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The Dye Industry.

FOLLOWING on the agreement which has at last come about between the dye-makers and the dye-users, the Cabinet decided, on December 1, to introduce a Bill for the protection of British dyestuffs. This was promptly presented to the House of Commons on December 2 by Sir Robert Horne, President of the Board of Trade, read a second time this week on Tuesday, and is expected to be passed into law before Christmas.

The Bill is quite short, and prohibits the importation into the United Kingdom of all synthetic dyestuffs, colours, and colouring matters, and all organic intermediate products used in their manufacture, for a period of ten years and no longer. The Board of Trade will, however, have power by licence to authorise the importation of any of these products, and for the purpose of advising it with respect to the granting of licences a Committee will be constituted, consisting of five persons concerned in the trades in which the above goods are used, three persons concerned in the manufacture of such goods, and three other persons not directly concerned in the production or use of dyes. One of the latter three persons will be chairman of the Committee. The Board may charge in respect of a licence a fee not exceeding 5*l*. The Act will not apply to goods imported for exportation after transit through the United Kingdom or by way of transhipment.

If, as is expected, this Bill is passed into law the British dye manufacturer will be relieved that the promises of the Government have been redeemed, and he may now set himself with redoubled energy to secure that his products are beyond reproach, and to erect plant for the manufacture of dyes not yet produced here, which are urgently wanted by the dye-users. Such will, no doubt, be imported under licence for a time, but a period of ten years should be ample for establishing in this country a great industry which will provide every possible requirement of the dye-user, and a combination of chemical manufacturers, if it can be brought about, ought to place the economic position of this industry beyond fear of attack.

The great advantages to be derived from co-operation in the dye industry, so well indicated by the great German combination, the "Interessengemeinschaft," have evidently been realised in America, for, according to the *Times* of December 1, five of the largest chemical works in the United States—namely, the General Chemical Co., the Semet Solvay Co., the Solvay Process Co., the Barrett Co., and the National Aniline and Chemical Co.—are to merge their interests, and the combination is to possess a capital of about 60,000,000*l*. This sum is about as large as that of the German Trust, but the scope of the American company will be rather wider, including, as it will, the distillation of coal-tar, the fixation of atmospheric nitrogen, and the manufacture of heavy chemicals.

This is an important step in the direction of the consolidation of interests in America, and, in view of the protective legislation which is now being considered by Congress, everything points to the firm establishment of the dye industry in that country. The output of dyes is already high, being about 30,000 tons per annum, and the wide interest that is being taken in the field of industrial organic chemistry is further shown by the fact that there are nearly 200 firms engaged in the manufacture of crude products, intermediates, dyes, lakes, medicinal preparations, flavouring media, photographic chemicals, synthetic phenolic resins, synthetic tanning materials, and explosives.

It is much more important to give attention to developments of this kind than to over-emphasise the relation of the dye industry to war products in order to enlist the sympathy of the public for its protection. In an article in the *Observer* of December 5 Prof. H. E. Armstrong expresses the opinion that, had the dye-users taken active and financial interest in the British Dyes Corporation during the war period, the present situation would probably not have arisen.

Evolution of Water Plants.

Water Plants: A Study of Aquatic Angiosperms. By Dr. Agnes Arber. Pp. xvi+436. (Cambridge: At the University Press, 1920.) Price 31*s.* 6*d.* net.

WE have here a comprehensive work embodying the results of a ten years' study of water plants, and dealing in a very practical fashion with the mass of literature that has grown up around the subject. As a book of authority on aquatic plants, it will be ranked with Schenck's work of a generation ago, and it would not receive its due if we did not add that it worthily holds the place. But we must not forget that other industrious investigators have in the meantime filled the gap. Prominent among them are Gluck, Goebel, Henslow, Pond, Sargant, Sauvageau, Willis, and many others. Since Schenck's time, however, new points of view have arisen, and new methods have been in use by numerous inquirers of both sexes, all keen in their desire to take a part in the new era of research.

Yet we find ourselves in an age of unrest and uncertainty in the botanical world. There is a note of discord in the rivalry of the two schools of thought that are divided between the respective claims of the present and the past, or, rather, of the last and first stages of the evolution of the higher plants, to occupy the attention of the investigator. Dr. Agnes Arber speaks of "the deep obscurity involving all evolutionary thought" in our own day, and demurs to the objection that when we cannot even be sure as to the origins of the numerous varieties springing up under our eyes it is not a time for discussing the origins of Dicotyledons or Monocotyledons. In this she is impugning the policy of restricting our efforts to the study of the last stage in the unfolding of the story of plant life. So we get the keynote to her book, the first six-sevenths of which are regarded by her as "a clearing of the ground for the more theoretic considerations concerning the evolutionary history of water plants." But inquiries into their origin must necessarily raise great issues affecting also their relatives on the land; and thus we find in our hands a book that in its general bearings will give birth to much serious thought.

Yet, apart from theory, we have here a very extensive record of observation, experiment, and research on aquatic plants and their ways. The practical side, ~~as we have seen~~, occupies by far the greater part of the work, and there is a wealth of illustration, mostly original. Quite a third of the space is devoted to the life-histories of the various groups of aquatic flowering plants, and these are followed by discussions on heterophylly, the morphology and anatomy of stems and leaves, the relation of the flowers to their environment, the wintering of water plants, the physical factors in their conditions of existence, and several other matters.

Taking our cue from the author, we will pass on to notice the more speculative portion of her book. There is first the question which might be placed among the "posers" little children are supposed to put. A primitive question about a primitive issue is concerned with the priority of the land- and the water-plant. As usually happens, the problem needs a good deal of straightening out before a reply can be made. Whilst it is generally recognised that the primeval forms were lowly aquatic plants, and that it is only in the higher plants that the terrestrial habit has become firmly established, we are far from being in a position to connect the one with the other.

Botanists are agreed that the aquatic Angiosperms are derived from terrestrial ancestors, but a cleavage in opinion began when they differentiated between Monocotyledons and Dicotyledons. Nature seemed to differentiate between them, and, being impressed by the preponderance of aquatic families among the Monocotyledons, botanists accredited the class with special aquatic proclivities. After considering the matter more closely, the author forms the opinion that these tendencies are hard to maintain.

Continuing to treat aquatic Angiosperms in the mass, and heeding only the systematic distribution of aquatics, the author lays down the principle that when a single genus or a species in an otherwise terrestrial family has taken to aquatic life, the habit may be a recent one; but when a whole family holding several genera is aquatic, we are dealing with a very ancient group of water plants where "the differentiation of the genera has occurred since the adoption of the aquatic habit." There are, in fact, "aquatics, new and old"; and they tend to choose their places in the systematic scale according to their age, the more ancient among the more primitive of the Angiosperms, and the more recent among those more advanced.

To the query as to which are the most primitive of the Angiosperms, the answer is: The families that are held within the Ranalean plexus. Those numerous families that go largely to form the Incompletæ of Bentham and Hooker, and which Engler places at the beginning of the Archichlamydeæ in the scale of development, are regarded as the more advanced and reduced forms

of that series. Dr. Newell Arber, who supplied the original impulse for this work, laid the foundation for the author's position in this respect, and Miss Sargant's derivation of the Monocotyledons from the primitive Ranalean plexus is here accepted.

An explanation of the great structural reductions involved in the transition from terrestrial to aquatic life, and in the transference by hypothesis of so many families from the beginning to the end of the series of the Archichlamydeæ, became a necessity; so the author proposed her "Law of Loss," which has proved to be related closely to Dollo's "Law of Irreversibility" for animals. This rests on the principle that what is lost in the course of plant evolution can never be regained, and, if required again, "must be constructed afresh in some different mode." From this point of view the leaf-blades of several aquatic plants would be regarded as expansions of the petioles, and much light would be thrown on the many difficult questions involved in the interpretation of the flowers.

The author's position regarding natural selection is discussed, so far as it is determined by aquatic plants. The principle is almost protean in its appearances. When we think we have disposed of it in one shape, it arises in another. If, like Dr. Willis, we exclude it in the case of the genera and species of the Podostemaceæ, it turns up again as the principal factor in the adaptation of the group for life in rapid waters. Dr. Agnes Arber shares with many others her difficulties in accepting whole-heartedly the principle May it not be possible to assume that these difficulties would disappear if we broadened the basis of the theory? Whilst supporting Darwin through so many years, Hooker was holding a view of divergence, under the name of "centrifugal variation" (really a conception of differentiation), that was directly opposed to important points of the theory. Yet he considered that the greatest hope of the investigator lay in the *general* lines marked out by Darwin.

However that may be, we are reminded by the author of this book of an evolutionary idea, both old and new, that is capable of great development. The principle that what organisms gain in specialisation they lose in plasticity presents us with quite another way of viewing evolution—a view in which progression offers itself as a succession of lost opportunities. Progress in one direction involves the closing of the gates in "countless other directions," the possibilities of choice ever narrowing as we go up the scale. It is suggested that this would be impossible but for the inheritance of acquired characters, bound up, probably, with the inheritance of unconscious memory. At all events, it presupposes a primeval era of plasticity in which heredity had but little power. The line of thought is similar to that followed by Beccari in his theory of plasmation. Here a long vista opens up, and at its distant end lie the problems connected with the origin of the great groups of the plant world.

H. B. GUPPY.

The Behaviour of Beetles.

The Glow-worm and other Beetles. By J. Henri Fabre. Translated by Alexander Teixeira de Mattos. Pp. viii+488. (London: Hodder and Stoughton, Ltd., 1919.) Price 8*s.* 6*d.* net.

THIS is the second volume on beetles in the complete English edition of Henri Fabre's entomological works. The first essay, "The Glow-worm," which gives its name to the book, did not form part of the "Souvenirs Entomologiques," but was written for translation into English towards the close of the veteran naturalist's life. Several chapters, like this first one, have already seen the light in English, but most of the book is fresh, and it is very convenient to have the studies on beetles brought together. Eventually there will be four volumes on beetles. The experienced translator, Mr. Alexander Teixeira de Mattos, has done his work with great skill.

These are wonderful stories. The glow-worm tweaks a snail with its sharp mandibles, and administers an anæsthetic; a number of other glow-worms hasten to the repast and fall to; the flesh is converted by exuded ferment into a sort of gruel, and the fluid is sucked up by the hollow jaws. We suspect that there is some inaccuracy in Fabre's account; it seems clear, for instance, that the fluid food enters the gullet by the mouth, and not *via* the mandibles. In any case, Fabre's observations must be compared with those of Bugnion and Miss Kathleen Haddon. In regard to the luminescence Fabre was cautious:—

"From start to finish, the glow-worm's life is one great orgy of light. The eggs are luminous; the grubs likewise. The full-grown females are magnificent light-houses, the adult males retain the glimmer which the grubs already possessed. We can understand the object of the feminine beacon; but of what use is all the rest of the pyrotechnic display? To my great regret, I cannot tell. It is and will be, for many a day to come, perhaps for all time, the secret of animal physics, which is deeper than the physics of the books."

The close of this frank admission of ignorance has the characteristic Fabre touch, the precise point of which is not very obvious. Bio-chemistry and bio-physics are both very young, but they have already had their triumphs, which pass automatically into the contemned books. What is wrong with the physics of the books except that naturalists do not read it?

The succeeding five chapters deal with the remarkable life-histories of sitares, oil-beetles, and the like, and they certainly demand the reader's close attention. It is easier to follow the fine study of the capricorn (the grub of the Cerambyx beetle), which burrows in the stem of the oak.

"This grub, so poor in sensory organs, gives us with its prescience no little food for reflection. It knows that the coming beetle will not be able to cut himself a road through the oak, and it bethinks itself of opening one for him at its own risk and peril. It knows that the Cerambyx, in his stiff armour, will never be able to turn and make for the orifice of the cell; and it takes care to fall into its nymphal sleep with its head to the door. It knows how soft the pupa's flesh will be and upholsters the bedroom with velvet."

Here we have an instance of Fabre's strength and weakness; the facts are so interesting; the discovery of them was a triumph; the exposition of them is extraordinarily vivid; but the interpretation seems wildly anthropomorphic. We do not, we confess, understand instinctive behaviour; but we feel sure that the "inimitable observer," as Darwin called him, was off the scent. We get tired of this "knowing" and "bethinking," all the more because we doubt whether Fabre believed in it himself. "It knows the future with a clear vision," he says, "or, to be accurate, behaves as though it knew the future." But even this wobbling between inaccurate and accurate expression might have been accepted with good humour—a little fly in the fine ointment of fact for which every naturalist is grateful—had not Fabre made us wince by such *obiter dicta* as "now that the evolutionists' interpretations of instinct have been recognised as worthless."

One of the fine qualities of Fabre's essays is the way in which they raise questions which we cannot answer. How is it that the sawfly Sirex, which undergoes metamorphosis not far from the centre of the trunk of the tree, makes its way out to the light by the shortest route? Over and over again we find these puzzling problems stated; one attempt at solution is tested and then another, only to be rejected; and then the author gives it up for the time being: "I leave the matter to the conscientious masters, to the experts who are able to say: I do not know." This is much more educative than a prejudiced dismissal of evolutionism.

Biologically of great interest is the essay on insect colouring, in which Fabre expounds and illustrates the theory that various bright colours are due to a utilisation of ammonium urate or some related nitrogenous waste-product.

"While the larvæ of the Hunting Wasps, unable to do better, stipple themselves with uric acid, there are plenty of industrious creatures that are able to make themselves a superb dress by preserving their excretions in spite of their own open sewers. With a view to self-embellishment [again the anthropomorphic taint], they collect and treasure up the dross which others hasten to expel. They turn filth into finery."

When he got hold of an attractive idea, Fabre often let himself go, and we like him none the less for that.

"Nature, that sublime economist, delights in these vast antitheses which upset all our conceptions of the values of things. Of a pinch of common charcoal she makes a diamond; . . . of the filthy waste products of the organism she makes the splendours of the insect and the bird. The metallic marvels of the Buprestis and the Ground-Beetle; the amethyst, ruby, sapphire, emerald and topaz of the Humming-Bird; glories which would exhaust the language of the lapidary jeweller: what are they in reality? Answer: A drop of urine."

It seems almost profane to ask how many of the pigments of birds are known to be chemically related to urates; it seems niggling to ask whether the picturesque reference to sapphire and emerald is relevant at all, since these particular colours in the humming-bird are surely due to physical sculpturing rather than to any number of drops of urine.

The Fabre we like best is the patient and ingenious and sympathetic observer who tells us, in other chapters, of the accomplishments of the burying-beetles and their not less marvellous limitations, of "death-feigning" in Scarites and Buprestis, of animal hypnosis at higher levels, of the supposed suicide of scorpions, and of the *vie intime* of half a hundred beetles. Was there ever such an observer? We suppose Réaumur and two or three others might be mentioned. But was there ever any other observer of this rank who could tell his story so that we fancy ourselves seeing what he saw? We know of none. And so we come back to our homage to Fabre.

Kinetic Theory.

A Kinetic Theory of Gases and Liquids. By Prof. R. D. Kleeman. Pp. xvi+272. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1920.) Price 16*s.* 6*d.* net.

THIS book deals mainly with the "free path phenomena" in the kinetic theory of gases, but this department of the subject is comprehensively treated. Whether the chief object of such a work—namely, to gain some information about the intermolecular forces—can ever be attained without taking account of the other parts of the subject seems somewhat doubtful.

The body of the book is concerned with the various forms of transfer which occur in gases and liquids—transfer of energy or heat conductivity, transfer of momentum measured by the viscosity, and transfer of matter as evidenced in diffusion. Some ten years ago it might have seemed that it was in these properties, which are a measure of the free path, that the key to the riddle of molecular interaction was to be found. To-day, one is inclined to feel, they have been overemphasised when such a subject as the law of equipartition of energy is given only a couple of pages, and the fundamental problem of the reason why it breaks down is not considered at all. In particular, a statement (pp. 32–33) that "it is unnecessary and futile to endeavour to establish the law of equipartition of energy on assumptions relating to the interaction of molecules, when the law follows directly from the fact that a molecule is continually radiating heat energy," should really not occur in a modern book intended for university readers. The statement entirely begs the question of defining the temperature. The "fact," if such it be, should be established by more adequate proof than by a reference to the hot air rising from a surface, and the main point—namely, that the law which is represented as so obvious, in reality does not hold—should be mentioned. Far from being "unnecessary and futile," it is one of the most urgent problems in physics to examine why a law which can be proved to be a necessary consequence of the most general assumptions in dynamics should not hold in actual practice.

Apart from these and allied problems—*e.g.* the chemical constants of substances and the change in the ratio of the specific heats of hydrogen at low temperatures—the kinetic theory is admirably treated. Even the kinetic theory of electrons in metals is developed, though it is to be regretted that the essential fallacy of treating these as a perfect gas is not emphasised, and the uninitiated reader is left to believe that there are $2 \cdot 10^{24}$ free electrons per unit volume, when such a number would involve a specific heat about fifteen times as great as is actually observed.

In spite of these omissions, however, the book is certainly to be recommended, especially to those who are interested in free path phenomena, although these alone are scarcely able to throw light on the process of molecular interaction until the quantum problem has been solved.

A Monograph on Margarine.

Margarine. By W. Clayton. (Monographs on Industrial Chemistry.) Pp. xi+187. (London: Longmans, Green, and Co., 1920.) Price 14*s.* net.

CURIOUSLY enough, the introduction of artificial butter dates from the early days of the Franco-Prussian War, and, while the butter and lard substitute industry has been carried on on a small scale since then, margarine, as an industry, became of prime importance to the nation only during the Great War. Many important improvements have been made, and these are set forth in the book under review.

In the first part a brief account of the oils employed in the manufacture of margarine is given, and some less known oils, such as Cohune oil, teaseed oil, and Babassu kernel oil, are mentioned. Later chapters deal with hydrogenised oils, and for the present writer's views on this subject reference may be made to the notice of Dr. G. Martin's book on "Animal and Vegetable Oils, Fats, and Waxes" in NATURE of September 9 last.

Interesting chapters treating bacteriologically of the pasteurisation of milk and of the production of "starters" for the ripening of the milk follow. A brief description of the actual manufacturing operations of forming an emulsion between the mixed oils and the milk is then given. The theory of emulsification is, of course, very well stated, as Mr. Clayton is an authority on colloid chemistry. His opinions are therefore of great interest, and when they have been digested by technical chemists, very valuable results should arise in their industrial application.

In regard to the causes of rancidity in fats, Mr. Clayton seems inclined to accept the view that they result from bacterial actions on the glycerides. We believe that rancidity is due, in the first instance, to the formation of super-oxides of the unsaturated glycerides and their subsequent decomposition with the production of aldehydes and aldo-acids by the action of moisture, aided, per-

haps, by the growth of micro-organisms. It would be out of place, however, to develop these views here.

The chapters on the analysis of margarine, etc., contain little to comment upon, except that enough stress is not laid on the iodine value and the hexabromide tests. In the portions dealing with nutritional chemistry the author gives a welcome review of the work done and of the opinions held by medico-chemists on the so-called "vitamines," "food hormones," "accessory food factors," "sitacoids," and "advitants." These are "substances" which are supposed to be present in, and give digestibility to, natural fats, and to be absent in prepared or artificial fats. The medico-chemist has thus named them. As Goethe says:—

> Denn eben, wo Begriffe fehlen
> Da stellt ein Wort zur rechten Zeit sich ein.

Blessed words! Not one of these so-called substances has been isolated, and no one knows their chemical formulæ or characters. Why a "substance" and not a "condition" of a known substance—say, a peroxidised form of some fat? Mr. Clayton seems to see this, and that the whole matter needs consideration from the chemical rather than from the medical point of view, for he states that the term "vitamine" is wrong, as no nitrogen has ever been detected in any of these alleged substances.

The book contains thirty-five pages of bibliography, and a patents index, and should prove of great assistance to food and emulsion chemists.

HARRY INGLE.

Our Bookshelf.

Le Parc National Suisse. Par S. Brunies. Traduit par Samuel Aubert. Pp. 274. (Bâle: Benno Schwabe et Cie, 1920.) Price 12 francs.

THE map of the Swiss Topographic Survey, on the scale of 1:50,000, forms part of this attractive publication. The reserve, established by the Federal Government in 1913, occupies a mountainous district trenched by two tributaries of the Inn. The best approach is by Zernez in the Lower Engadine, and the carriage-road to the Münstertal passes across the park. The author's description, translated from the original German, is picturesque and vivid; but the features that appeal to the visitor trained in scientific pursuits are always kept in view. Special chapters deal with geology and natural history, and the studious revival of the local Latin dialect is recognised by the stress laid on "romand" names. Pronunciations and a list are considerately furnished, and the careful translator informs us that the pronunciations given are those used in at least one village—that of Sinuos-chel. Great praise must be given to the illustrations. Apart from the four exquisite photogravures of the scenery of the park, Mr. H. Pfendsack of Pontarlier has supplied vigorous line-drawings of animals and plants, in every case connecting the subject with its stern environment. Compare, for instance, his *Pinus montana* (p. 149), recumbent but undefeated, clutching at the rock, with the climbing birds enjoying themselves as *alpinistes* on p. 217. He represents with equal insight the family life of the ibex, which it is proposed to restore to its former haunts, and the prolific poppy growing from a heap of stones. The author has well represented the history of the Alpine overfolds by successive sections. It is a pleasure to possess his book. G. A. J. C.

(1) *Easy Lessons in Einstein: A Discussion of the More Intelligible Features of the Theory of Relativity.* By Dr. Edwin E. Slosson. With an article by Albert Einstein and a bibliography. Pp. vii+128. (London: George Routledge and Sons, Ltd.; New York: Harcourt, Brace, and Howe, 1920.) Price 5*s.* net.

(2) *From Newton to Einstein: Changing Conceptions of the Universe.* By Dr. Benjamin Harrow. Pp. 95. (London: Constable and Co., Ltd., 1920.) Price 2*s.* 6*d.*

(3) *Die Einsteinsche Relativitätstheorie.* By Prof. U. Kopff. Pp. 24. (Leipzig: Greszner und Schramm, 1920.) Price 1.50 marks.

(1) DR. SLOSSON gives us in his book a breezy account of what he calls the more intelligible features of the theory of relativity with popular illustrations of distorting mirrors, references to Mr. H. G. Wells's "Time Machine" and other scientific romances, diagrams purporting to portray a four-dimensional cube, and general good-humour—a book with which the absolute layman may amuse himself for a few hours.

(2) Dr. Barrow gives a more serious, but equally readable, summary of the development of physical science from the mechanical period of the eighteenth century through the electrical theories of the nineteenth to the present day. Here also the layman will find profitable reading.

(3) The little pamphlet by Prof. Kopff is a reprint of a lecture on the relativity theory to the Natur-historisch-Medizinischen Verein at Heidelberg in June, 1920.

Technical Handbook of Oils, Fats, and Waxes. By P. J. Fryer and F. E. Weston. Vol. i., *Chemical and General.* Third edition. (The Cambridge Technical Series.) Pp. xii+280+xxxvi plates. (Cambridge: At the University Press, 1920.) Price 15*s.* net.

THE changes occurring in the industrial situation have caused the authors to add a certain amount of matter, and to make a number of alterations in the text of the first edition, which was reviewed in NATURE of January 17, 1918. Another addition has been made in the form of analytical data inserted in the text, and a number of footnotes, chiefly giving references to original papers, are now included.

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.*]

Name for the Positive Nucleus.

A NAME is wanted for the fundamental unit of matter, which is also the unit of positive electricity as at present known. The name "electron" is best limited to the unit of negative electricity, about which a good deal is by this time known. Less is known about the positive unit, but it appears to be the brick of which all atoms are built up, electrons acting as cement. Nearly all the mass belongs to the positive unit, and the simplest atom—namely, hydrogen—appears to consist of one positive and one negative unit electric charge. The heaviest atom known has ninety-two such charges, and among the chemical elements are all intermediate grades. Prout's famous hypothesis that every element was a multiple of hydrogen is thus, with some modification, being confirmed, though the unnamed unit is not exactly an atom of hydrogen, but the nucleus, the main substance, of that atom.

At the Cardiff meeting of the British Association Sir Ernest Rutherford suggested, or tentatively approved the suggestion, that the name "proton" should be applied to this hydrogen nucleus or unit of positive charge. To call it a positive electron is undesirable—that name might be assuming too much—for it is just conceivable that the progress of discovery may detach from the proton a positive charge more closely akin to the negative electron—in fact an image of it. (It is not clear why a positive unit should differ so markedly, as at present it does, from the negative unit.) But, whatever the proton's relation to positive electricity, and whatever its constitution may be, it seems undeniable that it is the most essential and massive ingredient in every atom of matter.

From the scientific point of view the name "proton" is therefore good, for it signifies a fundamental substance and conveys a suggestion of Prout. But from the literary point of view there may be some objection, and a name for the foundation-stone of the material universe ought to be capable of being used in poetry, as the word "atom" has been used. It would seem well, therefore, to ask for suggestions before any name is adopted and allowed to get into general use.

Added Later.—Before sending in the above explanatory note I consulted some men of letters, who will, I hope, allow their names to be mentioned, and who have made some excellent suggestions:

AMBRON, as an English version of *electron*, suited to the unit of positive electricity.

MERRON, a conventional modification of *μέρος*.

UR-ON, or something based on the root Ur-; or even UR itself.

PRIME, as a primordial substance irresolvable into factors.

CENTRON, as a nucleus round which things revolve.

HYLON, as the fundamental unit of matter.

Of these I personally prefer *Hylon*; it serves to convey a fact with a minimum of hypothesis; it is itself a convenient word, and it surely need not be regarded as too metaphysical. If its first syllable suggests a real, but painfully illegitimate, relationship to hydrogen, that may be for it or against it, according to taste. I find the word "proton" is not liked; it has been described as "used up and very dull." Wrong pronunciation may be hostile to "Ur," and, besides, it might be confused with the other end of the series (uranium), though otherwise it shares some of the advantages of the happily invented word "gas."

OLIVER LODGE.

The British Association.

THE correspondence in NATURE under this heading has been most instructive. The widely spread feeling that the Association fails as an organisation to promote the growth of the scientific spirit could not well be more definitely brought to light, particularly as many who are known to hold strong views have refrained from expressing them; unfortunately, moral indecision is fast becoming a characteristic of our class. It is all very well for the late secretary and the present holders of the office to hint that the recommendations cancel out; maybe they are different; nevertheless, excepting our dear old member, Father Cortie, who has the sense of humour on all occasions, everyone agrees that the Association does not touch the public.

The most serious contribution to the discussion, that of greatest import, is the frank statement by the secretary of the Press and Publicity Sub-Committee at Cardiff—for once a man who dares to give open expression to the views he has formed—that we were in no way worth what we cost the locality; he has voiced a whisper, not seldom heard at previous meetings, which has long weighed on the conscience of some members of the Association.

The least satisfactory letter is that of the two secretaries, who are merely apologetic, in no way constructive. The manner in which, in their opening paragraph, they quietly imply that they are "It" would be amusing were the issue not so serious. Majestically they tell us to send *them* our views and that *they* will consider them. No doubt—and consign them to the waste-paper basket, as of yore.

Even outsiders see that science is losing its influence. Dean Inge, in one of his recent outspoken addresses, pointed out that "a general revolt against the dictatorship of science had been the most remarkable tendency in modern thought. In politics the anti-scientific temper was rampant. The revolution which more than a hundred years ago guillotined Lavoisier, 'having no need of chemists,' was now proclaiming that it had no need of intellectuals of any kind. In Russia they had been tortured and massacred; in our own country they were ignored and despised."

Ephemeral writers such as Mr. G. K. Chesterton openly scoff at us and lead the public to believe that evolution is a theory of the past and eugenic doctrine moonshine. Their word is accepted, ours is not; the clown is ever popular, the comic actor always preferred to the tragic; if we will assume only the prophet's mantle we must expect to be stoned.

It is useless for Sir Ray Lankester to take such men across his knee and thwack them in his best grandfatherly style. The literary braggadocio is only to be silenced by showing him up as ridiculous; he is but playing a part—writing nonsense because it pays; it is his trade and we must not blame him but blame the school in which the class is bred and has its being. We are too conceitedly serious, hopelessly narrow in our outlook, too self-centred to be alive to public

needs—so individualised and so hopelessly jealous among ourselves that we will not co-operate and organise our forces. Nothing could show this more clearly than the way in which the Royal Society has sacrificed its opportunities during the war period by failing to bring all its fellows together and thus make our corporate influence felt. Little wonder that science is being more and more excluded. We are talking of government by public opinion but real opinion cannot be made public. The columns of the Press are not open to any serious discussion from our side; the books we write are not understood even by ourselves. Owing to excessive specialisation we are becoming less and less able to express and protect ourselves, less interested in stating our case in any broad way; what is worse, too selfishly immersed each in his own narrow occupation to consider the general interest: an we be not careful the position won for us by the protagonists of the past will soon be lost to us.

Our failure is as window-dressers; we have not displayed our goods in the right manner. When a business is a failure, the only way to re-establish it is to reconstruct the management. That we have yet to learn this elementary truth is clear, however, from the recent appointment to the treasurership. A young man should have been found for the office, gifted not only with scientific experience but also with some breadth of outlook, some understanding of men and affairs; instead, a senior member of the Association has been chosen.

If a senior were desirable, no better choice could have been made; but I believe my old friend Principal Griffiths will not mind my saying that he is saved from inclusion in my class of elderly amiables only by the fact that throughout the war he was conspicuously active in his efforts to bring the value of scientific method before the public; he is far too soft-hearted to face the exigencies of the present situation.

The council must cease to be all but entirely an old or even an elderly man's show; responsibility must be forced upon the younger generation of active workers.

The secretaries obviously have no policy; new men must be chosen at the earliest possible date—I trust on the three years' hire system advocated in my former letter, so that the different subjects may be cared for at shorter intervals.

The real question at issue is: "How are we to get at the public?" To do this we must look beyond the meetings and in some way arrange for the preparation and issue each year of a few authoritative tracts dealing with bedrock problems in language that can be understood by all. Subjects can easily be found; under E alone enough are to hand—*Economics*, *Education*, *Energy*, *Entomology*, *Eugenics*, *Evolution*. Nobody believes in these, few know what the terms comprise, yet the future of our race depends on an intimate understanding and application of the doctrines they cover. A great work would be done by the Association if only, by real discussion not the dreamy, introspective twaddle of Section L, the nonsense now spoken of as education were reduced to terms of wisdom.

HENRY E. ARMSTRONG.

The Constitution of the Elements.

SINCE my last letter under the above title in NATURE of July 1, experiments have been made with a few more elements. The work has been progressively more and more difficult, for it has not been easy to find volatile compounds suitable for use, and when found the very objectionable chemical properties of some of them have led to experimental trouble and disappointing results. Thus selenium, tin, antimony, and tellurium have so far yielded no result of any value.

Fortunately, iodine (atomic weight 126·92) gave definite and unmistakable effects. It proves to be a simple element of mass 127—a result satisfactorily confirmed by a single line at 142 corresponding to CH_3I, the vapour used in the experiments. This result has particular interest in view of the recent work of Kohlweiler (*Zeit. Phys. Chem.*, vol. xcv., 1920, p. 95), who deduces five isotopes of iodine, all of even integral atomic weights, and claims to have effected a considerable separation of these by diffusion.

Owing to the kindness of Prof. Collie and Dr. Masson in providing me with a sample of gas rich in xenon, I have been able to identify two more probable isotopes of that element and obtain trustworthy values for the atomic weights of the five already found. The provisional figures given for these turn out to be too low. The values quoted below were obtained from the position of the second-order line 64·5. They should be trustworthy to about one-fifth of a unit.

Additional evidence on argon leads to the conclusion that its isotope 36 need no longer be regarded as doubtful.

The following table gives the results to date:

Table of Elements and Isotopes.

Element	Atomic number	Atomic weight	Minimum number of isotopes	Masses of isotopes in orde of their intensity
H	1	1·008	1	1·008
He	2	3·99	1	4
B	5	10·90	2	11, 10
C	6	12·00	1	12
N	7	14·01	1	14
O	8	16·00	1	16
F	9	19·00	1	19
Ne	10	20·20	2	20, 22, (21)
Si	14	28·30	2	28, 29, (30)
P	15	31·04	1	31
S	16	32·06	1	32
Cl	17	35·46	2	35, 37, (39)
A	18	39·88	2	40, 36
As	33	74·96	1	75
Br	35	79·92	2	79, 81
Kr	36	82·92	6	84, 86, 82, 83, 80, 78
I	53	126·92	1	127
X	54	130·32	5, (7)	129, 132, 131, 134, 136, (128, 130?)
Hg	80	200·60	(6)	(197–200), 202, 204

(Numbers in brackets are provisional only.)

F. W. ASTON.

Cavendish Laboratory, November 30.

Solar Variation and the Weather.

IN NATURE of July 29 last (p. 678) appears an article by Dr. C. G. Abbot on solar variation and the weather, in which reference is made to the use of solar data by the Argentine Weather Service. Drs. Nansen and Helland-Hansen have also found some interesting correlations between the variations of solar radiation as measured by Dr. Abbot and variations of temperature and pressure in Norway.

As other investigators will no doubt be tempted into this field, I feel that it may be of interest to give briefly a summary of our latest results and conclusions. These conclusions are based on the study of an immense amount of data from various parts of

the world, the results of which will be published in due time.

The first and most striking result is that the solar radiation exerts a cumulative effect on the atmosphere so that prolonged periods of high or low solar radiation have a much greater response in atmospheric action than shorter periods of greater intensity. Thus a deviation of 5 per cent. from the average radiation of short duration might not produce so great an effect as a long period, with a mean deviation of 2 per cent.

The second result is that as the sun changes from one hemisphere to another the effect on the weather changes, so that in the hemisphere where the sun is nearly vertical the pressure falls over the land surface and rises over the water surface, while the opposite effect is found in the other hemisphere. This effect I take to be a proof that a considerable part of the increased solar radiation reaches the earth's surface and intensifies the normal effect of absorption of solar radiation by the land. There are, however, clear indications that a considerable part of the increased solar radiation is absorbed by the upper air and gives origin to atmospheric waves which, if they are not the determining cause, at least are very influential in determining the discontinuities referred to recently in NATURE by Prof. Bjerknes.

These atmospheric waves are of a complex nature, and for this reason the correlations with solar changes are best seen by separating the solar and weather changes into shorter and longer (or slower) waves.

By taking averages of ten days we found for 1916 correlations as high as 84 per cent. with certain Argentine stations, and correlations exceeding 80 per cent. in later years. The shorter waves do not give such high correlations, apparently for several reasons, the most important, perhaps, being that there are still some errors in the solar values due to the difficulties of eliminating the effect of changing transparency of the air while the solar observations are being made.

This difficulty has undoubtedly been greatly diminished during recent months by the use of the pyranometer, which enables the observers to get measurements of the solar heat from a single bolograph. Certainly since this method was begun the correlations of the solar variations with atmospheric waves have increased. Another difficulty appears to be that while the waves start from definite centres of action, these centres shift position to some extent, so that the time interval of the effects following solar changes is variable, and this variability is of greater importance in the shorter waves.

The prolonged effects following unusually high or low values of radiation shown by Dr. Abbot's curves, reproduced in NATURE, I believe to result from the normal sequence of events on the surface of the sun. After a marked excess or defect of radiation there is likely to follow a similar deviation from the normal after an interval of ten to thirteen days.

This result I believe to arise from the fact that when there is a marked outbreak of heated solar gases on the edge of the sun, where absorption is normally great, the total radiation is more intensified than when the outbreak is near the centre. If the outbreak is near the edge it will be carried by rotation to the opposite edge in from about eleven to nineteen days, according as to whether the position is on the east or west edge.

In the same way cooled gases produce their greatest absorbing effects when near the edge of the sun, and there is the same tendency to repeat. These effects also tend to repeat themselves after a solar rotation, but in that case the interval is so long that marked changes have usually occurred. However, these repetitions are sufficiently numerous to make it practically certain from the length of the rotation that the conditions causing the marked deviation from normal are in the region of the prominences, and not in that of the sun-spots, which have a period of about twenty-seven days.

These studies of the relations between solar changes and the weather have been in progress in the Argentine Meteorological Office for several years, so that when a station of the Solar Physics Observatory of the Smithsonian Institution was opened in Chile, arrangements were made between Prof. G. O. Wiggin, director of the Argentine Weather Service, and Dr. Walcott, director of the Smithsonian Institution, for the transmission of the solar radiation measurements by cable to Buenos Aires and for their use so far as possible in weather forecasting. To this work Prof. Wiggin and the assistant chief have given enthusiastic support, and through their efforts, and as a result of a growing interest in the subject in Argentina, the Legislature has recently appropriated some 25,000 pesos for the installation of a solar observatory in Argentina.

The forecasts are made for a week in advance by publishing estimated temperatures for each day, and also forecasts of expected rains. With increased experience there have been steady improvements and an increasing demand for the forecasts by commercial interests.

There are many complexities which remain to be solved, and perhaps some which can never be solved, but I believe that a distinct advance has been made in forecasting, and the progress is too far advanced to be turned backward. One of the greatest difficulties is the inversion of the solar relation with the season, and occasional inversions for other reasons not yet clearly understood.

Heretofore, most of the studies by others in regard to the relation of solar changes and atmospheric phenomena have been in reference to the sun-spots. Dr. Abbot's observations indicate clearly that there is a change of solar radiation corresponding to the eleven-year sun-spot period. The radiation increases with the increase in spottedness, but this change is of relatively small importance compared with shorter changes of greater intensity.

Sir Norman Lockyer suggested some years ago that there were weather changes due to solar changes other than the eleven-year period, and brought evidence to show that a period of about four years in the outbreak of prominences caused atmospheric changes having the same period. But solar radiation shows a variability far greater than is indicated by the observations of prominences, and the high value of the correlation between these and the weather which we have found for the Argentine and for other regions of the world leads me to believe that these changes are the chief, if not the only, cause of weather changes as distinct from the well-known diurnal and annual periods.

H. H. CLAYTON,
Chief of Forecast Division.
Oficina Meteorológica Argentina.

The Physical Meaning of Spherical Aberration.

THE nature of the distribution of light round the axial focus of a lens is a problem which has frequently been attacked mathematically. It has been quite successfully solved for points in the principal focal plane of an "aplanatic" lens when the intensity is found to

depend on functions of the form (assuming Huygens's principle)

$$\text{Intensity} = \text{const} \times J_1^2\left(\frac{2\pi k}{\lambda} \cdot \frac{a}{R}\right),$$

where J_1 is the Bessel function of the first order, R the radius of the wave-surface at the lens, a the semi-aperture, and k the distance of the point from the axis. At present it has not been found possible to give an expression for the light distribution in the presence of spherical aberration, or away from the focus, which can be physically interpreted in such a simple way. Prof. Conrady has been able, however, to determine the distribution numerically (Monthly Notices, R.A.S., vol. lxxix., No. 8) in a series of simple cases by mechanical quadratures which give the value of the integral

$$I = \text{const} \times \int_{a=0}^{a=a_1} \{J_0^2(aa)\cos^2\eta_a + J_0^2(aa)\sin^2\eta_a\} d(a^2),$$

where

$$a = \frac{2\pi k}{\lambda R},$$

η representing the phase which is supposed to vary in a spherical reference-surface by an amount depending on the spherical aberration. Prof. Conrady assumes a series of likely cases for phase distribution. No analytical expression for η can be obtained for any but the simplest optical systems, but empirical expressions can easily be derived from the result of trigonometrical ray tracing or Hartmann tests in the most complex systems, thus enabling the truth of the numerical results for light distribution to be checked experimentally. The value of

$$\eta_a = \frac{2\pi}{\lambda}\int_0^a \theta da \text{ (very nearly)},$$

where θ is the angular aberration derived from the calculated or observed lateral aberration or lateral intercept due to displacement from the centre of the spherical reference surface.

It is not too much to say that the thorough solution of the problem is of the greatest importance in the study of the performance of optical instruments. In order to search for the actual phenomena predicted by Prof. Conrady in theoretical cases, and further to explore the subject, I have recently carried out a critical examination of the image of a very small source of light (a fine "pinhole" in a silver film) produced by a microscope objective having excellent spherical correction, and for which the curves, glasses, etc., were known. The spherical aberration introduced by varying the tube-length can thus be calculated for any conditions. A nearly linear relation was found between the phase difference of the paraxial and marginal rays at the marginal focus and the reciprocal of the tube-length.

As a check on the calculation, I was able to devise a method of performing a test on the microscope objective very similar to the well-known Hartmann test employed for telescope object-glasses. By this means the properties of the objective became well known.

The changes in the distribution of light at the best focus in the presence of varying amounts of spherical aberration have been examined quantitatively, both visually and photographically. A perceptible loss of light from the central disc, estimated at 20 per cent., occurs when the residual aberration at the best visual focus amounts to 0·25λ. Such light is scattered into the surrounding field; it does not appear in the first bright ring at this focus. The sizes of the rings in the diffraction pattern at the best visual focus do not depart measurably from the theoretical values in the presence of residual aberration amounting to 0·6λ at the focus where there is least confusion of phase.

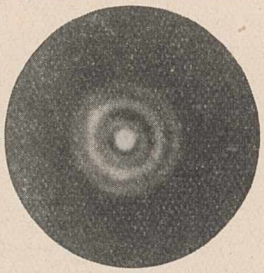
The "out of focus" appearances present many points of great interest. It appears that the successive bright rings retain a marked individuality, but suffer periodic variations in brightness and "thickness." This causes the dark rings between them to suffer corresponding variations in "darkness" and in radius. Under a high magnification the familiar broad, dark diffraction rings which appear to grow in the expanding "out of focus" disc are found to grow as the result of this periodic motion of the smaller dark interference rings, the whole action resembling that of a model to illustrate the propagation of the compression waves of sound.

If, when the aberration is a minimum, we go sufficiently far out of focus to introduce a path-difference between marginal and paraxial rays, $dp = 0{\cdot}5\lambda$, on either side of the focus, we find that the first dark ring has nearly filled with light. At about $dp = 1\lambda$ the central disc has lost all its light, and the first bright ring is at a maximum. At about $dp = 1{\cdot}5\lambda$ the central disc has again reached a maximum, the first ring is at its minimum, the second at a maximum, and the third nearly equal to the second. We thus see the first broad, dark diffraction ring between the central disc and the annulus of light formed by the second and third bright rings. So the various changes progress, the location of the successive bright rings being given fairly nearly by the ordinary theory. When, however, a definite amount of *aberration* is introduced, sufficient to cause a residual variation of phase of 0·5λ at the best focus, the changes are violently dissimilar on the two sides of the focus—a fact which is fairly well known. On one side there is a quick dissolution of the central concentration into a mere haze, while on the other a bright and well-formed ring system is found in which the broad diffraction rings spread out with much the same action as before, except that the periods of the variations are altered from those in the "no aberration" adjustment. Further, on this side of the focus, as was suggested by Prof. Conrady's numerical results, a central concentration persists which diminishes considerably in size as compared with the "best focus" disc, but remains brighter than the rest of the ring system up to a path-difference $dp = 3\lambda$—a displacement in the actual focussing point of 7 mm. in a total tube-length of 23 cm. It can easily be seen that this effect is quite capable of rendering possible instrumental performances, so far as resolving power alone is concerned, far in excess of any value possible in the absence of spherical aberration, although this would be a perfectly legitimate conclusion only for such cases as that of a double-star resolution by a telescope objective. A fairly complete set of photographs to illustrate the various appearances has been made. These have been measured and examined for the purpose of intensity determinations.

The importance of these matters lies in the determination of the effects of aberration, expressed in ray intercepts, on the distribution of light in the image, as the distribution suggested by ray concentration is often nothing approaching the truth. The "out of focus" appearances, too, are of great importance in dealing with "roundness of field." It is possible, in the light of such results, to form ideas as to legitimate tolerances in design and manufacture.

The investigation, to become complete, must be extended to other types of aberration, but it is hoped shortly to publish a complete account of the experimental work, of which the foregoing *résumé* may

give an idea of the scope. The photograph herewith shows the ring system when a residual aberration, in the sense of "over-correction," of 0·5λ is present at the best focus, and when the reference plane is taken sufficiently far outside the focus to make the path-difference $dp = 1{\cdot}8\lambda$. The small central concentration and the persistent individuality of the interference rings are shown. The first "broad" diffraction ring is now formed through the low intensity of the first bright interference ring. The whole of the above work relates to nearly monochromatic light only.



A good many of the broad features of these aberration and "out of focus" effects can be explained without difficulty on the basis of the Fresnel zone theory, and it is hoped to include a short discussion of this kind in the paper. No more need be said at present except to direct the attention of the readers of NATURE to the importance of the paper on "Star Discs" to which the reference is given.

L. C. MARTIN.

Imperial College of Science and Technology,
November 25.

"Phenomena of Materialisation."

IN NATURE of November 18 I find what purports to be a review of Dr. von Schrenck-Notzing's work translated by me under the above title. I have always supposed that a reviewer should tell the reader what the book is about. The review in question is headed "The Newer Spiritualism," and begins: "'Of making many books' on spiritualism 'there is no end.'" It states that the phenomena are alleged to have "a spiritistic interpretation," and refers to "the numerous photographs of her [the medium] sandwiched between faked spirit photographs." All this is thoroughly misleading. The book is not about spiritualism. Both the author (p. 30) and the translator (p. x) discard the "spirit hypothesis" as unnecessary. The author says that "it impedes and hinders in every way serious scientific investigation." The book contains no portrait of the medium, and not a single "spirit photograph," faked or otherwise. The photographs reproduced have not been manipulated in any way except Nos. 127, 128, 134, 136, 138, and 140, in which, for purposes of publication, the sex characteristics have been obliterated. These six photographs are marked "retouched," and the reason for retouching is stated in the text.

The review abounds with other inaccuracies. A red light was not always employed (see p. 306). Mme. Bisson did not "hop in and out" of the cabinet. The rare occasions on which she entered it are stated, as are all the other conditions, with what the reviewer calls "dreary uniformity," but with what the ordinary scientific reader would call conscientious accuracy.

The reviewer's challenge to "exhibit" the phenomena in London before well-known hostile critics is about as reasonable as to ask a performing mouse to exhibit its tricks before an audience of hungry cats. The psychological element would probably produce similar inhibitions in both cases. The phenomena are nearly as rare as the fall of a meteorite from the sky, and nearly as spontaneous as the production of biological "sports." They cannot, therefore, be produced before a massed audience. It is useless to think that any living individual is eminent enough to carry a general conviction of the reality of the phenomena, even though he be personally convinced. The only resource is to take the phenomena as and when they come, to record them carefully, if possible by photography and other instrumental means, and to make the experimental conditions gradually more rigid until we can only conclude that we are face to face with a new set of biological phenomena exhibiting the known powers of the human organism in an intensified and much accelerated form. And this is precisely what Dr. von Schrenck-Notzing has done.

E. E. FOURNIER D'ALBE.

IT will be well to deal with Dr. Fournier d'Albe's charges against my accuracy *seriatim*:

(1) "Both the author (p. 30) and the translator (p. x) discard the 'spirit hypothesis' as unnecessary." I might have made this clearer, but the repudiation is not easy to reconcile with the contents of a book crammed with references to occult phenomena, as, *e.g.*, mediumistic, psychic, and telekinetic.

(2) "The book contains no portraits of the medium, and not a single 'spirit photograph.'" This is an amazing statement. There are 225 illustrations. Of these there are 13 "drawings," so-called; all the rest are flashlight photographs of the medium (if not, then of whom?) in various attitudes, a large number showing the teleplasma issuing from her mouth, etc. There are 20 flashlight photographs—"phantasms" they are called—of dead and living people. Among the former Mme. Bisson recognised the features of a deceased nephew, Georges Thurner, and also of her husband, who died in 1912.

(3) "A red light was not always employed (see p. 306)." "All the sittings took place in a red light, so that during the four years there was not a single dark séance" (p. 21). The translator may be left to reconcile this statement with the exception to which he gives the reference.

(4) "Mme. Bisson did not 'hop in and out' of the cabinet." Probably she neither hopped nor skipped, but her visits to the cabinet were frequent enough to arouse suspicion as to collusion with a medium over whom she had "absolute control" (p. 59). Dr. Fournier d'Albe does not appear to have been present at the sittings.

(5) "The reviewer's challenge" cannot be accepted because the phenomena cannot "be produced before a mixed audience. . . ." "We are face to face with a new set of biological phenomena." So long as those who assert their belief in teleplastic exudations from the body and in the genuineness of photographs of the dead refuse to submit these "new biological" phenomena to the conjoint judgment of men of science and conjurers, they must not be surprised that their so-called "evidence" carries no weight save among the credulous.

THE REVIEWER.

Higher Forestry Education for the Empire.

A CORRESPONDENT has sent us some remarks upon Prof. Stebbing's letter dealing with forestry education in NATURE of December 2, but he has omitted to give his full name and address. No use can, therefore, be made of his communication.—EDITOR, NATURE.

Automatic Printing of Wireless Messages.

ONE of the recent developments in wireless telegraphy, which, as we have already announced briefly, was demonstrated by Mr. A. A. Campbell Swinton during his address on November 17 to the Royal Society of Arts, is the automatic printing of wireless messages in roman type. Several systems of printing telegraphy are in use on ordinary lines, but the ingenious method designed by Mr. F. G. Creed is, we believe, the only one that has been adapted to the printing of wireless messages. High-speed wireless reception in various forms is being used to an increasing extent, and Morse code messages are recorded by optical and mechanical methods, as well as by an instrument analogous to a phonograph; but the actual printing of the words in ordinary type on a paper strip presents obvious and very great advantages.

That this result has been rendered possible of achievement is mainly due to the greatly improved methods of amplification of the signals received now available, which have enabled current impulses of sufficient strength for the actuation of the necessary relays to be obtained from the minute oscillations in the receiving aerial. Briefly, the system consists in a combination of the existing printing telegraph apparatus designed by Mr. Creed with the latest arrangements of groups of thermionic valves such as those devised by Capt. L. B. Turner and other workers, who carried on important researches in this direction during the war.

In the Creed system, whether for wireless or line transmission, the message is first translated into the Morse code by punching a perforated strip of paper in an apparatus, with a typewriter keyboard, so contrived that each key perforates the strip, by a solenoid operated mechanism, with the Morse equivalent of the letter in question. This strip, exactly as in the case of automatic Wheatstone working, is passed through the transmitting instrument, which sends out current impulses in the ordinary way in the dots and dashes of the Morse code. These, in ordinary telegraphy, go direct into the line, but in wireless working they are used to actuate a special transmitting contact maker, forming the equivalent of a high-speed relay-operated Morse key. Messrs. Creed and Co. have developed several sizes of transmitters for this purpose, including one suitable for very powerful installations, worked by an electro-pneumatic relay arrangement, and capable of dealing with as much as 300 kw. This has eight sets of contacts in parallel, each breaking under a powerful air-blast.

The waves at the receiving station are picked up by a thermionic-valve receiver, and considerably amplified by a number of valves in cascade in the manner employed in connection with other methods of recording. Current impulses are thus supplied to the relay magnet, forming part of the apparatus known as the Creed receiving perforator. This is of the same form as that used in line telegraphy, and, as employed hitherto for wireless reception, is worked by compressed air, although the company is now developing an electrically driven pattern on a mechanical principle, which is simpler and more compact, and dispenses entirely with compressed air. The Creed air-engine relay used in the instrument is a very interesting piece of apparatus. The tongue of the electrical part of the relay, instead of operating electrical contacts, actuates a very small slide valve controlling a little auxiliary piston, which moves the slide valve of the larger main piston. This, by moving in one direction or the other, drives forward one or other of the perforating punches, through a system of levers.

A very ingenious device arrests the motion of the strip while the holes are being punched. The strip from the receiving perforator, which is still in the Morse code, is the exact counterpart of that used at the transmitting station, with holes side by side to indicate dots and staggered to represent dashes, and a continuous row of holes down the centre for feeding purposes. The arresting action is effected by a plunger being thrust forward between the teeth of a spur-wheel on the shaft of the feed-sprocket. The holes are punched opposite each other if the second punch moves forward soon enough after the first for this wheel not to have advanced a whole tooth pitch, so that the arresting plunger, in reaching the bottom of the space between the teeth, really brings the paper back a little way. On the other hand, if the wheel has advanced by a whole tooth pitch or more, the plunger engages in the next space, and the second perforation is advanced beyond the first. A Creed receiving perforator is seen in the centre of Fig. 1.

The perforated strip is then passed on to the Creed printer. The great feature of this remarkable piece of apparatus is that it forms an automatic typewriter controlled entirely by the position of the holes in the perforated strip, and translates Morse code into printed characters. It is impossible here to do more than to indicate the general principle on which the instrument works, although it is on the perfection of the design of details that much of its success depends. In Fig. 1 the strip from the perforator is seen passing direct to the printer, and a printer by itself is shown in Fig. 2.

The perforated paper strip is fed past a group of spring selecting needles, ten on each side, and when it is momentarily at rest with the portion corresponding to a letter opposite the needles, a certain number, forming a pattern corresponding to the letter, protrude through the holes in the strip. Each needle which has thus advanced causes, in a way indicated later, a change in the position of one of a pack of thin steel strips or sliding valve plates. These valve plates lie between two fixed perforated plates, and are

themselves perforated in such a way that the position assumed for each combination of the selector

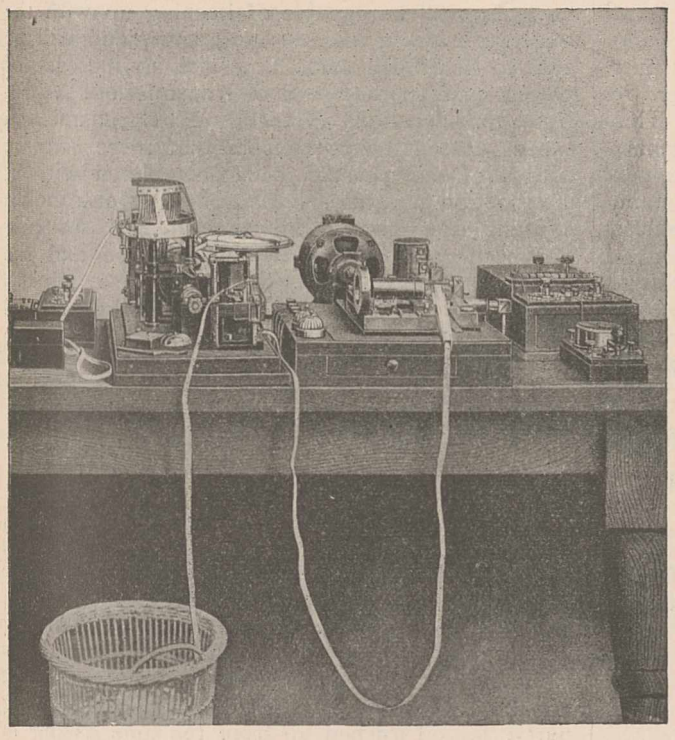


FIG. 1.—Complete receiving-printing apparatus, including receiving perforator with relay and printer.

needles corresponding to a letter in Morse on the strip causes coincidence of the perforations at one point only, so that there is a clear aperture through the whole pack in a position corresponding to a letter. The bottom plate is supplied with compressed air at the moment in the cycle of operations corresponding to the printing of a letter, and each aperture in the fixed top plate communicates with a small cylinder, in which moves a piston actuating one of the type bars, through levers like those of an ordinary typewriter. Thus a letter is printed corresponding to the position of the coincidence of the valve-plate apertures.

The arrangement whereby a variable feed is given to the strip, according to the length of the letter, is combined with that for actuating the valve plates in accordance with the selection made by the needles. A reciprocating feed-rack is provided, which, when required, can gear into a spur-wheel on the same shaft as the feed-sprocket. The length of its downward travel while out of gear depends upon the point where it is arrested by the projection of one of a group of spacing levers. Normally, these levers are pushed out of the way by the selecting needles, but where neither of a pair of selecting needles advances—*i.e.* where there is a space signal—a space lever continues to stand out, thus limiting the movement of the rack to the length of the letter. A sideways movement is then given to the rack, putting it into gear and causing the perforated strip to feed forward, by exactly the length of the letter just dealt with, during its return journey. Each selecting needle, as it advances, causes a hinged piece on the corresponding valve-plate extension to move forward and to form a shoulder by the side of the feed-rack, so that the sideways movement of the feed-rack is also the actual cause of the shifting of the selected valve plates. It was mentioned above that there are only ten valve plates, whereas twenty selecting needles are provided. It is only the lower group of ten needles that controls valve plates, but the remainder are required to actuate spacing levers. Although more selecting needles may pass through the strip than those corresponding to the letter in question, only the proper number of slide valves are acted upon by the rack, on account of the limitation of its travel by the spacing levers. There are several other features, including the method of withdrawal of the selecting needles and the timing of all the various operations by means of cams, which we cannot dwell upon. The whole apparatus, including a small attached air-compressor, is driven by an electro-motor, so that no external source of compressed air is required.

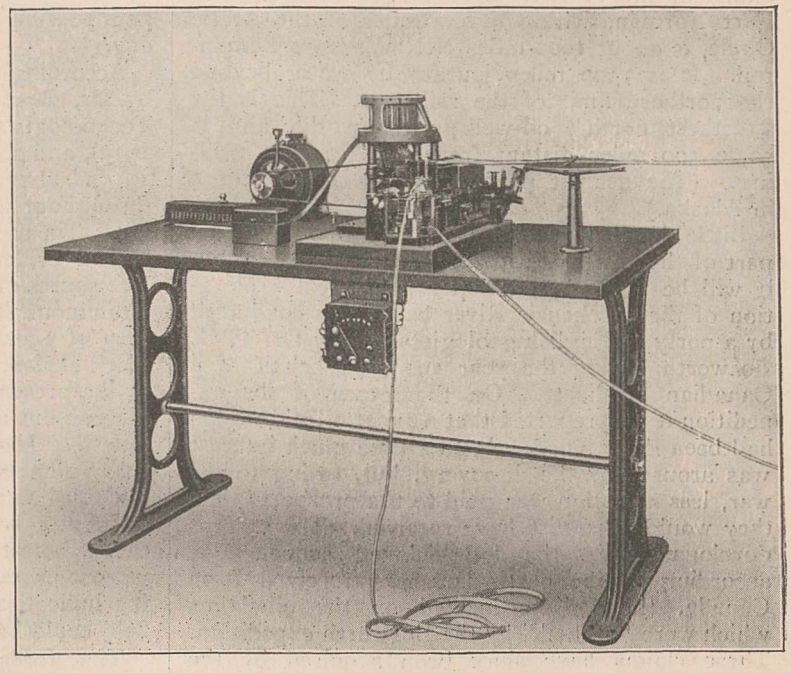


FIG. 2.—Creed type printer translating from perforated Mors strip.

Messrs. Creed and Co. have also developed an improved form of printer, in which compressed air is dispensed with, and the type characters are mounted on a circular disc and hit from behind by a little selecting hammer which is caused to stop at the part of the revolution corresponding to a letter by a circular group of selecting levers. This form of the apparatus is much more compact than the original instrument, and has a much higher printing speed; but we understand that it has not yet been adapted to wireless reception.

The Creed system with compressed-air working, as adapted to wireless reception, is capable of a speed of transmission of about 180 words a minute, which is in excess of the speed of the printer; so that, in order to obtain the full capacity, two printers would have to be installed for one receiving perforator. The improved printer, however, will be capable of keeping up with the receiver, even in its improved form, and will be able to deal with something like an increase of 50 per cent. in the speed of transmission. Apart from considerations of traffic, high transmission speeds present advantages in that there is more chance of the message being completed without interruption by atmospherics or other extraneous effects. Very successful experimental working has been carried out between Cologne and the War Office station at Aldershot, and a wireless printing equipment of this kind is to be adopted between Brussels and a large station in the Congo district.

The New Oilfield of Northern Canada.

By W. JONES.

CONFIRMATION has now been received from Canada of the news that an important oil-well has been obtained in the North-West Territory of Canada. The full significance of this event is only gradually being realised by the public. It is probable that this is the commencement of the development of the largest oilfield in the British Empire—possibly one of the largest in the world.

For several years it has been known that geologists had found a land of much promise in the north, but until now, owing to the difficulties of transportation, no drilling operations had been attempted. The well, which is situated on the banks of the Mackenzie River, 48 miles beyond Fort Norman, within a few miles of the Arctic Circle, is about 1000 miles N.N.W. from Edmonton. It is 1300 miles journey by water beyond the northern limit of the railroads. This is the "farthest north" oil-well in the world, and is some 500 miles distant from any previous drilling. (The nearest producing oil-wells are those in Alaska.)

Little detailed geological information about this part of the North-West Territory is available, but it will be remembered that a geological exploration of the Mackenzie River basin was conducted by a party of English geologists, led by Dr. T. O. Bosworth during the year 1914, on behalf of a Canadian syndicate. On the return of the expedition it was reported that a great oilfield region had been determined. At that time much interest was aroused by the discovery, but, owing to the war, less attention was paid to the prospects than they would otherwise have received. The present development is the long-delayed sequel, for, according to the particulars now received from Canada, the well is located on the oil-claims which were "staked" by the Bosworth expedition. These claims have since been acquired by the Imperial Oil Co., the geological department of which has been headed by Dr. Bosworth for a number of years.

The drilling machinery was sent north in 1919, and the well has been drilled on the site which was chosen in 1914 for the crucial test. The drillers stayed at their post throughout last winter, and the actual drilling commenced in the spring of this year. In the first 200 ft., useful quantities of a very high grade oil were struck, and at 800 ft., according to the report of the drilling party, the oil gushed up from the 6-in. casing in a column which rose 15 ft. above the top of the derrick. After half an hour the drillers capped the well, so that the oil may be preserved until storage tanks can be constructed. Until that time the well's exact yield will not be measured, but it is probable that it will produce a thousand, and possibly several thousand, barrels of oil a day.

According to the brief statement made in 1915 by Dr. Bosworth to the Institution of Petroleum Technologists (Journ. Inst. Pet. Tech., March, 1915), and also in the *Petroleum World* (February, 1915), abundant seepages of oil were found throughout a very large region occupied by the Devonian rocks, and "in that region all the geological evidences of oil conspicuously occurred." The source of the oil was a thick deposit of "black bituminous shales and limestones, which cover an area of enormous extent." "In some places the black shales were actually undergoing combustion at the present time, and in several places oil was seeping out into the water for distances of several miles." The structure also was favourable, for the region is traversed by a system of mountain building anticlines. In Dr. Bosworth's opinion "the discoveries which had been made were of the greatest importance," and "fields of the utmost promise had been marked out, bearing all the indications and evidences that an unexploited field could be expected to show."

The foregoing remarks, together with the splendid result of the first test well, are significant. On studying a geological map of North America it will be seen that the Devonian forma-

tion of the Mackenzie River covers a very large area, extending for hundreds of miles along the direction of the river. In the reported words of a geologist who accompanied the drilling party this year, "the biggest oilfield in the world is what has now been opened in the north."

Before this great oilfield can be made commercially profitable there are, of course, many difficulties to contend with, especially the long distance from civilisation, the severity of the Arctic climate, and the lack of adequate transportation. But as these obstacles did not prevent the exploitation of the gold in Klondike, we need have little fear but that this precious fluid in the Mackenzie valley will be won.

Several of the Canadian Geological Survey Memoirs describe the Mackenzie River district, though they do not enlighten us much on the subject of petroleum, which was the special object of the Bosworth expedition. The most interesting of these is the report by Mr. R. G. McConnell, published in 1891, which mentions the bituminous rocks and pools of tar and oil, which he observed in many places. Memoir 108, on "The Mackenzie River Basin," by Messrs. Charles Camsell and Wyatt Malcolm, which appeared in 1919, also cites particularly the oil indications which Mr. McConnell had found; some of which had been noticed also by Sir John Franklin a century ago. This official memoir is very guarded on the subject of petroleum, and does not afford great encouragement to oil prospecting on the Mackenzie; but it is a comprehensive summary of the previously established facts, together with many valuable observations, old and new.

During the next few months there can be little or no progress made with the development in this frozen land, but doubtless many preparations are afoot, and next spring will see an unprecedented migration of oilmen to this northern clime.

Industrial Research Associations.

V.—The British Portland Cement Research Association.

By S. G. S. Panisset.

ALTHOUGH the Portland cement industry had its origin in this country, the chief developments have occurred elsewhere, and the greater part of the manufacturing plant now in use is either of foreign production or a close copy thereof.

It may be disputed that this position has arisen from the absence of organised research in this country, but it is certainly true that the amount of scientific investigation in the British Portland cement industry has been insignificant compared with the work done in the United States and on the Continent.

With these circumstances existing, it is clear that the British Portland Cement Research Association is a needed institution, and it is some comfort to know that its arrival is not too late to be effective. The extent of the field of research still awaiting exploration is such that no agreed answer can be given to the fundamental questions, "What is Portland cement?" and "What happens when cement sets?"

In spite of the extensive research that has been conducted in the United States by Government institutions and by universities, the real nature of cement, and the chemistry and mechanism of its setting, are still matters of controversy, owing to the lack of concrete evidence.

The manufacture, in fact, is still in the empirical stage, based solely upon the knowledge that a mixture of calcareous and argillaceous materials containing about 76 per cent. of carbonate of lime will, when heated to incipient vitrefaction, yield a product which on grinding has pronounced hydraulic properties. Whether the hydraulic effect is due to the presence of simple silicates and aluminates of lime, whether complex ternary compounds exist, or whether a part of the lime is uncombined and in the state of solid solution, are all problems which must be solved before it can be claimed that the best possible constructional material is being produced.

In connection with the setting of cement, it is still undecided whether this is due to colloidal or to crystalline action, and the manufacturer is accordingly in the dark as to whether he ought to be aiming at the production of colloids or of crystalline bodies to produce the best results.

The composure of manufacturers has now and again been disturbed by predictions that cement can be made from a mixture containing only two-thirds the conventional proportion of lime, and again that the stage of incipient vitrefaction now produced in rotary kilns can be improved upon by adopting blast-furnace methods and carrying the temperature to melting point. From the point of view of scientific knowledge the manufacturer is unable to deny that such statements are within the range of possibility, and hence there is always the fear that more than half the present cement-making plant may be rendered obsolete by new discoveries.

This is not a happy position for an industry, especially when such a discovery is likely to be the property of those who have hitherto been foremost in research—namely, the foreign competitor—and in this connection the advent of the British Portland Cement Research Association is not a day too soon.

Again, if it be supposed that the present methods of manufacture are permanent, the fact has to be faced that the thermal efficiency of the kilns in use is seldom more than 50 per cent., and here is a field for research that may lead,

upon cultivation, to a reduction in the cost of production. The importance of the matter to an industry consuming 1½ million tons of fuel in a year can be readily appreciated.

It is obvious, therefore, that a very wide field lies before the British Portland Cement Research Association, and the scope both for scientific and for industrial research is ample warrant for the existence of the association for some years to come.

The British Portland Cement Research Association was incorporated in November, 1918, and had the advantage of being founded upon the research department of the two largest cement manufacturers in the country. This research department had been in existence for five years, and had gathered together an experienced staff and a valuable equipment of scientific apparatus, while the large amount of spade-work that had been done has proved of great value to the association. Both staff and equipment were taken over entire, so that no time had to be spent in organisation, and research was in progress from the first day of the association's existence.

The council of the association has addressed itself in the first instance mainly to the industrial side of research, and the chief activity has been the investigation of the thermal efficiency of rotary kilns. The basis of this investigation has been the fact that the consumption of fuel in an ideal kiln for cement calcination would be no more than 15 per cent., compared with the 30 to 40 per cent. consumptions which are prevalent in actual practice to-day.

Another prominent subject of investigation has been the mechanics of pulverising and grinding, and the importance of this will be realised when it is stated that, as a rule, the production of Portland cement involves reducing to powder three materials with a total weight three times that of the final product, the power so absorbed ranging from 60 to 150 h.p.-hours per ton of cement.

A feature of investigations of this nature has been the commercial scale upon which they have been undertaken, involving the presence of the research staff of engineers and chemists upon the factories of one or other of the members of the association, and this intimate connection with the practical side of the industry has been of value in preventing research becoming too academic and too far removed from practical issues.

The purely scientific side, however, has not been neglected, and in the laboratories of the association at Greenhithe researches upon the setting of cement, the influence of raw materials upon cement, and other chemical subjects are in progress, while an experimental grinding mill has also been set up in the laboratory.

The aim of the association may be briefly summarised as an attempt to cheapen the production and to improve the quality of cement, and the achievement of this aim cannot fail to benefit the consumer while tending to stabilise the British industry.

The hearty co-operation of British manufacturers in this enterprise is shown by the fact that more than 90 per cent. of their number are members of the association.

Obituary.

SIR WILLIAM ABNEY, K.C.B., F.R.S.

ANOTHER of the conspicuous leaders of British science who rendered the latter part of the nineteenth century and the commencement of the twentieth so famous as a time of remarkable progress, and whose name was almost a household word throughout the land, passed away on December 2 in the charming and unique personality of Sir William de Wiveleslie Abney. Sir William Crookes, Sir Norman Lockyer, and now Sir William Abney—the recent months have indeed been heavy with fate for that glorious band of scientific workers, and the only consolation that these severe losses in the front rank leave with us is the knowledge that their great work was done, that their last paper was written with all their full mental powers, and that they passed away, at a ripe age truly, but before any failure of their great master minds became evident to the world at large.

Sir William Abney will ever be remembered, especially under his better-known earlier designation as Capt. Abney, for four things in particular: for his great services to the nation and to the cause of science in the Department of Science and Art at South Kensington; for his researches on the infra-red of the spectrum, leading on to his masterly use of the spectrum in regard to colour vision and colour measurement; for his development of photography into an exact science; and for his studies of the forms of ice and snow in the high Alps. Those of us who had the great privilege of attending his lectures on colour and its measurement at the Royal College of Science, where for many years he was occasional lecturer in physics, will ever regard those hours as among the most delightful and thoroughly enjoyable ever spent in a lecture-room. They were brilliant, not for what was said so much as for what was done, for the experiments were ever most elegant, beautiful, and even exquisite as regards the phenomena exhibited, and marked by an originality which was the direct outcome of a most original mind. It was a still greater privilege to be able to follow him into his research laboratory, and to see something of the most fascinating experimental work going on there, with the aid of his devoted assistant, Mr. Walter Bradfield, and which at frequent intervals resulted in a paper to the Royal Society, of which Sir William was elected a fellow so early as the year 1876.

Yet perhaps the most charming side of Sir

William Abney's personality was brought out during his annual summer visits to his beloved mountains. There, among the monarch peaks, glaciers, and snowfields of the Swiss, French, and Italian Alps, he was at his best, a most delightful companion, from whom one learnt something of value almost every moment, and by association with whom one learnt to appreciate the beauty and the "call" of that magnificent world, high up above the vain ambitions and struggles of the world below, in a manner which became one of the highest experiences of one's life. For Sir William was not merely a man of science; he was also both a philosopher and an artist.

He saw and realised the beauty of the natural world as few perceive it, and he had quite a gift of expressing it in water-colours, yet was never satisfied, because he alone understood in so unique a manner how utterly inadequately the pure colours of sky and sea, landscape, and the eternal snows of the Alps can ever be imitated in pigments. And the luncheons on the ice, high up above the Alpine valleys, or the after-dinner talks when the expeditions were over, with the congenial company of distinguished climbers, such as his old friends, Mr. Horace Walker and his sister, Miss Lucy Walker, Mr. Matthews, Mrs. Jackson, Mr. Eccles, Miss Venables, and M Loppé—these are all memories of Sir William in his happiest moments, when, with Lady Abney and Miss Janet Abney, and often other members of his family, the most delightful anecdotes and stories from his immense répertoire used to delight all within earshot.

Sir William was the eldest son of Canon Abney, of Measham Hall, Leicestershire, and was born on July 24, 1843. He was educated at Rossall, and became Lieut. R.E. in 1861, and Capt. in 1873. He was president of the Royal Astronomical Society from 1893 to 1895, and of the Physical Society from 1895 to 1897. He was also chairman of the Royal Society of Arts in 1904. He was created K.C.B. in 1900, and was Hon. D.Sc. and D.C.L. of several universities. He was Principal Assistant Secretary, Board of Education, from 1899 to 1903. Besides his very numerous scientific memoirs to the Royal Society and other learned societies, he is perhaps best known for his published books, the chief of which are: "Instruction in Photography" (1870), "Treatise on Photography" (1875), "Colour Vision," "Colour Measurement and Mixture" (1893), "Thebes and its Five Great Temples" (1876), "The Pioneers of the Alps" (with C. D. Cunningham, 1888), and "Trichromatic Theory of Colour" (1914).

The moment, however, is not one for the appraisement of so full a life of scientific work, for the loss of his many-sided delightful personality is too fresh upon us. It is rather of the kindly, genial, and altogether lovable man himself that we think, and deplore the fact that nevermore shall we see his burly form and jovial face, and hear his cheery words, ever full of inspiration to all that was highest and best.

A. E. H. TUTTON.

MR. WILSON HARTNELL, who died on November 10 in his eighty-second year, was well known in connection with his work on steam-engine governors. He was elected a member of the Institution of Mechanical Engineers in 1872, and his paper on automatic expansion gears, read in 1882, has been a mine from which hosts of engineers interested in governors have extracted theorems and data of great practical value.

SIR FREDERICK TAYLOR, BT., who died on Thursday, December 2, was born in 1847, and received his medical training at Guy's Hospital. He proceeded to the degree of M.D. at London University in 1870, and was university scholar in obstetric and forensic medicine; later he represented the university on the General Medical Council. Sir Frederick was appointed consulting physician to Guy's Hospital, and remained in close touch with that institution throughout his life; he was also physician to the Seamen's Hospital, Greenwich. In 1907 he delivered the Harveian Oration. His career reached its culminating point when he was elected president of the Royal College of Physicians, and had illness not intervened he would probably have been re-elected for a second term of office. Sir Frederick was the author of numerous contributions to medical societies and journals, although he is probably best known for his "Practice of Medicine," a standard work which has reached its eleventh edition.

Notes.

IT has been generally understood that the Water Power Resources Committee of the Board of Trade has for some time been considering the possibility of tidal-power development, with special reference to the Severn estuary. In view of this it would be of interest to know to what extent the scheme formulated by the Ministry of Transport has been influenced by the conclusions of that Committee. As outlined and illustrated in the *Times* of November 26, the scheme would appear to be open to certain weighty objections, and, in view of the large number of technical problems, alike in mechanical, electrical, and hydraulic engineering, which require to be co-ordinated and solved before any such scheme can be embarked upon with any certainty of ultimate success, there would not appear to be any likelihood of its materialising immediately. At the same time the prospects of the scheme, should it prove commercially and mechanically feasible, are so great that every endeavour should be made to have the matter investigated in the fullest detail by a strong technical and scientific Commission. As pointed out in NATURE of June 3 last, much still requires to be known on such questions as those regarding the effect of the proposed barrage on the

silting of the estuary and on the general *régime* of the river, the best size and form of turbine and generator, the use of alternating- or direct-current generators and of geared or ungeared turbines, the maximum economic capacity of the installation, and the volume of water actually available in the case of such an estuary as that of the Severn under operating conditions. All these are problems to which existing data are inadequate to enable a complete answer to be supplied, but to which such experience as is available, augmented by some special experimental investigations, should be adequate to give a definite answer. Tempting as the scheme may appear, it would be wise to suspend judgment as to its possibilities until the report of some such Commission as is suggested is available.

IN continuation of the article in NATURE of April 1 last, p. 153, on the Tropical Agricultural College in the West Indies, it may be noted that a circular letter dated January 27, 1920, was sent out by the Colonial Office to Governors of West Indian Colonies directing their attention to the report of the Committee upon the proposed agricultural college, and to the advantages that would be likely to accrue to the Colonies from its establishment. It was pointed out that the West Indies had now the chance of creating an epoch in their economic history, especially as they are at present so prosperous that they might well hope to equal or surpass any similar institution on foreign soil. Much hard work and skilled direction will, however, be necessary if Buitenzorg is to be surpassed. The letter ends by demurring to the proposal that the Imperial Government should contribute half the cost, pointing out that the Colonies do not contribute to the cost of institutions in this country that are of value to them. Later telegrams announce that the vexed question of the site has been settled in favour of Trinidad, which Colony has now a great opportunity before it. The site has been selected on the Government farm at St. Augustine, about six miles from Port of Spain. The Governments of Trinidad, Barbados, Grenada, St. Lucia, St. Vincent, the Leeward Islands, as well as Bermuda, have offered financial support.

A CONSIDERABLE impetus should be given to electrical research by the incorporation under the Department of Scientific and Industrial Research of the British Electrical and Allied Industries Research Association, which is the outcome of the joint activities of the Institution of Electrical Engineers and the British Electrical and Allied Manufacturers' Association. Half of a guaranteed minimum income of 16,000*l.* per annum is to be contributed by the Department of Scientific and Industrial Research, which has also undertaken to contribute pound for pound against further manufacturers' subscriptions up to twice that figure. The association is in close touch with the British Engineering Standards Association and the National Physical Laboratory, and the council, which is under the chairmanship of Mr. C. H. Wordingham, includes seven representatives each of the Institution of Electrical Engineers and of the British Electrical and Allied Manufacturers' Association, with Prof. W. H. Eccles and Sir J. E. Petavel as representing the Department of Scientific and Industrial Research. The character of the work already undertaken gives some indication of the wide field which may be covered. This includes a comprehensive investigation into composite and fibrous insulating materials, porcelain, and mica, and inquiries into particular classes of apparatus such as mining switchgear. The present programme also includes investigations on sludging in insulating oils, the preparation of data for standard specifications for these and other insulating materials, and a research on the heating of buried cables. Arrangements are in hand for rapidly extending the programme of research, and all communications regarding the association should be addressed to Mr. E. B. Wedmore, secretary and director of research, at 19 Tothill Street, Westminster, S.W.1.

THE British Music Industries Research Association has been approved by the Department of Scientific and Industrial Research as complying with the conditions laid down in the Government scheme for the encouragement of industrial research. The association may be approached through Dr. R. S. Clay, Northern Polytechnic Institute, Holloway, London, N.7.

THE next meeting of the Chemical Society will be held on Thursday, December 16, at 8 p.m., in the lecture hall of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1, when Sir Robert Robertson will deliver a lecture entitled "Some Properties of Explosives."

SIR J. F. C. SNELL, member of council of the Institution of Civil Engineers and past-president of the Institution of Electrical Engineers, has been appointed by an Order of Council to be a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

PROF. J. PERRIN (Paris) and Prof. C. Fabry (Marseilles) have been elected honorary members of the Royal Institution, and Prof. Arthur Keith has been re-elected Fullerian professor of physiology for a further term of three years. The Christmas course of juvenile lectures this year will be delivered by Prof. J. Arthur Thomson on "The Haunts of Life," commencing on Thursday, December 30, with The School of the Open Shore as the subject, and followed by The Open Sea, The Great Deeps, The Fresh-waters, The Conquest of the Land, and The Mastery of the Air.

ON December 1 the Natural History Museum Staff Association held, by permission of the Trustees, the last of its scientific reunions for the current year. Many interesting exhibits of new acquisitions to the museum collections and other specimens of exceptional interest were shown in the board room, and in a darkened room close by Dr. E. A. Cockayne gave a demonstration of the remarkable fluorescent properties of certain moths and butterflies in ultra-violet light, the specimens used being drawn from the museum collection. Among the visitors present were Lord Rothschild, Lord Sudeley, Lt.-Col. A. W. Alcock, Prof. E. B. Poulton, Prof. J. H. Ashworth,

Prof. A. W. Hill, Prof. A. Dendy, Prof. J. P. Hill, Prof. E. W. MacBride, Dr. J. W. Evans, Dr. W. D. Matthew (of the American Museum of Natural History), and M. F. Le Cerf (of the Muséum de l'Histoire Naturelle, Paris).

THE weather for the autumn season in the several districts of the United Kingdom is shown in the Weekly Weather Report of the Meteorological Office for the week ending November 27. The period comprises the thirteen weeks from August 29 to November 27. Temperature attained its highest reading, 76° F., in the south-east of England, and the lowest shade temperature in England was 18° F. in the south-west. The mean temperature for the period was above the normal except in the eastern districts of England and in the Midland Counties; the greatest excess was 2° in Ireland. For the whole of the British Isles the mean was 51·1°. Rainy days were fewer than the average except in the south of Ireland. The amount of rain varied from 11·34 in. for the north of Scotland to 3·77 in. for the north-east of England. The fall was less than the average except in Ireland; the greatest deficiency was 4·17 in. for the north-west of England. Bright sunshine was deficient except in England east and north-west. At Greenwich the mean temperature for the autumn was 51·2°, which is 0·5° above the mean. The mean of the day or maximum readings was 1·5° in excess of the normal; the mean of the lowest or night readings was 0·7° in defect. September had a normal temperature, October an excess of 2°, and November a deficiency of 0·5°. The rainfall for the autumn was 1·23 in. deficient. September had an excess of 1·70 in., October a deficiency of 1·54 in., and November a deficiency of 1·39 in. Remarkable as the October deficiency of rain is in 1920, the amount measured in 1919 was even less at Greenwich.

JOHNSON CAÑON, probably the largest of the eastern tributaries of the Mancos Cañon, lies on the divide between La Plata and Montezuma Counties in Colorado. Here some important ruins are described by Mr. E. H. Morris in the thirty-third annual Report of the American Bureau of Ethnology. Large collections of interesting pottery, consisting of coil-ware ollas and some beautifully ornamented black-and-white and black-and-red bowls, have been discovered. The culture, as a whole, was a rather restricted characteristic of the Mesa Verde region, the materials for weaving, building, and pottery being procured in the immediate neighbourhood, while the fruits of wild trees and plants, as well as the cultivated crops, came, with few exceptions, from the neighbouring cañons and mesas.

THE Bulletin of the New York Zoological Society (vol. xxiii., No. 4) is devoted to a survey of the history of the white rhinoceros of the Belgian Congo. The habits and external characters of this vanishing species are tersely reviewed and comparisons made with its near ally, the black rhinoceros. The traffic in the horns of this animal, it is contended, must be completely restricted if it is to be saved from speedy extinction. A number of remarkably fine illustrations add much to the value of this publication.

THE Field Naturalists' Club of Victoria was founded in May forty years ago. In 1906 Mr. F. G. A. Barnard published in its organ, the *Victorian Naturalist*, a history of its first quarter of a century. In the October issue of that magazine he gives a retrospect of the last fifteen years. This vigorous society does excellent work in promoting a love of Nature and the study of natural history in the neighbourhood of Melbourne. That it succeeds in arousing the interest of the general public is shown by the fact that five exhibitions of wild flowers held during the war period for special objects brought in more than 622*l*.

AMONG the more important papers published in the thirty-third annual Report of the American Bureau of Ethnology is that by Mr. M. R. Gilmore on "The Uses of Plants by the Indians of the Missouri River Region." The writer remarks: "We shall make the best and most economical use of all our land when our population shall have become adjusted in habit to the natural conditions. The country cannot be wholly made over and adjusted to a people of foreign habits and tastes. There are large tracts of land in America whose bounty is wasted because the plants which grow on them are not acceptable to our people. This is not because these plants are not in themselves useful and desirable, but because their qualities are unknown. So long as the people of the country do not demand articles of food other than those to which our European ancestors were accustomed, these articles will be subject to demand in excess of production, with consequent enhancement of cost, while at the same time we have large land areas practically unproductive, because the plants they are best fitted to produce are not utilised."

THE report of the council presented to the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne at the end of October records an increase of membership and a resumption of activity after the war. The museum building, of which a large part had been occupied by Armstrong College, has been overhauled, lectures and talks have been well attended, an entomological section has been established, and field excursions have been organised. Though there is nothing of particular interest to report, it is pleasing to note that the exceedingly valuable collections of the Hancock Museum have received skilled curatorial attention.

THE United States Department of Agriculture has just issued Bulletin No. 794 on the waterfowl and their food-plants in the sandhill region of Nebraska, which is valuable and instructive because the resorts of these economically important birds are becoming more and more restricted owing to the draining of lakes and marshes. Hence, before it is too late, the Department has decided to take steps to conserve the remaining supply of waterfowl inhabiting these areas. This inquiry, it urges, is very necessary "if we are to take intelligently directed steps towards passing on what remains of our heritage of natural wealth." In this far-seeing policy the United

States sets an example which might well be followed by our own Ministry of Agriculture, which has frequently been urged to establish a Bureau of Ornithology for similar functions.

THE results of the inquiries made by the Special Committee on Food-grains with regard to the Indian rice industry are embodied in a report on the trade in Indian rice, to which are appended two further reports on the production and uses of rice and on the utilisation of Burmese rice and its by-products respectively ("Indian Trade Enquiry: Reports on Rice," published by John Murray). In the main report reference is made to the two branches of the world's rice trade, viz. the Far Eastern branch, requiring a cheap rice for feeding the native population, and the Western branch, requiring large quantities of a medium quality rice and smaller quantities of a high quality product. The sources of supply of these markets are referred to, and sections are devoted to the following subjects: The world's trade in rice; the rice trade of India with the British Empire and with the Continent; imports, exports, and home consumption of rice in European countries and the United States; and the comparative cost of handling, milling, and transporting rice in the United Kingdom and on the Continent. The industrial uses of rice are also dealt with, and a series of statistical tables forms an appendix to the report. In 1913 India (chiefly Burma), Siam, and Indo-China together contributed 94 per cent. of the world's exported surplus of rice (including paddy, *i.e.* unhusked rice), the amount of the Indian exports roughly equalling those from Indo-China and Siam combined. The total Indian export (2,450,000 tons) is approximately equivalent to the total requirements of the British Empire from the three chief exporting countries.

THE Cardiff Naturalists' Society has instituted a faunistic survey of Glamorgan, and as a preliminary has issued a useful pamphlet of instructions to collectors. Regional and faunistic surveys form part of the activities of many societies in Great Britain, but the work is hampered, as a rule, by the lack of concise instructions for collecting. This is a difficulty which the Cardiff Naturalists' Society has wisely foreseen and endeavoured to overcome. The pamphlet is concerned only with the terrestrial and fresh-water fauna, and each group of animals is dealt with separately and in detail. The collector is furnished with valuable hints on the habitats in which to search for special animals, and with instructions for their capture, preservation, and packing. We are glad to note the stress which is laid on the necessity for adequate data to accompany each specimen. It is a point which cannot be too often or too strongly insisted upon. The attention of workers is further directed to the advisability of collecting both the external and internal parasites of the vertebrate groups and of an examination of the stomach contents. Due regard is paid to the value of field observation in a survey such as this society contemplates, and useful advice on special points requiring further elucidation is given under each group of animals. The section devoted to insects is particularly good and full, and the collector will be specially grateful for the many hints on the manipulation of the more delicate and smaller forms. His work will be made easier for him, and the results will be more gratifying to the referees and to those who will ultimately have charge of the specimens. Altogether this is an admirable pamphlet which should be of the greatest service to those who are undertaking the field-work in connection with the survey, and should go far to ensure the success of the scheme. Other organisations contemplating similar work will find it invaluable. We understand that copies of the pamphlet may be obtained from the secretary of the Cardiff Naturalists' Society, Dr. J. J. Simpson, 35 Park Place, Cardiff, at a nominal charge of 6*d.* each, or in larger quantities at special rates if desired.

THE latest part of the Annals of the Transvaal Museum (vol. vii., part 2, 1920) contains two valuable papers by Dr. E. C. N. van Hoepen on remains of carnivorous dinosaurs from the Karroo formation of South Africa. The fossils are described in great detail, with adequate illustrations, and include all important parts of the skeleton except the skull. They seem to represent some genera allied to the European Triassic Plateosaurus, others to the North American Triassic Anchisaurus. One femur is exceptional in not being hollow. The author is to be congratulated on his painstaking work, which makes possible a more exact comparison of the South African Triassic carnivorous dinosaurs with those from other parts of the world.

DISEASES of bees known as foulbrood are dealt with by Mr. G. F. White, of the United States Department of Agriculture. In Bulletin No. 810 European foulbrood is discussed. It is an infectious disease of the brood of bees, characterised by death of the brood during its uncapped stage and by absence of odour. The stock may be weakened, or even exterminated, by the disease. In 1885 Cheshire and Cheyne ascribed the disease to a sporing bacillus, *B. alvei*. According to Mr. White, however, this organism is only a secondary invader of the dead larvæ, and not the cause. The causative organism is *B. pluton*, an ovoid and sometimes yeast-like form, which cannot be cultivated, and gains entrance to the larvæ by the mouth. American foulbrood (Bulletin No. 809) is characterised by a decided ropiness of the decaying brood and a peculiar foul odour. It is of almost world-wide distribution, and occurs in this country. The causative organism is a sporing bacillus, *B. larvae*, which can be cultivated on an agar made from bee larvæ and on an unheated egg-yolk agar. Full details respecting these diseases are given in these two bulletins.

THE latest volume (vol. xvi.) of the Special Reports on the Mineral Resources of Great Britain, issued by the Geological Survey, contains an account of the petrography and chemistry of the refractory materials, ganister, silica-rock, sand and dolomite, by Messrs. H. H. Thomas, A. F. Hallimond, and E. G. Radley. It may be looked upon as a continuation of vol. vi.

of the same series, which dealt with the geology and mode of occurrence of these materials, and thus completes the information on these important substances already published. The chemistry of the raw materials and the chemical changes which they undergo in order to fit them for use in the furnace are discussed in some detail, and a number of complete analyses, most of which have been made in the Survey laboratory, are included. Much attention has also been devoted to the microscopic examination of the materials in their native state, as prepared for use in the furnace and after such use. The volume is, therefore, likely to be found extremely valuable to all users of refractory materials, more particularly to steel-makers, whose requirements have evidently received special attention.

THE process of cold vulcanisation of rubber invented by Mr. S. J. Peachey, to which reference was made in NATURE of July 15, p. 625, consists in treating the rubber alternately with sulphur dioxide and hydrogen sulphide. The gases are separately absorbed by the rubber, and by interaction produce a highly active form of sulphur which brings about vulcanisation. The process obviates the use of sulphur chloride, and, since it takes place in the cold, renders possible the use of organic filling and colouring agents which are not affected by the two gases, but would be decomposed in the ordinary process.

AN excellent feature of a new catalogue received from Mr. Cuthbert Andrews (47 Red Lion Street, W.C.1) is a series of six coloured plates illustrating X-ray tubes in action. These illustrations, besides being extremely good technical productions, should be very instructive to those who desire to familiarise themselves with the various appearances of X-ray tubes. There is, of course, still a wide field of utility in the gas-tube, and the various devices designed to overcome some of their vagaries are dealt with in detail in this catalogue. Protective measures in X-ray work are not lost sight of; the appliances manufactured by Mr. Andrews are given the rather happy name of "Protex."

THE difficulty experienced by workers in damp climates in maintaining the insulation of electrostatic measuring instruments has, according to the July issue of the Journal of the Asiatic Society of Bengal, led Prof. Jackson and Mr. A. T. Mukerjee to enclose their Dolezalek electrometers in hermetically sealed cases and to test the efficiencies of the desiccators in common use. They find that for reducing the rate of leak from such an electrometer calcium chloride, sodium, quicklime, and phosphorus pentoxide are valueless, owing possibly to the chemical action between them and the moisture they take up producing ions which render the air conducting. Sulphuric acid boiled with a small quantity of ammonium sulphate, as recommended for Kelvin electrometers, and having a density of 1·84, corresponding to 95 per cent. of pure acid, is the only desiccant they have found to be entirely suitable. If occasionally stirred it retains its efficiency for several weeks.

THE October issue of the Journal of the Franklin Institute contains the address on optical glass given by Dr. A. L. Day, the director of the geophysical laboratory of the Carnegie Institution, and during the war in charge of optical glass production, to the physics and chemistry section of the institute in March last. In the course of the address Dr. Day described the steps taken by the United States Government to help the manufacturers to overcome the difficulties of the manufacture of optical glass in sufficient quantities to meet the demand produced by the war. It was found that the manufacture was not beset with mysteries as it had been represented to be, but that it was a straightforward scientific problem solvable by the methods commonly used in attacking problems of high precision. The results of the experience are all published, and are available for those who wish to make the manufacture of optical glass a permanent industry of the country. It is, however, recognised that the demand will be small, and that the industry may have to be subsidised by the Government, or, if not, to depend on other lines for its profits.

MESSRS. PASTORELLI AND RAPKIN, LTD., of 46 Hatton Garden, London, E.C.1, have forwarded to us their list of self-recording meteorological instruments. The various forms of barographs afford ample choice to satisfy the different uses for which these instruments are required. The "dial barograph," which gives the face of the ordinary aneroid as well as the charted record, adds much to the interest of the reading of atmospheric pressure. With the new units of measurement which are now becoming of such general use it seems desirable that the scale should be given in millibars as well as in inches. Barothermographs showing the records of pressure and temperature on the same drum will be welcomed by many. The Edney hygrograph seems an improvement on the ordinary arrangement for securing an accurate temperature and for reducing the sluggishness introduced into some other forms of thermographs. Prices are necessarily high in comparison with pre-war rates, but the advance is not excessive. The firm has a long record, since 1750, which is essentially an advantage to a maker of all kinds of scientific instruments, as many improvements are the more easily recognised.

THE presidential address of Mr. Ll. B. Atkinson to the Institution of Electrical Engineers, delivered on November 18, marked the commencement of the jubilee year of the institution, which was founded in 1871 as the Society of Telegraph Engineers, although a previous society, called the Electrical Society of London, had existed from 1837 to 1845. In reviewing the progress achieved during the last half-century the president traced the changes in our conceptions of electrical and other physical phenomena from Maxwell's original ideas to the modern electron theory and the newer outlook revealed by the researches of Einstein and others. The development of methods of generation of electrical currents by mechanical means was followed from the discovery of the self-exciting dynamo in 1867 to the large turbo-alternators of

to-day. Mr. Atkinson looked forward to further progress in the gas turbine, and hinted that some process of current production avoiding the limits imposed by the second law of thermodynamics might be found, and that perhaps an electrical method of unlocking the stores of energy in the atom might ultimately be discovered. After a few words on the history of electric supply, transmission of power, and cable manufacture, Mr. Atkinson passed on to a review of telegraph and telephone progress. Both submarine and land line telegraphy had reached a high degree of advancement when the institution was founded, but the telephone did not exist, and such ideas as there were on the possibility of communication without wires were in the direction of earth conduction. Recent developments included applications of the wonderful thermionic amplifier to cable telegraphy as well as to line telegraphy and wireless. Among matters requiring further research were the development of more exact methods of estimating the quality of transmitted speech and multiplex and superposed telephony.

MESSRS. W. HEFFER AND SONS, LTD., Cambridge, have just issued a catalogue (No. 194) of publishers' remainders which should be seen by those on the look-out for standard books in a new condition as Christmas or New Year presents. Many of the volumes offered for sale deal with scientific subjects, but most are of general interest. All are listed at prices far below those at which they were published. The catalogue is obtainable upon application.

Our Astronomical Column.

THE DECEMBER METEORS.—These meteors are due to reappear on the nights of December 10–13, and with suitable weather ought to be well observed this year, as there will be no interference from moonlight. The maximum will probably occur on December 12, when the radiant will be at 112°+33° near α Geminorum. The point of radiation apparently moves eastward at the rate of 1° daily. The meteors are moderately swift, sometimes slow, but their individual aspects depend in a measure upon their relative positions with respect to the observer and the radiant. In the early hours of the evening the flights are longer than in the later part of the night, the radiant being higher in the sky in the small hours of the morning.

MINOR PLANETS.—Ceres will be in opposition on Christmas Day in high north declination, its magnitude being 7·2. The following approximate ephemeris for Greenwich midnight is from Marseilles Circular No. 412:

	R.A.	N. Decl.		R.A.	N. Decl.
	h. m. s.	° ′		h. m. s.	° ′
Dec. 3	6 37 48	25 27	Dec. 18	6 24 30	26 41
8	6 33 54	25 52	23	6 19 24	27 5
13	6 29 24	26 17	28	6 14 6	27 27

Log r, log Δ December 3, 0·424, 0·240; December 23, 0·421, 0·219.

The planet is close to ε Geminorum at the beginning of December.

Astr. Nach. Circular No. 46 reports the discovery of a very interesting planet which has been provisionally named HZ. It was found photographically by Dr. W. Baade at Bergedorf on October 31, and observed again on November 2 and 12, its magnitude being about 13. Dr. G. Stracke has computed the following elements:

Epoch 1920 *October* 31·5 *G.M.T.*

M = 348° 33′ 35·4″	μ = 320·085″
ω = 57 38 40·2	log a = 0·696494
Ω = 21 22 26·8	log q = 0·2887
i = 41 28 58·6	T = 1921 March 9·2
φ = 37 31 0·8	Equinox 1920·0

It will be observed that the value of the mean motion would make it a member of the Trojan group, but the very large inclination and eccentricity (which are cometary rather than planetary) would prevent any close adherence to the equilateral configuration with the sun and Jupiter, which is the characteristic of that group.

Ephemeris for Greenwich Midnight.

	R.A.	N. Decl.
	h. m. s.	° ′
December 6 ...	0 8 16	18 27
10 ...	0 7 24	19 18

The perihelion and aphelion distances are 1·944 and 7·998 respectively.

PHOTOGRAPHIC PARALLAX DETERMINATIONS AT ALLEGHENY.—Vols. iv. and v. of the Publications of this observatory, of which Prof. F. Schlesinger is director, contain parallaxes of nearly three hundred stars, the average probable error being given as 0·008″. A few of the larger parallaxes are recorded below, with notes on previous determinations. An asterisk denotes a spectroscopic parallax:

Star	Parallax	Some previous determinations in ″
	″	
τ Cygni ...	0·058	0·125, 0·029, 0·006, 0·023
ι Pegasi ...	0·067	0·063, 0·120
μ ,, ...	0·043	
β Virginis ...	0·096	0·110, 0·100*, 0·096
42 Coronæ ...	0·064	0·119, 0·058
ζ Herculis ...	0·114	0·172, 0·101, 0·146, 0·086, 0·066*
μ ,, ...	0·104	0·122, 0·126, 0·093, 0·051, 0·096*
85 Pegasi ...	0·084	0·054, 0·096, 0·084, 0·101, 0·096*
∫ OΣ 547 (mean)	0·103	0·134, 0·095, 0·120*
⌊ Furuhjelm star[1]	0·099	0·112
χ Orionis ...	0·096	
8 Canum Ven.	0·109	0·089, 0·084, 0·105*
ξ Boötis ...	0·147	0·225, 0·151*
η Cassiopeiæ...	0·173	0·188, 0·182, 0·178*, 0·180
61 Cygni (mean)	0·285	0·270, 0·272, 0·322, 0·301
Castor (mean)	0·070	0·053

[1] This star has the same P.M. as OΣ 547, being 5½′ distant.

The great advance in the accuracy of photographic parallaxes in recent years is very satisfactory. It may be ascribed to the many additional precautions now taken, notably the equalisation of magnitudes by rotating sector or otherwise, and confining the photographs to the neighbourhood of the meridian to minimise the effect of atmospheric dispersion.

Vol. vi., No. 2, of the Allegheny Publications contains a paper by Mr. C. J. Hudson on the amount of error arising from this dispersion. The effect on pairs of plates taken at considerable hour-angles east and west is 0·021″. It should be quite negligible on the parallax plates.

Migrations of Cultures in British New Guinea.

THE HUXLEY MEMORIAL LECTURE FOR 1920.

THE Huxley memorial lecture of the Royal Anthropological Institute was delivered by Dr. A. C. Haddon at the rooms of the Royal Society on November 23.

In opening his address Dr. Haddon suggested that the immediate cause of the interest taken by Huxley in anthropology may have been the memorable voyage which he made more than seventy years ago in the *Rattlesnake* when he was sent out to survey the marine zoology of the Torres Straits and various parts of the coast of New Guinea. He himself had been first attracted to anthropology when in 1888 he visited the Torres Straits, also with the object of studying marine zoology. It was therefore, in his opinion, not inappropriate that it had fallen to his lot to pay homage to the memory of a master of scientific method and of clear exposition, and that he should select the area of their respective first experiences in travel for the subject of his discourse.

On the coast of British New Guinea is found a series of cultures, some of which are evidently related, others as obviously unrelated. Their affinity suggests a common origin, but any idea of indigenous development or of cultural migration from Australia may at once be dismissed.

The cultural problems of the south-eastern peninsula and of the outlying islands of New Guinea are, in the main, quite distinct from those to the west, and the differences between the two groups of cultures indicate clearly that there cannot have been any extensive cultural movements from the Papuo-Melanesians of the east to the western Papuans. We are thus driven, on general grounds, to the supposition that the cultures of the southern coast of British New Guinea came down more or less from the north.

The Tugeri, who live just beyond the Netherlands border, are cannibals and inveterate head-hunters who chew kava, *vati*. The inhabitants of several villages assemble at initiation ceremonies, at which bullroarers are swung, but the bullroarer is not known elsewhere in Netherlands New Guinea. There are many dances at which masks are worn and animals represented. The bullroarer is anthropomorphised as Sosom, a mythical monster of the bush, who at the annual festival at the beginning of the south-east monsoon devours the novices, but brings them back to life. There is such a striking resemblance between this complex and that of various tribes in the area from Astrolabe Bay to Huon Gulf that a relationship cannot be denied.

The use of kava has such ethnological interest that it is worth while noting its distribution in New Guinea. Several of the bush tribes west of the Fly estuary chew kava. Effigies of crocodiles are presented with kava by the Masingara, and a legend suggests a former monster who ate novices at the initiation ceremony. Kava plays an important part in the several ceremonies of the Kiwai peoples, and only those who have passed through all the stages of initiation may drink it. The Gogodara, who live between the Fly estuary and the Bamu, have an initiation ceremony in which a boy is supposed to be eaten by a crocodile, and kava is drunk. The tribes to the north of Huon Gulf hold a periodic circumcision ceremony at which, to the humming of bullroarers, the initiates are dragged into a hut constructed like a monster, which thus symbolically swallows them. An important part of the initiation ceremonies consists in teaching the novices how to play the sacred flutes.

To return to the south coast. The Kerewa folk live in Goaribari Island and its neighbourhood. They have carved shrines to which skulls of people who have been eaten are attached. Further east are the Namau group. Here are enormous ceremonial houses with numerous shrines, associated with a *manes* cult, in front of which are heaps of animal, and formerly of human, skulls. In the dim recess of the building are basketwork monsters. The Elema or Gulf culture, further east, is essentially similar, except that the monsters are lacking and the people are not cannibals.

The Great Sepik River possesses several cultures along its course, one of which is characterised by so many general similarities with the cultures of the south coast that there must have been some connection between them; for example, there are numerous plaitwork masks which find an exact counterpart in the Middle Fly, on the Bamu, and in the Kerewa country. The great difficulty alike in the supposed spread of kava-drinking from the Huon Gulf-Astrolabe Bay area to the mouth of the Fly and beyond, and in the extension of the Sepik culture to the south coast, is the great mountain chain of New Guinea. It would be easier to suppose that these cultures, which, so far as is known at present, are discontinuous, were carried to their respective areas by seafaring people, but no traces of similar cultures are found in the intervening coastal areas; furthermore, the western canoes (except in the Torres Straits area) are a river type, and can be matched from the Sepik. An interesting problem is that of the woven rattan cuirasses; these occur on the north coast at the Netherlands boundary and some way to the east of it, also some distance inland south of this area, and again on the Palmer River and Upper Fly, and, finally, a feebler type is found in the mountains up the Utakwa River in Netherlands New Guinea. It is inconceivable that a migration could have carried this armour all round New Guinea and right up the Fly without leaving traces *en route*. The most rational view is that it has spread down from the north coast, in which case it would have crossed the mountain chain, as the Sepik cultures are assumed to have done.

The south-eastern peninsula of New Guinea is characterised by the absence of the features of the western cultures and the presence of a big feast, with which in the region round Milne Bay is associated the cult of the mango-tree. In the Mamba and Kumusi river-systems initiation ceremonies are again met with, the bullroarer is employed, and a pair of sacred flutes played. The use of the sacred flutes links up with the initiation ceremonies of the peoples to the north of Huon Gulf, and their use extends all along the coastal peoples well into Netherlands territory, as well as up the Sepik. It seems as if the use of the flutes tended to supplant that of the bullroarer. The distribution of the flutes further coincides fairly closely with the employment of slit gongs. Both these instruments appear to belong to a relatively recent cultural movement from northern Melanesia.

From this it will be evident that the ethnological history of New Guinea is extremely complex; movements have taken place within the island, and cultural influences have come in from without. The south-eastern peninsula has been the scene of two different migrations, resulting in the Motu and Massim cultures, and probably a third one influenced the Trobriands. These were perfectly distinct from

the probable migrations from northern Melanesia which have modified the northern coastal cultures. These have come on the top of Papuan cultures, the more striking features of which have probably been due to earlier cultural drifts from Indonesia. At present it is only possible to state some of the problems and to hazard conjectures as to their solution. Very much work remains to be done before the history of this fascinating island can be unravelled.

At the conclusion of the address the Huxley memorial medal was presented to the lecturer by Sir Everard im Thurn, the president of the Royal Anthropological Institute.

International Weather Telegraphy.

THE International Commission for Weather Telegraphy, appointed at the general Meteorological Conference at Paris in October, 1919, met at the Air Ministry during the week November 22–27. The delegates were welcomed at the first meeting on Monday, November 22, by Major-Gen. Sir F. H. Sykes, Controller-General of Civil Aviation, who emphasised the special need for international agreement in meteorology because nations were more interdependent in respect of that science than of any other.

During the meeting the Commission came to an agreement upon the codes for the transmission of surface observations and upper-air observations in land messages and for a new figure code for the transmission of reports from ships at sea.

It also agreed upon a time-table for the issue by radio-telegraphy of data messages for the preparation of synoptic charts and upon the distribution of stations in Europe for the issue from the Eiffel Tower of collective data messages for the whole European *réseau*.

The principal changes in the new code are:

(*a*) The number of figures for reporting barometric tendency is reduced from two to one, and the unit for barometric tendency is standardised as the half-millibar per three hours, or, for countries using the millimetre scale, the half-millimetre per three hours.

(*b*) A two-figure code for reporting the weather takes the place of the old single-figure code, and permits the intensity and character of the precipitation to be reported.

(*c*) Provision is made for reporting visibility up to 30 km. according to a graduated scale.

(*d*) One figure is allotted to reports of humidity which will be given to the nearest 10 per cent.

Prior to 1911 the code for international messages provided for reports of the temperature of the wet bulb as well as of that of the dry bulb. The temperature of the wet bulb was omitted after the introduction of barometric tendency, and thereafter no information about humidity was included in the messages. The new conditions, which permit of the international exchange of the full report for 1 p.m. and 6 p.m., and for the inclusion of humidity in the upper air for reports of surface humidity, should prove of considerable value.

(*e*) One five-figure group is allotted to reports of the form, amount, and height above ground of the clouds. It may be noted that the height of the clouds above ground and the visibility are at present the two elements of the greatest importance to aviation.

(*f*) Provision is made for reporting twice a day the hour of commencement of rainfall. This has been proved to be of great value by actual trial in Scandinavia, and it is anticipated that it will ultimately be one of the most important data in the preparation of forecasts for agriculture.

(*g*) A special group of five figures is allotted to a selection of stations in each country for the purpose of reporting as exactly as possible the direction and relative speed obtained by nephoscopic observations of clouds.

(*h*) Three special groups are allotted to selected stations in each country for reporting the direction and speed of the upper wind as determined by observations with pilot-balloons, shell-bursts, kite-balloons, and other methods.

(*i*) Ten groups as a maximum have been allotted to one, two, or three stations in each country where facilities are available for obtaining the temperature and humidity of the upper air to great altitudes by means of aeroplanes or kite-balloons.

In connection with the observations of the upper air, the Commission was interested to learn from Prof. de Quervain of the proposal to establish a station in Switzerland at an altitude of 3500 metres, from which barometric observations would be of the highest value in the construction of charts for that level.

The code adopted for the reports by wireless telegraphy from ships at sea provides for the same information as that which is given in the messages on land with the omission of barometric tendency, relative humidity, and the height of clouds. A new feature is the introduction of the method of checking the reports already used in the Meteorological Service of India. The necessity for some system of this kind was emphasised at the Meteorological Conference at Innsbruck in 1905 during a discussion on the possibility of obtaining wireless messages from the Atlantic. The new code provides a simple and practical method for discovering any error which exists and for correcting it.

The Commission learned with much interest that meteorological observations were being made this winter on behalf of the Norwegian Institute in the Island of Jan Mayen, which is situated about 600 miles north-east of Iceland; and that there was a prospect in the not distant future of obtaining meteorological observations from Greenland by radio-telegraphy.

The hard work of the business meetings of the Commission was relieved by a number of social gatherings. On November 22 Sir Napier and Lady Shaw gave a reception to the delegates at 10 Moreton Gardens, S.W. On the afternoon of November 24 a visit was paid by the delegates to Croydon Aerodrome, and an opportunity afforded them of seeing the meteorological and wireless arrangements necessary at the terminus of air routes. On November 25 the delegates were entertained to luncheon at the Carlton Hotel by his Majesty's Government, when the Marquess of Londonderry, Under-Secretary of State for Air, referred in a characteristic speech to the achievements of the delegates, some of whom had come from countries so widely separated, both by distance and by climate, as Java and Iceland. On the evening of November 26 the Maharaj Rana of Jhalawar gave a dinner in honour of the delegates; they were one and all delighted with the informal hospitality of his Highness, who had assisted at the last meeting of the Commission in 1912 and had maintained his interest in meteorology, especially British meteorology, which had made notable advances under the direction of Sir Napier Shaw, the president of the International Meteorological Committee.

Zoology at the British Association.

THE meetings of Section D attracted a large gathering of zoologists from this country and a worthy representation from the Dominions and from the United States. Prof. Gilson, of Louvain, was the only Continental guest of the Section.

Discussions.

The discussion on the need for the scientific investigation of the ocean has already been reported in NATURE of September 2 (p. 30), and Mr. H. G. Maurice's address in which he urged that fisheries research is the business of the State was published in NATURE of November 25. The discussion on this address may now be briefly summarised.

Prof. James Johnstone entirely agreed with Mr. Maurice that a Government Department of Fisheries ought to be thoroughly staffed and equipped for the prosecution of scientific research. But this policy brought a serious responsibility, for sooner or later the fishing industries would ask for the results of the investigations, *e.g.* whether fish had become more abundant or whether investigation had suggested new and improved methods of utilising sea-fish and products at present useless. As a practical suggestion he thought that in all such economic scientific investigations a new kind of worker was now necessary—the man of the inventor type of mentality—whose task it would be to apply to industry the new discoveries of the laboratory, marine station, or exploring vessel. Pure scientific investigation for its own sake was the proper work of the universities and marine stations, and no development of economic research ought to curtail it.

Prof. Gilson (delegate of Belgium on the International Council) supported the view that a maritime country should have a Department of Fisheries Research, and stated that Belgium has adopted this system and, notwithstanding the profound disorganisation of her finances, granted the sum asked to enable her full share of oceanographical and fisheries research to be undertaken.

Prof. Garstang remarked that twenty years ago they were in the midst of acute controversies between rival groups of marine biologists and between all these and the Fisheries Department in regard to the initiation of the International North Sea Investigations. It was, therefore, particularly gratifying to him to note the unanimity which now prevailed as to the wisdom of the arguments which induced the Government to proceed with that enterprise and were now put forward by the Ministry of Fisheries as convincing reasons for its continuance. It must, however, be recognised that there is a danger to science of its best exponents in one subject being concentrated into one Government Department.

Prof. Meek said that all were of the same mind that a Government Department should be fully equipped for research so long as the independence of pure science was maintained and it was recognised that much of the work could be done in independent institutions. He then went on to refer to recent trawling results on the Northumberland coast, which showed that fishery conditions in those waters were the same to-day as in 1913. He referred to the areas of distribution of fish from the Canaries to Barents Sea, and pointed out that explanations must be sought in the study of movements of water and of the lives of diatoms and other microscopic organisms.

Mr. Neale (Cardiff) stated that neither the Government nor practical fishermen have given enough consideration to the future of fisheries. He found the catches to be no larger now than before the war, and in some cases they were smaller, and he was inclined to believe that natural causes were mainly contributory, and that knowledge of these was required. The amount of ocean fished is very small as compared with the total area of the ocean, and he asked for investigations which owners of commercial trawlers could not carry out.

Dr. E. J. Allen expressed satisfaction with the broad views on scientific research now held at the Ministry of Agriculture and Fisheries and put forward by Mr. Maurice, and remarked that it was also gratifying to hear that those engaged in the fishing industry now realised the usefulness of scientific investigations.

Mr. Maurice briefly replied, explaining that collaboration in fisheries research was on the high road to being achieved between England, Scotland, and Ireland, the three countries settling their schemes and policy by quarterly inter-Departmental conferences.

The president (Prof. Stanley Gardiner) suggested that the Section might arrange for a full day of discussion at its meeting in Edinburgh in 1921, and circularise the various fishery federations and associations to see if their members would be inclined to attend the meeting of the Association and put up their own facts and problems for friendly discussion with the scientific members of the Association. The position of the Scottish capital as a common meeting-ground for the four greatest trawler ports—Aberdeen, Fleetwood, Grimsby, and Hull—seemed to him to offer an eminently favourable opportunity for such discussion.

Protozoa.

Prof. C. A. Kofoid described recent observations by himself and his pupils on the neuro-motor system of ciliate and flagellate protozoa. The perfection of the Barber micro-dissection apparatus, which can be operated with great delicacy of action under an oil-immersion objective, has made possible the demonstration of the existence in certain protozoa of a complicated fibrillar system comparable with the nervous and muscular systems of higher animals. This integrated neuro-motor system is connected with the nucleus, and plays an important part in the division of the organism into two. Experimental proof of the conducting function of the fibrillar system in the ciliate Euplotes was established recently by Dr. Taylor, who succeeded in cutting the fibrils in the living animal. He observed that in these cases there was interference with the integrated co-ordinated movements of the animal. Cuts of similar extent made in other specimens, but which did not sever the fibrils, did not produce interference with co-ordination.

Prof. Kofoid pointed out that many of the flagellates are asymmetrical, and generally have a sinistral or left-handed torsion. The origin of bilateral symmetry which prevails in Metazoa, composed of many cells, appeared to him to be bound up with two features of the structure of protozoa: (1) The co-ordinating mechanism, already referred to, in the protozoa and its persistence in the form of fibrils connecting the constituent cells of the Metazoa; and (2) the production during division into two of a sinistral and a dextral daughter-cell, the latter due to a reversal of the primitive sinistral symmetry and forming a mirror-image of the left one, the maintenance of the union of these two cells thus providing the first step in the origin of primitive bilateral animals.

Prof. R. W. Hegner discussed the relations of nucleus, cytoplasm, and external heritable characters in the genus Arcella, in which the nuclei can be seen and measured in the living animal and the chromatin mass accurately determined. Pure lines of *Arcella dentata*, obtained during vegetative reproduction from "wild" specimens by pedigree breeding methods, differed from one another in size and spine-number, which are closely correlated—the larger the shell, the greater the number of spines. These two characters were found to be correlated also with chromatin mass, for uninucleate descendants of halves (obtained by cutting into two) of binucleate animals were only about half as large as binucleate specimens belonging to the same line. The uninucleate descendants of halves of binucleate specimens always regained the binucleate condition after a few generations. The later descendants were always binucleate, but the size and spine-number of the typical binucleate were reached only after three or four more generations, during which the diameter of the shell and the number of spines increased gradually, *i.e.* the great change within—the doubling of the chromatin mass—was accompanied externally by small changes in a definite direction. If the internal condition had not been known, the conclusion would have been reached that the change in external heritable characters was due to several gradual modifications instead of to one large mutation.

Messrs. E. Heron Allen and A. Earland read a paper on protoplasm and pseudopodia, based on observations on Foraminifera. They conclude that protoplasm is capable of almost unlimited extensibility and attenuation by imbibition of water, and that pseudopodia are not extended as such, but formed from protoplasm surrounding the shell. They claim for the pseudopodia a rudimentary nervous reaction to stimuli.

Prof. Kofoid exhibited a series of plates for a forthcoming monograph on the unarmoured Dinoflagellata, and Miss C. Herdman exhibited living specimens of Amphidinium from Port Erin.

The Influence of Salts on Growth.

Dr. Cresswell Shearer read a paper on the influence of salts on growth. He described experiments which show that living bacteria offer considerable resistance to the passage of ions of various salts; dead bacterial protoplasm offers no resistance. There is something peculiar to the living state that conditions this resistance, and this should be kept in mind in all applications of the results of protein chemistry to living protoplasm.

Annelids.

In a communication on the polyphyletic origin of genera in the Oligochæta and its bearings, Prof. J. Stephenson showed that the genera of the Megascolecidæ can be arranged in the form of a phylogenetic tree. The differentiating characters are few, *e.g.* in the majority of genera of the sub-family Megascolecinæ they concern only the setæ, prostates, and nephridia. The evolutionary changes in these systems have demonstrably taken place more than once, and the differentiating characters and their various combinations are few enough to render it probable that the same combination, *i.e.* the same genus, has been reached in more than one way. Apart from probability, there is anatomical and geographical evidence that the genus Megascolex has arisen from both Notoscolex and Perionyx, and from Notoscolex more than once. The multiple origin of Microscolex from Notiodrilus has also been demonstrated, and there is some evidence of the multiple origin of Pontodrilus. To assert the polyphyletic origin of a genus is, however, unorthodox; writers obviate it by merging the genera concerned, but this is to evade the difficulty. The answer given to the question of polyphyly has a bearing on geographical distribution. A number of genera of the sub-family Megascolecinæ occur both in India and Australia; the Octochætinæ occur only in India and New Zealand. These distributions are explained by assuming land-bridges between India and Australia and between India and New Zealand. But such connections cannot have existed since the Eocene, or Eutherian mammals would have entered Australia and New Zealand. Earthworms are, however, a recent group, and such a genus as Megascolex is among the phylogenetically youngest earthworms; its origin, and probably that of other genera common to the two regions, must have been recent (since the Eocene). Land connections are thus apparently insufficient to explain the distribution, and a double origin of at least the phyletically younger genera seems worthy of consideration.

Prof. Pierre Fauvel sent a summary of the results of his examination of the marine annelids collected in the Abrolhos Islands by Prof. Dakin. Sand- and mud-dwelling Polychæta were absent; Aphroditidæ and Eunicidæ were plentiful, together with Amphinomidæ and a few Nereidæ—a small fauna of Polychæta creeping on the stones and corals. Of the nineteen species from the Abrolhos, five are known only from the warmer parts of the Indian Ocean, eleven belong to the tropical area, but often extend beyond it northwards and southwards, and three belong to the Australian coast. The Polychæt fauna of the Abrolhos is probably the same as that of most of the coral-reefs of the Indian Ocean, with the addition of a few species belonging to the Australian coast.

Hookworm and Human Efficiency.

Prof. Kofoid, in an address on hookworm and human efficiency, described investigations made in the United States Army in connection with the elimination of hookworm infection among recruits. Examination revealed an infection of about 10 per cent. among men from the Southern States, and a slightly higher rate among whites than among blacks. A statistical investigation of the incidence of disease among 24,000 men at Camp Bowis, Texas, over a period of eight months (including that of the measles-pneumonia epidemic of the winter of 1917–18) showed that men in whom hookworm infection had been detected had a much higher sick-rate, and were more often sent to hospital for severe infections. Regiments with more than 10 per cent. infection by hookworm had a much higher death-rate from pneumonia than regiments with less than 10 per cent. infection by the worm. A comparison of the mental ratings obtained by the tests of the Psychology Board of the U.S. Army in the case of 10,000 recruits from the hookworm area showed that white able-bodied men with hookworm infection have a lower average rating than men in whom the infection was not detected. The mental deficiency thus measured was nearly 25 per cent., and affected all grades of intelligence from the highest to the lowest, but the latter somewhat more severely. Hookworm infection, even in cases when it is light, is a matter of great educational, sanitary, and economic importance.

Physiology of Migration.

Prof. A. Meek discussed the physiology of migration. He stated that the passive denatation of the egg, larval, and young stages of fish may be, and usually is, succeeded by an active down-current migra-

tion which is accompanied by seasonal on-shore and off-shore movements. But the periodic migrations of the species are markedly interrupted when the call of maturity comes. Then the migration is contranatant, a longer or shorter distance according to species and circumstances, due to the effects of an internal secretion or hormone which exercises a profound influence on the central nervous system, and may also produce somatogenic results. The only invertebrate which is definitely known to react in this way on the approach of spawning is the crab—the females migrate contranatantly at that period—but it may be presumed that other large, active Crustacea and Cephalopoda respond similarly. Prof. Meek referred to Amphibia as being similarly affected at the spawning season, the hormone bringing about a return to gregariousness as well as somatogenetic effects which characterised the period. The same appears to be true of aquatic reptiles, birds, and mammals, and Prof. Meek suggested that this pointed a way of approach to the subject of aerial migration. In the discussion following, Prof. Lloyd Morgan directed attention to the breeding habits of lapwings, and suggested that they were to be explained as due to hormone action, and other speakers proposed that attempts should be made to isolate and experiment with the hormone. Prof. Garstang discussed the question with reference to plaice, and Prof. Meek replied, pointing out in this case the distinction between the periodical and the spawning migrations.

Embryological Studies.

Prof. J. E. Duerden gave an account of the pineal eye of the ostrich (for a summary of this paper see NATURE, vol. cv., pp. 516–17), described a caudal vesicle in ostrich embryos, and recorded the presence of Reissner's fibre. In embryos of about ten days' incubation a prominent vesicular swelling is present at the tip of the tail or on the dorsal surface near the tip. The cavity of the vesicle, in which the central canal of the spinal cord terminates, varies much in size and shape in different specimens. The ventral wall of the spinal cord lines the floor of the cavity and terminates somewhat abruptly, and the dorsal wall of the cord merges gradually into the mesenchymal tissue which constitutes the dorsal and lateral walls of the vesicle, without, however, showing any differentiation into an epithelial layer. The cavity is filled with a coagulable fluid in which cellular tissue in process of degeneration frequently occurs, and occasionally much black pigment is present. The external enlargement persists for only a short time, rarely lasting after the twentieth day of incubation. A similar vesicle has been found in several reptiles, and is well-developed in the penguin and the puffin, though in these it is not so large as in the ostrich. It is suggested that the vesicle in the ostrich, which varies so much in size, is in some way concerned with the regulation of pressure of the cerebro-spinal fluid at this early stage. Longitudinal sections of the caudal region show the presence of Reissner's fibre and its posterior attachment to the mesenchymal tissue. Reissner's fibre has been found to occur within the central canal of the spinal cord of vertebrates from the cyclostomes to the primates.

Mr. J. H. Lloyd dealt with the early development of the pronephros in Scyllium and Chrysemys, and supported Mr. Burlend's view that the pronephros arises as a non-segmental groove from the somatic layer of the mesoblast, and that the anterior portion of the duct is formed by constriction from this groove, and not by fusion of the distal ends of tubules. The evidence, as presented by the illustrations, was not convincing, and was subjected to considerable criticism.

The Movements of the Sea.

At a joint meeting of Sections D and E, Dr. E. C. Jee gave a paper on the movements of the sea. He pointed out that the temperature of the deep waters surrounding the British Isles is essentially due to the Atlantic circulation. He dealt in some detail with the northern North Sea current, and stated that no significant correlation has yet been demonstrated between the variations of this current and fluctuations in the landings of fish. The current which enters the English Channel from the Atlantic affects the fisheries of the south-west area, and its strength seems to show the following variations: A winter maximum and a summer minimum, and a two-year, a six-year, and a twelve-year periodicity. It is probable that the fluctuations in the landings of pilchards are correlated with the variations in strength of the Channel current. The periodicities referred to are now being investigated by the International Council. The examination of numerous samples of sea-water and the liberation of surface and bottom drift-bottles are being undertaken with the object of obtaining information for a study of the migrations of mature plaice to and from their spawning-grounds in the Flemish Bight and the probable drift of the pelagic plaice eggs and the location of the fry in their various stages of development.

Prof. E. B. Poulton gave a preliminary account of the hereditary transmission of a minute, extremely variable, and generally asymmetrical marking in the forewing of the currant moth (*Abraxas grossulariata*).

J. H. ASHWORTH.

University and Educational Intelligence.

BIRMINGHAM.—At the last meeting of the council the Principal reported that the Staffordshire Education Committee is increasing its grant to the University from 450*l.* to 1000*l.* per annum. The Worcestershire County Council recently increased its annual contribution from 300*l.* to 500*l.*; and the Dudley Town Council has informed the University that it will include an annual sum of 50*l.* in its estimates.

Messrs. Dorman and Co., of Stafford, have presented a 20-h.p. petrol engine, and Messrs. Sturge and Co. an old beam engine. The Pro-Vice-Chancellor, Alderman Clayton, is providing 100*l.* towards the cost of removal and re-erection of the latter.

The University is affording facilities in the department of pathology to enable Prof. Shaw Dunn to take part in the training of the Naval and R.A.M.C. *personnel* required for the physiological department of the Chemical Warfare Section at Porton.

Mr. R. W. W. Sanderson has been appointed a demonstrator in physics for the current session.

Mr. R. G. Abrahams has been appointed honorary assistant curator of the pathological museum, Section of Surgery.

CAMBRIDGE.—By the time that this issue appears the vote on the admission of women to membership of the University will have taken place. Both sides are hopeful of the issue, and a fairly close vote is generally anticipated. Something of the vigour of the earlier fighting on this question has vanished, perhaps because the "old guard" realise that they are fighting a losing battle. If they hold their privileged position this time they know that their flanks are in the air, and that it is only a short time before they are liable to be overwhelmed in an attack from another quarter. Somewhat late in the day, many of them are holding out a promise of a place where everybody may go if only the Senate will throw out

the present proposal. But no details are given, and the fact that some of the signatories in favour of the new and unknown scheme have been on a syndicate for twelve months charged to prepare a suitable scheme, and have so far failed to meet their own and their friends' requirements, does not inspire much confidence in their future operations. The results of the vote and a forecast of the later developments will appear in the next issue of NATURE.

DR. J. N. PRING, reader in electro-chemistry, University of Manchester, has been appointed head of the Physical Chemistry Branch, Research Department, Royal Arsenal, Woolwich.

SIR RICHARD GREGORY will deliver an address on "Scientific Fact and Popular Fallacy" to the students of the Journalism Diploma course at the University of London, South Kensington, S.W.7, on Monday, December 13, at 5 p.m. The chairman will be Prof. C. H. Lees.

IN connection with the London County Council lectures for teachers, a lecture on "The Antiquity of Man" will be given by Prof. Arthur Keith at the Regent Street Polytechnic, W.1, on Saturday morning, December 18, at 10.30 o'clock. The chair will be taken by Major J. E. K. Studd.

THE University College (University of London) Committee will shortly elect a Quain studentship in biology. The studentship is open to past or present students of the college who have taken a course in botany. The value of the studentship is 150*l.* per annum for three years. Candidates should communicate with the Secretary, University College, Gower Street, W.C.1, before December 16.

THE annual meeting of the Geographical Association will be held at the London Day Training College on Friday and Saturday, January 7 and 8, 1921. There will be a discussion on Historical Geography, opened by Mr. J. Fairgrieve and Capt. W. W. Jervis, and one on Geography in Continuation Schools, opened by Mr. L. Brooks and Capt. V. A. Bell. Dr. Unstead will lecture on The Study and Teaching of International Relations, and Dr. Haddon on Racial and Cultural Distributions in New Guinea. The presidential address by Prof. Gilbert Murray will be delivered on the afternoon of January 8.

AT a time when almost every university and technical institution in Great Britain has to close its doors to new students because of their already congested condition, it is difficult to believe that any circumstances could justify the extinction of a college which has been a pioneer of the most effective type in the work of technical education. Such, however, is the position of Finsbury Technical College, and a defence committee has been formed to consider the possibility of helping in any way to carry on the work of the college and thus to obviate its contemplated closing in July next. The college was given its distinctive character by Profs. Armstrong, Ayrton, and Perry, who were followed by Profs. Meldola and Silvanus Thompson, and the educational methods they introduced were both practical and sound, with the result that every student who took advantage of the opportunities afforded him was well equipped for his work in life. The college was founded by the City and Guilds of London Institute, and has in every way been worthy of its founders. In the last financial year the expenditure was about 12,400*l.*, of which about 7600*l.* was contributed by the institute and 4800*l.* was received in students' fees. It will thus be seen that the students' fees were nearly 40 per cent. of the income expended, which is a much higher ratio than in universities and colleges generally. The average proportion of tuition fees in universities and colleges in receipt of State aid in England and Wales is 28 per cent., and in the United States 10 per cent. Assuming that the City and Guilds Institute contribution is continued, a sum of at least 5000*l.* a year additional is required to enable the college to continue its work, and double that annual amount would not be too much to pay to secure its development. The defence committee has a strong case to put before the City Companies and the public, and it invites all who are interested in the preservation of the college to become members. Applications, with an entrance fee of 2*s.* 6*d.*, should be sent to Dr. Atkinson, Finsbury Technical College, Leonard Street, E.C.2.

Societies and Academies.

LONDON.

Royal Society, November 25.—Sir J. J. Thomson, president, in the chair.—Prof. L. **Hill**: The growth of seedlings in wind. Mustard-and-cress seeds have been grown on lamp-wicks in a continuous wind of approximately 5 metres a second, and the control seeds in still air. The seeds grown in the wind are stunted and bent, and contain less water, more ash, less protein, and, presumably, more cellulose. To counterbalance the drying effect of the wind the seeds have been irrigated with water, and to balance the cooling effect of the wind due to evaporation this water has been warmed, so that a part of the irrigated wick in the wind has been as warm as, or warmer than, the control wick. By the combining effect of thorough wetting and warming the growth of the seeds in wind has been made much more nearly equal to that of the control. While the right amount of moisture is the most important factor, the cooling of the germinating seeds by the wind is also a factor in explaining the stunting of growth in wind-swept places.—Prof. P. T. **Herring**: The effect of thyroid-feeding and of thyroparathyroidectomy upon the pituitrin content of the posterior lobe of the pituitary, the cerebro-spinal fluid, and blood. (1) Neither thyroid-feeding nor thyroparathyroidectomy in cats affects the pituitrin load of the posterior lobe of the pituitary body as tested by the action of similar strengths of extract upon the rat's uterus and the blood-pressure of the pithed cat. (2) There is no evidence of the presence of pituitrin in the cerebro-spinal fluid of the fourth ventricle in normal, thyroid-fed, and thyroparathyroidectomised cats. (3) The defibrinated blood of normal, thyroid-fed, and thyroparathyroidectomised cats has no appreciable action on the rat's uterus. The blood of thyroid-fed cats has a greater depressor action upon the circulation of an anæsthetised cat than has the blood of the normal animal. The blood of thyroparathyroidectomised cats has a pressor effect upon the circulation accompanied by contraction of the kidney and a diminution in the secretion of urine.—W. A. **Jolly**: Reflex times in the South African clawed frog. The reflex times of the homonymous and heteronymous reflexes in the hind limbs of the spinal clawed frog have been measured at temperatures ranging from 14° C. to 30° C. The average heteronymous time (66 observations) is 18·7 σ (0·0187 second). The average homonymous time (68 observations) is 14·9 σ. That is to say, the crossed reflex time is longer than the same-side reflex time by 3·8 σ.—Prof. J. A. **Gunn** and R. St. A. **Heathcote**: Cellular immunity. Observations on natural and acquired immunity to cobra venom. (*a*) *Natural Immunity.*—

The minimum lethal dose of cobra venom for the cat is twenty times that for the rabbit (by subcutaneous injection per kg.). (*b*) *Acquired Immunity.*—When a rabbit is immunised to cobra venom the isolated heart and intestine, perfused with Locke's solution so as to remove the serum, withstand higher concentrations of venom than the heart or intestine of a normal unimmunised rabbit.—L. T. **Hogben**: Studies on synapsis. III.: The nuclear organisation of the germ cells in *Libellula depressa*. (*a*) The nuclear organisation of the germ cells in *Libellula depressa* is investigated with a view to further knowledge of (i) relation of kinetic processes in premeiotic and meiotic phases, and (ii) bearing of nuclear emission in oocyte upon integrity of chromosome complex in meiotic phase. (*b*) In the premeiotic telophase the chromosomes spin out into finely granular loops, displaying initially a polar disposition, becoming increasingly more attenuated in the spirophase, and first recognisable individually in the prophase at attenuated convoluted filaments. (*c*) The Leptotene bouquet is regarded as owing its character to the polarisation of the normal telophase. (*d*) The behaviour of the "double nucleolus" has been thoroughly studied; the plasmosome is independent of the chromatin organisation of the nucleus.

Zoological Society, November 16.—Prof. J. P. Hill, vice-president, in the chair.—Dr. W. A. **Cunnington**: Fauna of the African lakes, with special reference to Tanganyika. After referring to certain physical and geological features which have a bearing on the subject, the nature of the various animal forms inhabiting the lakes was dealt with. Tanganyika was shown to have a very distinctive fauna, in that (1) it includes many more different types than any of the other lakes, (2) an extremely large proportion of them are not found elsewhere, and (3) certain forms (notably Gasteropoda) are considered to have a marine-like appearance. The view previously put forward which regarded the lake as the remains of an old Jurassic sea was considered untenable, since many of the types thought to be marine and primitive belong to essentially fresh-water groups and show signs of specialisation. The Jurassic hypothesis proves likewise incompatible with recent geological evidence. After discussing various other theories, it was suggested that Tanganvika probably owes its remarkable organisms to a prolonged period of isolation, coupled, perhaps, with the effect of an increased salinity which isolation would involve.—H. F. **Carter**: Descriptions of the adult, larval, and pupal stages of a new mosquito from Lord Howe Island, South Pacific.—Prof. C. L. **Boulenger**: Filariid worms from mammalia and birds in the society's gardens, 1914–15.

Institution of Mining and Metallurgy, November 18.—Mr. Frank Merricks, president, in the chair.—C. **Brackenbury**: An automatic counting machine for checking tram-wagons. At a quarry in which the workmen were paid on piecework, their wages depending chiefly on the number of wagons of material sent to the dump and over the weighbridge, the author devised a simple scheme for registering each wagon as it passed up the incline. The up-line was provided with catch-rails for the purpose of derailing runaway wagons, and as each wagon passed the open switch the wheel-flanges moved the rail. Suitable levers and wires connected the switch with an automatic counting machine situated in the office, with the result that every complete movement of the switch-rail registered a new unit on the counter. In this manner both the management and the workmen were satisfied that a correct record of the movements of the tram-wagons could be kept.—H. C. **Robson**: Converting high-grade matte in magnesite-lined converters. This paper contains a record of work done at the Spassky Copper Mine, Siberia, where in 1915 two 10-ft. "Great Falls" magnesite-lined converters were installed in place of three 5-ft. acid-lined converters. From the start the new converters were run with the idea of keeping a protective coating of magnesite on the brick lining. This was effected by blowing to white metal a 5-ton charge of matte with flux, followed by a similar amount without flux and 1½ tons of cold matte, the whole being blown to blister-copper. One of the chief difficulties in converting high-grade matte is keeping the tuyères open, especially with slags high in iron and low in silica. From his experience the author can see no reason why any commercial grade of matte should not be treated if correct working conditions be maintained; with matte assaying between 55 and 60 per cent. of copper it was not possible to produce a slag containing less than 6 per cent. of copper. A blister-copper assaying about 98·8 per cent. of copper with a small percentage of sulphur was always produced; attempts to produce copper of a higher grade caused difficulties by the cooling of the charge. The paper contains tables showing respectively the operating data of the converters, analyses of the converter products and by-products, and particulars of the operating temperatures in three trial charges.

Linnean Society, November 18.—Dr. A. Smith Woodward, president, in the chair.—Prof. E. S. **Goodrich**: A new type of teleostean cartilaginous pectoral girdle found in young Clupeids. In the young of *Clupea sprattus*, *C. harangus*, and *C. pilchardus*, about 20–30 mm. in length, the right and left coracoid regions fuse to a solid cartilaginous ventral bar, which becomes bent and again subdivides in later stages. This fusion is probably a specialisation to strengthen the support of the pectoral fins before the complete development of the dermal bones of the pectoral girdle.—Dr. J. C. **Willis**: Endemic genera in relation to others. In a paper of 1916 the deduction was made that in general endemic species of small area were not relics, but species in the early stages of spreading, and much evidence has since been brought up to show the truth of this. It is now proposed to extend this deduction to endemic genera, and to endeavour to show that there is no appreciable difference between a local endemic and an allied genus of wide distribution (of course, working always with groups of genera) other than age. The author has added up all the endemic genera of all the islands in the world, and for comparison also those of (1) West Australia, South Africa, and Brazil (the mainland areas richest in endemics); (2) of Australia, Africa, and South America; and (3) of the world. Examination of the tables thus obtained soon shows that if one takes the families in groups of ten in order according to the number of genera they contain in the world (*i.e.* beginning with Compositæ and ending with monotypic families), the proportion of island genera to the total is closely the same throughout the list, and the same holds for all the four areas mentioned. Thus the first ten families contain 40·1 per cent. of the genera of the world, 39·4 per cent. of those of Australia, Africa, and South America, 40·5 per cent. of those of West Australia, etc., and 38·3 per cent. (606 genera out of 1582) of the endemic genera of islands. And the approximation is equally close all down the scale, so that the curves produced almost coincide. Comparison shows with equal clearness that the proportional representation among the endemic genera of islands decreases as one goes down the scale. The

first 100 families in the world have island endemic genera in 92, the genera being 12·9 per cent. of the total genera in the families. The intermediate 92 families are represented by 45 only, with 9·28 per cent. of their genera, and the last 100 by 13, with 8·72 per cent.

EDINBURGH.

Royal Society, November 22.—Sir Alfred Ewing, vice-president, in the chair.—Prof. W. **Peddie**: Fechner's law and the self-luminosity of the eye. This law states that the change of visual perceptivity is proportional to the fractional change in the intensity of the light. At weak intensities a term, regarded as constant, has to be added to the intensity of the external light on account of the self-luminosity of the eye. By integration over the whole stimulated part of the retina Helmholtz obtained an expression for the perceptivity which agreed with observation in so far as the general nature of the relation between perceptivity and external stimulus is concerned. There was, however, a measurable difference for a certain range of intensities. A close correspondence can be obtained by assuming that the self-luminosity term in Fechner's expression is itself a simple function of the external stimulus, rising rapidly to a maximum, and thereafter slowly falling to a steady value.—Dr. H. S. **Allen**: Æther and the quantum theory. Although some supporters of the principle of relativity reject the idea of æther, most physicists still employ the æther conception in describing electric and magnetic phenomena. Certain classes of physical facts appear to contradict the laws of classical mechanics, and the quantum theory has been developed by Planck and others to meet such cases. It is argued in this paper that the quantum theory necessitates the physical existence of lines or tubes of magnetic force as discrete entities, and yields a quantitative estimate of what must be the fundamental unit magnetic tube. This unit magnetic tube is determined by the ratio of Planck's constant, h, to the charge, e, of an electron, and is equal to $4{\cdot}12\times10^{-7}$ c.g.s. units. Consequently, one c.g.s. line (one maxwell) contains $2{\cdot}43\times10^{6}$ "quantum tubes." On this theory æther may be regarded as an assemblage of lines of force in accordance with the representation given long ago by Faraday and Maxwell.

PARIS.

Academy of Sciences, November 15.—M. Henri Deslandres in the chair.—C. **Moureu** and A. **Lepape**: The rare gases in natural gases of Alsace-Lorraine. The natural gases examined included five from petroleum wells of Pechelbronn, one from the Wittelsheim potash mines, one firedamp from the Sarre-et-Moselle coal mines, and two from mineral springs (Niederbronn and Soulzmatt). The carbon dioxide, oxygen, combustible gases, and nitrogen (including rare gases) were determined and then the nitrogen was analysed separately. The rare gases were separated into two groups: argon with traces of krypton and xenon, and helium with traces of neon. The argon–nitrogen ratios found varied only between 0·91 and 2·48, but the helium–nitrogen ratios varied much more widely, 23·8 to 2·6.—P. **Théodoridès**: The thermal variation of the coefficient of magnetisation of some anhydrous chlorides and an oxide in the solid state: the magneton theory. Measurements were made on the anhydrous chlorides of cobalt, manganese, and nickel and on manganous oxide at temperatures ranging between 0° C. and 550° C. For the chlorides of nickel and cobalt the results conform to the magneton theory, but this is not the case for the determinations with manganese chloride and oxide.—R. **de Mallemann**: The rotatory power of tartaric and malic acids in solution. Study of the variations in rotatory power produced by the addition of benzene to alcoholic solutions of tartaric acid; the rotations are to the left for all colours, and the dispersion is normal. In aqueous solution this acid reverses its rotation in presence of calcium chloride, and the dispersion, at first abnormal, becomes normal after a certain quantity of the salt has been added. Malic acid resembles tartaric acid and shows similar variations, but in the inverse sense.—E. **Darmois**: The dispersion of the refraction of hydrocarbons. If n and n' are the refractive indices of a given hydrocarbon for two colours, the difference $\frac{n'-n}{d}$, where d is the density, is called the specific dispersion. For different classes of hydrocarbons the differences in the specific dispersion are sufficiently great to be of service in the analysis of mixtures such as occur in petrols.—A. **Bolland**: The micro-chemical reactions of iodic acid. A description of the crystals obtained with iodic acid and salts of thallium, silver, barium, strontium, calcium, and rubidium.—P. **Fleury**: The catalytic decomposition of an alkaline solution of sodium hypobromite by copper sulphate. The opposing action of iodine. The decomposition of the hypobromite solutions was measured by the amounts of oxygen evolved in 1, 2, and 4 days. As little as 0·25 milligram of copper per litre of solution was found to exert a marked catalytic action. This effect can be completely counteracted by adding small quantities of iodine.—C. **Dufraisse**: The ethylene isomerism of the monobromostyrolenes in the lateral chain.—P. H. **Fritel**: The presence of the genera Gangamopteris and Schizoneuta in the grits of Ankazomanga (south of Madagascar). The presence of these plants indicates a lower level of the Permian in Madagascar than that recognised by M. Boule in the Sakamena Valley.—G. **Bertrand**: Observations on the properties of tear-producing substances and the measurement of their activity. Comments on the method used by MM. Dufraisse and Bongrand in a recent communication on the same subject. There are difficulties in the exact definition of the limiting concentration producing effects on the eyes; moreover, the sensibility of the observer varies with the time of day. The mode of attack by the different irritating substances is not the same in all cases; chloropicrin, for example, acts suddenly, whilst the effect of other substances, of which monochloroacetone is an example, is progressive.—A. **Bach** and Mme. Sophie **Zoubkoff**: Contribution to the study of the indices of the blood enzymes. The estimation of catalase, peroxydase, and etherase in one drop of blood.—E. **Kayser**: The influence of luminous radiations on a nitrogen fixer. Cultures of *Azobacter agile* were grown under shades of coloured glass and the nitrogen was assimilated by the bacteria determined. The maximum nitrogen assimilation was under yellow and green light.—J. Y. **Heymans**: *In vivo*, as *in vitro*, micro-organisms pass through the walls of a filter.—L. **Léger**: The endogenous multiplication of *Chloromyxum truttae*.

ROME.

Reale Accademia dei Lincei, June 4.—A. Ròiti, vice-president, in the chair.—S. **Pincherle**: Iterated function of a rational integral one.—G. **Fano**: Surfaces of the 4th order with infinite discontinuous groups of birational transformations, i. The author commences this series of papers with the F/4 containing two skew lines, the first example of the complete study of a group for which Severi's quadratic form is ternary.—G. **Ciamician** and C. **Ravenna**: Considerations regarding the function of alkaloids in plants.—

A. **Angeli** and C. **Lutri**: Black compounds of pirrol, viii.—H. S. **Washington**: Italite, a new leucitic rock. This was discovered by Baron G. A. Blanc and F. Jourdain on the western flank of the volcano of Rocca Monfina in a lava-current more than 100 metres in length.—G. **Andreoli**: Some functional inequalities leading to developments in series.—T. **Boggio**: Lines of force in a stratified spheroid.—C. **Mineo**: Transference of co-ordinates along a geodetic. The formulæ established by the author are applied to a numerical example in geodesy previously calculated by Pizzetti, and are found to agree with his results.—M. **Pascal**: Resultant pressure on a wing of an aeroplane. This is a solution of a hydrodynamical problem in two-dimensional stream-line motion by means of a conformal transformation.—G. **Aliverti**: State of contraction of electrolytic metal deposits, i. Stoney's method is applied to test whether the contraction is or is not due to thermic effects.—E. **Oddone**: Determination of the seismic hypocentre. An empirical formula is established connecting the depth of the hypocentre with the period of the waves of maximum length. As applied to recent earthquakes, this formula gives values for the hypocentric depth of from 9 to 13 km., agreeing fairly well with the known results obtained by more exact methods.—E. **Clerici**: Pelagosite from Canalgrande (Iglesias). This mineral, which was discovered in the form of encrustations on a cavern excavated by the waves, was found to agree in its properties with specimens obtained from Argentario.—L. **Pieragnoli**: Pathology of *Ursus spelaeus* from the caves of Equi. These remains, which were excavated by Prof. Carlo de Stefani, were found to be greatly affected by tuberculosis, showing these animals to be liable to the same diseases as man, and this to an extent which may have been instrumental in causing the extinction of the species.—C. **Artom**: Biology of the genus Artemia.—L. **Petri**: Cause of arrested development of the ovary in the olive. According to Dr. Pirotta, olive-trees could be classified into four distinct types, characterised by the presence or absence of sterile or fertile flowers, flowers with imperfectly developed ovaries, or mixtures of these forms. The author disagrees with Dr. Pirotta's theory, and maintains that the arrested development of the ovary is a phenomenon common to all varieties of wild and cultivated olives, which may be brought about by extraneous temporary causes of recent date. The conditions favourable to the production of the different forms of flowers remain to be determined.—A committee, consisting of L. Luzzatti, G. de Marchi, and R. Pirotta (recorder), presented a report on Dr. Girolamo Azzi's proposals for dealing with meteorological and geographical problems relating to agriculture.

Books Received.

The Principles of Economic Geography. By Dr. R. N. Rudmose Brown. Pp. xv+208. (London: Sir Isaac Pitman and Sons, Ltd.) 10*s.* 6*d.* net.

Infant Education. By Dr. E. Pritchard. Second edition. Pp. xv+226. (London: H. Kimpton.) 6*s.* net.

Physiology and Biochemistry in Modern Medicine. By Prof. J. J. R. Macleod. Third edition. Pp. xxxii+992+9 plates. (London: H. Kimpton.) 42*s.* net.

The Yeasts. By Prof. A. Guilliermond. Translated by Dr. F. W. Tanner. Pp. xix+424. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 32*s.* net.

Handbuch der Regionalen Geologie. Edited by Prof. G. Steinmann and Prof. O. Wilckens. 20 Heft, III. Band, 1 Abteilung.: The British Isles. By P. G. H. Boswell and others. Local Editor, J. W. Evans. With an Appendix, The Channel Islands, by J. Parkinson. Pp. 354+plates. (Heidelberg: Carl Winter.)

Nucleic Acids. By Prof. W. Jones. Second edition. Pp. viii+150. (London: Longmans, Green and Co.) 9*s.* net.

Bolshevik Russia. By G. E. Raine, in collaboration with Dr. E. Luboff. Pp. 192. (London: Nisbet and Co., Ltd.) 1*s.* net.

London Trees. By A. D. Webster. Pp. xii+218+32 plates. (London: Swarthmore Press.) 15*s.* net.

Medical Research Council and Department of Scientific and Industrial Research. Reports of the Industrial Fatigue Research Board. No. 10: Preliminary Notes on the Boot and Shoe Industry. Pp. 32+vii plates. (London: H.M. Stationery Office.) 1*s.* 6*d.* net.

A Last Diary. By W. N. P. Barbellion. Pp. xlviii+148. (London: Chatto and Windus.) 6*s.* net.

Ancient Egypt. Part 4, 1920. (London: Macmillan and Co., Ltd.) 2*s.* net.

Prevention of Venereal Disease. By Sir G. Archdall Reid. Pp. xviii+447. (London: W. Heinemann, Ltd.) 15*s.* net.

Science German Course. By G. W. P. Moffatt. Third edition. Pp. xii+270. (London: W. B. Clive.) 5*s.*

Practical Biological Chemistry. By Prof. G. Bertrand and P. Thomas. Translated from the third edition by H. A. Colwell. Pp. xxxii+348. (London: G. Bell and Sons, Ltd.) 10*s.* 6*d.* net.

Highways and Byways in Northumbria. By P. A. Graham. Pp. xviii+380. (London: Macmillan and Co., Ltd.) 7*s.* 6*d.* net.

The League of Nations Starts. An Outline by its Organisers. Pp. xi+282. (London: Macmillan and Co., Ltd.) 10*s.* 6*d.* net.

Diary of Societies.

THURSDAY, DECEMBER 9.

ROYAL SOCIETY, at 4.30.—Lord Rayleigh: Double Refraction and Crystalline Structure of Silica Glass.—Prof. J. W. Nicholson and Prof. T. R. Merton: The Effect of Asymmetry on Wave-length Determinations.—Prof. T. R. Merton: The Effect of Concentration on the Spectra of Luminous Gases.—Prof. E. Wilson: The Measurement of Low Magnetic Susceptibility by an Instrument of New Type.—Prof. W. T. David: The Internal Energy of Inflammable Mixtures of Coal-gas and Air after Explosion.—Prof. A. McAulay: Multenions and Differential Invariants.

LINNEAN SOCIETY, at 5.—Prof. R. Newstead: Uganda Biology (Lantern Lecture).

LONDON MATHEMATICAL SOCIETY (at Royal Astronomical Society), at 5.—S. Beatty: The Algebraic Theory of Algebraic Functions of One Variable.—F. Debono: The Construction of Magic Squares.—Prof. A. S. Eddington: An Application of the Calculus of Tensors to the Theory of Finite Differences.—Prof. A. R. Forsyth: Developable Surfaces through a couple of Guiding Curves in Different Planes.—J. E. Jones: The Distribution of Energy in the Neighbourhood of a Vibrating Sphere.—L. J. Mordell: (1) The Reciprocity Formula for the Gauss's Sums in a Quadratic Field. (2) A New Class of Definite Integrals.—Prof. G. N. Watson: The Product of Two Hypergeometric Functions.—Prof. W. H. Young: (1) Integration over the Area of a Surface and Transformation of the Variables in a Multiple Integral. (2) A New Set of Conditions for a Formula for an Area.

ROYAL SOCIETY OF MEDICINE (Balneology and Climatology Section), at 5.15.—Dr. Max Porges: Mud Baths and Nephritis.—Dr. F. Hernaman-Johnson: The Importance of Combined Methods in Diagnosis and Treatment.—Dr. S. Burridge: Some Possible Ill-effects of Barium Waters.

INSTITUTION OF ELECTRICAL ENGINEERS (at Institution of Civil Engineers), at 6.—Adjourned Discussion on Papers by W. B. Woodhouse and R. O. Kapp on The Distribution of Electricity and Some Economic Aspects of E.H.T. Distribution by Underground Cables.

ROYAL SOCIETY OF MEDICINE (Neurology Section), at 8.30.—Dr. F. Buzzard: Tabes, its Early Recognition and Treatment.

FRIDAY, DECEMBER 10.

ASSOCIATION OF ECONOMIC BIOLOGISTS (in the Botanical Theatre, Imperial College of Science), at 2.30.—Exhibition of Specimens and Short Communications.—W. J. Dowson: Problems of Economic Biology in British East Africa.—Dr. M. C. Rayner: Nitrogen Fixation in the Ericaceæ.

ROYAL ASTRONOMICAL SOCIETY, at 5.—J. K. Fotheringham: A Solution of Ancient Eclipses of the Sun.—W. H. Wright: The Displacements of the Hydrogen Absorption Lines in the Spectrum of Nova Geminorum in March, 1912, with Remarks upon their Interpretation.—H. C. Plummer: The Question of Stationary Radiants.—Rev. J. G. Hagen: A Map showing Obscure Nebulæ and their Situation towards the Milky Way.—P. H. Hepburn, M. A. Ainslie, W. H. Steavenson, and H. L. Waterfield: Observations of Saturn, 1920, November 6 to November 20.—C. D. Perrine: Cepheid Variation: Acknowledging a Correction and Some Further Considerations.—C. D. Perrine: Behaviour of Radiations at λλ 4634-41 and at λ 4654 in the Wolf-Rayet Stars.—C. D. Perrine: Presence of Emission at λλ 4634 and 4641 in the Spectra of the Wolf-Rayet Stars.

PHYSICAL SOCIETY OF LONDON, at 5.—J. St. Vincent Pletts: Some Slide Rule Improvements.—N. A. Allen: The Current Density in the Crater of the Carbon Arc.—F. H. Newman: A Sodium Vapour Electric Discharge Tube.—F. H. Newman: Absorption of Gases in the Electric Discharge Tube.

ROYAL SOCIETY OF MEDICINE (Clinical Section), at 5.30.

INSTITUTION OF MECHANICAL ENGINEERS (Informal Meeting), at 7.

TECHNICAL INSPECTION ASSOCIATION (at Royal Society of Arts), at 7.30.—Dr. G. H. Gulliver: Some Features of Tensile Fractures.

ROYAL SOCIETY OF MEDICINE (Ophthalmology Section), at 8.30.

MONDAY, DECEMBER 13.

ROYAL GEOGRAPHICAL SOCIETY (at Lowther Lodge), at 5.—Lt.-Comdr. R. T. Gould: The History of the Chronometer.

ROYAL SOCIETY OF MEDICINE (War Section), at 5.30.—Surg.-Comdr. E. L. Atkinson: Snow Blindness: Its Prevention, Cause, and Treatment.

INSTITUTION OF ELECTRICAL ENGINEERS (at Chartered Institute of Patent Agents, Staple Inn Buildings), at 7.—W. J. Minton and Others: Discussion on (1) Percentage and Accuracies; (2) Meter Constants and Standards; (3) Name-plates.

INSTITUTION OF MECHANICAL ENGINEERS (Graduates' Meeting), at 7.—A. G. Hopking: Die Casting.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.—M. S. Briggs: Saracenic Architecture in Egypt and Palestine.

ROYAL SOCIETY OF ARTS, at 8.—A. Chaston Chapman: Micro-organisms and Some of their Industrial Uses (Cantor Lecture).

INSTITUTE OF BREWING, at 8.—H. Lloyd Hind: The Reconstruction of French Breweries.

CHEMICAL INDUSTRY CLUB, at 8.—Dr. W. R. Ormandy and Others: Discussion on Phosphorescence and Invisible Light.

SURVEYORS' INSTITUTION, at 8.—F. H. A. Hardcastle: The Work of the Measuring and Quantity Surveyor, and the Use and Abuse of Bills of Quantities.

FARADAY SOCIETY (at Chemical Society), at 8.—Annual General Meeting.—At 8.15.—Prof. E. D. Campbell: A Force Field Dissociation Theory of Solution applied to Some Properties of Steel (Discussion to be opened by Dr. A. E. Oxley).—A. L. Norbury: The Electrical Resistivity of Dilute Metallic Solutions.—W. E. Hughes: The Forms of Electro-deposited Iron and the Effect of Acid upon its Structure. Part I. Deposited from the Chloride Bath.

TUESDAY, DECEMBER 14.

ROYAL HORTICULTURAL SOCIETY, at 3.

ROYAL SOCIETY OF MEDICINE (Therapeutics and Pharmacology Section) (at Mount Vernon Hospital), at 4.30.—Dr. W. E. Dixon: Quinine Derivatives as Local Anæsthetics.—Dr. O. Inchley: Absorption of Drugs by means of the Electric Current.—Dr. W. E. Dixon and Dr. D. Cow: Actions of Isomeric Methyl Chlorides of Tellurium.

ROYAL SOCIETY OF MEDICINE (Medicine Section) (at London Hospital), at 5.—D. Hunter: The Results of Fractional Test Meals on Patients.

ROYAL STATISTICAL SOCIETY, at 5.15.

INSTITUTION OF PETROLEUM TECHNOLOGISTS (at Royal Society of Arts), at 5.30.—Capt. P. W. Mangin: Boring in Palestine.—F. Esling: Estimation of Sulphur by the Lamp Method.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—Sir Robert A. Hadfield, Bt., and S. A. Main: Notes on the Standardisation of Shock Tests, and Discussion on this Paper and on the three Papers on Notched-Bar Tests read at the Meeting on November 30.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.

QUEKETT MICROSCOPICAL CLUB (at 11 Chandos Street, W.1), at 7.30.

ILLUMINATING ENGINEERING SOCIETY (at Royal Society of Arts), at 8.—Report on Progress during the Vacation, and an Exhibition of New Developments in Lamps and Lighting Appliances, Illumination-photometers, etc.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Capt. L. W. G. Malcolm: The Ethnography of the Central Cameroons.

WEDNESDAY, DECEMBER 15.

SOCIETY OF GLASS TECHNOLOGY (at Royal Society of Arts), at 2.30.—W. A. Whatmough: The Re-Annealing of Glass.—Dr. C. J. Peddle: The Development of Various Types of Glass. Parts VI., VII., VIII., and IX.: Silicate Glasses containing Sodium Oxide, Potassium Oxide, and Lead Oxide.

OPTICAL SOCIETY (at National Physical Laboratory), at 3.30.—Dr. J. S. Anderson: Photographic Shutter Testing; Testing of Objectives; Differential Refractometry for Liquids; Immersion Refractometry.—J. Guild: Curvature Measurements; Note on Pyramidal Error in Prisms; Note on the Corrections for Temperature and Atmospheric Pressure in Refractometry.—J. Guild and Miss A. B. Dale: Critical Angle Refractometry.—T. Smith: The Dispersion of Glass and the Determination of Probable Corrections to Observations; Notes on the Calculation of Multiple-Glass Objectives.—T. Smith and G. Milne: A Recalculation of the Objectives of Steinheil and Voit, with additions.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—Dr. T. O. Bosworth: The Tertiary and Quaternary Geology and Tectonics of the Littoral of Peru.—H. Woods: The Fauna of the Tertiary Deposits of Northern Peru.

INSTITUTION OF ELECTRICAL ENGINEERS (Wireless Section) (at Institution of Civil Engineers), at 6.—Capt. R. C. Trench: Range of Wireless Stations.

ROYAL MICROSCOPICAL SOCIETY (at Mortimer Halls, Mortimer Street), at 7.30.—Conversazione.—At 8.—Ordinary Meeting.

ROYAL SOCIETY OF ARTS, at 8.—Major-Gen. Lord Lovat: Forestry.

INSTITUTE OF CHEMISTRY (London and South-East Counties Section) (at 30 Russell Square), at 8.—Annual Meeting.

ROYAL METEOROLOGICAL SOCIETY, at 8.—Capt. C. K. M. Douglas: Temperature Variations in the Lowest Four Kilometres.—A. P. Wainwright: A New Form of Sunshine Recorder (Mechanical Type).—Lt.-Col. J. E. E. Craster: An Investigation of River Flow, Rainfall, and Evaporation Records.

THURSDAY, DECEMBER 16.

ROYAL AERONAUTICAL SOCIETY (at Royal Society of Arts), at 5.30.—H. Ricardo: Possible Developments in Aircraft Engines.—A. J. Rowledge: The Instalment of Aeroplane Engines.

INSTITUTION OF MINING AND METALLURGY (at Geological Society), at 5.30.—E. J. Prior: Some Sources of Error in Alluvial Boring.—R. E. Palmer: Some Observations on Mining by the Opencast or Stripping Method.

INSTITUTION OF ELECTRICAL ENGINEERS (at Institution of Civil Engineers), at 6.—Discussion: Report on the Heating of Buried Cables.

INSTITUTION OF AUTOMOBILE ENGINEERS (Graduates' Meeting) (at 28, Victoria Street), at 8.—T. E. B. Whiting: Carburation.

CHEMICAL SOCIETY (at Institution of Mechanical Engineers), at 8.—Sir R. Robertson: Lecture: Some Properties of Explosives.

RÖNTGEN SOCIETY (in Physics Lecture Theatre, University College), at 8.15.

FRIDAY, DECEMBER 17.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Dr. W. J. Walker: Thermodynamic Cycles in Relation to the Design and Future Development of Internal-combustion Motors.

ROYAL SOCIETY OF ARTS, at 8.—Col. R. J. Stordy: The Breeding of Sheep, Llamas, and Alpacas in Peru, with a view to supplying Improved Raw Material for the Textile Trades.

SATURDAY, DECEMBER 18.

PHYSIOLOGICAL SOCIETY (at St. Thomas' Hospital), at 4.

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