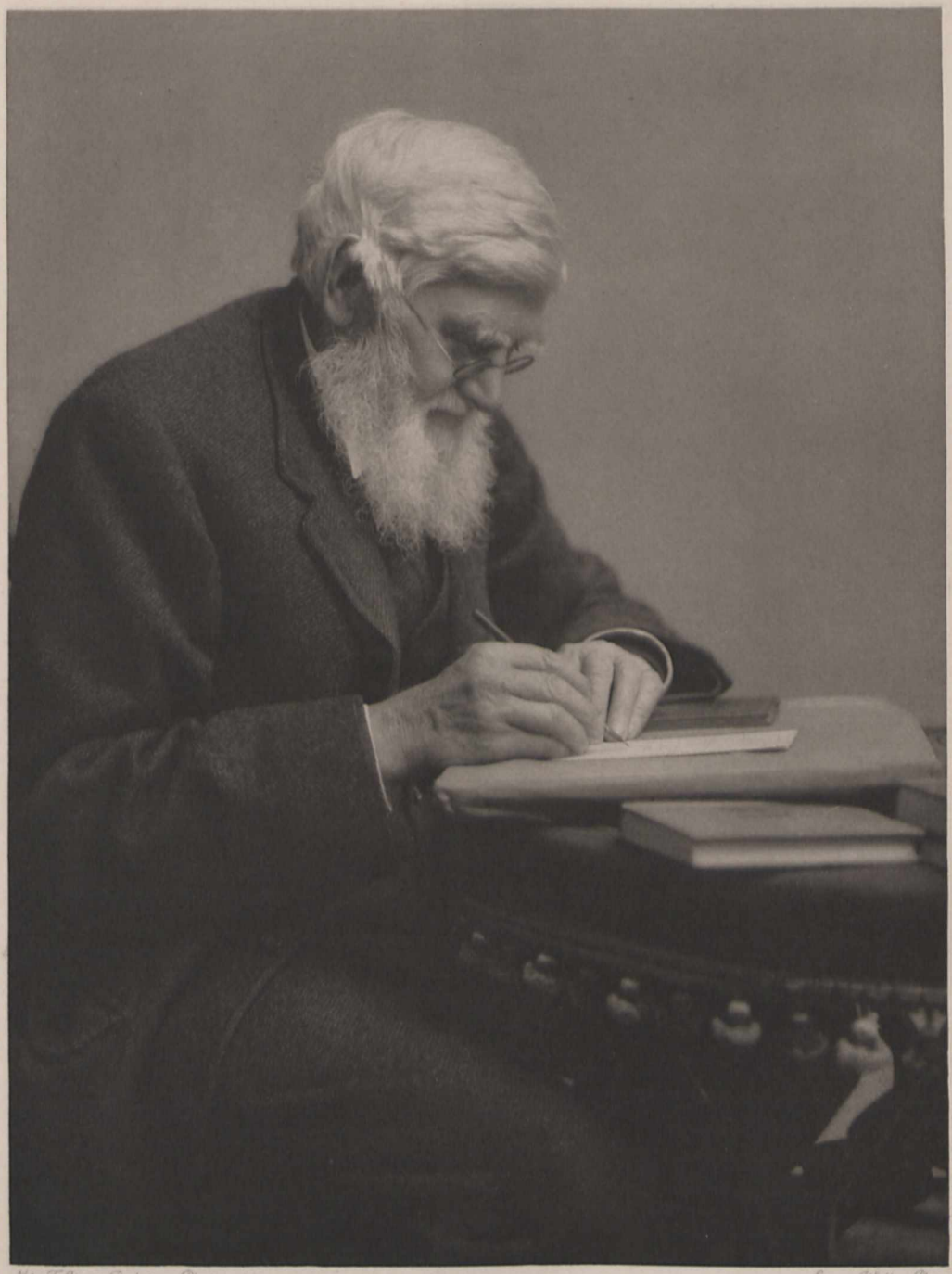

Miss F. Chant, Parkstone, Photographer. Emery Walker Photo.

Alfred R. Wallace

THURSDAY, JUNE 13, 1912.

SCIENTIFIC WORTHIES.

XXXVIII.—Dr. Alfred Russel Wallace, D.C.L., O.M., F.R.S.

In a retrospect of British biology during the "wonderful century" there stand out four men whose names will endure—Lyell, Darwin, Wallace, and Galton. The first three were closely kindred spirits whose work begins and ends a great epoch. Galton marked out his own way along quite an independent line, which will be the more appreciated the more the kinship of his ideas with those of Weismann and Mendel is recognised. Now that Wallace, the sole survivor of the group, has attained the ninetieth year of his age, and the sixty-fourth year of active service and productiveness, we may write of him in the spirit of the lines of Aristophanes: "Honour to the venerable man who, in the declining vale of years, continues to learn new subjects and add to his wisdom."

The distinction of endurance came to Lyell and Wallace through the readiness of each to grasp an opportunity in a revolution of thought such as can never recur, through a continued line of attack by precisely similar methods of reasoning over an extremely broad field. When Lyell faltered, Darwin and Wallace went on. As to the closeness of the intellectual sequence between these three men, those who know the original edition of the second volume of "The Principles of Geology," published in 1832, find it the second[1] biologic classic of the century, on which Darwin, through his higher and much more creative vision, built up his "Journal of Researches." Lyell and Darwin may be said to have united in guiding the mind of Wallace, because the young naturalist, fourteen years the junior of Darwin, took the works of both his seniors with him on his journey to South America, in which his career fairly began. From his observations during twelve years of life in the tropics, he will be remembered not only as one of the independent discoverers of the theory of natural selection, but next to Darwin as one of the great naturalists of the century. His range and originality are astounding in these days of specialism. His main lines of thought, although in many instances suggested somewhat suddenly, were developed and presented in a deliberate and masterly way through a series of papers and books.

Nature and nurture conspire to form a naturalist. Predisposition, an opportune period, and a happy series of events favoured Alfred Russel Wallace. He was born January 8, 1823, in Usk, Monmouthshire, of remote Scotch and Huguenot and of immediate English ancestry. His school life was uninspiring, and he feels that he owed more of his real education to the cultivating influence of his home in Hertford. At sixteen we find him as a land surveyor in Bedfordshire, also making his first observations on plants, and these early and serious studies in botany, continuing for four years, prepared him for the plant wonders of the tropics. At the age of twenty-one he came to London. He afterward regarded his difficulty in obtaining employment as the first turning point in his career, "for otherwise," he writes, "it seems very unlikely that I should ever have undertaken what at that time seemed rather a wild scheme, a journey to the almost unknown forests of the Amazon in order to observe nature and make a living by collecting." He also gives us, in his autobiographic volumes of 1905, "My Life, A Record of Events and Opinions," an interesting sketch of his state of mind at this time.

"I do not think that at this formative period I could be said to have shown special superiority in any of the higher mental faculties, but I possessed a strong desire to know the causes of things, a great love of beauty in form and colour, and a considerable but not excessive desire for order and arrangement in whatever I had to do. If I had one distinct mental faculty more prominent than another it was the power of correct reasoning from a review of the known facts in any case to the causes or laws which produced them, and also in detecting fallacies in the reasoning of other persons."

The parallel between Wallace's intellectual tendencies and environment and those of Charles Darwin is extraordinary. They enjoyed a similar current of influence from men, from books, and from nature. Thus the second turning point in the life of Wallace was his meeting with Henry Walter Bates, through whom he acquired his zest for the wonders of insect-life which opened for the first time for him the zoological windows of nature. It is noteworthy that the greater and most original part of his direct observations of nature were upon the adaptations of insects. Both naturalists fell under the spell of the same

[1] Lamarck's "Philosophie Zoologique," published in 1809, may be regarded as the first biologic classic of the century.

books, first and foremost those of Lyell, as noted above, then of Humboldt in his "Personal Narrative" (1814–18), of Robert Chambers in his "Vestiges of the Natural History of Creation" (1844), of Malthus in his "Essay on the Principle of Population" (1798). It was, however, Darwin's own "Journal," published in 1845, and read by Wallace at the age of twenty-three, which determined him to invite Bates to accompany him on his journey to the Amazon and Rio Negro, which filled the four years 1848–52. In this wondrous equatorial expanse, like Darwin, he was profoundly impressed with the forests, the butterflies, and birds, and with his first meeting with man in an absolute state of nature. Bates, himself a naturalist of high order, was closely observing the mimetic resemblances among insects to animate and inanimate objects and introducing Wallace to a field which was subsequently made his own. Bates remained several years after Wallace's departure, and published his classical memoir on mimicry in 1860–61.

Wallace's "Narrative of Travels on the Amazon," published in 1853 when he was thirty years of age, does not display the ability of his later writings, and shows that his powers were slowly developing, to reach maturity during his eight years of travel between 1854 and 1862 in the Indo-Malay islands, the Timor Group, Celebes, the Moluccas, and the Papuan Group. It is apparent that his prolonged observations on the natives, the forests, the birds, and mammals, and especially on the butterflies and beetles, were gradually storing his mind for one of those discharges of generalisation which comes so unexpectedly out of the vast accumulation of facts. "The Malay Archipelago" of 1869, published seven years after the return, is Wallace's "Journal of Researches." Its fine breadth of treatment in anthropology, zoology, botany, and physiography gives it a rank second only to Darwin's "Journal" in a class of works repeatedly enriched by British naturalists from the time of Burchell's journey in Africa.

Wallace's first trial at the evolution problem was his essay sent to the *Annals and Magazine of Natural History* in 1855, entitled "On the Law Which has Regulated the Introduction of New Species." This paper suggested the *when* and *where* of the occurrence of new forms, but not the *how*.

"It has now been shown," he concludes, "though most briefly and imperfectly, how the law that *'Every species has come into existence coincident both in time and space with a pre-existing closely allied species,'* connects together and renders intelligible a vast number of independent and hitherto unexplained facts."

In February, 1858, during a period of intermittent fever at Ternate, the *how* arose in his mind with the recollection of the "Essay" of Malthus, and there flashed upon him all the possible effects of the struggle for existence. In two days the entire draft was sketched and posted to Darwin, who had been working upon the verification of the same idea for twenty years. The noble episode which followed of the joint publication of the discovery was prophetic of the continued care for truth and carelessness of self, of the friendship, mutual admiration, and cooperation between these two high-minded men, which affords a golden example for our own and future ages. Each loved his own creations, yet undervalued his own work; each accorded enthusiastic praise to the work of the other.

This discovery again turned the course of Wallace's life. In his autobiography he writes:—

"I had, in fact, been bitten with the passion for species and their description, and if neither Darwin nor myself had hit upon 'natural selection,' I might have spent the best years of my life in this comparatively profitless work, but the new ideas swept all this away. . . . This . . . will perhaps enable my readers to understand the intense interest I felt in working out all these strange phenomena, and showing how they could almost all be explained by that law of 'Natural Selection' which Darwin had discovered many years before, and which I also had been so fortunate as to hit upon."

It is a striking circumstance in the history of biology that Wallace's rapidly produced sketch of 1858 "On the Tendencies of Varieties to Part Indefinitely from the Original Type" not only pursues a line of thought parallel to that of Darwin, except in excluding the analogy of natural with human selection, but embodies the permanent substance of the selection theory as it is to-day after fifty-four years of world-wide research. It may be regarded as his masterpiece. The attempt has been made by De Vries and others to show that Wallace in his "Darwinism" of 1889 differed from Darwin on important points, but whatever may be true of this final modification of the theory, a very careful comparison of the Darwin-Wallace sketches of 1858 shows that they both involve the principle

of discontinuity; in fact, fluctuation in the sense of plus and minus variation was not recognised at the time; the notion of variation was that derived directly from field rather than from laboratory notes.

The distinctive features of the later development of the theory in Wallace's mind were his more implicit faith in it, his insistence on utility or selection value, his rejection of Lamarckism, his dependence on spontaneous variations as supplying all the materials for selection. This confidence appears in the following passages from his militant reply in the volume of 1889 to the critics of Darwinism:—"The right or favourable variations are so frequently present that the unerring power of natural selection never wants materials to work upon. . . . The importance of natural selection as the one invariable and ever-present factor in all organic change and that which can alone have produced the temporary fixity combined with the secular modification of species." The principle of discontinuity is less clearly brought out; the selection of fluctuation is favourably considered. The laws and causes of variation are, however, assumed rather than taken up as a subject of inquiry. These opinions of 1889 were the summation of twenty-nine years of work.

The colouring of animals as observed in the tropics and the Malayan Islands was the subject in which Wallace made his most extensive and original contributions to Darwinism. Returning from the Archipelago in 1862, he published in 1864 his pioneer paper, "The Malayan Papilionidæ or Swallow Tailed Butterflies, as illustrative of the Theory of Natural Selection," in which he at once took rank beside Bates and Müller as one of the great contributors to the colour characteristics of animals. We see him step by step developing the ideas of protective resemblance which he had fully discussed with Bates, of alluring and warning colours, and of mimicry, pointing out the prevalence of mimicry in the female rather than in the male. The whole series of phenomena are believed to depend upon the great principle of the utility of every character, upon the need of colour protection by almost all animals, and upon the known fact that no characteristic is so variable as colour, that, therefore, concealment is most easily obtained by colour modification. Protective resemblance in all its manifold forms has ever been dominant in his mind as a greater principle than that of the sexual selection of colour which Darwin favoured.

In 1867 Wallace advanced his provisional solution of the cause of the gay and even gaudy colours of caterpillars as warnings of distastefulness in a manner which delighted Darwin; in 1868 he propounded his explanation of the colours of nesting birds, that when both sexes are conspicuously coloured, the nest conceals the sitting bird, but when the male is conspicuously coloured and the nest is open to view, the female is plainly coloured and inconspicuous. His theory of recognition colours as of importance in enabling the young of birds and mammals to find their parents was set forth in 1878, and he came to regard it as of very great importance. In "Tropical Nature" (1878) the whole subject of the colours of animals in relation to natural and sexual selection is reviewed, and the general principle is brought out that the exquisite beauty and variety of insect colours has not been developed through their own visual perceptions, but mainly and perhaps exclusively through those of the higher animals which prey upon them. This conception of colour origin, rather than that of the general influence of solar light and heat or the special action of any form of environment, leads him to his functional and biological classification of the colours of living organisms into five groups, which forms the foundation of the modern more extensive and critical classification of Poulton. Twelve years later he devoted four chapters of his "Darwinism" to the colours of animals and plants, still maintaining the utility, spontaneous variation, and selection theory.

The study of geographic distribution of animals also sprang from the inspiration of the Malayan journey and from the suggestiveness of the eleventh and twelfth chapters of "The Origin of Species" which Wallace determined to work out in an exhaustive manner. Following the preliminary treatises of Buffon, of Cuvier and Forbes, and the early regional classification of Sclater, Wallace takes rank as the founder of the science of zoogeography in his two great works, "The Geographical Distribution of Animals" of 1876, and "Island Life" of 1881, the latter volume following the first as the result of four years of additional thought and research. His early observations on insular distribution were sketched out in his article of 1860, "The Zoological Geography of the Malayan Archipelago." Here is his discovery of the Bali-Lombok boundary line between the Indian and Australian zoological regions which has since been generally known by his name.

In these fundamental works Wallace appears as a disciple of Lyell in uniformitarianism, and a follower of Dana as regards the stability and permanence of continental and oceanic areas, for which he advances much original evidence. He taxes his ingenuity to discover every possible means of dispersal of animals and plants other than those which would be afforded by hypothetical land connections; he considers every possible cause of extinction other than those which are sudden or cataclysmal. "Island Life" is in itself a great contribution, the starting point of all modern discussion of insular faunas and floras. The conservative theory of dispersal is applied in an original way to explain the arctic element in the mountain regions of the tropics, as opposed to the low-temperature theory of tropical lowlands during the Glacial Period; his explanation is founded on known facts as to the dispersal and distribution of plants, and does not require the extreme changes in the climate of tropical lowlands during the Glacial Period on which Darwin founded his interpretation. The causes and influence of the Glacial Epoch are discussed in an exposition of Croll's theory. In this connection may be mentioned one of Wallace's original geological contributions, in the article "Glacial Erosions of Lake Basins," published in 1893, namely, his theory of glacial erosion as a means of explaining the origin of valley lakes of glaciated countries.

The natural trend of Wallace's thought as to the ascent of man is first shown in the three anthropological essays of 1864, 1869, and 1870, contained in the volume "Contributions to the Theory of Natural Selection." This work, published in 1871, includes all his original essays from 1855 to 1869 on selection, on colour, and human evolution, which foreshadow the later development of his speculative philosophy. In his article of 1864, "The Development of Human Races under the Law of Natural Selection," he first pointed out that so soon as man learned to use fire and make tools, to grow food, to domesticate animals, to use clothing, and build houses, the action of natural selection was diverted from his body to his mind, and thenceforth his physical form remained stable, while his mental faculties improved. His subsequent papers, "The Elements of Natural Selection as Applied to Man" of 1869, "On Instinct in Man and Animals" of 1871, mark the gradual divergence of his views from those of Darwin, for in his opinion natural selection is believed to be inadequate to account for several of the physical characteristics of man, as well as his speech, his colour sense, his mathematical, musical, and moral attributes. Here is found the opinion that a superior intelligence is guiding the development of man in a definite direction and for a definite purpose, which finds final expression in the largely metaphysical volume of 1911. It is also prophetic of later thought that we find at the end of the closing pages of "The Malay Archipelago" the first statement of the feeling which so many travellers have experienced from a comparison of the natural and so-called civilised condition of man that "social evolution from barbarism to civilisation" has not advanced general human welfare. These humanitarian and partly socialistic ideas are developed in a series of recurrent essays between 1882 and 1903, including "The Nationalisation of Land," and "Studies Scientific and Social."

Our perspective has covered a long, honourable span of sixty-five years into the beginnings of the thinking life of a natural philosopher whose last volume, "The World of Life," of the year 1911, gives as clear a portrayal of his final opinions as that which his first essay of 1858 affords of his early opinions. We follow the cycle of reflection beginning with adaptation as the great problem, adaptation as fully explained by selection, and closing with adaptation in some of its phases as entirely beyond human powers of interpretation, not only in the evolution of the mind and spiritual nature of man, but in such marvellous manifestations as the scales of butterflies or the wings of birds. From our own intellectual experience we may sympathise with the rebound of maturity from the buoyant confidence of the young man of thirty-five who finds in selection the entire solution of a problem which has vexed the mind and aroused the scientific curiosity of man since the time of Empedocles. We have ourselves experienced a loss of confidence with advancing years, an increasing humility in the face of transformations which become more and more mysterious the more we study them, although we may not join with this master in his appeal to an organising and directing principle. Younger men than Wallace, both among the zoologists and philosophers, of our own time have given a somewhat similar metaphysical solution of the eternal problem of adaptation, which still baffles and transcends our powers of experiment and of reasoning.

HENRY FAIRFIELD OSBORN.

PROBLEMS OF MODERN PLANT PHYSIOLOGY.

Pflanzenphysiologie. By Prof. W. Palladin. Pp. vi+310. (Berlin: Julius Springer, 1911.) Price 8 marks.

EVERYONE who is interested in the problems of plant physiology will accord a welcome to Prof. Palladin's book, which in a German form represents the sixth Russian edition, and therefore may be taken as a matured expression of its author's point of view. Those who are conversant with Prof. Palladin's work will naturally expect to find the chemical aspects of the science, or rather certain portions of it, more fully presented than is often the case in works of this dimension, nor will they be disappointed. Nevertheless, the book does not belong to the category of abstruse manuals; it is eminently readable, and even contains several good stories of the great men of the past. One of these is worth relating. Boussingault, when engaged on investigations on the gaseous exchange of plants, had aroused considerable interest amongst his colleagues both on account of the actual results obtained and of the accurate methods of analysis he employed. Suddenly, however, the readings of the experiments began to give contradictory and unexpected values for the amounts of carbon dioxide present, notwithstanding that the conditions of the experiments apparently remained unchanged. Boussingault and his collaborator were hopelessly at a loss to explain the results obtained, when they happened to meet Regnault, who laughed at their long faces, and asked what was the matter. To their complaints he replied that he had been doubtful whether their means of investigation were really as delicate as they had claimed, and that in order to test them he himself had gone and breathed into their apparatus for several mornings while they were at breakfast!

The book is divided into two parts of very unequal value. The first, which is the longer, as it is also the better, is devoted to the metabolic processes; the second and shorter part contains a rather brief, but still not uninteresting, sketch of irritability and other "living" questions. In dealing with metabolism, the chemico-physical aspect is kept well to the front, though it is a little curious to find, on an earlier page, that emphasis is laid rather on the mysterious, than on the physical, attributes of heredity. Heredity, regarded from the general point of view adopted in this part of the book, is thus somewhat opposed to the attitude generally maintained with regard to other topics. It might, however, perhaps be argued that, from a chemical point of view, heredity implies that the course of chemical change in a group of really related forms should run along similar lines, as the natural outcome and expression of a fundamentally similar physical structure. We should anticipate resemblances among related organisms if their forms and functional attributes really depend on physical qualities and the serial reactions which are conditioned by them.

The book is very suggestive and is really full of interesting matter, but it is too short, and thus the treatment of many of the problems is far too much curtailed. Furthermore, one misses at times an adequate reference to modern work, particularly that of British writers. The treatment of photosynthesis and of the ascent of sap may serve to illustrate what is here meant. In the latter connection no mention appears to be made of Dixon and Joly's work, and this although a fair account of it has already been printed in German. The author's meaning is sometimes a little obscure, but this is perhaps due to the difficulty of a foreign edition. It is certainly not a legitimate inference from Timiriazeff's well-known experiments to allege that the same rays of light which split up carbon dioxide can be held to be responsible for the formation of starch (p. 32). The latter process depends upon the concentration of the sugar and sundry other factors, but its occurrence only stands in indirect relation to the source of light. The omission of any reference to the excellent work done at Rothamsted on soil problems is also regrettable, inasmuch as avenues of further work have been thereby opened up which will certainly lead to results of the highest importance in connection with plant nutrition.

The discussion of the essentials of fermentation is both useful and stimulating in a field which is being so assiduously cultivated. The successional action of ferments commonly to be observed in certain organisms is attributed to the corresponding withdrawal of the inhibiting agency of antiferments or "anti-kinases."

It is, perhaps, becoming difficult for some of us to resist the impression that there must be some underlying and simplifying principle still to be sought in connection with these rapidly multiplying ferments. At the present time, however, it is rather the fashion to postulate the existence of a separate and specific ferment to account for almost every different reaction that goes on in the body. But it should not be forgotten that nobody has ever isolated a pure ferment, and one is inclined to inquire whether the evidence for their separate individuality is really conclusive, or whether the reactions from which their existence is inferred may not depend after all on the protean diversity of structural aggregation and organisa-

tion of albuminous substances relatively simple and few in number.

We can honestly say that Prof. Palladin has well earned the gratitude of a wide circle of colleagues by rendering his book more generally accessible than heretofore. Not only the botanist and physiologist, but many others who are interested in the working of living organisms will find much that is suggestive in its pages, in which the endeavour is made "die komplizierten Lebenserscheinungen in einfache zu zerlegen und sie schliesslich auf Gesetze der Chemie und der Physik zurückzuführen." J. B. F.

PROTOZOOLOGY.

Lehrbuch der Protozoenkunde. Eine Darstellung der Naturgeschichte der Protozoen mit besonderer Berücksichtigung der parasitischen und pathogenen Formen. By Prof. Doflein. Dritte Auflage. Pp. xii+1043. (Jena: Gustav Fischer, 1911.) Price 26 marks (unbound).

THE extent to which the Protozoa are absorbing the attention of scientific investigators at the present time cannot be better illustrated than by the fact that the second and greatly enlarged edition of Prof. Doflein's treatise on the Protozoa, which appeared towards the end of 1909 (reviewed in NATURE, No. 2105, vol. lxxxiii, March 3, 1910), passed out of print within a year of its publication, and now a third edition of the work is before us. The book has undergone thorough revision in every part, and is increased substantially in size to 1043 pages and 951 figures as against 914 pages and 825 figures in the second edition.

In the general part the most noteworthy changes are the discussions of autogamy and of Hartmann's theory of polyenergid nuclei, and an additional section of eight pages dealing with spontaneous generation, the conception of species, variation and heredity in Protozoa. An error must be pointed out on p. 294, where it is stated that "while *Trypanosoma brucei* and *T. lewisi* can be cultivated in dogs side by side, *T. brucei* disappears and *T. lewisi* alone reproduces itself when rats are injected with this blood." It is well known that *T. lewisi* will not reproduce itself in the blood of the dog in any circumstances; the reference is to certain experiments of Koch, who showed that *T. brucei* and *T. lewisi* would live side by side in the blood of the same *rat*, but that if a *dog* was injected with the blood of that rat, *T. lewisi* disappeared and *T. brucei* alone persisted. The author has stated the facts quite correctly in another of his works ("Probleme der Protistenkunde," i., Jena, 1909, p. 33), whence it is evident that the misstatement is merely a clerical error, but nevertheless it is exceedingly misleading as it stands.

In the special part of the book the section on spirochætes has been revised, with the addition of new figures after Gross, Margarete (not Margarine!) Zuelzer, and others. No mention is made, however, of the developmental facts made known by Leishman in January, 1910, and now confirmed abundantly, namely, the formation of so-called coccoid bodies or spores. Possibly a consideration of these facts might have led the author to recognise that the evidence for the bacterial affinities of the spirochætes far outweighs any indication of relationship to Protozoa afforded by similarity in reactions to therapeutic agents. The section dealing with the trypanosomes has also undergone many changes, and extensive revisions and additions are made in the account given of the parasitic amœbæ, especially in the description of the dysenteric amœba (*Entamoeba histolytica*).

The illustrations of the book are its great feature, and the new edition contains, like the last, advance figures from investigations not yet published. Many of the figures of the preceding edition have been cut out; we think the pruning might have been carried further with advantage in some cases. Fig. 219, showing spore-formation in Myxosporidia, is quite out of date, and is in contradiction to other figures in the book. Figs. 363 and 367, illustrating trypanosomes, are scarcely worthy of a place in a modern text-book. The cultural development of Leishmania might have been illustrated better than by Figs. 401 and 404. Fig. 707 is very poor, and Fig. 877, a new figure, has not been reproduced successfully.

Taken as a whole, however, the value and usefulness of the book is greatly augmented, and it is well worth the slight increase of price over the former edition. As a treatise on the Protozoa it is a monumental production, with which no other can compare that has appeared since the 'eighties. E. A. M.

MODERN EXPLOSIVES.

Historical Papers on Modern Explosives. By George W. MacDonald. With an introduction by Sir Andrew Noble, Bart., K.C.B, F.R.S. Pp. xi+192. (London: Whittaker and Co., 1912.) Price 7*s.* 6*d.* net.

ACCESS to the literature of the early part and middle of the last century in connection with a subject which has become a great industry in modern times is possible, as a general rule, only to a limited number of those whose lot it is to

conduct and extend that industry, and no such literature can prove of greater interest to those specially concerned with its modern development, or the large number of men of science outside its particular sphere, than that of explosives.

The names of those discoverers and early workers in connection with fulminate of mercury, guncotton, nitroglycerine, &c., are familiar to all, but few probably realise the risks encountered, the difficulties to be overcome, and the patience and perseverance exhibited in overcoming those difficulties. The thorough and exhaustive manner in which Abel and his colleagues investigated the problems of the manufacture, decomposition, and safe storage of guncotton, leading to the publication of that marvellously complete series of memoirs by Abel in 1866–67, has seldom been equalled, and ten of these are given in sufficiently extensive form in the present volume. In view of the now well-recognised catalytic effect which the products of decomposition of guncotton exercise in promoting further decomposition, the experiments of Abel in submitting stable guncotton to the action of the fumes from an unstable sample are of particular interest, as are also his experiments of the effect of moisture on the keeping qualities, especially when the moist material is exposed to the action of sunlight. One of the most fundamental of Abel's discoveries was that decomposition appeared to be due to foreign matter in the original cellulose, which, on nitrogenising, yielded unstable products.

The work of Nobel, again, in connection with nitroglycerine and its application is another example of perseverance, ingenuity, and inventive genius, but here Mr. MacDonald has been somewhat sparing, for only four pages are devoted to his labours.

Of great interest are the early communications of Pelouze and Schönbein relating to their rival claims as the discoverer of guncotton. Pelouze (1838), in extending Braconnot's work on nitro-starch, which he indicated might be applicable to artillery, also noted that paper, cotton, and linen were nitrated, their new properties being ascribed to xyloïdine (nitro-starch) which covered their surfaces. Schönbein's first nitration (1845) appears to have been on sugar, but soon after the other nitro-substances of like character, including guncotton, were prepared. Schönbein no sooner realised the possible value of the latter than he instituted trials in pistols, carbines, and cannon. Whilst Pelouze therefore nitrated cotton prior to Schönbein, he undoubtedly thought it the same body as from starch and does not appear to have pursued the matter. Schönbein realised their essentially different character, but it remained for Crum of Glasgow to demonstrate the different composition of the two bodies, and his original paper (1847) is of great interest.

Mr. MacDonald's collection of memoirs covers fully the development of guncotton both in England and on the Continent, and many are the interesting points the reader will find, among them a communication from Berzelius to Schönbein, and the correspondence between the latter and Mr. Hall after the terrible disaster at the Faversham works in July, 1847.

From the few points mentioned it will be seen that Mr. MacDonald's collection of these papers, which first appeared in "Arms and Explosives," is particularly welcome, and one may hope that similar reprints or condensations of papers of great historical interest may, from time to time, become available to the student of to-day, for they would form an excellent course of post-graduate reading. J. S. S. B.

PROGRESS OF SCIENCE.

Fortschritte der naturwissenschaftlichen Forschung. Herausgegeben von Prof. E. Abderhalden. Dritter Band. Pp. iv+352. Price 16 marks. Vierter Band. Pp. iii+300. Price 15 marks. (Berlin and Vienna: Urban and Schwarzenberg, 1911 and 1912.)

THESE further volumes of a valuable work are quite up to the level of the preceding ones. There is, however, a considerable reduction in the number of the separate essays, and while this enables the writers to deal with their subjects at greater length, it somewhat narrows the range. In vol. iii., A. Wegener deals with recent investigations in atmospheric physics, including the stratification of the atmosphere, the isothermal layer, the formation of air-billows, the structure of hail and thunder clouds, and Birkeland and Störmer's electronic theory of the aurora. The article is lavishly illustrated by photographs and diagrams. W. Johansen, of Copenhagen, deals with heredity on the principle of the genotype, *i.e.* the aggregate of inherited tendencies embodied in the germ. His main thesis is to show that genotypes differ discontinuously, and thus recall the discontinuities between chemical species. Dr. Gustav Eichhorn, of Zürich, has an essay on the present position of wireless telegraphy and telephony. The system chiefly dealt with is the Telefunken system. As regards telephony, we find an interesting account of the comparative merits of Duddell, Poulsen, and Goldschmidt's recently invented high-frequency generator.

There is a lengthy article on directive forces in plant geography by M. Rikli, of Zürich. He goes

fully into the effects of heat, moisture, light, wind, soil, micro-organisms, range, and idiosyncrasy. Although the author describes plant geography as a young science, the great catalogue of references to literature appended to his article gives one quite a different impression. Prof. H. Klaatsch, Breslau, gives the first of a series of articles on the genesis and acquisition of human characteristics, dealing in the first instance with the development of the human hand. He answers the question as to why the ape did not evolve into a man by saying: Because he lost his thumb.

In vol. iv. we find Prof. London, of St. Petersburg, discoursing on the development of operative method in the study of digestion and resorption. The treatment is of great practical interest, but the article is illustrated in a manner provocative of fierce attacks from anti-vivisectionist quarters. Dr. H. Zickendraht, Bâle, treats of experimental aerodynamics, with interesting sidelights on voluntary and automatic stabilisation. F. Zschokke, Bâle, deals with the zoobiological significance of the Ice Age, pointing out how the fauna characteristic of low temperatures must have been gradually restricted as the ice receded from Europe, and that the isolated survivors in special districts cannot have got into their refuges by recent migration, having been caught in a mesh of higher temperatures and high-temperature organisms. K. Heilbronner's article on aphasia exhibits at once the theoretical limitations and the great practical attainments of specialists dealing with aphasia, alexia, agraphia, and apraxia. He denies that a special area of the brain can be called the "speech area."

Dr. W. Pauli's essay on the colloid changes of state of albuminous bodies is a summary of recent work on substances of steadily increasing importance. The volume is concluded by an admirable and timely contribution by Dr. G. Eichhorn on automatic telephony, in which it is explained how, by a suitable subdivision and decentralisation of exchanges, it is possible to set up an automatic system for some 100,000 subscribers, which offers advantages both in trustworthiness and economy of time.

OUR BOOKSHELF.

Spices. By Henry N. Ridley, C.M.G., F.R.S. Pp. ix+449. (London: Macmillan and Co., Ltd., 1912.) Price 8*s.* 6*d.* net.

IT is difficult to realise now the important position which spices occupied in the Middle Ages, when the great commercial cities of central Europe owed no small part of their wealth to commerce in these products, and the desire to share in this lucrative trade led the Portuguese to seek a sea-route to India. In this volume Mr. Ridley does not neglect this peculiarly interesting part of his subject, but gives, in each of the series of monographs of which his book is composed, a short account of the commercial history of the spice dealt with.

In the technical portion of each monograph the mode of treatment adopted is to give a description of the plant and of its varieties in cultivation, followed by an account of the soil and climate suited to it, the modes of cultivation, the pests and diseases which attack it, and the methods of preparing the spice for export. Lastly, an account is given of the industry as carried on in the chief producing countries, with notes on the uses of the spice locally and in Europe. The statistics of trade given are in most cases not very recent. It may also be suggested that it would have been worth while to state that clove-leaves yield a valuable essential oil, which has been exported in small quantity from Seychelles.

The chemistry of spices has been adequately dealt with elsewhere, and Mr. Ridley properly refers very briefly to the nature of the volatile oils and other constituents to which spices owe their aromatic or pungent properties. These notes on the chemistry of the spices are, however, occasionally so compressed as to be somewhat misleading to the inexpert.

A book of this kind must appeal mainly to planters in the tropics, and Mr. Ridley's extensive experience of the needs of this class of readers has enabled him to produce a volume which is a valuable addition to the rather scanty literature of tropical agriculture. T. A. H.

Catalogue of the Noctuidae in the Collection of the British Museum. By Sir George F. Hampson, Bart. Pp. xvii+689. (Catalogue of the Lepidoptera Phalænæ in the British Museum. Volume xi.) Accompanied by a volume of plates (clxxiv–cxci). (London: Printed by order of the Trustees. Sold by Longmans and Co., B. Quaritch, Dulau and Co., Ltd., and at the British Museum (Natural History), 1912.) Price: text, 20*s.*; plates, 17*s.* 6*d.*

IN the fourth volume of the present work the Noctuidæ were commenced, and fifteen subfamilies were defined. Four of these have now been monographed, and vol. xi., which has just appeared, includes four more: the Eutelianæ, with 12 genera and 175 species; the Stictopterinæ, with 10 genera and 112 species; the Sarrothripinæ, with 58 genera and 330 species; and the Acontianæ, with 70 genera and 324 species. In the series of species of Noctuidæ, the numbers in vol. xi. extend from 6198 to 7127. "The four subfamilies are modifications of the great Quadrifid section of the Noctuidæ, and are almost confined to the tropical and warmer temperate regions, few genera and species extending to the colder zones, and none to the arctic and alpine zones."

We have no special remarks to make on the present volume, except that it appears to be fully up to the standard of former ones. In addition to the plates, there are 275 figures in the text, and at the end of the volume we find some "addenda and corrigenda."

Ancient Types of Man. By Prof. A. Keith. Pp. xix+151. (London and New York: Harper and Bros., 1911.) Price 2*s.* 6*d.* net.

In this little book Prof. Keith gives a most interesting account of the known fossil remains of man, and enlivens his pages by numerous allusions to the circumstances in which the various discoveries were made. He begins by referring to the skeletons of comparatively recent date, which differ in no essential respects from those of existing men; and he then gradually works backwards through the Neanderthal type until he reaches the primitive Pithecanthropus. His descriptions are not only interesting, but are also important as being based in many cases on personal observation; and they are illustrated by a series of original drawings, in which overlapping outlines and tints are ingeniously used to facilitate comparisons.

The limits of space necessarily tend to a somewhat dogmatic style, especially when referring to the geological age of the different specimens; and we miss the scientific caution so conspicuous in the pioneer writings of Lyell and Boyd Dawkins, of which Prof. Keith curiously makes no mention. It is clear that the human frame in its present form is of immense antiquity, but it is far from certain that it arose at a period so remote as a casual reader might infer from Prof. Keith's well-written story. A. S. W.

University of London. Francis Galton Laboratory for National Eugenics. Eugenics Laboratory Memoirs, xv., "Treasury of Human Inheritance." Parts vii. and viii., Section xva., "Dwarfism." By Dr. H. Rischbieth and Amy Barrington. Pp. xi+355–573+plates li–lviii, O-Z, AA-WW. (London: Dulau and Co., Ltd., 1912.) Price 15*s.* net.

Parts vii. and viii. of "The Treasury of Human Inheritance" consist of a monograph on dwarfism by Dr. H. Rischbieth and Miss Amy Barrington. Failure to reach a normal stature may be due to Achondroplasia, Ateleiosis, to lesions of the thyroid gland, or to rickets. Achondroplasic dwarfs have a trunk of approximately normal size and very short limbs, while in the ateleiotic the proportions are almost normal, the condition being one of arrested or retarded development. Heredity plays a part in the causation of both these conditions, though the actual transmission of the defect is uncommon for the following reasons. Achondroplasia is much more common in women than in men, and in achondroplasic women the malformation of the pelvis renders normal childbirth impossible. Delivery of a living child must be by Cæsarean section, and most of the children are either born dead or die soon after birth. In the ateleiotic, the sexual organs are rarely normally developed, so that sterility is the usual condition; exceptions, however, do occur, and one of the pedigrees recorded in this volume shows the birth of an ateleiotic son to a father of a similar character and an achondroplasic mother. The grandfather was probably also ateleiotic.

LETTERS TO THE EDITOR.

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

The Distastefulness of Danaida (Anosia) plexippus.

Referring to Mr. A. M. Banta's letters on the above subject (Nature, December 21, 1911, and May 9, 1912), it seems strange that a writer who professes to prove "*positively* that our [viz. N. American] birds do not eat butterflies to an appreciable extent" should make no reference to the one memoir in which all the available evidence on the subject up to 1909 has been collected together—"Birds as a Factor in the Production of Mimetic Resemblances among Butterflies" (Trans. Ent. Soc. Lond., 1909, pp. 329–83). Mr. Banta writes very dogmatically, although he has made no attempt, or at least no successful attempt, to consult the literature of the subject of which he professes to treat.

In Mr. Guy A. K. Marshall's paper above referred to, records of the attacks of birds upon butterflies in the Nearctic region are to be found on pp. 373–9, although it is right to point out that the numerous definite statements of one observer, Gentry, have been severely criticised since the appearance of Mr. Marshall's paper, and apparently in consequence of the publicity they attained in that paper. Omitting these, there remains a considerable body of positive evidence, from which I will only quote two examples. I choose the first (p. 379) because it bears so obviously upon Mr. R. I. Pocock's results, and indicates that experiments upon birds in confinement are not so untrustworthy as Mr. A. M. Banta imagines. The late Mr. C. V. Riley recorded that "Mr. Otto Lugger, of Chicago, while on the U.S. Lake Survey, once saw a bird dart after an *archippus* (=*plexippus*) butterfly, seize it, and immediately drop it without devouring the body" ("Third Missouri Report," 1871, p. 169, note).

The second observation (p. 377) bears on Mr. Banta's assumption that birds could quite easily catch butterflies if they so desired. Prof. C. B. Davenport, of Cold Spring Harbor, states that:—"On Center Island, in the town of Oyster Bay [U.S.A.], in August, 1902, I saw a king-bird (*Tyrannus tyrannus*) chase a Colias. I stood still and watched it for nearly a minute. It seemed to have great difficulty in getting the insect, and I could hear the beaks snap in the air in their unsuccessful attempts to close upon the insect. The persistence of the bird and the difficulty of the operation of catching the butterfly impressed me very much at the time."

It is certainly true that a complete and perfect series of observations upon the preferences of a single individual has only very rarely been made upon birds in the wild state. One such happy chance occurred on January 12 last to Mr. S. A. Neave, travelling entomologist in East Africa of the Entomological Research Committee of the Colonial Office, and he gave an account of it at the meeting of the Entomological Society on May 1. Mr. Neave watched, from a distance of three or four yards, a wagtail (probably *Motacilla capensis*) catching and eating butterflies settled on the damp sand in the bed of a forest stream at Gabunga's, about seven miles north-west of Entebbe. In twenty-five minutes the bird ate eighteen Lycænidæ ("blues") and one Terias (a yellow black-margined Pierine). It also seized, but immediately rejected, an Acræa (*A. pelasgius*), which

was afterwards picked up by Mr. Neave and found to have lost one hind wing. This specimen will be preserved in the Hope Department of the Oxford University Museum. The bird ate four or five Lycænidæ after it had rejected the Acræa. It also missed many specimens. All the butterflies were swallowed whole. The observations were still being continued when the bird was unfortunately disturbed by a party of natives.

The injury seen to have been inflicted on the Acræa is of special interest, because such mutilation is not uncommonly found in Lepidoptera with warning colours. Thus on April 2 Mr. W. A. Lamborn, residing in the Lagos district of West Africa, found and sent to me a conspicuous Geometrid moth, *Pitthea famula*, from which both the wings on the left side had been shorn. Disabling injuries of this description are, in my experience, rarely seen in species with procryptic colouring, but are characteristic of those with warning colours. The facts suggest the reasonable inference that a disabled procryptic species is devoured, and not rejected. Injuries that do not disable—chips out of a single wing or symmetrical notches out of both sides, injuries which leave the insect with undiminished powers of flight—are commonly found in butterflies with all kinds of patterns. The amount of this indirect evidence is even now large, and it could be obtained in almost any quantity if naturalists made a point of seeking for it, and did not discard the poorer specimens. I will refer to one more example only, and that because the species is mentioned by Mr. Banta. In 1897 I captured near Chicago a very fresh specimen of *Limenitis* (*Basilarchia*) *archippus* with a large piece torn out of one hind-wing, an injury that may reasonably be explained as the result of an attack.

I do not agree with Mr. Banta's inference that "to make a good case for mimicry in the sense in which that term is ordinarily used, the mimic *Basilarchia archippus* should be tested and found palatable" (NATURE, December 21, 1911, p. 243), and that we should expect birds "scarcely, if at all, [to] molest these two forms," viz. the model and its mimic (NATURE, May 9, 1912, p. 242). In the first place, the mimicry is probably Müllerian and not Batesian, for the mimic belongs to the genus Limenitis (s.l.), containing species which are themselves models for mimicry, and allied to the still more widely mimicked South American genus Adelpha. Secondly, it is not supposed, on any theory of mimicry, that the enemies instinctively know the qualities indicated by warning colours. This knowledge is believed to be gained by each individual enemy as the outcome of its own experience. Furthermore, it is probable that in times of special scarcity the dangers from the attacks of certain enemies would be increased by the presence of warning colours.

It should be noticed that Mr. Banta's criticism of mimicry applies equally to protective resemblance. If his facts and arguments be sound, the rock- or bark-like underside of a North American butterfly is as useless to its possessor as is, according to Mr. Banta, the resemblance of the mimic to its Danaine model.

It is necessary to make a few remarks upon the negative evidence afforded by the examination of stomachs. Conclusions in harmony with those of Mr. Banta have been reached by Mr. G. L. Bates, who has found no traces of butterflies in the stomachs of insect-eating birds of the South Cameroon (*Ibis*, ser. 9, vol. v., No. 20, October, 1911, pp. 630–1). In this case I know that Mr. Bates's inferences are considered erroneous by Mr. C. F. M Swynnerton, who has for some years been making a special study of the relationship between birds and butterflies at Chirinda, in south-east Rhodesia. It would not be right to anticipate the results which Mr. Swynnerton, in a truly scientific spirit, desires to establish on as solid a foundation as possible; but, as the question has been raised and dogmatic assertions have been made, I feel sure he will not object to the following brief statement, prepared in consultation with Mr. Guy Marshall:—

(1) The results of Mr. Swynnerton's earlier investigations, up to the end of 1908, were in accordance with those of Mr. Bates, and might well have justified the conclusions reached by him and by Mr. Banta.

(2) From the time when, three and a half years ago, Mr. Swynnerton first saw his way into the details of the question and the methods by which to investigate it, he has obtained the records of nearly 800 attacks made by thirty-five species of birds, belonging to thirty genera and eighteen families, upon seventy-nine species of butterflies, belonging to nine families or subfamilies.

(3) Mr. Swynnerton is thus led to conclude, in opposition to Mr. Banta, that the negative evidence believed to be supplied by the examination of stomachs should not be too implicitly relied upon. The negative evidence itself, he considers, may be accounted for in various ways:—

(*a*) The treatment of butterfly prey by birds. Some swallow the insect whole, but usually after masticating or beating it; some remove inconvenient portions by "worrying" like a dog or beating against perch or ground; some grasp the prey in one foot and tear off the rejected portions with the bill, eating the rest piecemeal. Except when the wings are swallowed the probability that butterflies will be recognised in the stomach-contents is extremely remote.

(*b*) Insectivorous birds get rid of the chitin of their prey partly in a finely divided form in the excreta, partly in pellets ejected from time to time by the mouth. Mr. Swynnerton believes that he has noted the ejection of pellets by every purely insectivorous bird kept in captivity. The wings of butterflies that were swallowed whole appeared, for the most part, both in pellets and excreta, as minute fragments that could not be easily recognised except with the microscope. After a large meal of butterflies, the pellet cast up by a captive bird would often consist of fine débris, quite unrecognisable except after a thorough and minute examination.

(*c*) Other groups of insects, viz. the Diptera, Orthoptera, Coleoptera, and Hymenoptera, are each of them many times as numerous in individuals as the diurnal Lepidoptera, and we should therefore expect butterflies to be proportionately far less commonly found in the stomachs of insectivorous birds.

Finally, Mr. Swynnerton has found that a recently captured adult bird shows by its behaviour that it possesses a very fair knowledge of the main types of pattern and the relative edibility of the local butterflies. That this knowledge is the outcome of individual experience is proved by the fact that it is not possessed by a bird removed from the nest when young.

EDWARD B. POULTON.

Oxford University Museum, June 3.

The Weather of 1911 and the Ultra-violet Radiations of the Sun.

IN connection with an extremely interesting discussion recently carried on in the correspondence columns of NATURE I ventured to direct attention (NATURE, December 14, 1911) to the unusual diminution of the ultra-violet radiation from the sun as a possible cause of the abnormal weather of the summer

of 1911. My intention was less to explain the particular phenomenon of this summer than to direct the attention of meteorologists to a new point of view. In so far I succeeded, for a series of letters in NATURE devoted attention to this point. The fullest treatment was contained in a letter from Mr. L. G. Schultz in the issue of March 14.

I should like to reply briefly to this letter, which, owing to university holidays, I have only lately seen. According to my views, his interesting observation, that for both the middle and end of the year 1911 the state of the weather in South America was diametrically opposite to that in Europe (extremely dry summer in the north with rainy winter in the south, and extremely dry summer in the south with rainy winter in the north) does not contradict my attempt at explanation, but rather proves its correctness.

With normal ultra-violet radiation from the sun, *i.e.* with normal production of condensation nuclei, the water vapour formed in the north or south hemisphere will condense again on the same hemisphere if the necessary conditions are brought about by cooling and alterations of pressure. With abnormally small production of nuclei rain will probably not cease all over the earth, as Mr. Schultz seems to conclude, for the evaporated water must come down somewhere or other, but the occurrence of condensation will be rendered more difficult. Consequently it is possible that the water evaporated on the summer half of the earth will first find the required preliminary conditions for condensation on the colder winter half, and so come down there.

In other words, if the abnormal weather of 1911 was conditioned by the decrease of ultra-violet radiation from the sun, then the abnormal dryness on the summer hemisphere had to be accompanied by abnormal rainfall on the winter hemisphere. This is exactly what Mr. Schultz has shown beyond doubt occurred not only for the period of the northern summer, but also for the period of the southern summer. Accordingly, the period of abnormally low ultra-violet radiation of the sun extended over the whole of the year 1911. CARL RAMSAUER.

Radiologisches Institut, Heidelberg, May 30.

Alleged Ultra-violet Rays from Filament Lamps.

IN the note referring to the proposed electric lighting in the House of Commons by metal filament lamps, in NATURE of June 6 (p. 352), it is stated that "The present proposal is to use metallic filament lamps enclosed in holophane globes behind amber-coloured glass to cut off completely all ultra-violet rays." Investigations made in America and in Germany show that the ultra-violet rays from such lamps are insignificant, and are far less than in daylight giving the same illumination, and probably less than with some kinds of incandescent gas mantles.

Both physicists and electrical engineers would be interested to learn if there is any foundation for the allegation that metal filament lamps emit any appreciable ultra-violet rays or any rays which are injurious to eyesight. A. P. TROTTER.

June 8, 1912.

Earthquake of May 23.

REFERRING to the second paragraph of Fr. Sidgreaves's letter (NATURE, June 6), I think that in the reading of seismograms it is often very difficult to determine which is the first long wave from a distant earthquake. In the case of shocks which are powerful enough to give a definite impetus to the seismograph at the inception of each of the two preliminary phases, it would seem easier to determine the distance of the epicentre by means of the time elapsing between the arrival of the first and of the second phase. On May 23, by this method, both horizontal booms here gave the origin at 73.8° (8200 km., roughly), which would not be far from Burmah.

F. EDWARD NORRIS.

Woodbridge Hill, Guildford, June 8.

SOLAR HALOS AND MOCK SUNS.

THERE have been recently many observations of optical phenomena in the atmosphere which can usually be identified with the halos of 22° and 46° radius or with the allied and complementary arcs and mock suns. A brief description of the principal phenomena which can be attributed to reflection and refraction of the sunlight by ice-crystals may therefore be of interest. Full accounts of such phenomena and of the theoretical explanation of their production are given in the classical memoir on halos by Bravais, in the third volume of Mascart's "Optics" and in the third part of Pernter's "Meteorological Optics."

Ice-crystals are mainly hexagonal, and may be divided into two main classes, plates or stars with short axes and needles or prisms with long axes. The resulting optical prisms have angles of 60° or 90° for the most part. The 22° halo is formed by light which has passed through those prisms of 60°, the right cross sections of which pass through the sun. The prisms must be in the position in which the rays to the sun and to the observer make equal angles with the faces, and this is possible, for yellow light, only for prisms on a cone of 21° 50′ angular radius. The 46° halo is produced in a similar way by prisms of 90°.

If there is a preponderance of crystals floating with faces vertical, the reflection of light from these faces will give rise to a horizontal circle of light passing through the sun; and at points on this circle where the light is reinforced by refracted light, there will be unusual brilliance or mock suns. Hence the name mock sun ring. Two of the mock suns are formed by light refracted through prisms of 60°. They are at 22° from the sun when it is on the horizon, and their distance increases with the altitude of the sun. The mock suns produced by prisms of 90° are similarly at 46° or more from the sun, according to its altitude.

The arcs of contact or tangent-arcs of the 22° halo are produced by refraction through prisms of 60° floating with their axes horizontal. If the sun's altitude is less than 29°, the upper and lower arcs are distinct, but for greater altitudes they are joined to form the elliptic halo circumscribing the ordinary 22° halo.

The arcs of contact of the 46° halo are formed, according to Galle and Pernter, by refraction through crystals with vertical axes oscillating about the equilibrium position; according to Bravais and Mascart by simple refraction through crystals with one face horizontal. In the former case the arc is not part of a circle, but always touches the 46° halo; in the latter it forms part of

a circle around the zenith, and touches the halo only for solar altitudes of about 20°.

The sun pillar, a column of light extending as much as 20° above the sun, is formed by reflection at a horizontal face of a crystal, either simple reflection at a lower face or total internal reflection at an upper.

The phenomena produced by refraction are coloured; those due to reflection only are white.

Mr. Haskett Smith (NATURE, May 30) appears to have observed the 46° and the 22° halos and the upper arc of contact of the 22° halo; the Rev. R. J. Roberts (*The Times*, June 1) appears to have seen the horizontal mock sun ring with the mock suns associated with the 22° halo.

Dr. W. G. Smith sends a description of an observation at Armagh between 6 and 7 p.m. on May 26 of the halo of 22°, and apparently of the upper arc of contact of the 46° halo. Between noon and 1 p.m. on the same day, at Comlongon Castle, Dumfries, Mr. Whellens observed the 22° halo and a lateral tangent arc of the 46° halo.

Mr. David Smart observed at 6.45 p.m. on June 4, near Hove, three separate brightly-coloured patches, the sun being at the time hidden by cloud. The order of the colours and the approximate distances which he gives indicate that the patches were probably parts of the halo of 22°.

Mr. Bartrum asks in NATURE of June 6 if the needles would float vertically and the plates with their axes horizontal. Neither position would be stable. The needles would tend to set themselves horizontally and the plates with their axes vertical. The optical effects would, however, remain unaltered, the plates producing certain of the phenomena attributed to the needles and *vice versâ*. Both Pernter and Mascart appear to have assumed that the crystals would take the direction for which the resistance to their motion was a minimum, and that the needles would be vertical and the plates with axes horizontal.

E. G.

CANADIAN MINERAL RESOURCES.[1]

THE continued progress of the mineral industry in Canada is shown by the Annual Report and Statistics by Mr. John McLeish. Mineral statistics for the whole of the Dominion were first compiled in 1886, and the annual value of the production between then and 1909 has increased ninefold. The minerals raised in Canada in 1909 were worth more than 6,300,000 dollars above those of the previous year. The most important increase was in the structural materials and clays, in which the rise was from 11,339,000 to 16,533,000 dollars. The yield of the metallic products increased in value about 2,500,000 dollars, but there was a fall in the total for the non-metallic minerals of a million dollars.

The arrangement of mineral products into metallic and non-metallic is unsatisfactory owing to the ambiguity in the term "metal," and the variations in its meaning introduce uncertainty into the comparison between the returns of different countries. The Canadian report differs from general practice by including arsenic and chromite among the non-metals; magnesite, pyrites, and the minerals of which aluminium and the alkalies are the chief constituents are regarded as non-metallic.

The most striking development of the Canadian mineral industry during the year is the great increase of silver due to the mining field of Cobalt. It yields 90 per cent. of the total silver production of Canada, and about one-tenth of that of the world. The output both of gold and copper has declined since 1908, and there has been a fall of nearly 400,000 short tons in the output of coal and of more than 100,000 barrels of petroleum. The rapid expansion of settlement in Canada has led to the great increase in the demands for building materials, which have contributed the largest rise to the mineral products of the year.

Canada is poor in iron ores of present commercial value, but has large supplies of low-grade ores, and is therefore especially interested in the problem of their concentration. Mr. G. C. Mackenzie's Bulletin records the results of a series of experiments on magnetic concentration, a process which appears particularly suitable for iron ores. The many countries which have large deposits of banded ironstones will watch the progress of the Canadian investigations with interest. Mr. Mackenzie has experimented with three ores. The first was a low-grade magnetite from the Bristol Mines in Quebec; the magnetite is mixed with felspar, quartz, hornblende, and calcite, and is associated with much pyrites. This ore was found to be easily concentrated magnetically, and 70 per cent. of the sulphur was eliminated. By the use of a wet method 90 per cent. of sulphur was removed, and the phosphorus reduced to a trace. The concentrated ore, as in all these cases, would have to be briquetted before smelting.

The second ore tested was a siliceous ironstone from the Bathurst Mine of New Brunswick, and represents a widespread type. The iron occurs in minute particles of magnetite and hæmatite. The results showed that a satisfactory magnetic concentration by the dry process is impracticable; a wet method, however, gave a somewhat more encouraging result.

The third series of experiments was on the separation of the copper and nickel in the ore from Nairn, Ontario. The experiments in this case were incomplete, and the separation unsatisfactory.

Mr. F. G. Wait's report consists of the analyses made in the years 1906–8 in the chemical laboratories, and contains many interesting contributions to the geology and economic mineralogy of

[1] Annual Report of the Division of Mineral Resources and Statistics on the Mineral Production of Canada during the Calendar Year 1909. By J. McLeish. Pp. 291. (Canada: Department of Mines, Ottawa, 1911.)

Magnetic Concentration Experiments with Iron Ores of the Bristol Mines in Quebec; Iron Ores of the Bathurst Mines, New Brunswick; A Copper Nickel Ore from Nairn, Ontario. By G. C. Mackenzie. Pp. 28+4 figs. (Canada: Department of Mines, Ottawa, 1910.) Bulletin No. 5.

Report of Analyses of Ores, Non-metallic Minerals, Fuels, &c., made in the Chemical Laboratories during the Years 1906, 1907, 1908. Pp. 126+2 plates. By F. G. Wait. (Canada: Department of Mines, Ottawa, 1909.)

Report on the Molybdenum Ores of Canada. By T. L. Walker. Pp. 64+14 plates+10 figs. (Canada: Department of Mines, Ottawa, 1911.)

Canada. The report includes twenty-seven analyses of igneous rocks collected by Dr. R. A. Daly during the work of the International Boundary Commission in 1902–5. Some of these analyses show that rocks rich in alkali extend far westward through the mountains of western Canada toward the Pacific province, where such rocks are not expected. The most numerous analyses are of lignites and iron ores. An appendix by Mr. H. A. Leverin describes the commercial methods of analyses of oil shales.

Dr. T. L. Walker contributes an interesting report on the molybdenum ores of Canada, in which he describes their distribution and geological conditions. Dr. Walker personally examined most of the chief molybdenum deposits in Canada. They usually occur in Archæan rocks near the border of intrusive masses of granite. Some of the chief occurrences of molybdenite are in pegmatite veins traversing gneisses, slates, and quartzites. Some of these pegmatites are so poor in felspar that they become practically veins of quartz; and, as is usual with such veins, they are very poor in metallic constituents.

Molybdenite also occurs along joint planes in granite, and it is then usually associated with fluor-spar, and fine scales of it impregnate the granite along the joints. Some important deposits have been found along the contact between granite or pegmatite with crystalline limestone. The reaction between these rocks has produced a band of pyroxenite containing pyrite, pyrrhotite, and molybdenite.

In most of the ores the molybdenum is so scattered that its concentration is necessary. Dr. Walker says that none of the processes hitherto employed are very satisfactory.

The larger part of the report describes the chief known Canadian molybdenum occurrences. It includes a list of twelve, which are regarded as the most promising; but the author is very cautious in expressing his opinion as to their value. His conclusion (p. 57) that "some of these are more promising than others" is a very safe hypothesis. J. W. G.

PROF. EDUARD STRASBURGER.

THE science of botany has sustained an irreparable loss through the death, on May 19, of Prof. Eduard Strasburger. It is especially sad that this melancholy event should have occurred at a time when it had been arranged by his many friends to celebrate his approaching seventieth birthday. A *Festschrift* was in course of preparation, toward which contributions had been promised by botanists in all parts of the world.

It has fallen to few men to have achieved so much, and to have taken so active a share in the many and diverse branches of the science to which Strasburger devoted his life. There is scarcely any comprehensive modern botanical memoir concerned with cytology, anatomy, embryology, and even certain aspects of plant physiology, which does not contain references to Strasburger's contributions to the subject.

Apart from the work of his earlier years on the gymnosperms and the problems therewith connected, it is in the field of cytology, and in a lesser degree in anatomy also, that his claim to enduring fame will be everywhere recognised.

In the seventh decade of the last century Strasburger began publishing those remarkable series of investigations which have rendered his *Histologische Beiträge* indispensable to the cytologist and anatomist, and will ever stand out as landmarks in the history of the science. Considering the time at which they were written, the papers on the nucleus and the cell are really wonderful productions. They ushered in a new epoch, and introduced certainty and clearness where nebulosity and chaos had previously reigned. In reading his work and comparing it with that of his contemporaries in the early 'seventies, one seems to pass in one step from mediævalism into modern science. Much brilliant work had, of course, already been accomplished by others, but it was largely due to Strasburger that cytology emerged so rapidly from the mists of speculation and developed into a science founded on demonstrable facts, which the more recent work has shown to be, in the main, of great and far-reaching importance.

Naturally his earlier work did not escape the need of revision here and there, but having regard to the means at his disposal, and to the relatively primitive character of the technique at that time available, it is little short of marvellous that his genius should have proved to have been so little at fault. The reason for this is to be sought partly in the strength of the highly trained intellect which he focussed on every problem that interested him, and partly in the untiring industry with which he pursued his extensive investigations. He was not satisfied with elucidating, as far as might be, the course of events in this or that single instance, but he checked his observations and inferences by researches extending over a wide choice of objects. In reading any of his more important memoirs, one cannot fail to realise the effectiveness with which Strasburger drew on his immense store of first-hand knowledge in attacking the problems confronting him. The meticulous accuracy which marks the description of his observations is continually illuminated by that indefinable but very real quality of greatness which enabled him so well to grasp essentials, and to separate them from relatively unimportant masses of new facts. It is true that in his later years perhaps this very quality became magnified almost into a fault. Where he thought he saw clearly, he was apt, as he used himself to say, to attach great weight to aspects of a problem that coincided with theoretical anticipation, but even in this he bore no more resemblance to the inferior minds who often endeavour to adopt a similar attitude than does a great artist of the impressionist school to the man who cannot draw, but can only daub and smudge.

Strasburger has sometimes been reproached for the rapidity with which he occasionally changed his attitude towards an interpretation of results.

In reality, however, there is but little foundation for such a reproach. A correct observation is one thing; the interpretation of it is another. Interpretation must almost necessarily change as new facts become known, and a mere clinging to exploded theories affords no claim to distinction. But no one has ever accused Strasburger of carelessness in observation. His scientific memoirs are repositories of facts many of which as yet cannot be fully utilised. He, no less than others, strove to fit the facts into their place, but unlike many people, he was always ready to reconsider the grouping.

Amongst his many contributions to our knowledge of important problems of wide biological importance, special allusion may be perhaps made to a paper that appeared in the *Biologisches Centralblatt* about twelve years ago, in which he traced the effect of *Ustilago violacea* in causing the normally latent stamens in *Lychnis dioica* to develop within the female flower. In this paper are also detailed many experiments on the possibility of influencing the numerical ratio of the sexes in diœcious plants.

Limitations of space, however, quite forbid any attempt to do justice here to Strasburger's scientific work. That will be more appropriately dealt with in another place. It is rather of the man and of his personality that one would speak, even though briefly.

He was possessed of a singular charm of manner, which also makes itself felt in many of his writings. In controversy he was always a courteous opponent, and set in this respect an example which is unfortunately not always followed.

He attracted to his laboratory students from all parts of the world, and many who have studied at Bonn will recall the respectful affection in which the Geheimrath, as he was generally spoken of, was held. A country walk with him was a delight not easily forgotten; he would talk deeply and lucidly on many subjects—the philosophy of science and of politics, of art and of literature—and there was always abundant food for reflection in what he said.

In his later years Prof. Strasburger was an occasional visitor to this country, where he was always sure of a warm welcome from a wide circle of scientific *confrères*. He was a foreign member of the Royal and the Linnean Societies. His loss will be felt as a very real and a very personal one by those who were privileged to count him as a friend. J. B. F.

NOTES.

WE are asked to say that Lady Hooker will be grateful if any of her friends who possess letters written by her late husband, Sir Joseph Hooker, will lend them to her for the purposes of a biography which Messrs. Smith, Elder and Co. will publish. The letters, which should be forwarded to Lady Hooker at The Camp, Sunningdale, will be carefully returned.

IT is officially announced that Captain H. G. Lyons, F.R.S., has been appointed assistant director of the Science Museum, South Kensington.

D. STENQUIST, Frejgatan 69, Stockholm, Sweden, asks us to say that he will be glad to receive papers or unpublished observations of terrestrial magnetism and electricity, meteorological phenomena, and optical effects such as halos, luminous night-clouds, auroræ, &c., for the following dates:—1908, June 30 to July 1; 1909, September 25; 1910, May 19.

THE Albert medal of the Royal Society of Arts for the current year has been awarded by the council, with the approval of the president, H.R.H. the Duke of Connaught, to the Right Hon. Lord Strathcona and Mount Royal, G.C.M.G., F.R.S., for his services in improving the railway communications, developing the resources, and promoting the commerce and industry of Canada and other parts of the British Empire.

THE death is reported of Dr. W. McMichael Woodworth, assistant in the Harvard Museum of Comparative Zoology. He had been a member of the teaching staff of Harvard for more than twenty years. His researches were devoted chiefly to the study of worms. Dr. Woodworth was a close friend of the late Prof. Alexander Agassiz, whom he had accompanied on several of his explorations in Pacific islands.

IN the course of his address at the annual general meeting of the Linnean Society of New South Wales on March 27, the president, Mr. W. W. Froggart, reported that the fellowships endowment capital has increased to 40,000*l*. In response to the invitation of the council of the society for applications for two fellowships for the period 1912–13, Mr. E. F. Hallmann and Mr. A. B. Walkom have been appointed. Mr. Hallmann has selected zoology as his branch of study, and will devote his attention particularly to the further elucidation of the characters of the Monaxonellid sponges. Mr. Walkom has been appointed in geology, and will proceed to a detailed study of the stratigraphical relations of the Permo-Carboniferous areas of Australia and Tasmania, with special reference to the palæogeography of that period.

A CIRCULAR letter from Mr. R. T. A. Innes informs us that the Transvaal Observatory at Johannesburg is now renamed "The Union Observatory," and its activities will be mainly of an astronomical nature, but the first-order meteorological observations will be continued, and the observatory will also collect seismological data for the Union. The Natal Observatory at Durban has been closed, and the Cape Meteorological Commission dissolved. On April 1 a new Department of Meteorology was formed in Pretoria, which will embrace the meteorology of the four provinces of the Union (Cape Colony, Transvaal, Orange Free State, and Natal). In future, communications relating to meteorological affairs should be addressed to the Chief Meteorologist, Department of Irrigation, P.O. Box 399, Pretoria, Union of South

Africa, and for astronomical affairs to the Astronomer, Union Observatory, Johannesburg, Union of South Africa.

PROF. P. LENARD, professor of physics at the University of Heidelberg, celebrated his fiftieth birthday on June 7, the event being marked by great rejoicings among his present and past students. Prof. Lenard is best known by his fundamental researches on the kathode rays, in recognition of which he was elected Nobel laureate in 1905; but he has done a great amount of work of the first importance on other subjects, having, in particular, elucidated the various actions of ultra-violet light and the many phenomena of phosphorescence. His publications on the former have been recently augmented by a series of papers describing experiments carried out in collaboration with Dr. Ramsauer, in which the photo-electric action on gases and the chemical effects of the light were clearly distinguished, and attributed to definite groups of wave-lengths. The work on phosphorescence, begun in conjunction with Klatt, and since developed in great detail by Lenard and his students, has greatly added to our knowledge of the mechanism of emission of light by the atom. The new institute of physics now being constructed for Lenard at Heidelberg is rapidly nearing completion, and will put at his disposal greatly increased conveniences of laboratory equipment.

A REUTER message from New York reports that a steamer arrived at Seward (Alaska) on Sunday covered with volcanic dust from an eruption at Katmai, in the Aleutian Islands. It is stated by those on board that a steady stream of volcanic fragments and ash followed a terrific explosion, spreading over the countryside. The sun was obscured. Although the vessel was seventy miles distant, at four o'clock on Thursday afternoon complete darkness set in and ash fell in a thick layer on the decks. It is estimated that volcanic ash covers three hundred square miles of fertile country. According to a telegram from Seattle (Washington State) the volcanic disturbance is rendering wireless telegraphic communication with Kadiak, Rospberry, and Afognac, three of the most important islands of south-western Alaska, impossible.

SIR WILLIAM WILLCOCKS lectured before the Royal Geographical Society on June 10 on "The Garden of Eden and its Restoration," a title which will be easily understood as referring to the great work which he has been planning at the request of the Turkish Government—the regulation of the lower Euphrates and Tigris and the use of their waters to restore the former fertility of the territories through which they flow, the now desolate seat of some of the oldest known civilisations. He explained the difficulties of raging floods with which the ancient engineers had to contend, contrasting them with the regular and comparatively gentle rise of the Nile, and remarking that Egypt, where everything was made easy, "produced no world ideas." He placed the original home of the inhabitants of Sumer and Akkad in Arabia, close at hand. He described his discovery of a depression in the desert, containing Euphrates shells, just as the limits of the ancient lake Moeris are marked by Nile shells. He designed the Habbania escape to carry the overflow of the Euphrates into this depression. He also detailed schemes for the more difficult regulation of the Tigris, which the ancient engineers never completely effected, and showed that the delta of the two rivers, once the works were completed would be a richer agricultural region than Egypt or the Sudan, adding, among other proofs, comparative analyses of the soils in the three areas.

THE flight round London, the so-called "Aërial Derby," of eighty-one miles for a gold cup presented by *The Daily Mail*, and cash prizes of 250*l*., 100*l*., and 50*l*., given by Mr. Harold Barlow, took place without serious mishap on June 8. The starting and finishing points were the London Aërodrome at Hendon, and the course lay over Kempton Park, Esher, Purley, Purfleet, Epping, and High Barnet. Although fifteen machines had been entered, only seven went to the starting line, and only five completed the course. The official results were given as follows:—1st, G. Hamel (and passenger, Miss Trehawke Davies), 70-h.p. Gnome Blériot monoplane, time 1h. 38m. 46s.; 2nd, W. B. R. Moorhouse, 50-h.p. Gnome Radley-Moorhouse monoplane, time, 2h. 0m. 22s.; 3rd, J. Valentine, 50-h.p. Gnome Bristol monoplane, time, 2h. 26m. 39s. T. O. M. Sopwith, on a 70-h.p. Gnome Blériot monoplane, was the first to return, but was disqualified for having turned a considerable distance inside the Purley mark, having missed his course; P. Verrier, carrying a passenger on his 70-h.p. Renault M. Farman biplane, got lost in the clouds over Esher, and did not complete the course; S. V. Sippe (50-h.p. Gnome Hanriot monoplane) also missed his way; and M. Guillaux (45-h.p. Anzani Caudron monoplane) was robbed of the first prize by running out of petrol, and being compelled to descend only four miles from the finish. The outstanding features of the race were the awakening interest of the general public, who turned out in vast numbers all along the route, the extraordinary speed of a comparatively low-powered monoplane (the Caudron), showing very great efficiency in design; the fact that not a single British motor competed, the fact that the successful pilots steered more by the course indicated by the crowd of spectators than by maps and compass; and, finally, the urgent necessity for more delicate and precise instruments for aërial navigation. Methods for instantly determining the speed over land, the speed of the wind, and the amount of drift on an aëroplane have long been desired by the aviator, and until they are forthcoming it is impossible to reduce aërial navigation to an exact science.

THE President of the Local Government Board has authorised the following special researches to be paid for out of the annual grant voted by Parliament in aid of scientific investigations concerning the causes and processes of disease:—(1) Further investigations (*a*) as to the distribution of tubercle bacilli in children having died between the ages of two and ten years, and the special characteristics of such bacilli; and (*b*)

in collaboration with the general register office, on the incidence of different forms of tuberculosis in different parts of the country, according to age, sex, occupation, and other conditions. (2) A continuation of a research into the causes of premature arterial degeneration in man by Dr. F. W. Andrewes, of St. Bartholomew's Hospital. (3) A joint investigation into the virus of Poliomyelitis, by Drs. F. W. Andrewes and H. M. Gordon, of St. Bartholomew's Hospital. (4) A continuation of an investigation into the micro-organisms known as non-lactose fermenters occurring in the alimentary canal of infants, by Dr. C. J. Lewis, of Birmingham University, Dr. D. M. Alexander, of Liverpool University, and Dr. Graham-Smith, of Cambridge University. (5) A continuation of the investigation by Prof. Nuttall, of Cambridge University, on fleas and on the range of flight of the domestic and allied flies.

IN the twelfth Bulletin of the Bankfield Museum, Halifax, Messrs. H. P. Kendall and H. Ling Roth, the honorary curator, publish a catalogue of an interesting exhibition, now open, of prehistoric implements collected in the neighbourhood of the city. They are found under a layer of peat, associated with remains of the Bronze age. But the implements of that metal hitherto brought to light are small and fragmentary, and it is thus obvious that the age of stone overlapped that of bronze. The period assigned to these specimens is about 500 B.C. Some of the arrow-heads are fine examples of secondary chipping. Of special interest are the so-called "pygmy" flints, found in considerable numbers. Mr. Ling Roth dismisses the theory that these were fixed together in a handle and used like the implement found by Dr. Livingstone among the Makalolo for the destruction of the inner tissue of hides. While admitting that some of them may have been used for the purpose of tattooing, he urges that their great numbers show that this cannot have been their only object. Many uses may be conjectured for these curious implements, but no single explanation yet suggested accounts for their special forms.

THE proprietors of *The Bioscope* have promoted some educational kinematograph demonstrations which are given at Cinema House, 225 Oxford Street. That on medical subjects (June 5) included amœboid movements of leucocytes, trypanosomes and spirochætes in the blood, examination of the stomach under X-rays, and the life-history of the mosquito. The movements of the spirochætes and trypanosomes were vividly portrayed, and the study of the mosquito outlined in a few minutes the life of the insect. The movements of the larvæ and the effects of petroleum as a culicide were shown, and the final scene, the emergence of the perfect insect from the pupa, demonstrated the capabilities of the kinematograph for reproducing biological phenomena.

A COPY has been received of the report to the trustees of the Indian Museum on zoological and anthropological work undertaken during the Abor expedition of 1911–12, written by Mr. S. W. Kemp, the senior assistant superintendent of the museum. Reference has already been made in these columns (June 6, p. 365), in our report of the meeting of May 1 last of the Asiatic Society of Bengal, to two papers upon specimens collected during the expedition, and other papers will no doubt be presented to the same society shortly. The report just received gives a brief account of what was accomplished by Mr. Kemp as zoologist and anthropologist to the expedition, and by his assistant, Mr. R. Hodgart, the zoological collector in the Indian Museum.

A SATISFACTORY year's work and progress are recorded in the report of the Zoological Society of Philadelphia for 1911, the receipts from admissions having shown a considerable increase over those of 1910, despite an unfavourable winter and an unusually large number of wet Sundays in the summer. Attention is directed to the increasing cost and difficulty of obtaining living specimens of representative wild animals, due, it is surmised, in great part to diminished supply, protection of faunas, and restrictions on importations of livestock of all kinds. Further experiments in outdoor life for monkeys and carnivores were successfully instituted.

IN the concluding portion of the report of Prof. H. F. Osborn's Harvey lecture, published in the May number of *The American Naturalist*, it is argued that the occurrence of discontinuity in heredity in three widely sundered families of mammals is not to be regarded as evidence of discontinuity of origin. If discontinuities in origin do exist, they must be so minute as to be indistinguishable from those fluctuations round a mean which appear to accompany every stage in the evolution and ontogeny of unit characters. The principle of predetermination, of which the author finds evidence, is in direct opposition to the views of Bateson, de Vries, and Johannsen, and there seems to be "an unknown law operating in the genesis of many new characters and entirely distinct from any form of indirect law which would spring out of the selection of the lawful from the lawless."

IN the course of the above-quoted Harvey lecture, Prof. Osborn records some very interesting comparisons between the skulls and cheek-teeth of horses, mules, and asses. The tendency of these is to confirm the view that the mule is generally only a partial blend of the characteristics of its parents, most of its features inclining to one or the other type. In skull-characters mules assimilate in the main to horses (which are a polyphyletic type), whereas in the pattern of their cheek-teeth, as well as in external features and disposition, they are more like the monophyletic ass, thus showing that the ass-like characters are displayed by epiblastic structures. Several of the horse-like features recorded by the author as occurring in the mule are, it may be observed, much less apparent in the wild Mongolian tarpan than in domesticated horses, thus suggesting that they are derived from an Arab source.

IN the Bulletin of the St. Petersburg Botanical Garden (xii., 1), Dr. V. Arcichovskij describes various objects—some well known, others new—

which are suitable for the study of the anatomy of plants with the naked eye. Teachers of botany know that a good deal of "histology" can be done without the aid of the microscope if suitable material be selected, as, for instance, the stems of cucumber, marrow, balsam, or begonia, in which the cells and vessels are readily seen. The author gives measurements of the large parenchyma cells in the stems of these and other plants, but the largest sizes are apparently attained in the leaves of various succulents, such as Echeveria, Kleinia, Crassula, and Aloe. The nucleus can be seen with a lens magnifying ten diameters, or even with the naked eye, in the cells of the arbutus fruit; the protoplasmic streaming in the elongated cells of the stonewort Nitella is readily observed in the same way. The leaves of various conifers and succulents show the distribution of the stomata well without microscopic aid, especially after the waxy 'bloom" has been removed.

THE last number of the *Bollettino* of the Italian Seismological Society (vol. xv., No. 12) is devoted to notices of the earthquakes recorded in Italy towards the close of 1908. The interest of these notices naturally centres in the Messina earthquake of December 28. The present number contains a summary of all the instrumental records, the personal observations, which are very numerous, being reserved for one of the special *Annali* to be issued shortly by the Meteorological and Geodynamic Office of Rome. As a rule, the instrumental records in all parts of the country are incomplete, seismographs having been thrown out of action by the violence of the shock, or the writing-pens swung off the drums or caught by some other part of the apparatus. For so strong an earthquake, the recorded after-shocks are few in number, but this, it is suggested, may be due to the fact that they were practically confined to the most strongly shaken regions, and therefore escaped registration owing to the want of observers.

THE "New Method of Weather Forecasting," published by M. G. Guilbert (Paris, 1909), has again been brought to the special notice of meteorologists by the publication of a critical study of the question by Heer P. H. Gallé in the *Mededeelingen* of the Royal Netherlands' Meteorological Institute (No. 12, 1912). Guilbert's rules depend upon three principal ideas:—(1) normal wind; (2) region of least resistance; and (3) convergent (or divergent) winds. Our readers will find a very lucid statement of the method by one of our leading meteorologists in NATURE, vol. lxxxii., p. 271 (1910). It is there explained, *e.g.*, that, after a careful scrutiny of the daily weather charts, Guilbert found that if the wind force is in excess of the normal for the gradient, a surge of high pressure in the direction of the gradient may be expected, and *vice versâ*, and that any wind which has a component directed away from a centre of low pressure marks a region of low resistance to its advance. Heer Gallé applied these principles to the prediction of the chief meteorological elements for various districts, and has given the results for each case. The general conclusion arrived at is that while the method in question may not be expected to revolutionise the meteorological service, it may promote the progress of weather prediction and, especially, may lead to an improvement of storm warnings.

AN important article on "Modern Uses of the Metal Aluminium," by Dr. R. Seligman, appears in the April issue of *Science Progress*. The sudden demand for the metal in 1905 was due to the requirements of the motor-car industry; but as additional supplies were not forthcoming sufficiently quickly, the industry turned to the use of thin steel sheets and frames of special steels, which were often found actually to be lighter than aluminium parts of equal strength. The increase of output from 9000 tons in 1905 to 34,000 tons in 1910 resulted in a fall in price to about one-half, and brought back a certain amount of the earlier demand for aluminium in motor-car work. But other uses were required to consume the enlarged supply, and in this country a very important outlet has resulted from the discovery of methods whereby, with the help of a special flux, sheets of aluminium may be fused together without the use of any extraneous solder. Vessels made in this way are of special value for chemical industries, and most of all in those involved in the manipulation of food materials. The metal is not only entirely non-poisonous, but resists corrosion in a way that is in many respects remarkable, and has the further advantage that it imparts no coloration to the materials in contact with it. In the brewing industry, fermenting tanks up to 30,000 gallons have been constructed, and pressure vessels for fermenting up to 45 lb. per square inch have been made of 1800 gallons' capacity; the metal has here the special advantage that it can easily be kept clean from bacteria, and is as innocuous to yeast as it is to the human stomach.

IN studying the hydrolysis of salicin by emulsin, MM. Bourquelot and Bridel have been able to show that the action goes on in strong alcoholic solutions, but that the hydrolysing action stops when about a half of the salicin has been acted upon. It seemed possible that this might be a reversible reaction, and in the *Comptes rendus* for May 20 they describe an attempt to synthesise salicin from saligenin and glucose by the action of emulsin in alcoholic solution. The change was followed by measuring the changes in the rotatory power of the solution, and after twenty-four days the optical properties of the liquid were exactly those which would be expected for the equilibrium with 55 per cent. of salicin. But in spite of this coincidence the glucoside formed was found, after extraction and purification, to be different from salicin. This shows that conclusions previously drawn as to the reversible action of emulsin are unsound.

AN exhaust-gas calorimeter for internal-combustion engines, in use at Glasgow University, is described by Messrs. Nicholson and Morley in *Engineering* for May 31. The principle of the apparatus lies in the transfer of heat from the exhaust gases into a water

jacket surrounding the exhaust pipe. To ensure rapid cooling, the exhaust gases are led through Serve tubes. The water jacket is formed by the space between the Serve tube and an external tube of slightly greater diameter; the annular space is kept small in order to obtain a high velocity of flow in the circulating water. Thermometers are inserted in suitably packed pockets. The whole apparatus is exceedingly simple and inexpensive to construct, being built up of standard pipe fittings, and should prove a useful addition to the testing appliances of an engineering laboratory or of a works' test plate; the otherwise troublesome operation of determining the heat wasted in the exhaust gases may be easily performed by its use.

We learn from *The Engineer* for June 7 that rapid progress is being made with the leviathan dock at Liverpool, and that it is hoped to complete the work in the summer of 1913. This dock is 1020 ft. long —nearly 140 ft. longer than the *Olympic*—and has an entrance 120 ft. wide. The structure of the dock is to be such that it will be available when required as a graving dock for overhauling and repairing the largest steamers likely to be met with for some years. The entrance will be provided with a sliding caisson having a clapping face on each side, so as to maintain the water in the dock or exclude it therefrom according to the duty required. The caisson is 134 ft. in width. The dock walls are 60 ft. high, and are practically complete. For emptying the dock, five sets of centrifugal pumps with Diesel engines will be installed. These will be capable of emptying the contents of the dock, amounting to about seven million cubic feet of water, in two and a half hours.

Several new editions of scientific works have been received recently. These include a second edition of Prof. A. G. Webster's "The Dynamics of Particles and of Rigid, Elastic, and Fluid Bodies," published by Mr. B. G. Teubner, of Leipzig, and Messrs. Williams and Norgate, in London, at the price of 14*s.* net. This edition is substantially identical with the first, except that a few errors have been corrected. —A second edition of Prof. E. C. C. Baly's "Spectroscopy" has been issued by Messrs. Longmans, Green and Co., at the price of 12*s.* 6*d.* In it Prof. Baly has given a *résumé* of the salient points of the more modern work, and has provided useful lists of references.—Messrs. Hazell, Watson and Viney, Ltd., have issued a ninth edition of "The Dictionary of Photography," by Mr. E. J. Wall, which has been edited by Mr. F. J. Mortimer. The book has been completely revised and brought up to date, and nearly a hundred pages of new matter have been added. The price of the new edition is 7*s.* 6*d.* net.—A sixth edition of Miss M. N. Oxford's "Handbook of Nursing" has been published by Messrs. Methuen and Co., Ltd., at the price of 3*s.* 6*d.* net. This work has been entirely revised, and in the work of revision the author has had considerable expert assistance.—From the same publishers we have received a copy of the ninth edition of Sir Oliver Lodge's "Man and the Universe," which can now be obtained at 1*s.* net.

OUR ASTRONOMICAL COLUMN.

Nova Geminorum No. 2.—The more salient features of two series of spectrograms taken at the Pulkowa Observatory (March 15–18 and March 25 and 26) are described by Dr. Tikhoff in No. 2, vol. v., of the *Mitteilungen* of that observatory. The scale was small, 6·3 mm. from Hβ to Hε, but the negatives clearly disclose the extraordinary changes which took place in the spectrum of the nova. By employing different plates and filters, Dr. Tikhoff secured negatives giving the whole spectrum from Hα to Hη, and he states that on March 15 the characteristic feature was a series of intense absorption lines, both broad and narrow, the bright lines being but little brighter than the intense continuous spectrum. He classifies the spectrum as lying between types F and G. On March 16 the continuous spectrum generally had diminished considerably in brightness, except in the ultra-violet, where it was brighter and extended to about λ3600; the absorption bands of hydrogen were scarcely visible on this date, although H and K were very strong and the bright bands of hydrogen very intense. The striking features on March 25 were the reappearance of the absorption bands and the strong continuous spectrum.

During the two periods of observation two analogous series of changes occurred in the spectrum, such as might be produced, Dr. Tikhoff imagines, by the shattering of successive absorbing envelopes by fresh outbreaks of incandescent gases from the central mass.

Prof. Belopolsky, in the same *Mitteilungen*, gives, in great detail, the measures of the structure of the various H, Ca, He, and N (?) lines, from which he deduces the radial velocities and possible physical conditions of the emitting masses.

The Minor Planet 1911 MT.—From a note in *The Observatory* (No. 449, p. 243) we learn that the elements for the orbit of the exceedingly interesting asteroid 1911 MT., calculated by Messrs Haynes and Pitman, are, as shown by the observations, fairly accurate. The planet has a period of about 2·6 years, while its perihelion distance is about the same, 1·15, as that of Eros, but the eccentricity of the orbit is nearly twice as great. The next opposition will take place in March, 1913, but the planet's magnitude will then be 17 or 18; most of the oppositions take place when the planet is near aphelion, and are therefore unfavourable for observation. According to amended elements published by Prof. Franz, in No. 4575 of the *Astronomische Nachrichten*, the orbit is like that of Eros, but the planet approaches even nearer the earth than does the famous object discovered by de Witt.

The Spectrum of P Cygni.—Discovered by Janson in 1600 and observed as a third-magnitude star, by Cassini, for a short period in 1655, the star P Cygni has for more than 230 years remained at nearly constant magnitude, 5·0, and its spectrum still requires adequate explanation. Prof. Frost, dealing with it in a paper published in No. 4, vol. xxxv., of *The Astrophysical Journal*, offers some interesting points for consideration.

Among other things he finds that in recent years the spectrum has remained practically constant, that the apparently large displacements of the dark companions to the bright lines are spurious, being produced by the obscuration of their less refrangible portions by the bright lines, and that there is a difference of 70 kms. between the radial velocities of the dark- and bright-line systems. The lines of H, He, O, and N are represented both as emission and absorption, while Ca and Si present dark lines only;

there are numerous bright and dark lines as yet unidentified. The spectrum somewhat resembles those of novæ in the early stages, but the lines are narrower, and the enhanced lines, such a prominent feature in what has been called the "typical" nova spectrum, are comparatively few. From the dark silicon lines Prof. Frost finds a practically constant radial velocity of −82 kms., which is, however, not shared by the narrow, dark calcium line at K. Mr. Merrill has found bright companions to the silicon lines on spectrograms taken at the Lick Observatory, so that Prof. Frost's value of −82 kms. may prove to be too large. If hydrogen and helium radiations behave under pressure like those of metallic vapours, the observed displacements would indicate a pressure of something like 200 atmospheres in the emitting mass, with normal pressures in the absorbing layers.

SECONDARY OSCILLATIONS IN RADIAL-VELOCITY CURVES.—In quite a number of cases the velocity curves derived from the spectroscopic examination of binary systems have shown a secondary oscillation suggesting a departure of the orbit from the true elliptical form, such as might be caused by the presence of a third body, but some doubt has always remained as to the objective reality of such departures.

In an attempt to settle this question, Dr. Schlesinger studied the spectrograms of 30 H Ursæ Majoris, especially taken on fine-grained plates; this star has provided a typical example of the secondary oscillation. He found that the sharp K line did not exhibit this peculiarity, and concludes that the secondary oscillation is only apparent. Possibly the inherent difficulty of measuring the broader hydrogen lines introduces a systematic error which has been insufficiently reckoned for when apportioning the weights to the various measures (Publications of the Allegheny Observatory, Nos. 15 and 16, vol. ii.).

CONGRESS OF UNIVERSITIES OF THE EMPIRE.

IT is surprising to learn that the Empire boasts, at the present moment, fifty-four seats of higher education entitled by Charter or by Act of a Colonial Legislature to the style of university. Advisedly we write, at the present moment. Last summer Queensland and Hong Kong added two to the list; the University of Western Australia came into being on January 1; those of Calgary and British Columbia are still younger. It is the age of universities. When the Victorian Universities of Manchester, Birmingham, Liverpool, and Leeds made their appearance they were viewed with considerable misgiving from Oxford and Cambridge. The older universities feared lest they should suffer severely from the competition. The number of their students and their efficiency have increased as rapidly as their rivals'.

British universities, whether at home or overseas, have developed in every case along natural lines. None has been planted in a community by the State or by a wealthy benefactor, fully equipped and staffed. Each has commenced its embryonic life as a college—the beginnings of the ancient universities can be but dimly discerned—and has passed through a larval stage as a university college before it received its degree-giving powers. In its adult form it has adapted itself with remarkable ingenuity to its particular environment. As compared with those of the Continent and of America, British universities are characterised by their idiosyncrasies. Very justly, they are extremely jealous of State interference with its inevitable tendency towards uniformity of pattern.

If this capacity of adaptation be the genius of our universities, if each must work out its own constitution, define its aims, devise methods proper to its sphere of work, "Why," it may be asked, "summon the universities in parliament?" This question may be answered, if on no higher ground, by assuming that the discussions of their delegates will make for economy of time and labour. Underlying their diversities, there is much that is common to all seats of learning. Conference and comparison of experience will clear the mind of many misapprehensions, and, focussing attention upon matters of immediate importance, will reveal the way in which difficulties have been or may be dealt with. Every teacher who takes an active share in academic life groans under the intolerable burden of "university business." Time and thought which might be devoted to research are absorbed on a lavish scale in the drudgery of keeping the university machine up to date, mending and modifying, not driving it. If a man-hour be taken as the unit, fifty units of intellectual energy wasted daily is a moderate estimate for one of the larger universities. It may be predicted that during the four days' session of the congress some progress will be made towards settling policies which would take a longer time to formulate if considered by each university as a problem peculiar to itself.

There are many forms of academic activity which, for their effective promotion, demand cooperation. For some the discovery of a common path is needed; others require that the several universities agree to diverge. The ever-present question of a satisfactory test of fitness for admission is an illustration of the former class of problems. At what stage of training should a lad be allowed to follow special studies? How are we to ascertain whether the gymnastic of the school has rendered his mind sufficiently strong and agile? When may he cross the frontier which separates school from university? The congress will endeavour to delimit the adjoining provinces, and incidentally to introduce a scientific boundary line—to agree upon a parallel which may be crossed at any point. Schoolmasters will be very grateful if it simplifies their task, reducing in some degree the complexity of the arrangements necessary for the teaching of their higher forms. Their work is confused at present by the bewildering variety of entrance tests for the different universities, the professions, and the public services.

As an illustration of the subjects of the second category proposed for discussion, we may cite "specialisation among universities." It is impossible, nowadays, to make adequate provision for advanced work in all subjects at any single institution. Some tendency to specialise is the characteristic mark of every vigorous university. Uniform distribution of effort is proof of mediocrity. It is unmistakable evidence of the absence of any teacher whose fame attracts students, whose learning fits him to be leader of a School. Universities which have teachers of renown concentrate, almost unconsciously, upon the branches of study which they represent. Local surroundings also point the way to specialisation. It is eminently desirable that universities should foster the sciences upon which depend the industries of the districts which they serve. Specialisation at once raises a further question. It is in the interests of scholarship that a senior student should find his way made easy to a university of high repute in the subject of his choice. Every inducement should be held out to him to seek a famous School. Free trade in students ought to be a governing principle of the Empire. Yet many artificial barriers still remain. However undesirable it may be that undergraduate

life should be interrupted during its earlier years, there is an urgent demand on the part of students for greater facilities of migration. In this brief article we can but give examples of the kind of subjects put down for discussion, but those to which we have referred will suffice to illustrate the thought which has guided the committee in their selection. All the items on the agenda paper are such as will lead to decisions which may issue in practical results.

A congress of this magnitude could not be organised without long and laborious preparation. Two years have elapsed since the Colonies were first consulted. Preliminary conferences were held in Canada and in Australia last summer, and in Delhi just before the Durbar. The subjects proposed for discussion by the several universities of the United Kingdom and of the Empire overseas were considered by the committee early in the autumn. The paper of agenda was drawn up in November. All the universities have sent in returns of information regarding their regulations and customs so far as these are relevant to the subjects to be discussed. Speakers will be in no uncertainty as to matters of fact.

The importance attached to the congress is indicated by the names of those who have promised to take part in it. There are absolutely no gaps in the list. All the Chancellors and Lord Rectors of the home universities are members of the general London committee. The executive committee consists of the Vice-Chancellors. The chairmen of its several sessions will be: Lord Rosebery, Chancellor of London and Glasgow; Lord Curzon, Chancellor of Oxford; Lord Rayleigh, Chancellor of Cambridge; Lord Strathcona, Chancellor of McGill and Aberdeen; Mr. Arthur Balfour, Chancellor of Edinburgh; Lord Haldane, Chancellor of Bristol. We shall take the opportunity of giving the names of invited speakers and readers of papers at a later date. Delegates will be received in the Marble Hall of the University of London by H.R.H. Prince Arthur of Connaught, president of the general London committee, on Tuesday, July 2.

In addition to the delegates and representative members nominated by the various universities, associate members, whose names are approved by the committee, will be admitted on payment of a fee of 10*s.* 6*d.* They will receive the report, and will be invited to certain entertainments offered to the members of the congress, but will not be entitled to take part in its discussions. Further information can be obtained from the secretary, Dr. Alex Hill, at the Congress Office, University of London.

THE NATIONAL PHYSICAL LABORATORY.[1]

VOL. VIII. of the Collected Researches of the National Physical Laboratory maintains the high standard we have learnt to expect in the publications issuing from our national scientific consultants. It is almost impossible to omit mentioning any one of the thirteen memoirs which the volume contains without feeling that an injustice has been done to a research of great interest.

In the standards department Dr. Kaye has constructed a standard meter of silica which by its low coefficient of expansion seems specially adapted for such a purpose. Advantage has been taken of the setting up of the Blythswood dividing engine in the laboratory to secure photographs of the various parts, and these add materially to the interest of the description of the instrument contributed by Mr. Scoble. Every spectroscopist will join with Dr. Glazebrook in the hope that at no very distant date Lord Blythswood's engine will be turning out diffraction gratings free from periodic error.

The research on the alloys of aluminium and zinc carried out by Dr. Rosenhain and Mr. Archbutt under the auspices of the Alloys Committee of the Institution of Mechanical Engineers proves that these alloys are much more complex than has been previously supposed. Mr. Batson's work on the mechanical properties of hard-drawn copper and bronze wires for the Engineering Standards Committee shows that the uniformity obtained in modern manufacture is such that tests on specimens a few inches long agree with those on lengths of 50 ft.

Dr. Stanton breaks new ground in his measurements of the shearing stress in the flow of air through pipes with speeds which render the motion turbulent or eddying, and the frictional resistance at the surface proportional to the square of the velocity.

At the request of the Wiring Rules Committee of the Institution of Electrical Engineers, Messrs. Melsom and Booth have investigated the rise in temperature of electric cables of different sizes and types when transmitting current. They find that the currents allowed by the 1907 wiring rules of the institution give rises of temperature of much less than 20° F. for cables under 0·05 square in. in section and more than 30° F. for 1 square in. cables. According to the tests made by Messrs. Paterson and Kinnes on instruments sent on long railway and road journeys, watt hour meters of the induction type can be relied on to remain constant to within 0·5 per cent. The report by Messrs. Campbell, Booth and Dye on the results of tests of five samples of magnetic sheet iron and steel made in the first place at the laboratory, then at the Reichsanstalt at Charlottenburg and at the Bureau of Standards at Washington, and then again at the laboratory, shows that the methods now in use at the various laboratories give results which are in close agreement.

The methods and apparatus used in testing the flash points of petroleums have received a thorough investigation at the hands of Dr. Harker and Mr. Higgins, who conclude that the temperature which determines the flash is not that of the bulk of the oil as indicated by the thermometer, but that of the oil and vapour interface which is not measured. It is hoped that the further work on the subject in contemplation will lead to a marked increase in the value of flash-point determinations. The report on the equipment of the Froude national tank by the superintendent, Mr. Baker, shows that it is now in order, and that preliminary runs have been made.

One cannot close the volume without realising how important the work carried out at the laboratory must be for the future of many of our industries. It seems now almost incredible that those industries were without such a national institution until the beginning of the present century. C. H. LEES.

[1] "Collected Researches of the National Physical Laboratory." Vol. viii. Pp. iv+251. (1912.)

THE ETIOLOGY OF KALA-AZAR.

ON March 27 of this year Captain W. S. Patton, I.M.S., gave a university lecture at the Senate House, Madras, on his investigations into the etiology of kala-azar. His Excellency Lord Carmichael, Chancellor of the University, presided, and there was a large audience of fellows and graduates. Captain Patton first directed attention to the deadly nature of kala-azar, and pointed out that little at present was known regarding the extent of the disease either in Madras or in the Presidency. He

referred to the brilliant discovery of the parasite by Sir Wm. Leishman, R.A.M.C., and of the discovery of the flagellate stage by Major Rogers, I.M.S. It was at this stage of our knowledge of the parasite that, the lecturer said, he began his experimental work in 1905, and a detailed description was then given of how this problem was attacked, and the results which have followed this work during the last seven years. There were two main theories as to how the parasite leaves man's body in order to undergo its extracorporeal flagellate stage. Sir Patrick Manson had suggested that the parasite was discharged from ulcerated surfaces, either cutaneous or intestinal, and that it was then ingested by some foul-feeding fly. Against this hypothesis, however, was the fact that the parasite would not flagellate in any medium containing bacteria. Two years ago the lecturer had fed a large number of bred house-flies (*Musca nebulo*) on fresh splenic juice, and had found that the parasite disappeared from the alimentary tract of the fly in a few hours; it was difficult, then, to understand how the parasite could be transmitted in this way.

The other hypothesis, first advanced by Major Rogers, and later by Major Christophers, was that the parasite was ingested by some blood-sucking insect. In order, however, for this to take place it was necessary for the parasite to be present in the circulating blood of an infected person. Colonel Donovan, I.M.S., Major Christophers, I.M.S., and the lecturer had no difficulty in finding the parasite in the circulating blood of practically every case of kala-azar. The lecturer also pointed out in 1907 that in certain stages of the disease, namely, severe dysenteric attacks, the parasite could be found in large numbers in a drop of finger blood. Captain Patton then went on to describe how he fed *Pediculus capitis*, *P. vestimenti*, *Culex fatigans*, *Neocellia stephensi*, *Stegomyia sugens*, and *Ornithodorus savignyi* on cases of kala-azar in the peripheral blood of which there was a large number of parasites, but was unable to observe any developmental changes undergone by the parasite in these insects. He next described his feeding experiments with the Indian bed-bug *Cimex rotundatus*, and pointed out that he was able to trace the parasite from its unchanged state in a leucocyte in the stomach of the bug up to the formation of the mature flagellate stage. In twelve bugs which had only fed once on a patient, and which were all dissected by the fifth day, he was able to confirm these earlier observations. As he was then unaware of the probable final stages in the development of the parasite, the bugs were not kept long enough. The failure to obtain a massive infection with the bug when fed on a case in the peripheral blood of which there were immense numbers of parasites was extremely disappointing, and it was felt that there was some factor in connection with the development of the parasite in the bug which had yet to be discovered. Assuming that kala-azar is an insect-borne disease, it is a remarkable fact that it has scarcely, if at all, spread outside Madras. In order to explain this curious epidemiological truth, Captain Patton came to the conclusion that, in addition to the small number of parasites which are found in the peripheral blood in the majority of cases, there was some natural obstacle which came in the way of the parasite completing its life-history in the bug. Further work on kala-azar was then abandoned, and the study of insect flagellates of the genus Herpetomonas taken up. As a result of these studies, Captain Patton was able to show not only how several insects containing these flagellates became infected, but also pointed out that they had three phases in their life-histories—pre-flagellate, flagellate, and post-flagellate—and that in the majority of instances insects become infected by ingesting the post-flagellate stage. He then gave a detailed description of the life-history of *Herpetomonas muscae-domesticae* and *H. culicis*. As a result of this work he came to the conclusion that the parasite of kala-azar, in order to be transmitted to man, must pass back to its post-flagellate stage. He directed attention to the fact that almost every blood-sucking insect was infected with these natural flagellates, and that in order to investigate the kala-azar problem it is imperative for the observer to have first-hand knowledge of these insectan forms. Further, by studying *H. culicis*, he found that blood had an injurious effect on the flagellate stage of the parasite, and this has led to the remarkable discovery that if a bug contains the flagellate stage of the parasite of kala-azar, this stage is destroyed within twelve hours when the bug again feeds, either on man or on a monkey. He further found that if the bug, which contains flagellate stages, is not fed again, the parasites by the eighth, ninth, and tenth days pass on to their post-flagellate stage, and finally round up in the stomach of the bug by the twelfth day. His previous failures to find a massive infection in the bug or to observe the rounding up of the parasite were obviously due to the bugs having been repeatedly fed, and not being kept long enough after their last feed.

This observation is of extreme importance, because if we are to attempt to try and infect a susceptible animal by means of the bug, it would be futile to feed infected bugs on the animal before the post-flagellate stage had been formed. Captain Patton believes that the destruction of the flagellate stage of the parasite by fresh blood is the natural obstacle referred to above. It would at present appear that the bug only becomes infected when it feeds on a case in the peripheral blood of which there are a large number of parasites, and it can only become infective if the interval noted above is obtained for the parasite to complete its development.

Captain Patton then gave a short description of his recent work on Oriental sore in Cambay, and stated that he had only succeeded in obtaining the development of the parasite in the bed-bug. He believed that his failures to transmit this parasite to man by the bite of the bug were due to the fact that the bugs used in the experiments were repeatedly fed, and that an interval for the parasite to complete its development was not allowed. He was at present carrying out further transmission experiments with the parasite of Oriental sore, and he hoped, in the light of his recent discoveries, to transmit this parasite by the bite of the bed-bug.

He fully realised that the conclusive proof that the bed-bug is the transmitter of the parasite of kala-azar was still wanting. Unfortunately, at present it is impossible to infect any known animal with this parasite; he would therefore ask those who would be ready to criticise his work to exercise still further patience. The investigation of the problem of the method of transmission of the parasite of kala-azar bristles with difficulties, but he believed that a distinct advance in the right direction had now been made. He was at the present time repeating all his experiments with blood-sucking insects by feeding them once on a case of kala-azar in the peripheral blood of which there were large numbers of parasites, so that all the different kinds of insects utilised would certainly ingest many parasites. He hoped in this way conclusively to prove that the parasite will only develop in the bed-bug. He had in this way

already utilised *Conorhinus rubrofasciatus*, and had found that the parasite, after being ingested by this bug, degenerated. Further, an exhaustive attempt was being made to find whether kala-azar existed in dogs in Madras, and a long series of experiments by inoculating dogs and many other animals would be carried out at the first opportunity in order to find a susceptible animal.

Captain Patton then shortly referred to the human and canine forms of kala-azar which occurred along the Mediterranean littoral. He very much doubted whether the human form was of canine origin, and that the dog-flea or human flea transmitted the parasite. The flagellates found in human and dog-fleas in Italy and elsewhere were unquestionably natural flagellates of the fleas, for he had found identical Herpetomonads in the dog-fleas in Madras. He had studied these parasites, and knew that the flea became infected in its *larval* stage, so that no precautions had been taken by other observers to exclude these parasites. He was aware that one observer claims to have transmitted the parasite of canine kala-azar by the dog-flea, but these experiments were lacking in precision, and certainly required confirmation. Even though it may eventually be found that the parasite was transmitted by the dog-flea, there was no proof whatever that the human parasite would be transmitted by the human flea. He also doubted whether the recent observations of the development of the human parasite in mosquitoes were accurate, for the two mosquitoes which were utilised, namely, *Anopheles maculipennis* and *Stegomyia fasciata*, were known to be infected in Europe with natural flagellates.

In conclusion, Captain Patton believed that the parasite of kala-azar had once been a natural flagellate of the bed-bug, and that as this insect had altered its habits from being a plant-feeder to a blood-sucker, the life-history of the parasite had been so modified that the post-flagellate stage had become transferred to the host of the bug, in whom it had become the pre-flagellate stage. In support of this view there was the fact that human blood was at the present day *unsuitable* for the flagellate stage of the parasite in the bug. He shortly referred to *Conorhinus rubrofasciatus*, which was at the present day becoming sanguivorous, like its ally, *C. megistus*, which is now entirely a blood-sucking insect. *C. rubrofasciatus* in Madras was known to be infected with a species of Crithidia, and it seemed probable that the life-history of the parasite may in course of time be so modified that it will become transferred to the host of this bug.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Public Orator, Sir John Sandys, spoke as follows on June 6 in presenting Major Leonard Darwin for the degree of Doctor of Science *honoris causâ* :—

Salutamus patris illustris filium, fratrum insignium fratrem dignissimum, Societatis illius perquam idoneum praesidem, quae populum totum in illis omnibus rebus educandum curat quae nomine novo εὐγενικὰ nuncupantur. Salutamus Regiae Societatis Geographicae praesidem emeritum, qui a Societate illa nominatus studiorum geographicorum concilio nostro iam dudum profuit. Olim in exercitu Britannico scientiae machinalis peritissimus, etiam itineribus longinquis scientiarum causa interfuit, et planetam Venerem praesertim solis orbem transeuntem, primum abhinc annos duodequadraginta, deinde abhinc annos triginta, patria procul observavit. Senatui Britannico per triennium adscriptus, diuque scientiae oeconomicae deditus, et libero de commercio et municipiorum de commercio luculenter disputavit; idem, velut iudex aequus, illorum sententiam exposuit, qui non unius tantum metalli sed auri atque argenti e valore monetae mensuram petendam putant. Quot gentium leges monetales subtiliter examinavit; quot orbis terrarum in partibus impigre peregrinatus est; quot scientiarum provincias inter se diversas feliciter peragravit!

Duco ad vos virum ingenio perquam versatili praeditum, virum et suo et fratrum suorum Cantabrigiensium nomine nobis acceptissimum, Leonardum Darwin.

The General Board of Studies have reappointed A. Henry, of Gonville and Caius College, as reader in forestry; Dr. Myers as lecturer in experimental psychology; Dr. Nicholson as lecturer in Persian; W. H. R. Rivers, of St. John's College, as lecturer in physiology of the senses; and R. P. Gregory, of St. John's College, as lecturer in botany. Approved by the General Board of Studies for the degree of doctor of science, Francis Hugh Adam Marshall, of Christ's College. The General Board of Studies have appointed G. Udny Yule as University lecturer in statistics for five years from October 1, 1912, until September 30, 1917, and this appointment has been confirmed by the Special Board for Economics and Politics. The electors to the Sandars readership in bibliography, palæography, &c., have appointed Dr. Greg, librarian of Trinity College, to be Sandars reader for the year 1913. The Forestry Committee are prepared to appoint an adviser in forestry, whose duties will commence on October 1, 1912. The appointment will be for three years. The chief duty of the adviser will be to supply to landowners and others, in a group of counties in the east of England, advice on the management of their woods and plantations. He will also be required to study in detail local conditions in all matters pertaining to forestry. Applications should be sent to the secretary of the Forestry Committee, School of Agriculture, Cambridge, to arrive not later than July 31, 1912.

OXFORD.—A decree will be proposed in Convocation on June 18, authorising the Vice-Chancellor to apply, on behalf of the University, to the Board of Agriculture and Fisheries for a grant of 300*l.* a year for the expenses of agricultural research relating to the soils of Oxfordshire and parts of the adjacent counties, to be conducted in the School of Rural Economy under the direction of the Sibthorpian professor (Prof. W. Somerville). On the same day a decree will be submitted to Congregation, authorising the curators of the University chest to receive a sum of 900*l.*, which has been offered by the Development Commissioners through the Board of Agriculture and Fisheries, to be applied under the direction of the Committee of Rural Economy in aid of investigation into the economics of agriculture; and to provide from the resources of the University a sum of 300*l.* a year for each of the three years from October 1, 1913, for the same purpose, if the Development Commissioners shall in each of the same years, according to their offer, make to the University a grant of not less than 600*l.* towards the same object. Prof. Karl Pearson, F.R.S., having declined it, the Weldon Memorial Prize for 1912 has been awarded by the electors to Dr. David Heron.

LONDON.—Mr. W. J. Dakin, assistant lecturer and demonstrator in zoology in the University of Liverpool, has been appointed senior assistant in the department of zoology and comparative anatomy at University College.

THE former students of Prof. O. Henrici, F.R.S., who, as already announced in these columns, recently retired from the chair of mathematics at the City and Guilds Engineering College after twenty-seven years' service, have had engraved in his honour a medal to be awarded annually for proficiency in mathematics. The first copy of the medal struck has been presented to Prof. Henrici himself.

THE Department of Agriculture and Technical Instruction for Ireland has issued its programme for technical schools and science and art schools and classes for the coming session of 1912–13. An explanatory circular included in the pamphlet makes it clear that the regulations at present in force will continue with certain slight alterations. An outline syllabus of domestic economy which has been added will be of service to teachers as indicating what may be considered matters of fundamental importance in the early teaching of "home" science. Many of the changes incorporated in the new programme are purely of an administrative character.

THE late Sir Julius Wernher bequeathed several legacies for the purposes of higher education. These include 250,000*l.* to the Treasurer of the Union of South Africa, as a gift to such Union for the purpose of assisting in building, and, if sufficient, partly endowing, a university at Groote Schuur, near Cape Town, provided that the constitution of the said university is approved in writing by Sir Leander Starr Jameson, Bart., and Sir Lionel Phillips, Bart.; 100,000*l.* to the Imperial College of Science and Technology, South Kensington, to be used at the discretion of the governing body for the purposes of the said college, together with two-twelfth parts of his residuary estate, but not exceeding 50,000*l.*

THE Commemoration Day proceedings of Livingstone College were held on June 5. In his statement, the principal, Dr. C. F. Harford, said at the start of the college, nineteen years ago, there was a need for a course for missionaries in medicine and surgery, in order that they might be able to preserve their own health and minister to the needs of the natives. The college was called after Dr. Livingstone, and with the near approach in 1913 of the centenary of his birth it is hoped that the college will take a step forward, and a Livingstone Centenary Fund is being inaugurated for this purpose. This fund will be devoted to:—(1) The paying off of the mortgage of 3500*l.* on the property; (2) the carrying out of certain important improvements in the college premises; (3) the raising of an endowment; and for this at least 10,000*l.* will be needed. Full particulars can be obtained from the principal at the college, Leyton, E.

THE commencement address delivered by President B. I. Wheeler, president of the University of California, has been reprinted in pamphlet form from the *University of California Chronicle* (vol. xi., No. 3). From a copy which has reached us we find that President Wheeler attempted to answer the question, "What may the community fairly expect of a college graduate?" From his answer to the inquiry, the following *obiter dicta* will prove of interest:—"The world may fairly expect the college graduate to know something. It will be willing, however, to excuse him from the persistent assertion thereof." "One of the chief advantages . . . which an educated man ought to have over other men should be that he knows what he does not know." "Specialisation of the right sort in the right men gives range and perspective." President Wheeler insists rightly that it is a pity so few students have yet come to appreciate the value of being able to express what they know in intelligible and effective language, both written and spoken. "Knowledge," he says, "without language is gold coin withdrawn from circulation and placed in a safe-deposit box."

THE annual report of the school medical officer for Exeter, Mr. P. H. Stirk, for the year 1911 has been received. The impression made by an examination of the records collected in it is that a well-considered scheme is providing the information necessary to arrange for modifications of the conditions of school life which will result in improved health and physique for the children. The head teachers and attendance officers are cooperating heartily, and already many improvements have been noticed. During the year 3817 children were medically examined out of 7380 on the register. Of this number, 2666 were routine examinations, 612 were special cases at the inspection clinic, and 520 were re-examinations of defective children. In some schools well over 90 per cent. of the parents were present at the examination, and the average throughout the city was 75 per cent., numbers which show that the parents understand and appreciate the efforts made for their children. Moreover, 83 per cent. of the children have received the treatment suggested, and, as shown by the medical officer's subsequent examination, this proved of a satisfactory nature.

IN submitting for the first time the Education Estimates for England and Wales, which amount to 14½ millions, Mr. Pease, the Minister of Education, gave, in the House of Commons on June 6, an admirable *résumé* of the work of the Board of Education during the past year. In his speech he referred to every branch of our national education, and it is possible here to make reference only to one or two points of outstanding importance. Speaking of the abolition of the examinations in the elementary stages of science, which have been conducted by the Board for many years, Mr. Pease said it is hoped by the present policy to arouse increased interest among the employers of the country and to get them to do more for their employees by forming committees to work with the local education authorities to establish technical classes connected with engineering, building, and textile industries, and to assist the work by holding examinations locally for themselves, the certificates awarded being in suitable circumstances endorsed by the Board of Education. Dealing with university work, the President explained the method of allocating the various Treasury grants, and spoke of the need for greater private munificence.

THERE was considerable discussion at the meetings of the General Medical Council last week as to the present condition of English secondary education. Sir Clifford Allbutt described it as chaotic, and the president, Sir Donald MacAlister, agreed with the description, and urged that the Government should establish something like a leaving certificate, such as exists in Scotland. An amendment to refer back certain recommendations made by the Education Committee relative to a higher standard for the preliminary examinations of the profession was lost. Another amendment to the effect "That no further additions be made to the list of secondary schools approved by the council as recognised teaching institutions until the council has had the experience of some years regarding the effect of the recognitions already granted," was also lost. It was decided that a secondary school applying for recognition as a place of study in chemistry, physics, or biology be required to state (1) that it is a public foundation; (2) the subjects in which it desires approval; (3) the name of the licensing body by which it has been recognised as a place of study and the subjects in which it has been recognised; and (4) the date of the last inspection for that purpose.

THE announcements in the issue of *Science* for May 18 last show that there is no falling off in the United States in the interest in higher education, which expresses itself by liberal gifts for the development of universities and colleges. Our contemporary states that by the will of Mr. C. H. Pratt, the Massachusetts Institute of Technology receives a large bequest to endow a Pratt school of naval architecture and marine engineering. The income of the estate is to accumulate until the sum of 125,000*l.* has been reached, though it may be used at the expiration of twenty-one years. The Governor has signed the Bill passed by the Massachusetts Legislature appropriating 10,000*l.* annually for five years to the Worcester Polytechnic Institute. The grant is to be extended for an additional five years if in the meantime the institute obtains 70,000*l.* An anonymous benefactor has given 20,000*l.* to Hamilton College for the erection of a new library building. Columbia University has received from Mr. and Mrs. W. R. Peters a gift of 10,000*l.* to establish a fund for engineering research in memory of their son. A second gift of 5000*l.* to Brown University from Mr. John D. Rockefeller, jun., is announced. The endowment has now reached 163,000*l.* toward the desired 200,000*l.* Appropriation Bills for the College of Agriculture, Cornell University, to the amount of 181,000*l.*, of which 158,000*l.* is immediately available, were passed by the New York Legislature at its recent session. The Veterinary College received an appropriation of 21,000*l.*, bringing the total up to 202,400*l.*

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 6.—Sir Archibald Geikie, K.C.B., president, in the chair.—Dr. Keith **Lucas**: The process of excitation in nerve and muscle: the Croonian lecture. Attention has lately been directed to the slow progress made by physiologists in understanding the physico-chemical nature of the nervous impulse. In the present lecture an attempt is made to examine one aspect of the experimental knowledge which must precede the formulation of any hypothesis of this nature. The first problem is to analyse by experiment the relation between each of the phenomena observed in an excited nerve or muscle and that central disturbance which constitutes the nervous impulse. This analysis determines what phenomena must be taken into account in any hypothesis of the nervous impulse. By the recognition of the local excitatory process there is opened a fresh possible line of advance in the direction of determining what the nature of the propagated disturbance may be. The former constitutes the condition which initiates the latter, and a knowledge of the physico-chemical nature of the local change may therefore form an important step towards formulating an hypothesis of the nature of the disturbance which is the basis of propagation. The hypothesis of Nernst, that the local excitatory process is a concentration of ions at a membrane impermeable to those ions, is examined critically. Some objections already brought against it prove unfounded. The genuine difficulties of the hypothesis are in themselves of service in suggesting experimental work which is needed for the complete verification of any such hypothesis.—Dr. H. L. **Duke**: Antelope as a reservoir for *Trypanosoma gambiense*.—Dr. H. L. **Duke**: Observations on fowls and ducks in Uganda with relation to *T. gallinarum* and *T. gambiense*.—Sir D. **Bruce**, Major D. **Harvey**, Major A. E. **Hamerton**, Dr. J. B. **Davey**, and Lady **Bruce**: The morphology of the trypanosome causing disease in man in Nyasaland.—Prof J. C. **Fields**: Theory of the algebraic functions.

PARIS.

Academy of Sciences, June 3.—M. Lippmann in the chair.—G. **Bigourdan**: The advantages of the reflection meridian circle and the question of small planets. The advantages of the reflection meridian circle have been pointed out by Prof. H. H. Turner. The author confirms this, with special reference to the observation of the minor planets.—Armand **Gautier** and Paul **Clausmann**: The detection and estimation of very small quantities of fluorine in minerals, in waters, and in living tissues. A description of the method of concentrating quantities of fluorine of the order of 1 milligram from large quantities of water or organic matter without loss. The object of the work is to be able to follow the introduction of fluorine into the animal economy by food materials and to determine its localisation in each organ.—L. **Mangin** and N. **Patouillard**: Atichia, a group of the lower Ascomycetes.—J. **Violle**: Results of measurements effected during the eclipse of April 17. Details of the variations in atmospheric temperature and humidity, and of the solar radiation.—C. E. **Guillaume**: The specific heat of water from the experiments of Regnault. Taking a specific heat at 60° C. of 0·9994, the mean of the data of Barnes, Callendar, and Dieterici, the values for temperatures up to 200° C. are recalculated from the data of Regnault. Up to 120° C. the recalculated values are in good agreement with the determinations of Dieterici.—M. **Flajolet**: The reception of the radio-telegraphic signals from the Eiffel Tower at the Observatory of Lyons during the eclipse of the sun of April 17. If any variations in the intensity of the signals were due to the eclipse they were very small and of the same order as the changes of the zero.—Émile **Borel**: Series of analytical functions and quasi-analytical functions.—Alfred **Rosenblatt**: Some inequalities in the theory of algebraic surfaces.—Gustave **Dumas**: The singularities of surfaces.—M. **Arnaud**: A new formula for barometric levelling.—Ch. **Fabry** and H. **Buisson**: The mass of the particles which emit the two spectra of hydrogen. The method is based on the observation of the limiting order of interference; it was found that the mass of the particles emitting the second spectrum of hydrogen is equal to the atomic mass of hydrogen. Hence the lines of the second spectrum are not due to an association of several atoms, but to corpuscles identical with the atom or differing from it very slightly. A study of the first spectrum, the distribution of which follows Balmer's law, leads to a similar conclusion.—Jean **Danysz**: The deceleration undergone by the β-rays when traversing matter. The slowing down of the rays observed for various metals is of the same order as those recently given by Whiddington for the kathode rays. Applying the theory of J. J. Thomson to these data as a rough approximation the number of electrons contained in an atom is of the same order of magnitude as the atomic weight.—F. **Diénert** and A. **Guillerd**: The application of physico-chemical methods to the estimation of the constituents of natural waters.—E. **Chablay**: Contribution to the study of the metallic glycol-alcoholates.—F. **Bodroux** and F. **Taboury**: The bromination of cyclohexanone and of cyclohexanol.—André **Meyer**: Dibromophenylisoxazolone and its derivatives.—F. **Bodroux** and F. **Taboury**: The bromination of some hydroaromatic compounds.—A. **Mailhe**: The nitro-derivatives of diphenylene.—J. B. **Senderens**: The use of carbonates in the catalytic preparation of ketones. The conversion of fatty acids into ketones by means of heated calcium or barium carbonates is not a true catalytic reaction.—V. **Hasenfratz**: Trimethyldiapoharmine, a new base

arising from the application of the Hofmann reaction to apoharmine.—H. Jacob **de Cordemoy**: The structure of two Melastomaceæ with tuberised roots from the east of Madagascar.—Maurice **Mangin**: Contribution to the study of the disease of the pine supposed to have been caused by *Rhizina inflata*.—M. **Lecercle**: Heat of the gases of respiration.—J. E. **Abelous** and E. **Bardier**: The mechanism of anaphylaxy. The immediate production of the anaphylactic shock without preliminary injection of antigen.—Raoul **Bayeux**: The anoxhemia of high altitudes and its treatment by hypodermic oxygenation. — N. A. **Barbieri**: Anatomical study on the aretinian of the optic nerve in vertebrates.—A. **Magnan**: The growth of ducks submitted to four different methods of feeding.—E. **Vasticar**: The structure of Deiters's cell.—G. **Rebière**: The properties and chemical composition of electrical colloidal silver precipitated from its solutions by electrolytes. Colloidal silver prepared electrically in pure water and precipitated by electrolytes is a mixture of silver and silver oxide in variable proportions.—C. **Gerber**: The hydrolysis of starch paste by hydrogen peroxide alone or in presence of the plant or animal amylases.—J. **Giraud**: The geology of the south of Madagascar.—A. **Delage**: The traces of the great quadrupeds in the lower Permian of Hérault.—J. **Deprat**: Two new genera of Fusulinidæ of eastern Asia, interesting from the phylogenic point of view.—Ph. **Glangeaud**: Hydrographic changes produced by the volcanoes of the Puys chain.

NEW SOUTH WALES.

Linnean Society, March 27.—Mr. W. W. Froggatt, president, in the chair.—The President delivered the annual address, which was devoted largely to a consideration of the advances made in the study of insect-life from an economic point of view, including a summary of what the various nations are attempting to do in the way of protecting man and his belongings from the drawbacks resulting from the wholesale disturbance of the conditions under which insect-faunas formerly locally attained something like equilibrium for each country, and what national efforts have now become necessary in order to cope with the depredations of insects which have been unintentionally introduced, and flourish amazingly under new conditions, or of indigenous insects which assert themselves in a menacing manner under modified natural conditions.—Dr. H. L. **Kesteven**: The constitution of the gastropod protoconch: its value as a taxonomic feature, and the significance of some of its forms.—E. W. **Ferguson**: Revision of the amycterides. Part ii., Talaurinus.

April 24.—Mr. W. W. Froggatt, president, in the chair.—J. M. **Petrie**: The chemistry of *Doryphora sassafras*, Endl. The *D. sassafras* tree is endemic to East Australia. Its bark contains 1·35 per cent. of an essential oil, besides fixed oils, aromatic resins, tannin (1·38 per cent.), sugars, calcium oxalate, and 0·63 per cent. of an alkaloid. The essential oil is also found in the leaves (4·3 per cent.) and fruit (4 per cent.). The alkaloid is an amorphous, grey powder, darkening when exposed to light and air. It is highly electric, and possesses a bitter taste, and alkaline reaction. It is concluded that the alkaloid is a new one, and the name "doryphorine" is proposed for it.—A. H. S. **Lucas**: Supplementary list of the marine algæ of Australia. By an oversight, the red algæ of the subfamily Dasyeæ were omitted from the list of Australian Florideæ published in the Proceedings for 1909 (p. 9). This omission has been rectified, and the list amplified.—P. **Cameron**: A collection of parasitic Hymenoptera (chiefly bred) from New South Wales, collected by Mr. W. W. Froggatt, with descriptions of new genera and species. Part iii. Four genera and thirty-seven species, referable to six families, are described as new.—P. **Cameron**: Description of two new species of Ichneumonidæ from the island of Ard. A species of Suvalta and one of Erythromorpha are described as new.—Dr. J. M. **Petrie**: Hydrocyanic acid in plants. Part i. Its distribution in the Australian flora. The paper consists of a list of about 300 native plants, representing sixty-five natural orders. These plants were tested for the presence of cyanogenetic glucosides and of emulsin-like ferments. The table shows thirty-six plants giving positive results, in which hydrocyanic acid is liberated by a natural ferment in the plant. It includes also seven exotic plants, in which the presence of hydrocyanic acid is recorded for the first time. Hydrocyanic acid is now held to play an important part in the metabolism of those plants in which its compounds occur.

BOOKS RECEIVED.

Smithsonian Institution. Bureau of American Ethnology. Bulletin 47:—A Dictionary of the Biloxi and Ofo Languages. By J. O. Dorsey and J. R. Swanton. Pp. v+340. (Washington: Government Printing Office.)

Oscillations et Vibrations. Étude générale des mouvements vibratoires. By A. Boutaric. Pp. 403. (Paris: O. Doin & Fils.) 5 francs.

Handwörterbuch der Naturwissenschaften. Edited by E. Korschelt and others. Zehnte und elfte Lief. (Jena: G. Fischer.) 2.50 marks each.

Das Buch der Natur. By Dr. F. Schoedler. Dreiundzwanzigste Auflage. Dritter Teil. Astronomie und Physik. Zweite Abteilung. Physik. By Prof. H. Böttger. Erster Band. Mechanik, Wärmelehre, Akustik. Pp. xiii+983. (Braunschweig: F. Vieweg & Sohn.) 15 marks.

Man in the Old Stone Age. By Rev. G. W. Bancks. Pp. 26. (London: Unwin Bros., Ltd.) 1*s*.

A Hand-list of British Birds. With an Account of the Distribution of each Species in the British Isles and Abroad. By E. Hartert and others. Pp. xii+237. (London: Witherby and Co.) 7*s*. 6*d*. net.

Ordnance Survey. Professional Papers—New Series, No. 1. An Account of the Measurement of a Geodetic Base Line at Lossiemouth, in 1909, together with a Discussion on the Theory of Measurement by Metal Tapes and Wires in Catenary. Pp. 39. (London: H.M.S.O.; Wyman and Sons, Ltd.) 2*s*.

Fancy Mice. Their Varieties and Management as Pets or for Show. By C. J. Davies. Pp. iv+84. (London: L. Upcott Gill.) 1*s*. net.

The Story of "Eight Deer" in Codex Colombino. By J. C. Clark. Pp. 33+10 coloured plates in text. (London: Taylor and Francis.) 21*s*. net.

Oil-finding: an Introduction to the Geological Study of Petroleum. By E. H. C. Craig. Pp. x+195. (London: E. Arnold.) 8*s*. 6*d*. net.

Exercises in Chemical Calculation. By Dr. H. F. Coward and W. H. Perkins. Pp. v+152. (London: E. Arnold.) 2*s*. 6*d*. net.

A History of British Mammals. By G. E. H. Barrett-Hamilton. Part xi. (London: Gurney and Jackson.) 2*s*. 6*d*. net.

The House-fly—Disease Carrier. By Dr. L. O. Howard. Pp. xix+312. (London: J. Murray.) 6*s*. net.

Further Researches into Induced Cell-reproduction and Cancer. By H. C. Ross, J. W. Cropper, and E. H. Ross. Vol. ii. Pp. 125. (London: J. Murray.) 3*s*. 6*d*. net.

The Oxford Country. Its Attractions and Associations described by Several Authors. Collected and arranged by R. T. Günther. Pp. xvi+319. (London: J. Murray.) 7s. 6d. net.

Science of the sea. An Elementary Handbook of Practical Oceanography for Travellers, Sailors, and Yachtsmen. Edited by Dr. G. H. Fowler. Pp. xviii+452. (London: J. Murray.) 6s. net.

Department of Applied Statistics, University College, University of London. Drapers' Company Research Memoirs. Biometric Series VIII.—Mathematical Contributions to the Theory of Evolution, XVIII. On a Novel Method of Regarding the Association of Two Variates classed solely in Alternate Categories. By K. Pearson. Pp. 29+2 plates. (London: Dulau and Co., Ltd.) 4s. net.

Problems in Physical Chemistry, with Practical Applications. By Dr. E. B. R. Prideaux. Pp. ix+311. (London: Constable and Co., Ltd.) 7s. 6d. net.

Laboratory Test Cards. By J. Don and H. Jamieson. First Year—Measurement and Matter; Second Year—Heat; Third Year—Chemistry. Eighteen Cards and two sets of Answers to each year. (London: W. B. Clive.) 1s. net each.

Allgemeine Biologie. By Prof. O. Hertwig. Vierte Auflage. Pp. xviii+787. (Jena: G. Fischer.) 19.50 marks.

North Sea Fisheries Investigation Committee. Fourth Report (Southern Area) on Fishery and Hydrographical Investigations in the North Sea and Adjacent Waters, 1909. Pp. ix+497+8 charts. (London: H.M.S.O.; Wyman and Sons, Ltd.; and others.) 13s.

DIARY OF SOCIETIES.

THURSDAY, JUNE 13.

ROYAL SOCIETY, at 4.30.—An Expansion Apparatus for making Visible the Tracks of Ionizing Particles in Gases, and some Results obtained by its Use: C. T. R. Wilson.—A Chemically Active Modification of Nitrogen, produced by the Electric Discharge, IV.: Hon. R. J. Strutt.—(1) On the Series Lines in the Arc Spectrum of Mercury. (2) On the Constitution of the Mercury Green Line λ=5461 AU and on the Magnetic Resolution of its Satellites by an Echelon Grating: Prof. J. C. McLennan.—(1) On the Convergence of certain Series involving the Fourier Constants of a Function. (2) On Classes of Summable Functions and their Fourier Series: Prof. W. H. Young.—The Number of β Particles emitted in the Transformation of Radium: H. G. Y. Moseley.—Portland Experiments on the Flow of Oil in Pipes: S. D. Carothers.—On a Form of the Solution of Laplace's Equation suitable for Problems relating to two Spheres: G. B. Jeffery.—On the Emission Velocities of Photo-Electrons: A. Ll. Hughes.

FRIDAY, JUNE 14.

ROYAL INSTITUTION, at 9.—Unknown Parts of South America: A. H. Savage Landor.

GEOLOGISTS' ASSOCIATION, at 8.—The Geology of West Mayo and Sligo, with special reference to the August Long Excursion: Prof. G. A. J. Cole.

ROYAL ASTRONOMICAL SOCIETY, at 5.—On Librating Planets, and on a New Family of Periodic Orbits: Sir G. H. Darwin.—The Sidereal System, revised in 1912: Maxwell Hall.—Observation of the Spectrum of Nova Geminorum: L. Becker.—Micrometrical Measures of Double Stars: Rev. T. E. R. Phillips.—*Probable Papers:* Note on the Spectrum of Nova Geminorum, April 24, 1912: Rev. A. L. Cortie.—Further Observations of the New Star in Gemini: A. A. Rambaut.—Occultation Results, January-April, 1912: M. E. J. Gheury.

PHYSICAL SOCIETY, at 8.—Demonstration of a Method of Determining very small Differences of Density: T. H. Blakesley.—The Maximum Sensibility of a Duddell Vibration Galvanometer: Dr. F. H. Haworth.—An Accurate Examination of the Steinmetz Index for Transformer Iron, Stalloy and Cast Iron: F. Stroude.

MALACOLOGICAL SOCIETY, at 8.—On a collection of Molluscs collected by Mr. E. Jacobson in Java: M. M. Schepman.—Description of Thirty-three New Species of Gastropoda from the Persian Gulf, Gulf of Oman, and Arabian Sea: J. Cosmo Melvill.—Note on the Generic Name Pectunculus: Wm. H. Dall.—Note on Ianthina species: Tom Iredale.—Egyptian Non-marine Molluscs: Maxwell Smith.

MONDAY, JUNE 17.

VICTORIA INSTITUTE, at 4.30.—Annual Address: Sir Andrew Wingate, K.C.I.E.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Production and Polymerisation of Isoprene and its Homologues: W. H. Perkin.—A Hand Photometer: W. J. Dibdin.—The Oxidation of the Drying Oils: J. Newton Friend and W. J. Davison.

TUESDAY, JUNE 18.

ROYAL STATISTICAL SOCIETY, at 5.—The Measurement of Employment—an Experiment: A. L. Bowley.

MINERALOGICAL SOCIETY, at 5.30.—The Isomorphism of the Acid Tartrates and Tartar-emetics of Potassium, Rubidium and Cæsium: T. V. Barker.—On Topaz and Beryl from the Granite of Lundy Island: W. F. P. McLintock and T. C. F. Hall.—On the Rathite Group: R. H. Solly.—On the Minerals of the Nakhla Meteorite: Dr. G. T. Prior.—Note on the Occurrence of Cassiterite and Strüverite in Perak: J. B. Scrivenor.

WEDNESDAY, JUNE 19.

GEOLOGICAL SOCIETY, at 8.—The Discovery of a Fossil-bearing Horizon in the Permian Rocks of Hamstead Quarries, near Birmingham: W. H. Hardaker.—On the Geology and Palæontology of the Warwickshire Coalfield: R. D. Vernon.

ROYAL METEOROLOGICAL SOCIETY, at 4.30.—The Adoption of a Climatological Day: Walter W. Bryant.—A Three-year Period in Rainfall: Arthur Pearse Jenkin.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Notes on Pollen: The Rt. Hon. Lord Avebury.—Demonstrations of a method of obtaining Frozen Sections after Embedding in Gelatin: Dr. J. F. Gaskell.—On some New Astrorhizidæ and their Structure: Heron-Allen and A. Earland.

THURSDAY, JUNE 20.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* An Investigation into the Life-history of *Cladothrix dichotoma* (Cohn): Dr. D. Ellis.—The Relation of Secretory and Capillary Pressure. I. The Salivary Secretion: Leonard Hill and M. Flack.—The Origin and Destiny of Cholesterol in the Animal Organism. Part IX. On the Cholesterol Content of the Tissues other than Liver of Rabbits under Various Diets and during Inanition: G. W. Ellis and J. A. Gardner.—A Note on the Protozoa from Sick Soils, with some Account of the Life-cycle of a Flagellate Monad: C. H. Martin.—Further Observations on the Variability of Streptococci in Relation to Certain Fermentation Tests, together with some considerations bearing upon its possible meaning: E. W. A. Walker.—The Chemical Action on Glucose of a Variety of *B. coli communis* (Escherich) obtained by cultivation in presence of a Chloroacetate (Preliminary notice): A. Harden and W. J. Penfold.—The Action of Enzymes on Hexosephosphate: V. I. Harding.—The Oxydases of *Cytisus Adami*: Prof. F. W. Keeble and Dr. E. F. Armstrong.

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