said to be more frequently consulted than the catalogue of books.

The Survey Department of Egypt has published its meteorological report for 1907, containing hourly readings at Helwan and climatological tables at thirty-five stations of the second and third order; the monthly tables give tri-daily readings in the form adopted by the International Meteorological Committee, and also include the daily amount of evaporation, as that element is of considerable importance in Egypt and the Sudan. Additional tables include hourly observations by Dines's pressure anemometer at Alexandria, rainfall and wind direction for a number of stations, and river-gauge observations. In compliance with a desire expressed by the International Meteorological Committee in 1907, tables of normal values are also given. Rainfall was in excess in Egypt and in North Sudan, but in considerable defect throughout the rest of the Sudan, and, as we have previously stated, the Nile flood was worse than any recorded during the past fifty years.

The meteorological year-book of the Bremen Observatory for 1908 has been received. From small beginnings this institution, under the superintendence of the late Dr. P. Bergholz, has attained a position of considerable importance; the observations, which include hourly readings and means, with monthly and yearly summaries, have been reduced by Prof. Grosse in the same thorough manner as heretofore, with the addition of hourly tabulations of sunshine records and monthly means of earth temperatures. The valuable materials, which now extend over many years, await a general scientific discussion; this desideratum is urgently pointed out by Dr. Grosse, but under present arrangements, while the director has to divide his energies between the observatory and other official duties, this important work has to be postponed.

WORK OF THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT IN 1908.

FROM the annual report of the above institution for last year, recently published, we find that the same steady progress is made in research work of a varied nature; the following notes give some particulars of a few of the more interesting investigations completed or in progress in 1908.

The saturation pressure of water vapour between 50° and 200° was determined as a continuation of the experiments in the previous year, the resultant pressures being tabulated in the report. The limit of accuracy over the whole range depended on the measurement of temperature, and the greater part of the work was devoted to such measurements. In the neighbourhood of 100° the temperature scale could be considered as trustworthy to 0·01°, and at 200° to 0·02°. The platinum thermometers used were compared at 150° and 200° with the nitrogen thermometer, after the constants of the latter had been determined, the comparison being made in an electrically heated oil-bath.

The experiments on the heat of evaporation of water, which were previously made between 30° C. and 100° C., have been continued for temperatures above 100°. Up to the present it had only been possible to obtain the values for the evaporation-heat from Regnault's observations of the total heat by calculating the heat of the water. It therefore appeared desirable to make direct measurements of the evaporation-heat. The experiments were carried out between 100° C. and 180° C. The results show that in the first approximation it is admissible to extrapolate beyond 100° the formula

$$L = 94{\cdot}210(365 - t)^{0{\cdot}34129} \text{ Cal. } 15,$$

which has been drawn up for the evaporation-heat L between 30° C. and 100° C. as limits for t.

The work connected with the silver voltameter was brought to a conclusion, and a paper published dealing with the subject. The object of the measurements was (1) to compare with the aid of the voltameter and a resistance the E.M.F. of the Weston normal cell, which was last determined by means of the silver voltameter in 1898; (2) to determine the accuracy attainable in measurements with the silver voltameter (*a*) under conditions which are as regular as possible, and (*b*) with a variation of the factors in connection therewith. It was found (as at the National Physical Laboratory) that the differences obtained by Richards and by Schuster, attributable on the one hand to the influence of the anode liquid, and on the other to that of the oxygen, could not, within the errors of observation, be confirmed.

Particulars of the changes in shellacked manganin coils due to varying humidity were published in 1908. The changes in question are so slight in the German climate as only to be of importance for resistances equal to or greater than 100 ohms, and even then only for measurements of the highest precision. For resistance standards of 1000 and 10,000 ohms the changes during the summer of 1908 amounted to 5 parts in 100,000 only. By taking the precaution of keeping resistances in a hygrostat of 50 per cent. humidity the constancy of all resistances up to a 100,000-ohm coil was secured. A comparison of the mercury standards with the manganin coils is in hand.

Various institutions (*e.g.* the National Physical Laboratory, Teddington, and the Bureau of Standards, Washington) have issued specifications for the setting up of standard cells, and detailed instructions are given for the preparation of the mercurous sulphate. It is directed that this salt shall not be washed with water, but with dilute sulphuric acid or with a saturated solution of cadmium sulphate. The Reichsanstalt is of opinion that the manner of washing the preparation is without influence on the result. It follows from this that the same E.M.F. results whether the salt be hydrolysed or not.

In connection with the research on anode rays mentioned in the last report, it was found that when in the presence of substances which emit intense anode rays the electro-negative bodies such as iodine, bromine, &c., considerably favour the formation of the rays. It was found that the red and blue fluorescent tints of glass which can be produced by slow kathodic rays can also be caused by sufficiently dense kathodic rays. For the blue fluorescence it was shown that they are connected with the emission of negative electrons. A fixed point for the presence of the positive electrons could not be ascertained.

The experiments commenced in 1907 on the electrolytic properties of silver and copper were concluded, and show that silver in the aqueous solutions of HCl, HBr, and HI, and copper in the aqueous solutions of HF indicate an electrolytic valvular action which does not appear, as in the other metals, to be caused by a gas stratum, but by a solid stratum.

For the determination of the absolute values of standards of self-induction, which are made by comparing with capacities measured absolutely, a standard air condenser was constructed. The new air condenser consists of 107 magnalium discs of 20 cm. diameter, 1 mm. thickness, and 1 mm. apart. It has a capacity of about 0·03 mfd. Amber is used for insulating, the insulation resistance being of the order 10^{15} ohms.

The work done in the magnetic laboratory includes a comparison of the methods of testing magnetic materials and experiments on initial permeability. An exhaustive series of measurements of self-induction was carried out with high-frequency alternating currents, and papers bearing on this subject have been published. A rotating interrupter for absolute capacity measurements by Maxwell's method is described.

A number of tests were made on various forms of flicker photometer which could be used on a straight photometer bench, with the view of determining whether the use of the flicker photometer is to be advocated for tests. It was found, however, that the flicker photometer offered to the skilled operator no advantage over the usual method of measurement as regards rapidity and certainty of adjustment.

Nearly seventy official and private papers of a scientific nature by members of the staff were published during 1908, particulars of these being given in an appendix to the report.

ZOOLOGY AT THE BRITISH ASSOCIATION.

BY arrangement between the organising committees, the presidents of the biological sections gave their addresses at different hours, so as to make it possible for members to attend them all. The address in Section D was delivered by Dr. Shipley on Friday, August 27.

The programme for Thursday, August 26, was opened by Dr. E. Goodrich with a paper on the origin of the vertebrates. The object of this paper was to show that none of the theories of the origin of vertebrates hitherto brought forward, deriving them from some existing class of the invertebrates, was satisfactory, because the theories violated the sound principles of phylogeny based on the combined evidence of comparative anatomy and physiology, embryology and palæontology. This evidence enables us to trace back the Gnathostomes to a primitive shark-like fish, the Gnathostomes and Cyclostomes to a common form of much more uniformly segmented structure, and, finally, the Craniata and Cephalochorda to an ancestor of very simple structure, without dermal skeleton and without pronounced cephalisation, which probably became extinct even before the Silurian age.

Mr. C. L. Boulenger followed with a paper on certain subcutaneous fat-bodies in Bufo. These structures are to be found in a number of different species, and consist of masses of adipose tissue situated at the junction of the hind-limbs with the trunk.

On Friday, August 27, after the presidential address, Prof. H. Jungersen read a paper, illustrated by lantern-slides, on the osteology of the Lophobranchii. The author pointed out that the skeletons of these fishes have hitherto been most unsatisfactorily examined, and the cranial structures, especially the suspensory apparatus, the gill-arches and the scapular arch, have been incorrectly interpreted by all previous authors. In the skull, parietals and opisthotics are wanting, the pterotics are greatly developed, reaching below to the basioccipital, and preventing the exoccipitals from meeting the prootics. These two features, together with the prolongation of the anterior part of the skull (mesethmoid and vomer), the Lophobranchii have in

common with the Solenostomidæ, the Fistulariidæ, the Aulostomidæ, and the Centriscidæ, these families forming with the Lophobranchii a natural group, the "Solenichthyes" of Regan.

The scapular arch is cartilaginous to a much greater extent than is the case in other Teleosteans, but a small ossified scapula is to be found as well as a coracoid.

The three anterior vertebræ are immovably joined together, their neural arches being firmly bound by sutures with long dentations; in addition, the two anterior ones are fixed to the expanded clavicle. The vertebræ bearing the interspinous bones for the dorsal fin are provided with secondary transverse processes behind the primary ones, thus enlarging the surface which gives attachment to the powerful muscles of the dorsal fin, the chief agent in swimming.

After a paper by Dr. S. Hadwen on Texas fever in cattle, and its cure by the use of drugs, the day's programme closed with the reports of the special committees on grants.

The meeting on Monday, August 30, was opened by Prof. A. B. Macallum, who read a paper, illustrated by numerous lantern-slides, on palæobiology and the age of the earth.

Prof. C. J. Patten followed with two papers:—(1) on the pre-nuptial plumage in *Calidris arenaria*, illustrated by lantern-views of the sanderling at different periods; (2) on the germinal disc in naturally incubated eggs of *Passer domesticus*. Due reflection of the facts that nests (or, in the case of those birds which make no nest, the soil on which the eggs are deposited) vary to an extraordinary extent in their heat-retaining properties; that the protecting egg-shells vary strikingly, not only in their thickness, but in their porosity and other structural peculiarities; and, lastly, that avian embryos vary to a considerable extent as regards their vitality when heat is withdrawn from the shell, has led the author to think that the method of studying avian embryology by means of the artificial incubator is not always the most trustworthy. He therefore described the changes which he observed during the first six hours in a clutch of naturally incubated eggs of the house-sparrow (*Passer domesticus*).

The next paper, on the *rôle* of visual function in animal and human evolution, was, in the absence of the author, Dr. G. M. Gould, taken as read.

Prof. S. H. Reynolds read a paper on the British Pleistocene Canidæ. Three species are found, the wolf, the fox, and the Arctic fox. There is no evidence of the existence in Britain in Pleistocene times of any animal that could be called a dog. The jaw described as *Lycaon anglicus* is thought by the author to be better regarded as a somewhat abnormal wolf. While, apart from any difference in size, the skull of a fox is readily distinguished from that of a wolf or dog by the depressions in the post-orbital processes of the frontals, it is extremely difficult, if not impossible, to find any valid distinctive character between dogs and wolves. The most useful character, for which we are indebted to Studer, is the orbitofrontal angle. He regards as belonging to wolves skulls in which this angle measures 40°–45°, and as belonging to dogs skulls in which the angle is greater than 45°. The author's measurements, while confirming Studer's contention that the angle in question tends to be decidedly less in the wolf than in the dog, show that the distinction is not absolute, and cannot be relied on in all cases.

The programme for the last day of the meeting, Tuesday, August 31, opened with a paper by Mr. C. F. Rousselet, on the geographical distribution of Rotifera. The author showed that the results of recent investigations point more and more to the fact that the Rotifera enjoy a cosmopolitan distribution, which is not limited to continents, but extends to all places on the surface of the earth where suitable conditions prevail. Wherever search has extended in Europe, America, Africa, India, China, Australia, and even the north and south polar regions, the same genera, and even species, have been met with, and it is not possible to speak of any typical or peculiar rotatorian fauna for any continent, zone, or region.

The very erratic appearance of rare or uncommon species in widely separated places seems to show that distance is no obstacle to their distribution, provided only that they find suitable conditions. To account for such a distribution over the whole of the globe, it has been supposed that most species of Rotifera can be dried up and their bodies carried by the wind, as dust, for long distances, and then come to life again on landing in suitable surroundings. This Mr. Rousselet showed to be a very erroneous generalisation of the fact that a very few species of bdelloid Rotifera, and in particular *Philodina roseola*, are capable of secreting a gelatinous envelope in which they can resist drought for many months, and come to life again on being placed in water. The author's experience has shown him that the vast majority of rotifers die immediately on being dried, and do not revive after complete desiccation; but their eggs, and in particular their resting eggs, can stand a prolonged state of desiccation and also freezing, and can therefore readily be transported by the wind or by aquatic birds and other animals, and will hatch when deposited in suitable pools of water. In his opinion it is by this means that the cosmopolitan distribution of the Rotifera over the world has in the course of time been brought about.

Dr. J. Pearson read a paper on the processes of autotomy in the Crustacea, and Prof. H. Jungersen communicated an account, by Dr. J. Schmidt, of the distribution of the fresh-water eels (Anguilla) throughout the world.

The following papers were, in the absence of the authors, taken as read:—Dr. F. A. Dixey, on the parallelism between the nymphaline genera Adelpha and Chlorippe; and Mr. W. J. Dakin, histology of the eye of Pecten.

In the afternoon Mr. J. Stanley Gardiner delivered a lecture on coral-reefs, illustrated by numerous lantern-views.

Two resolutions were passed by Section D during the meeting at Winnipeg:—

(1) "The zoological section of the British Association wish to record their sense of the danger caused by the approach of the Norwegian rat, which threatens the wheat industry of western Canada, and to urge the Governments concerned to take immediate steps to organise the extermination of this dangerous pest."

(2) "In view of the enormous importance of the fisheries of Canada in connection with her prosperity and her rapidly developing position as the great source of the food supply of the Empire, and appreciating the danger of exhaustion which menaces certain of the fisheries, the members of the zoological section of the British Association for the Advancement of Science, now in meeting in Winnipeg, desire to congratulate both the Dominion and the Provincial Governments upon the work already accomplished in connection with the study of the food-fishes, upon the establishment of a marine biological station on both the Atlantic and Pacific coasts, and upon the cooperation with the Government of the United States in an International Commission from whose labours much may be expected. At the same time, the members of the section are of the opinion that further and more extensive efforts in all these directions are urgently needed if certain of the fisheries, notably that of the Pacific salmon, are to be maintained even at their present condition of productiveness. For the framing of satisfactory and effective regulations for the utilisation and conservation of the food-fishes a complete knowledge of their life-history is absolutely necessary, and the section desires to impress on the Governments concerned the immediate need for an extensive prosecution of investigations along this line, for greater facilities for the scientific study of the fisheries, especially those of the Pacific coasts, and for a continued cooperation of the Dominion Government with the governments of the provinces and also those of the United States in all efforts looking towards the conservation of the fisheries, one of the most valuable natural resources of Canada."

GEOGRAPHY AT THE BRITISH ASSOCIATION.

THIS section was presided over this year by Colonel Sir Duncan A. Johnston, K.C.M.G., C.B., formerly director-general of the Ordnance Survey of the United Kingdom, and, as usual, the opening address dealt with matters of which the president had been made intimately cognisant through his life-work. After briefly referring to

the additions made to geographical knowledge during the year by the journeys of Dr. Sven Hedin, Dr. Aurel Stein, and Lieut. Shackleton, Sir Duncan Johnston devoted the bulk of his address to the subject of topographical maps, considering specially the preliminary triangulation for such maps, the methods of detail survey, the scale of the map, the scale of the field survey, the methods of representing details on the map, and the methods of reproduction. The address was printed in NATURE of September 9.

The remainder of the first morning sitting of the section was taken up with the reading of papers by Miss Luella A. Owen, of St. Joseph, Mo., on floods in the great interior valley of North America; by Mr. James White, head of the Geographical Department of the Dominion of Canada, on the nomenclature of the islands and lands of Arctic Canada; and Dr. Robert Bell, formerly head of the Geological Survey of Canada, on the Hudson Bay route in its present aspect. The first of these papers, written by an eye-witness of the flood of 1903, when at the end of May and the beginning of June the valley at Kansas City "was filled from bluff to bluff with the turbulent muddy waters, which on June 2 completely submerged the entrances to the main waiting-room of the Union station," gave in a compact form an account of the conditions which produce floods in the region in question and of the diversified character of their consequences, and then considered the possibility of their future control as a subject of vital interest to the United States, and one involving a careful examination of the methods of control in order to avoid the possibility of bringing about evils more disastrous than the floods themselves. Mr. White's paper necessarily consisted entirely of details, but as these are of no little interest in the history of geography, geographers will be glad to learn that they will be made available in the pages of the *Geographical Journal*. In the third of the morning papers Dr. Bell reiterated the views he has long held and urged as to the practical importance of the Hudson Bay route for the development of the north-west of Canada, emphasising on this occasion the urgency of the problem in view of the rapidity with which that development is taking place and the effect which it may be expected to have in promoting more intimate commercial relations between that region and the mother country.

No separate meetings of Section E were held in the afternoons, but the afternoon of Thursday, August 26, was devoted to a joint meeting of that section with the subsection on agriculture, at which a paper contributed to Section E by Prof. A. P. Brigham, secretary of the American Association of Geographers, on the development of wheat culture in North America, was followed by one contributed to the subsection on agriculture by Prof. Mavor, of Toronto, on the agricultural development of Canada, 1904–9. The first of these papers will be published in full in the annual report of the association, as well as in the *Geographical Journal*. Here, therefore, it will be enough to say that it laid stress on the enormous possibilities still remaining for the expansion of wheat production even in the United States, directing attention, among other things, to the large production of wheat relatively to population in some States not generally thought of as wheat States, such as Maryland, which this year produced eleven bushels of wheat per head. Prof. Mavor's paper was a continuation of his well-known report to the Board of Trade on the same subject, coming down to the year 1904, and, like it, protested against some of the more sanguine estimates of the possibilities of wheat production in Canada, although he admitted that his estimates of 1904 ought to be increased. An animated discussion followed the reading of the two papers. The prevailing note of that discussion was sanguine, both as to the possibility of enormously extending the area under wheat in North America and increasing the production in the area already placed under that crop. Major Craigie, chairman of the subsection on agriculture, directed attention, however, to the dependence of that increase on the distribution of population, and thus implicitly raised the question of the future rate of increase of wheat production in North America, and the possibility of maintaining that increase without a concurrent advance in prices.

The first paper read in Section E on Friday, August 27, was also by Prof. Mavor—a summary sketch of the economic geography of Canada. Mr. J. Stanley Gardiner, F.R.S., then gave a semi-popular account, illustrated by many beautiful lantern-slides, of the Seychelles, a subject on which he sent a report to the association as secretary of the committee for the investigation of the Indian Ocean appointed by the association. Two papers relating to physical geography followed. The first of these, by Prof. W. H. Hobbs, of the University of Michigan, Ann Arbor, developed an interesting theory of the cycle of Alpine glaciation, showing how many of the phenomena of glacial erosion found their explanation in the alternation of the conditions bringing about the advance and retreat of glaciers. This paper will also appear in the pages of the *Geographical Journal*. The other was by Prof. Dodge, of Columbia University, on the formation of arroyos in adobe-filled valleys in the south-western United States. The origin of these arroyos, or wadis, as they would be termed in arid regions frequented by Arabic-speaking peoples, was attributed in this paper to the introduction of sheep, the grazing of the herbage by which in gently sloping valley floors first gave the water an opportunity to become concentrated in streams instead of running off the surface in sheets, a theory which confirms an observation of the Navajos, the native race of the region. The last paper read that morning was by Mr. Lawrence J. Burpee, of the Carnegie Library, Ottawa, on the water route from Lake Superior to the westward. Of the three routes, that of the Kaministikwia, that by Grand Portage, and that by way of Lake Nipigon, the first-mentioned was the first to be discovered, but was neglected and forgotten after the discovery of the Grand Portage route, and remained forgotten until the Canadians ascertained that Grand Portage lay in the territory of the United States. Search for another route led to the re-discovery of that by the Kaministikwia, and rendered the nearly simultaneous discovery of the Nipigon route of no practical importance.

Two hours of the morning of Monday, August 30, were taken up with a discussion on the teaching of geography in secondary schools at a joint meeting of Sections E and L, held at the meeting place and under the chairmanship of the president of the latter section. The discussion was opened by an informatory and helpful paper by Prof. R. E. Dodge, of Columbia University, New York, and followed by one (read in the absence of the writer by the recorder of Section E) by Dr. C. H. Leete, principal of the Sachs School for Girls, New York, who has been engaged in the secondary teaching of geography for upwards of a quarter of a century. Several professors and teachers of geography took part in the discussion that followed, and almost all these coincided with the view expressed by Prof. Dodge, that the teacher of geography should look upon it as his business to let the relation of the earth to man dominate his presentation of the subject. The remainder of the morning was taken up with a lecture by Mr. A. O. Wheeler, president of the Alpine Club of Canada, on some characteristics of the Canadian Rockies, which attracted a larger audience in Section E than was assembled on any other occasion during the meeting.

The meeting on Tuesday, August 31, was opened by a carefully prepared and instructive paper on the influence of mechanical transportation upon the framework of cities, by Mr. George E. Hooker, civic secretary to the City Club of Chicago. It was, unfortunately, read to a very meagre audience, but there is reason to hope that it will appear somewhere in a permanent form. Prof. A. P. Coleman, of Toronto University, followed with a paper on the Yellowhead Pass and Mount Robson, an adjacent peak, the highest in the Canadian Rockies. Prof. J. W. Gregory, of Glasgow, then gave a brief but very illuminating account of the remarkable success which has attended the replacement of kanaka by white labour on the sugar plantations of Queensland. The last two papers read that morning furnished two illustrations of the action of waves and currents in bringing about changes in shore-lines. The first was by Prof. Douglas W. Johnson, of Harvard University, and dealt with the physical history of Nantasket

Beach, a spit running northwards from the east end of the south shore of Boston Harbour. This beach consists of sand, gravel, and cobbles deposited by wave action between several drumlins which formerly existed as islands, and with the aid of a series of lantern-slides the reader of the paper showed how the form of the beach ridges and their relation to abandoned marine cliffs on the drumlins prove the former existence of several drumlin islands now entirely destroyed by the sea. The second of these papers was by Dr. F. P. Gulliver, secretary to the geographical and geological section of the American Association for the Advancement of Science, and dealt with what he called the Wauwinet-Coscata Tombolo, Nantucket, Mass. The term tombolo, the Italian for a "pillow," applied in Italy to the low ridges or necks connecting Mt. Argentario with the mainland, Dr. Gulliver proposes as a general designation for such necks. The paper described and illustrated by lantern-views the opening of the neck referred to by a storm in December, 1896, when a channel navigable by small boats was formed, and the closing of this channel by waves and currents nearly twelve years later—November, 1908.

Some of the most interesting papers read in the section during the meeting were reserved for the last day, Wednesday, September 1, which was so far fortunate that the winding up of several other sections on the previous day allowed of the gathering of a larger audience in this section than was present on most of the other mornings. The first two papers were by Mr. James White, of Ottawa, one of them on the progress of the geographical knowledge of Canada from 1497 to 1909, the other on the economic development of Canada from 1867 to 1909. The subject treated of in the first of these two papers, which will appear in full in the *Geographical Journal*, was illustrated by a number of maps for different dates, for the most part at intervals of fifty years, illustrating for the earlier years the extent of exploration within the territory of the present dominion, and for the later years the extent of territory that remained unexplored. The subject of the second was illustrated mainly by means of statistical diagrams. These were followed by a very interesting paper by Mr. J. B. Tyrrell, formerly of the Geological Survey of Canada, on a remarkable forgotten, or nearly forgotten, geographer, Mr. David Thompson, a native of London but of Welsh parentage, who, in the latter part of the eighteenth and the early part of the nineteenth century, travelled more than fifty thousand miles in the western wilds of Canada, making surveys wherever he went, and producing a map which was for many years the only one available, and was distinguished by such accuracy as to induce the reader of the paper to claim for its compiler the designation of the greatest practical land geographer who had ever lived. This paper also will appear in full in the *Geographical Journal*. Dr. L. A. Bauer, director of the department of terrestrial magnetism at the Carnegie Institution of Washington, then gave a brief general account of the progress of the general magnetic survey of the earth in recent years, a subject dealt with more fully in a paper read by the same author to Section A. It may here be mentioned, however, that the author stated that since April 1, 1904, the declination and dip of the magnetic needle and the intensity of the magnetic current had been determined at some 900 land stations in different parts of the world, and a general magnetic survey of the Pacific Ocean had been made, in the course of which the non-magnetic cruiser *Galilee* had made cruises amounting to about 60,000 nautical miles. The last paper read before the section was by Mr. Allorge, of the Oxford School of Geography, on the eastern (Tunisian) Atlas Mountains, their main structural and morphological features, a paper embodying the results of a journey made by Mr. Allorge and a companion in Tunis last spring.

It may be mentioned, in conclusion, that a somewhat dramatic incident marked the close of the meeting of this section. The last paper had been read, the audience had withdrawn, and the two secretaries, after winding up the work of the meeting, were just about to leave also, when they were summoned to the telephone to be informed of the reported reaching of the North Pole by Dr. Cook.

PHYSIOLOGY AT THE BRITISH ASSOCIATION.

THE president's address on "The Physiological Basis of Success," as distinguished from simple survival, has already appeared in NATURE (September 23, p. 384).

The report of the committee on Anæsthetics formed the basis of an interesting discussion. Presented by Dr. Waller, the chairman, the report gave, in the first instance, a summary of the work done during the year by the members of the committee, each of whom added appendices on the particular branch of the subject they had investigated. Appendix i. gave the results in clinical practice of Drs. Hewitt and Blumfeld, who employed a mixture of two parts of chloroform and three parts of ether; this they consider to be safer than chloroform alone when given by the open method.

Appendix ii. described Dr. Waller's chloroform balance, which shows at a glance the percentage of chloroform given to the patient. Appendices iii. and iv. summarise Dr. Waller's results on the comparative anæsthetising power of chloroform, ether, and alcohol, and Appendix vi., by Drs. Waller and Symes, gave a method of intravenous anæsthesia which can be used for the basis of a similar calculation. The very important results are reached that 1 gram of chloroform is equivalent to 8 grams of ether and 32–40 grams of alcohol, according to the method used for the calculation. Further, the effect of mixtures of anæsthetics is that of the sum of the constituents. As the anæsthetic action of ether (and still more of alcohol) is so much less than that of chloroform, a mixture of ether and chloroform will behave in practice like dilute chloroform, so far as the experiments have gone.

In the discussion that followed all the speakers expressed their appreciation of the scientific value of the determinations that had been made. Dr. N. H. Alcock referred to the excellent results that had been obtained by the administration of known percentages of chloroform vapour, and summarised the work that had been done on the individual variations in susceptibility to the drug. He regretted that the case of sudden death under a mixture of chloroform and ether (*Times*, August 5) had supplied such an inauspicious comment on Appendix i. of the report.

Prof. A. R. Cushny considered that the results obtained by Messrs. Buckmaster and Gardiner were of great importance to the general theory of pharmacological action. He considered that as the concentration of chloroform in the blood of patients who had succumbed during anæsthesia had not yet been ascertained, it was possible that the concentration was not unduly high.

Prof. W. T. Porter suggested that the unhappy result in some of these cases could not at present be averted by the most skilful anæsthetists, and that the cause might be sought in the hyper-irritability of the heart and vasomotor apparatus.

Dr. Webster contributed a paper on the use of atropine and allied drugs in conjunction with anæsthetics, giving the results of numerous experiments. The conclusion reached was not favourable to the use of drugs of this class in conjunction with a general anæsthetic.

Prof. A. B. Macallum read two papers on the inorganic constituents in the blood of fishes, the first dealing with the osmotic pressure and the second with the relations of the inorganic salts to one another. He also read a third paper, on the inorganic composition of the blood in puerperal eclampsia, in which he pointed out the greater preponderance of magnesium, and especially potassium, in comparison with sodium.

A group of papers on the tracts in the spinal cord was furnished by Dr. Page May and Prof. Sutherland Simpson. Dr. Page May, who exhibited microscopical specimens and lantern-slides, gave a further description of a descending tract discovered by him, and which he names the "postero-septal tract." The origin and course, as determined by Wallerian degeneration and by retrograde chromatolysis, is from a joint region of the optic thalamus and corpora quadrigemina along chiefly the mesial fillet into the posterior column of the spinal cord, where it lies symmetrically on either side in close contact with the posterior septum,

terminating in the tenth and eleventh thoracic segments. Its function is still undetermined, a series of detailed experiments showing only that it is not concerned with the pyramidal or voluntary motor path, or with any obvious vasomotor process of the spleen, kidney, and other organs, as examined with the plethysmograph.

Dr. Page May also demonstrated, by the method of retrograde chromatolysis, the delimitation of the motor area in the cerebral cortex. The method is free from the fallacies that attend stimulation and ablation, and has enabled the author and Dr. Gordon Holmes to map out the cerebral motor area with great precision. This area in man and the higher mammals is definitely precentral, as Sherrington and Grünbaum have found by other methods.

Dr. Sutherland Simpson and his pupils described the pyramidal tract in the sheep and guinea-pig. The fibres were traced by the degeneration method after removal of the motor cortex of one side, the staining being carried out with Marchi's method. In the sheep it was found that no pyramid fibres could be found in the posterior columns, the proportion of direct fibres was large as compared with the crossed fibres, and the fibres could not be traced at all below the first cervical segment.

Prof. Simpson also communicated a paper by Mr. E. C. Peterson on the ascending tracts in the spinal cord of the cat.

The report of the committee on the ductless glands, drawn up by Prof. Swale Vincent, furnished an interesting group of papers by Mrs. W. H. Thompson (of Winnipeg), Drs. Halpenny and Brandson, and Dr. Young.

Mrs. Thompson (who illustrated her paper with a series of excellent diagrams), as a result of the study of the thyroids and parathyroids throughout a wide range of the animal kingdom, supported the views of Vincent and Jolly, and Forsyth, that these bodies are not separate and independent, but are very intimately related. Although distinct in the lower Vertebrata, and of somewhat different embryological origin, in the Mammalia they form, in fact, one apparatus.

Dr. Halpenny discussed the operation of parathyroidectomy, and also the effect on the parathyroids after excision of the thyroids.

Dr. Young investigated the effect of excluding the blood passing through the adrenals from the circulation; he found no fall of blood pressure even after several hours; there was, however, a distinct rise when the ligature was removed.

In presenting the report of the committee on Arum spadices, Dr. Waller referred to the result obtained by him of the effect of local heat on vegetable and animal tissues. "Thermic shocks," short of actual injury to the tissues, produce no excitation, in contradiction to the usual text-book statement, but give an electrical effect of opposite sign to that given by excitation.

Prof. E. J. McWeeney read a paper on the bacilli connected with food poisoning, for the details of which the report must be consulted.

The joint discussion with Section B, to which Dr. E. Frankland Armstrong, Dr. E. J. Russell, and Prof. J. Wilson communicated papers, proved one of the most successful features of the meeting, and it is to be hoped that the precedent thus set will be followed on future occasions. Dr. E. Frankland Armstrong directed attention to the difference in composition of different proteins, and pointed out that not only should the total nitrogen be taken into account in comparing the different foods, but due regard should also be paid to the composition and nature of the constituent units. Dr. E. J. Russell referred to the very great difference in food value between different samples of hay and roots, which showed but small variation with the usual methods of analysis. Prof. J. Wilson gave a most interesting historical account of the practice of farmers in feeding live-stock, particularly bullocks. He pointed out the great economic importance of the knowledge of the proper amount of the different proportions of the more expensive protein to the less expensive fat and carbohydrate, and showed how the practice of farmers had changed in this matter. Prof. H. E. Armstrong, Prof. Cushny, Dr. Alcock, and Dr. Hardy also joined in the discussion.

On the last day of the meeting Dr. Alcock gave a demonstration of his chloroform apparatus in the theatre of the Winnipeg General Hospital, and subsequently there was a discussion on the structure and function of the nucleus, in which Prof. A. B. Macallum and Dr. W. A. Hardy took part.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—At a meeting of the master and fellows of St. Catharine's College, held on October 19, Prof. R. H. Biffen, of Emmanuel College, was elected to the vacant professorial fellowship. Prof. Biffen, who was a scholar of Emmanuel College, was placed in the first class in part i. of the natural sciences tripos in 1895, and in the first class in part ii. of the same tripos in the following year. Shortly after taking his degree he was elected to the Frank Smart studentship at Gonville and Caius College, and soon afterwards he undertook a research which greatly modified the process of the manufacture of india-rubber. Later, as professor of agricultural botany, he has done much to produce new wheats, some of them rust-resisting, others combining a high yield with the "strength" which bakers desire. This autumn, for the first time, the seeds of these wheats are being distributed to agriculturists. Prof. Biffen is also a well-known authority on fungoid diseases of plants.

Mr. V. H. Mottram, of Trinity College, has been appointed additional demonstrator of physiology until Michaelmas, 1912.

Mr. W. McD. Scott has been elected to a John Lucas Walker studentship, and Dr. C. W. Ponder, of Emmanuel College, has been elected to a second studentship.

The Arnold Gerstenberg studentship has been awarded to Mr. C. D. Broad, scholar of Trinity College.

MANCHESTER.—In response to the appeal made by Prof. Perkin at the opening of the new extension of the chemical laboratories on October 4, the following donations have been received towards the cost of the necessary apparatus, material, and equipment:—Dr. Hugo Müller, 300*l.*; anonymous, 250*l.*; Mr. Vernon K. Armitage, 250*l.*; Mr. M. J. Fernandez Ferreira, 50*l.*; Mr. Noah Kolp, 50*l.* The sum of 1100*l.* is still required.

Dr. C. P. Lopage has been appointed lecturer in observation of children and school hygiene.

OXFORD.—The geographical scholarship for 1909–10 has been awarded to Mr. H. Wallis, scholar of Hertford College.

MR. A. P. I. COTTERELL has been appointed lecturer on sanitary engineering in the faculty of engineering of the University of Bristol. The faculty is provided and maintained in the Merchant Venturers' Technical College.

DR. A. CAMPBELL GEDDES has been appointed successor to the late Prof. A. Fraser in the chair of anatomy at the Royal College of Surgeons in Ireland. Prof. Geddes was formerly assistant to the late Prof. D. J. Cunningham, F.R.S., Edinburgh.

To show his personal interest in the new Hong Kong University, the King has directed that holders of Government scholarships shall be styled "King Edward VII. scholars." Lord Crewe, the Secretary of State for the Colonies, suggests that the scholarships should be confined to Hong Kong Chinese and Chinese born in the Straits Settlements.

THE corporation of Yale University has received from Messrs. W. D. and H. T. Sloane, of New York, a gift of 425,000 dollars for the erection and equipment of a physics laboratory. Among other recent gifts are 25,000 dollars from Mr. A. G. Vanderbilt toward the general

endowment, and 15,000 dollars for the school of forestry from Mr. G. H. Myers, a graduate of that school.

THE Joint Matriculation Board of the Universities of Manchester, Liverpool, Leeds, and Sheffield has appointed Mr. J. Murray Crofts, of Emmanuel College, Cambridge, as their organising secretary for the inspection and examination of schools. Mr. Crofts was for two years assistant master at Giggleswick, for two years junior inspector of the Board of Education, secondary branch, and for five years headmaster of the Johannesburg College, Transvaal, a post which he recently resigned.

WE learn from the *Scotsman* that during the recent recess many alterations and additions to the buildings in connection with the physiological department of the University of Edinburgh have been carried out, and that the additional accommodation will be available in the course of the present month. By utilising what was formerly the lecture-room, a new physiological chemical laboratory has been obtained, and the former chemistry room has been re-fitted as a laboratory for special research in chemical physiology. In addition to the foregoing, a new lecture-room has been erected on a piece of vacant ground at the south-west corner of the new buildings of the University. It is a one-storey building, designed to harmonise in appearance with the older adjacent buildings, and accommodates about 350 students.

THE *Electrician* for October 1 reprints in slightly abridged form from the *Electric Journal* an article by Mr. F. W. Taylor, an employer and past president of the American Society of Mechanical Engineers, on the reasons why manufacturers dislike college graduates. The difficulty in America appears to be that the graduate, on first entering works, becomes dissatisfied with the simplicity of the jobs allotted to him, and only after a year or two of shop experience develops character enough to do monotonous, unpleasant, or disagreeable work. Mr. Taylor suggests as remedy a year of hard work in the shops to follow immediately the first year of college life of all students, whether they are intended ultimately for the engineering profession or the Church. He believes they will in this way get a sounder knowledge of man and his duty in this world than can be gained by any other means. The *Electrician*, in a leading article devoted to the question raised by Mr. Taylor, cordially endorses many of the opinions he expresses.

PROF. W. OSLER, F.R.S., formally opened on October 15 three new laboratories for physiology, chemistry, and physics, respectively, at the London Hospital Medical College. The laboratories have been constructed and equipped at a cost of about 8000*l.*, and afford accommodation for some 120 students. In declaring the laboratories open, Prof. Osler said that, after all, laboratories are the foundation-stones on which the work of a hospital rests. Medical students cannot spend too long a time in them. Medical students ought to get their laboratory methods so thoroughly ingrained into their constitution that they carry them with them to their dying day. If they are to be good practitioners they have to carry their laboratory work with them into their practice. Prof. Osler said he would like every medical student in one or other of the laboratories to undertake during some portion of his career a small piece of research work. It is difficult, but it altogether depends upon the individual will of the individual man. All can do it if they only make up their minds to it, and in view of their large research endowment fund there is no reason why some of the money should not go to helping the research work of some of the younger men.

THE new University College of South Wales and Monmouthshire at Cardiff was opened on October 14 by Lord Plymouth, president of the college. The King, as Protector of the University of Wales, sent wishes for the success and prosperity of the future work of the college. The Prince of Wales, as Chancellor of the University, sent a letter to Lord Plymouth to be read at the ceremony. In the letter the Prince said:—"The steady growth of the college and the record of work accomplished during the first twenty-five years of its life are evidence that it has adapted itself to the needs of the community. This development is particularly noticeable in the technological and medical schools, and, thanks to the generous support of the coalowners of South Wales to the former and the assistance specially given by the Treasury to the latter, still further vigour and usefulness may be looked for from these departments. To Principal Griffiths and the students past and present I offer my hearty congratulations upon the good results achieved by the college. Meanwhile, we must look ahead and endeavour to be ready to meet all the requirements of scientific and intellectual progress. The imperative necessity for higher education and research is becoming more and more recognised, and I feel sure it is not lost sight of by those who direct the great commercial industries of the district. The University College of South Wales is destined to provide the want, and I confidently believe that the people of South Wales, through whose patriotic generosity so much has already been accomplished, will by their continued sympathy and material support not only extinguish the debt upon the new buildings, but secure the funds necessary for still further developments."

THE trustees of the Oxford University Endowment Fund have completed the first year of their administration of the fund. The total sum received by the trustees was 86,570*l.*, the greater part of which was forwarded to them as the result of Lord Curzon's appeal for donations for the further endowment of Oxford University. Among grants made by the trustees the following may be mentioned. A grant of 500*l.* a year has been promised for eight years to the curators of the Bodleian Library. The trustees have also provided the funds required to convert the North Gallery into a new reading-room, and have undertaken to meet the cost of constructing an underground chamber for the storage of books belonging to the Bodleian Library. It is estimated that this chamber will cost 10,000*l.* Five hundred pounds have been offered to meet the cost of equipment for further accommodation if space can be found by the University for the expansion of the school of geography. The trustees have agreed to pay for three years the salary of the newly appointed lecturer in Japanese, so that the school of Japanese—the first to be established in any English university—may be initiated without more than nominal calls upon the funds of the University. A school of engineering has been provided, largely by gifts allocated by donors and passing through the hands of the trustees. From the sum thus provided the trustees have promised a payment of 600*l.* a year for five years as a contribution to the cost of the engineering school, and have paid 300*l.* for equipment. Out of the general income of the trust fund a further sum not exceeding 150*l.* per annum has been promised for three years to furnish accommodation for the professor, for whom at present there is no adequate laboratory available. The sum of 61,553*l.* has been invested. The income will enable the trustees to make annual grants in aid of studies at present endowed inadequately, or in the establishment and initiation of new studies.

SOCIETIES AND ACADEMIES.

MANCHESTER.

Literary and Philosophical Society, October 5.—Mr. Francis Jones, president, in the chair.—A new binary progression of the planetary distances, and on the mutability of the solar system: Dr. H. **Wilde.** In his table of planetary orbits the author has adopted the radius vector of Mercury as the unit to which the other planetary distances should be referred, the terrestrial unit being a survival of the geocentric system of the universe. The change in the unit of distance has revealed a new binary progression of the planetary distances nearer the observations than that of Bode's law.

PARIS.

Academy of Sciences, October 11.—M. Bouchard in the chair.—The total sugar of the plasma and globules of the blood: R. **Lépine** and M. **Boulud.** The sugar estimated in the blood by the ordinary methods is called by the authors the immediate sugar of the blood; after heating with hydrofluoric acid the maximum amount of sugar found is called the total sugar. An investigation is described on the estimation of the immediate and total sugar in the blood from dogs both in a normal healthy condition and after deprivation of food.—Observations on the surface of the planet Mars from June 4 to October, 1909: R. **Jarry-Desloges.** The work was done at two observatories, both at a high altitude, at Revard (1550 metres above the sea) and near Massegros (900 metres). The paper is illustrated by two diagrams.—The effects of mechanical shocks on the residue of condensers: Paul L. **Mercanton.** A glass condenser was charged to about 400 volts, and the effects of mechanical shocks and also vibrations on the amount of the residual discharge studied. The results are summarised in tabular form.—The reduction of weighings to vacuum applied to the determination of atomic weights: Ph. A. **Guye** and N. **Zachariades.** The substances studied in this work, twenty-six in all, were chosen from material actually used in atomic-weight determinations. The reduction to vacuum weights was first applied in the usual way from the known densities of the substances, and the results compared with direct weighings in a vacuum. The differences on 100 grams of material varied between 1 and 32 milligrams, and the conclusion is drawn that it is completely illusory to weigh bodies closer than 1 part in 10,000, or to calculate atomic weights with a greater precision, whenever the weights of powdered substances, determined in air, are reduced to vacuum by calculation.—The probable influence of the motion of the moon on atmospheric radio-activity. Some meteorological consequences: Paul **Besson.** The radio-activity of the principal spring of Uriage-les-Bains has been found to vary with the barometric pressure and also with the movements of the moon. If this latter effect is confirmed, it would result that the moon, by increasing or reducing the number of condensation nuclei, would have an effect on weather.—The asymmetry created by a continuous current in liquid chains, initially symmetrical, formed by aqueous couples of identical viscosity: M. **Chanoz.**—The revision of the density of gaseous hydrochloric acid; the atomic weight of chlorine: Otto **Scheuer.** Twenty-eight determinations, made in seven series, of the density of hydrochloric acid gas give 1·6394 grams as the normal weight of a litre ($t=0°$ C., H=760 mm., $h=0$, $\gamma=45°$). This leads to the figure 35·45 as the atomic weight of chlorine.—The spectrographic analysis of blendes: G. **Urbain.** The spectra were taken from the arc, iron being taken as the comparison spectrum. Out of sixty-four blendes, thirty-eight gave clear evidence of the presence of germanium, and amongst these five contained the element in such a proportion that all the germanium lines were observed. Indium was found in forty-one blendes, three being remarkably rich. Nearly all the blendes contained gallium, there being only five in which gallium could not be detected. The other elements noted included iron, copper, silver, tin, antimony, cobalt, bismuth, arsenic, and molybdenum.—Some derivatives of hexahydro-oxybenzoic acid: P. J. **Tarbouriech.** This acid was first obtained by Bucherer from cyclohexanone. This latter substance can now be readily obtained in quantity by the Sabatier and Senderens reaction, and Bucherer's work is repeated and extended.—A new series of leucobases and colouring matters derived from diphenylethene: P. **Lemoult.**—The liquid crystals of the combinations of cholesterol and ergosterol with urea: Paul **Gaubert.**—The Dioscorea cultivated in tropical Africa, and on a case of natural selection relating to a species spontaneous in the virgin forest: Aug. **Chevalier.**—The stratigraphical position of the *Heterodiceras Lucii* layers at Saléve: E. **Joukowsky** and J. **Favre.**—The distribution of granites in the French Congo: H. **Arsandaux.**—The earthquake of October 8, 1909: Alfred **Angot.** The earthquake felt in Croatia was registered in the observatories of Parc Saint-Maur and Grenoble.—Some remarks on the great magnetic disturbance of September 25, 1909, and the accompanying solar phenomena: Émile **Marchand.**

CAPE TOWN.

Royal Society of South Africa, September 15.—Borchard's form of the eliminant of two equations of the nth degree: Dr. T. **Muir.**

DIARY OF SOCIETIES.

THURSDAY, OCTOBER 21.

INSTITUTION OF MINING AND METALLURGY, at 8.—The Influence of the Railroads of the United States and Canada on the Mineral Industry: Dr. J. Douglas.—The Development of Heavy Gravitation Stamps: W. A. Caldecott.

OPTICAL SOCIETY, at 8.—The Theory of Vision and Colour Perception: Dr. F. W. Edridge Green.

FRIDAY, OCTOBER 22.

PHYSICAL SOCIETY, at 5.—On Cadmium Amalgams and the Normal Weston Cell: F. E. Smith.—The Production of Helium from Uranium and Thorium: Frederick Soddy.—The Production of Radium from Uranium: Frederick Soddy.—Note on a Gravitational Problem: Dr. C. V. Burton.

TUESDAY, OCTOBER 26.

QUEKETT MICROSCOPICAL CLUB, at 8.—Notes on the Life-history of the Tachnid Fly, *Phorocera serriventris*, Rondani: W. Wesché.—Note on a Quick Method of Preparing and Staining Pollen: W. Wesché.—Low-power Photomicrography, with Especial Reference to Stereoscopic Work: A. C. Banfield.

WEDNESDAY, OCTOBER 27.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.—Annual Meeting: Address by the President.

FRIDAY, OCTOBER 29.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Prof. W. E. Dalby's Report on Heat Transmission (*Resumed Discussion*).

CONTENTS.

	PAGE
The Species Question Re-opened. By Prof. R. Meldola, F.R.S.	481
The Geographical Distribution of Lepidoptera. By W. F. K.	482
Agricultural Fertilisers. By M. J. R. D.	482
The Nature of Attention	483
Tables for Mathematicians and Physicists	484
Our Book Shelf:—	
Raffety: "An Introduction to the Science of Radio-activity"	485
Abraham: "British Mountain Climbs"	485
Ewald: "The Pond and other Stories"	485
Letters to the Editor:—	
Magnetic Storms.—Sir Oliver Lodge, F.R.S.	485
Why has the Moon no Atmosphere?—Prof. Alex. Johnson	486
A "Canaan Stone."—G. Harold Drew	486
Orthite in North Wales.—Herbert H. Thomas	487
Drought in South-west Ireland.—Geo. A. Armstrong	487
The Meteor in Sunshine, October 6.—W. F. Denning	487
An Aurora Display on October 18.—W. Harcourt-Bath	487
Jupiter's South Tropical Dark Area.—Scriven Bolton	487
Further Experiments with the Gramophone. (*Illustrated.*) By Prof. John G. McKendrick, F.R.S.	488
Peat in North America. By G. A. J. C.	490
An Anthropological Survey of the Sudan. By Dr. A. C. Haddon, F.R.S.	491
North Sea Fishery Investigations	491
Double-star Studies	492
Notes. (*Illustrated.*)	493
Our Astronomical Column:—	
Mars	498
Solar Observations: a Novel Spectroscope	498
The Aurora of September 25	498
September Meteors	498
Hydrogen Layers in the Solar Atmosphere	498
Percy Sladen Memorial Expedition in South-west Africa, 1908-9. II. (*Illustrated.*) By Prof. H. H. W. Pearson	499
Modern Methods of Illumination. (*Illustrated.*) By Leon Gaster	500
Annual Meterological Reports	503
Work of the Physikalisch-technische Reichsanstalt in 1908	504
Zoology at the British Association	504
Geography at the British Association	505
Physiology at the British Association	507
University and Educational Intelligence	508
Societies and Academies	509
Diary of Societies.	510