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Biology and the Fur Trade.

DURING the last quarter of a century there has been an enormous increase in the demand for furs. In the United States alone, according to Mr. David C. Mills, the general director of the National Association of the Fur Industry, "the annual catch of fur bearers in the United States was roughly estimated at about twenty-five millions of dollars twenty-five years ago. We estimate it roughly at sixty millions to-day, with quantities fairly well maintained, on the whole, because of the impetus given to trapping by the higher returns to the trapper." But this impetus means more intensive slaughter. How great the slaughter is may be gathered from the lists of skins exposed for sale at the fur auctions during the winter of 1925. The total number of skins (excluding Chinese and Australian) greatly exceeded four and a half millions, and a few of the larger items included: skunk 652,293, American opossum 456,195, musquash 787,195, squirrel 837,097, mole 357,599.

Such destruction of fur-bearers could have but one result; it has involved the usurpation of the annual increase of the animals, and beyond that a trenching upon the capital stock itself to a serious degree. That the destruction has already gone too far in many areas is admitted on all hands. The officials in charge of the Fur Resources Division of the U.S. Bureau of the Biological Survey, from a detached point of view, state (September 1924) that "the fur trader of the past was interested chiefly in the quantity of pelts he could collect . . . and when the dressing of furs became well established as an industry in the United States, the fur trade began to appreciate the fact that some of the more valuable fur animals had almost disappeared from our forests and streams, and that the production of a large part of the most important fine furs was confined to the Canadian Provinces. While the musk rat, the skunk, and, in places, a few other species are left in considerable numbers, the remnants of this once rich heritage in this country are fast dwindling under present-day conditions." The director of the fur industry association, viewing the matter from a business point of view, is equally emphatic (April 1925): "certain species in some districts have been thoroughly trapped out or at least reduced to a point at which they are commercially unimportant. Broadly speaking, the future of the commercial supply of some of the fur-bearing species in all districts is problematical."

Efforts have been made to check the excessive destruction by means of legislation; but legislation labours under special difficulties in these North American territories. Each State frames its own State laws, with the result that there is often a lack of

co-ordination in adjacent regions, expressed in differences in the species of animals protected, in varying methods of protection, and, even when method and species agree, in serious variations in the period covered by the close season, when the protected creature is supposed to be safe from interference.

It is here that biology has a lesson to teach. Knowledge of the life-histories of fur animals and of the biological zones where conditions of livelihood are more or less uniform, should be able to bring order out of the chaos of legislation. It is to biology that both the fur-traders and the officials interested in animal resources look for rescue from the slough into which the fur industry is sinking of its own weight. It is impossible, and only a narrow outlook could regard it as desirable, to put a stop to those interferences with natural breeding grounds—the felling of woods, the draining of marshes, the tilling of the prairie—which are the accompaniments of agricultural progress and of the march of civilisation. The most that biology can do is to suggest how the stock of fur animals can best be conserved, and at the same time yield a full harvest, in these areas where food, shelter, and suitable haunts still exist.

In the first place it is found that trapping of animals is often carried on after the breeding season has set in. This obviously is biologically unsound; for the death of a breeding animal means the loss not only of an individual, but of a prospective adult progeny. Furthermore, it is uneconomic, since the breeding season marks a period when the pelt deteriorates in quality, to the loss of the trapper and the trader. Everywhere the onset of breeding time should mark the commencement of the "close season," and the open season should not commence until the breeding season has ended.

Here another biological consideration comes into force, further to curtail the open season. At the close of the breeding period the pelts are in poor condition, and the fact that many poor pelts reach the market is a clear indication that in places the trapping season is too long. The casting of the old fur and its replacement by a fresh coat is a routine process influenced by specific idiosyncrasy and by climate, but for most animals the time for prime pelt is limited to a comparatively short period in the autumn. Let this, then, be the trapping season, and the markets would gain by a raising of the standard of quality, and the trapper would be better repaid for his labours during a shorter but more intense trapping season.

Lastly, variations in State-to-State laws should be regulated, first by the amount of the stock, upon the annual increase of which the trapper may safely trench without endangering the capital, and, secondly, by the climatic factors which regulate the routine of the life-history. Broadly speaking, a maximum open season would exist uniformly among adjacent States ranged along a climatic, or more strictly a climato-biological, zone, the uniformity being broken here and there by shorter close seasons where the natural stock was at a low ebb.

Such are the biological considerations which the officials of the United States Department of Agriculture are endeavouring to work into the legislation of the States. It is matter for thought that while other countries are approaching this high pitch of perfection in the protection of their native animals, Britain has not yet taken even a first legislative step to protect the waning remnant of its land mammals.

JAMES RITCHIE.

The Chemistry of the Sugars.

(1) *The simple Carbohydrates and the Glucosides.* By Dr. E. Frankland Armstrong. (Monographs on Biochemistry.) Fourth edition. Pp. xi+293. (London: Longmans, Green and Co., 1924.) 16*s.* net.

(2) *Zuckerchemie.* Von Prof. Dr. Hans Pringsheim. Unter Mitwirkung von Dr. Jesaia Leibowitz. Pp. xii+322. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1925.) 18 gold marks.

THERE is at the present time no up-to-date treatise on carbohydrate chemistry. The last edition of Tollens's "Kurzes Handbuch" was published in 1914, the third edition of von Lippmann's "Chemie der Zuckerarten," in two volumes, appeared in 1904, and Maquenne's "Les Sucres" in 1900. Neither of the books before us can claim to be a treatise on the subject, yet they both form useful additions to the literature.

(1) Armstrong's monograph has gone through four editions in fourteen years, a fact which is in itself a testimonial. Besides having been thoroughly revised and the subject matter to a great extent rearranged, the present edition has been enlarged by the addition to the text of some fifty pages, including two new chapters. The author acknowledges his indebtedness to Principal (now Sir James) Irvine and to Dr. T. P. Hilditch for giving him many valuable suggestions, as well as to Mr. Rex Furness for assistance in the compilation of the enlarged bibliography.

The opening chapter on glucose outlines the general character of this typical sugar and its derivatives, whilst other chapters are devoted to the chemical properties of the hexoses and pentoses as a class and to the carbohydrate alcohols. Stereoisomerism is most ably dealt with, and here the author refers to his own work and to that of Lowry and of Hudson. The di-saccharides, tri-saccharides, and the one known tetra-

saccharide, stachyose, are also discussed. The chapter entitled "Configuration and Biological Behaviour" is concerned with fermentation, oxidation, selective hydrolysis by enzymes, and the behaviour of sugars in the blood.

The two new chapters deal with hydrolysis and synthesis and with the polysaccharides respectively. In the former the simple law of mass action, illustrated by the rate of hydrolysis of sucrose, is described. The synthesis of sugars *in vitro* and *in vivo* is discussed. Bourquelot's work on synthesis by enzymes is referred to as proving that when this takes place a balanced reaction is concerned. It is pointed out, however, that the work of the author in 1901, and of Hudson in 1914, proves that the system invertase, fructose, glucose produces no sucrose. It will be remembered that Brown and Morris, working with the leaves of Tropæolum, found that the first sugar which could be identified as a result of the assimilatory processes is sucrose. Parkin made a similar observation in the case of the leaves of the snowdrop, and Davis Daish and Sawyer in that of mangold leaves. The first actual sugar to be synthesised is probably a reducing sugar, but the storage carbohydrates are of the nature of sucrose, starch, and the like. Whether sucrose will ever be synthesised *in vitro* must remain an open question; its formation in the plant would seem, however, to be associated with vital processes.

The chapter on the polysaccharides is useful, but it has not been possible to give more than a bare outline of the subject. Pectins and gums are not mentioned.

The chapters on the natural and synthetic glucosides, and on the function of carbohydrates and glucosides in plants, will be read with great interest, containing as they do so many valuable suggestions. Under respiration in plants, a concise account is given of Palladin's theory of respiratory chromogens, whilst Wheldale's work on antho-cyanins is alluded to. In connexion with the tannins, the observations of Kraus and of Busgen that they are structural materials, as instanced by their disappearance from young cork cells, are mentioned, but there is no reference to the work of Drabble and Nierenstein that condensation products giving reactions similar to those of cork are formed by treating a mixture of formaldehyde and phenol or tannin with an acid. This is important as giving a clue to the formation of cork from tannins.

Whilst as a whole the monograph deserves the highest praise, we venture to think that the subject matter might have been better arranged. There is over-lapping, and even repetition, between some of the chapters. This, however, can only be remedied by rewriting and recasting the book; it is unavoidable when an edition has only been revised and extended. The diction is clear and there are no serious typographical errors. We notice one contradiction in terms on p. 47. "In anhydrous alcohol (which, however, contains traces of water) . . ." This is a mere slip, and it is quite clear what the author means. One important feature of the monograph is that it is written in an unbiassed manner. The author states his own views as well as those of other chemists who differ from him on any point. We cordially recommend the monograph to all students of the subject with which it deals.

(2) Prof. Pringsheim's book is intended by him as a text-book for beginners in sugar chemistry. It differs entirely in its lay-out from Dr. Armstrong's monograph, being more in the nature of sketchy outlines on the subject, in which bare facts are stated devoid of full explanation or of suggestion. It is written almost exclusively from the point of view of the organic chemist, the biochemistry of the subject taking only a subsidiary position. Structural formulæ are reproduced freely, but little detail is given of the experimental data on which they are based. It is only just, however, to add that original references are cited in all cases. The author has condensed his subject matter with great skill, but we venture to think that the text has been reduced to too small a compass, for, in addition to the meagre nature of the arguments justifying the theoretical deductions set forth, there are numerous omissions. Obviously, therefore, such a book can scarcely be recommended, without qualification, as a text-book for beginners, who at the present time are too often trained merely to memorise formulæ rather than to study chemistry logically as a branch of experimental science.

The text is divided into twelve sections under the headings: general properties and constitution; oxidation; reduction; condensations; configuration; anhydrous and reducing sugars; amino sugars; synthesis and degradation of the monosaccharides; biochemical reactions of the sugars; the glucosides and their synthesis; disaccharides; occurrence, preparation, and special properties of the most important sugars. A useful feature of the work is the inclusion at the end of each section of tables giving the melting point, rotatory power, and principal derivatives of the compounds dealt with, as well as references to the literature. References to the literature are also given throughout the text as footnotes.

Such criticism as we have ventured to make demands some justification, and to supply this we propose citing some points from the text. Just over two pages are devoted to the pentoses, of which arabinose, xylose, and ribose are briefly described: lyxose is once mentioned.

Of the hexaketoses, fructose and sorbose only are described. It is stated that, according to Hudson's rule, the difference of the specific rotatory powers of the α- and β-aldoses is approximately a constant; this should refer to the difference of the molecular rotations. It is incorrect that starch can be converted quantitatively into maltose by malt diastase, even in the presence of the so-called amylase complement, as the recent work of Ling and Nanji has shown. Nothing is said of Baker's method of preparing maltose by the action of translocation diastase on starch. There is no reference to the cyclic sugars. The obsolete method of Soxhlet of titrating sugars with Fehling's solution in a porcelain dish is described. Following this, however, is a description of Bertrand's permanganate method. Willstätter and Schudel's iodometric method of estimating reducing sugars is described, but there is no mention of the more recent, improved method of Baker and Hulton. Croft Hill's observation that under the influence of yeast maltase (not maltose, *sic*) glucose yields revertose is referred to, but β-glucosido-maltose and isomaltose, which Ling and Nanji have shown to be constant products of the hydrolysis of amylopectin, are not mentioned.

There can be no doubt that, so far as it goes, Prof. Pringsheim's book will be found useful to the student under the guidance of a competent teacher.

ARTHUR R. LING.

Physiological Optics.

Helmholtz's Treatise on Physiological Optics. Translated from the third German edition. Edited by Prof. James P. C. Southall. Vol. 2: *The Sensations of Vision.* Pp. ix+480. (Ithaca, N.Y.: Prof. F. K. Richtmyer, Secretary, Optical Society of America; London: The Hatton Press, Ltd., 1924.) 30*s*.

"IN developing the consequences of any valid general principle in individual cases, one constantly comes on new and quite unexpected surprises. And as the consequences are not arbitrary, nor contingent on the caprice of the author, I have often the impression that it is not my own work that I am writing out, but some one else's."

HERMANN V. HELMHOLTZ.

The text of this volume occupies 468 pages, of which nearly one-quarter takes account of new matter extending beyond the original first-edition treatment; and, of that quarter, fully one-ninth part is specially contributed to the American edition. The contributions of the late Prof. Nagel are a note on the stimulation of the organ of vision by Röntgen and Becquerel rays; another on visual acuity; a section on changes of the retina due to light; a note on complementary colours; one on flicker scotoma; and a large appendix on adaptation, twilight vision, and the duplicity theory. The contributions of v. Kries are a note on contrast, and a long appendix dealing with normal and anomalous colour systems, and with theories of vision. Dr. Christine Ladd-Franklin contributes a new appendix on the nature of the colour sensations.

In his preface to the German edition, Nagel gives his views on the relations of the new work to the older work, as utilised by Helmholtz, in the following words.

"In that region of the 'Sensations of Vision' the main question to be decided first of all was whether Helmholtz's conception of the structure and action of the mechanism of colour perception could still be considered as an adequate explanation of all the new observations that have been made in the last four decades; and if not, whether these ideas should be discarded altogether, or, finally, whether it would be really profitable to introduce here additional supplementary hypotheses. The editor's position on this question is that there is no reason whatever to abandon the fundamental ideas of the colour theory which Helmholtz espoused; although the assumption of the organisation of the mechanism of colour perception in three components is no longer sufficient to give an entirely satisfactory account of all the known facts of colour vision."

Helmholtz so clearly recognised the differences of the rod and cone structures and functionings that, in the first edition of his work, he showed with elaboration (pp. 30, 31, ii., Amer. edn.) that the rods could not act in the same way as the cones, and he considered them to be visually ineffective. The cones he regarded as "the elements that are *peculiarly* sensitive" (italics are ours). Subsequent gain of knowledge gave rise, in the second edition, to the statement that

"From the perfectly analogous anatomical structure of the rods it is extremely probable that they also must have the same sort of capacity; which was the opinion of H. Müller and Koelliker. Nevertheless they must play an entirely different rôle in the localisation of sensations, because, in spite of their being finer and more numerous in the peripheral parts of the retina where they predominate, the power of discrimination between very similar impressions is more imperfect in this region than it is in the fovea."

Since it was known to Helmholtz (second edition) that rod vision is colourless, these statements, if they be not regarded as an actual initiation of those developments of view which have become known as the Duplicity Theory, most certainly pave the way for it. The reticence of his assertions is an example of the characteristic caution and single-eyed aim at the expression of truth which led him to avoid all statements not based on recognised fact. On the whole, from probabilities regarding development of the organ of sight, and also in view of the more recent

investigations, it seems to be most likely that rods and cones are examples of specialisation along a common line, arrest of development towards colour discrimination occurring early in the case of the rods. So that Helmholtz's general scheme of colour vision, including colourless vision as a special case of course, applies throughout the whole range of normal and abnormal vision.

The distinguished developer of the Duplicity Theory, v. Kries, says that "Even at the present time the theory of Helmholtz is thoroughly justified as to its fundamental conceptions," and he corrects "some misunderstandings under which the theory has laboured in many ways." "Fundamentally, the Helmholtz theory was simply the expression of a direct fact of observation, namely, that *the resultant of all the various light stimuli so far as sensations are concerned can be completely represented as a function of three variables.* It is idle to try to explain this fact except on the assumption that the *result of the stimulation* also can be represented completely as a function of three variables." The point may be put even more strongly, for it is the component and resultant *sensations* that are estimated. The equation

$$cC = rR + gG + bB$$

asserts as a fact that the general sensation of type C can be produced by compounding three sensations of independent fixed types R, G, B. It is the psychological trichromasy of all sensations that is asserted. In regard to dichromatic vision, v. Kries says that "the researches have completely verified Helmholtz's conjecture of two main types each due to abstraction of one component fundamental sensation," but he finds difficulty with regard to anomalous trichromasy. The reason is that he overlooks Helmholtz's own use of intertransference, partial or complete, of actions which normally affect one fundamental sensation alone. This is given with other matters in seventy-two precious pages of the second edition, the absence of which from the third is an unfortunate consequence of the adoption of the text of the first edition. Some extracts from the second edition are given. It is regrettable that these pages were not included as an appendix, for they contain the development, by Helmholtz himself, of the trichromatic theory to its highest consummation, in making which he must have had "the impression that it is not my own work that I am writing out, but some one else's."

Dr. Christine Ladd-Franklin gives an account of her views on colour vision, in which she postulates five physiological activities corresponding to red, yellow, green, blue and white. All phenomena of vision can be expressed in terms of five or more activities, but the law of trichromasy, being a psychological law, asserts that only three are independent. The two conditions, $R+G=Y$ and $R+G+B=W$, which she gives, specify the two interconnexions requisite to limit the independence to the observed amount. The outstanding interest of her suggestions lies in the exhibition of a mechanism, which may prove to be the actual one, which satisfies the conditions for restriction of independence, and accounts readily (as also does the developmental view of Helmholtz's trichromatic scheme) for a fused yellow sensation.

The strictures made in the appendices on Hering's scheme are really unmerited. Any condition explainable on the trichromatic scheme can be explained by his with appropriate specifications.

This volume, because of the wealth and importance of the new matter, should be regarded as indispensable by every student of, or worker in, the subject of visual sensation. W. PEDDIE.

More Torchbearers of Science.

The Torch-Bearers. By Alfred Noyes. Vol. 2: *The Book of Earth.* Pp. vii+375. (Edinburgh and London: Wm. Blackwood and Sons, 1925.) 7*s.* 6*d.* net.

MR. NOYES has followed up his first volume of "Torch-bearers," which was reviewed in these columns on May 20, 1922, by a second and rather larger book, volume ii., with the sub-title of "The Book of Earth." It will be remembered that the first volume was inspired by a night spent in the Sierra Madre Mountains when the first trial was made of the new 100-inch telescope, and it treated of the growth of astronomy from Copernicus to Herschel. It was a notable attempt to carry out the destiny predicted for poetry both by Wordsworth and Matthew Arnold in Great Britain, to express the truths of science in the sort of language which had always served mankind as the vehicle of the highest and eternal ideas. We hailed it as such and are glad to think that the three years since its publication have deepened the public appreciation of Mr. Noyes' effort. The second volume will not be found to belie these expectations. It deals with a much more difficult subject from the point of view of poetic presentation, namely, biology, or rather geology as a preface to zoology and evolution as crowning geology. It leaves one in some doubt as to the scope of the third volume which we are promised in the preface to the first. Is the biology to be completed? Heaven, earth and man would seem to be the natural division. Yet in this second volume we are brought down to Huxley at the famous Oxford meeting of the British Association: so what remains for the third, unless it is to be devoted to relativity and the general

philosophical change in scientific ideas which has taken place in the twentieth century?

It is rather to be hoped that this is not the case, as Mr. Noyes' original instinct was correct: to seek for, and, if necessary, create, dramatic moments to express the onward march of scientific thought. He is least successful in the more abstract parts of his argument, but effective and often moving in his narrative and dialogue.

This second volume begins by thoughts suggested by gazing downward into the Grand Canyon, as the first began by looking upward from the Sierra Madre. The contrast is apt and the field is well chosen from the New World, where land and waters and all the expanses of space are so much vaster than with us. The cantos then proceed chronologically from Pythagoras and Aristotle through the East (Farabi and Avicenna) to Italy with Leonardo da Vinci, France with Jean Guettard, Sweden with Linnæus; and evolution in three cantos, Lamarck and the revolution, Goethe and Darwin.

There are good things throughout, but we will select three as typical of Mr. Noyes' thought in different aspects. The first comes from the second canto, in which the poet imagines a scroll written by Pythagoras and handed by Nicomachus to the young Aristotle as they were walking by the seashore near Stagira. The boy lies down at full length on the rocks and spreads out the papyrus which bids him

> "Guard the immortal fire,
> Honour the glorious line of the great dead.
> To the new height let all thy soul aspire;
> But let those memories be thy wine and bread."

A noble song, sustained through seven verses, and giving the keynote of Mr. Noyes' thought in these volumes, the triumph of new truth found by following the footprints of great thinkers in the past.

Our second extract is from the fourth canto—The Torch in Italy. The subject is a conversation between Giulio, the pure artist, a believer in the absolute and self-sufficient inspiration of the moment, and Leonardo, who does not disclose his identity until the last word. The artist proclaims the independence of the artistic inspiration. "All genius is capricious. You'll admit that men who lived like beasts have painted well."

> "Yet," replies the stranger,
> "For the greatest Art I have always found
> A certain probity, a certain splendour
> Of inner and outer constancy to law."

This is the note which Mr. Noyes has recently developed, so far as poetry is concerned, in his essays in criticism: it is also of the highest moment for his theme in this book, the essential connexion between the right direction of the mind in both science and art. Each aspect is creative of new truth, and neither can attain its fullest realisation without elements belonging more intimately to the other.

The part of the book which will attract the most attention is Canto IX., called "Darwin." This contains the most vivid and moving account ever written of the debate at the Oxford meeting of the British Association in 1860. It is evidently based on the reports of eyewitnesses and is an admirable piece of poetic narrative. The tense excitement of a crowded audience, largely clerics, the determination of Wilberforce to crush Darwin once for all, the postponement of the debate, the ticking of the clock until the moment arrives when Huxley muttered low—"The Lord hath delivered him into my hands." The portraits of all the leading speakers, Henslow, Draper, Owen, as well as the two protagonists, are as good as possible. Then the book winds up with the reaction in Huxley's own mind that night after the triumph of the day. Had not his victory "a relish of the dust"? Had he not used more skilfully the unworthy weapons of his foe? Was there not yet a far larger truth than Darwin had proclaimed and he had so successfully defended? And so on to the Epilogue on "The Eternal Mind which enfolds all changes and can never change."

A remarkable and inspiring book.

F. S. MARVIN.

A Quantitative Study of Regeneration in Plants.

Regeneration: from a Physico-Chemical Viewpoint. By Jacques Loeb. (McGraw-Hill Agricultural and Biological Publications.) Pp. x+143. (New York and London: McGraw-Hill Book Co., Inc., 1924.) 10*s.* net.

IN view of the sudden loss of Jacques Loeb from the ranks of scientific workers, it is particularly valuable to have in the form of this monograph his own presentation of his views upon regeneration, based upon the long series of experiments he carried out upon Bryophyllum in recent years, recorded so far only in a number of papers in the *Journal of General Physiology*.

In the preface, Loeb states that it is "not more facts which are needed in this field but a method and a principle which allow us to pass from the stage of blind empiricism to the stage of an oriented research." This method Loeb thinks he has found in the study of the quantities of the regenerated tissue by dry weight determinations; the principle he suggests is the simple mass relation thus indicated as determining the amount of regenerated tissue, namely, that it is proportional to the mass of original tissue allowed to regenerate. His point of view brings him sharply into conflict with many views in great favour at the present day, and is

perhaps none the less valuable for that. He rejects entirely the suggestion that wound hormones stimulate new growth, a view much in favour on the Continent under the influence of Haberlandt, and concludes as the result of quantitative studies that the mutilation favours regeneration, because it isolates within a limited mass of tissue, as a severed leaf, a local store of food material which is thus available for regeneration. On the undamaged plant this store would be withdrawn and used for normal growth elsewhere.

The same quantitative attack leads Loeb to another interpretation than that now frequently prevalent, as to the inhibiting action of one growing tissue upon another. Starting from a simple quantitative analysis of the fact that a leaf alone regenerates more freely than a leaf still attached to a piece of stem, he reaches the conclusion that the food supply used for regeneration in the isolated leaf is shared between leaf and stem in the second case, and largely exhausted in growth processes within the stem, including callus formation. He is thus led to reject a view first adopted by him, as is clear from his original papers in the *Journal of General Physiology*, which still seems to emerge in his phraseology when he speaks (in Chapter xii.) of the inhibiting action of the "descending sap from the leaf" upon shoot formation on lower regions of the stem. This inhibiting action he now traces to the fact that the food supply from the leaf is wholly used up in growth processes within the young stem, just as the inhibiting action of an actively regenerating shoot or root upon other shoots or roots later in starting, is put down to the utilisation by the earliest growth centres of all the reserves available for growth. He thus discards the view that the "descending sap" inhibits in virtue of its content in growth-inhibiting hormones (now sometimes termed "chalones").

Loeb's point of view was very physiological, and apparently he never felt the need to work out his conceptions upon a basis of anatomical detail. He was satisfied to interpret his interesting experiments upon the influence of gravity upon regeneration, as showing the movement through the tissues of the plant of soluble substances necessary for growth, so that they collected in the lowest regions and favoured growth there. On experimental grounds he concluded this movement was distinct from the movement of sap in the vessels of the plant, but he never considers further the path by which this nutrient sap moves under the influence of gravity. Again, his experiments upon polarity lead him to the conclusion that the *anlage* of the regenerated shoots and roots must lie in different regions of the plant, but he makes no reference, for example, to the detailed anatomical investigation of cases of regeneration from leaves, in which it has been shown that shoots may originate from epidermal cells whilst roots always arise from cells in the neighbourhood of the vascular cambium.

Loeb's experiments may be in many respects open to criticism; one criticism already made has been that Bryophyllum plants do not always behave like Loeb's plants. But there can be little doubt that Loeb has placed on record a series of valid quantitative data which do supply some guidance as to the phenomena involved in regeneration, and though their complete interpretation will require much further work, involving correlated studies in anatomy, cytology, etc., Loeb has once again blazed a pioneer trail in his steadfast insistence upon quantitative work in a field which is almost obscured with descriptive qualitative details.

Relativity and the Metaphysician.

The Tyranny of Time: Einstein or Bergson? By Charles Nordmann. Translated from the French by E. E. Fournier d'Albe. Pp. 217. (London: T. Fisher Unwin, Ltd., 1925.) 10*s.* 6*d.* net.

ALL our life we have looked with awe on metaphysics; its problems are so abstruse and the meaning of the metaphysician's solutions so difficult to understand. Occasionally a doubt arises in our mind whether metaphysics is empty words with no reality behind. But we always suppress the doubt. For how could a subject be mere empty words which has held such an exalted and honourable position through all the ages from the brilliant era of the Greeks down to our own times.

Then comes Einstein's doctrine of relativity. The aim of the metaphysician is to take the laws of Nature, including those provided by mathematicians and physicists, and fuse them into an intelligible whole. It is, therefore, incumbent on him to understand Einstein's doctrine. Even if he rejects it, he must first understand in order to be in a position to reject it. A study of the treatment of relativity by different metaphysicians brings us a little nearer to the answer to our question whether they deal with words or with realities.

The first group treat the subject with all the understanding of the mathematician. It is, in consequence, open to us to believe that those portions of their work that are beyond our understanding are equally sound, and our respect for them continues.

Another group find all the knowledge of the doctrine that they need in the word "relativity." The name reminds them of Bishop Berkeley, who believed in the relativity of the external world in the sense that that world existed only if there was a conscious mind present to perceive its existence. This group is content to identify Einstein's doctrine with Berkeley's.

A third group have studied Einstein's doctrine and

have failed to understand it, and, at the same time, are unconscious of their failure. The author of the book named above belongs to this group. The object of the book is to decide between Einstein who teaches that the simultaneity of two events is relative, and Bergson who holds Einstein to be wrong and simultaneity to be absolute. The author's conclusion is that both of them, as well as every other writer he mentions, are wrong, sometimes if not always. He tells us that Einstein's original exposition, published in 1905, is perfectly correct, but that he is a bad populariser and that his little book, "Über die spezielle und die allgemeine Relativitätstheorie gemeinverständlich," is wrong, and that poor Bergson was led astray through reading the popular account only. He then proceeds to give what he calls an improved and correct popular account, and throws in (page 185) the modest disclaimer: "In making this attempt I do not, of course, wish to put myself above Einstein."

Actually the author is floundering in the bog of his own misconception of Einstein's meaning, one of his mistakes being failure to distinguish when Einstein is engaged in overthrowing the classical theory and when he is stating the theory which is to take its place.

The contemplation of the second and third groups of metaphysicians compels us to conclude that in some cases the discussion is of empty words with no underlying reality, and that we shall be wise to exercise discretion in all cases as to the acceptance of the metaphysicians' conclusions.

Nor was any other conclusion to be expected. Consider the magnitude of the task the metaphysician undertakes. His aim is to fuse all knowledge into an intelligible whole. To do that he must first make himself acquainted with all knowledge. It is true that he needs only general principles and may ignore details, but even so the mass of knowledge at the present day makes it an enormous task. Moreover, that is not the worst, for he must keep abreast of developments in all subjects, and developments of importance are taking place to-day in many subjects. We can only admire his courage and leave him to it. D. B. M.

Folklore in India.

The Folklore of Bombay. By R. E. Enthoven. Pp. 353. (Oxford: Clarendon Press; London: Oxford University Press, 1924.) 14*s.* net.

MR. ENTHOVEN'S book will be welcomed by those who require a very full synopsis of the folklore of the Bombay area. He has gathered together a vast mass of items which he has classified under subject headings—such as worship of natural objects, tree- and snake-worship, spirit-possession, totemism and animal-worship, evil-eye, dreams and omens, etc. Under each category he cites a large number of beliefs and practices, the material having been partly collected by himself and partly derived from the works of others, such as B. A. Gupte and Sir J. Campbell. The compilation of this material must have involved much labour and search. The value of such a "corpus" of facts is evident, and the volume will prove an important reference-work.

The facts are simply stated for the most part, without elaboration; and there is little attempt to diagnose and explain the underlying motives which have dictated the beliefs, rituals, and customs recorded. Such interpretation would have added much to the interest and usefulness of the book; but the author may, no doubt, have realised the difficulties attending any attempt to probe the "true inwardness" and origin of superstitious beliefs and practices. Natural reticence on the part of the natives, coupled, as it usually is, with actual ignorance of the original, and even the present significance of their observances, militates against accurate diagnosis on the part of the researcher, and satisfactory explanations are not easily found. Mr. Enthoven's long residence in India gave him opportunity for seeing below the surface, and his views upon the *raison d'être* of many of the, seemingly, more inconsequent practices and beliefs which he describes, would have been welcome. At the same time, it must be admitted that long residence is liable to instil caution, by revealing difficulties and pitfalls which are hidden to the tenderfoot, and to cause the experienced Western student to realise how ill-equipped he really is to probe and analyse the mentality of Oriental peoples. Recognition of obstacles difficult to surmount may have acted rightly as a deterrent, and have induced the author to abandon the open, speculative game and to play for safety.

The *comparative* study of superstitions has done much towards suggesting explanations of folk-phenomena, and will surely lead to further results. The object of the author of this volume is, however, to deal with the subject from a descriptive and not a comparative point of view. The book makes available for the student an extensive, classified collection of *data*, concerning in the main a single, if extensive, area; and it has an intrinsic interest, as reflecting the culture-status of the people within that area. This collection of facts will be appreciated by the comparative folklorists and ethnologists, who can collate the local material with similar phenomena recorded from other regions, and can study the whole on a broader basis. The book would have had added value had the author given in all cases the sources whence the items of information were collected. References are, unfortunately, few, and it would have been of interest to

know the extent to which the author's own observations have played a part in supplying material for this interesting volume.

A useful appendix has been contributed by the late Dr. William Crooke, in the form of a *questionnaire* on folklore. This enumerates many of the chief topics upon which information is needed, and should prove of considerable service to those residents who are anxious to increase our knowledge of the peoples among whom they live. The field-student should be warned that, in pursuing his investigations, *direct questions* should be avoided at all costs. HENRY BALFOUR.

Our Bookshelf.

Geschichte der Rübe (Beta) als Kulturpflanze von den ältesten Zeiten an bis zum Erscheinen von Achard's Hauptwerk (1809). *Festschrift zum 75jährigen bestande des Vereins der Deutschen Zuckerindustrie.* Von Prof. Dr. Edmund O. von Lippmann. Pp. vi + 184. (Berlin: Julius Springer, 1925.) 12 gold marks.

PROF. E. O. VON LIPPMANN, Director of the Zucker-raffinerie, Halle, to whom we are indebted for such a vast quantity of accurate information upon the history of chemistry, has now written a book which will interest not only those engaged in the sugar industry, but also botanists, chemists, and agriculturists. It is unnecessary to say that this latest production is characterised by the same sound scholarship and exhaustive research which marked the "Entstehung und Ausbreitung der Alchemie."

The earliest mention of the mangold appears to be in the "Acharnians" of Aristophanes (455–388 B.C. ?). It is described by Theophrastus in the "Historia plantarum," and was certainly cultivated by the Greeks. Among the Romans, again, the plant was well known and is mentioned by Cicero, Catullus, and others. Since species of Beta grow wild on the North African shores of the Mediterranean, it is possible that turnips and mangolds may have been known to the ancient Egyptians. Whether this is so or not, they were common in Egypt at the time of Alexander the Great (333 B.C.), and are often mentioned by the Alexandrian alchemists of the third to fifth centuries A.D.

In later times, turnips, mangolds, and beetroot were all widely cultivated, and Prof. Lippmann takes his story up to the beginning of the nineteenth century. Although he modestly says of his book, with Luther, *Exemplum vobis dedi ut plura faciatis*, he has obviously searched the available literature with great care.

E. J. H.

Coal and Civilisation. By Prof. Edward Charles Jeffrey. Pp. xvi + 178. (New York: The Macmillan Co., 1925.) 10*s.* 6*d.* net.

THIS work may be considered as consisting of two parts, namely, a description of coal, its origin and structure on one side, and the application of coal in the service of mankind on the other. The former is of great interest and contains much novel matter, as might be expected from so distinguished a botanist as Dr. Jeffrey. The second theme is, however, very indifferently handled and forms a sad contrast to the former. Dr. Jeffrey has evidently failed to appreciate the real effect of coal upon the history of civilisation; thus he repeatedly urges that British supremacy in the eighteenth century was due to the application of mineral fuel to the smelting of iron, but entirely overlooks the far greater issue, namely, that almost simultaneously the steam engine was developed in Great Britain, thus for the first time pressing latent energy into the service of mankind, which had up to then been forced to rely upon kinetic energy only. The author's technical knowledge of the subject is also not so sound as it might be. For example, he states that brown coals are treated "by briquetting with suitable binding media," whereas the chief value of brown coal lies in the fact that it is capable of being briquetted without the use of a binder.

In respect of the structure of coal and of the plants that enter into its composition, the views of Dr. Jeffrey are important and instructive; it may, however, be suggested that he seems inclined to put too much stress upon the fresh-water origin of coals and to have somewhat neglected the evidence of marine conditions. It might have been expected that the Delta theory of Fayol would have received some attention; Dr. Jeffrey is a convinced supporter of the view that coal is the product of plant remains transported to the waters in which the organic matter was deposited, but scarcely deals effectually with evidence contradicting that view, such as that afforded by the existence of under-clays with stigmarian rootlets.

An Introduction to Psychology. By Prof. Hugh A. Reyburn. Pp. v + 324. (Cape Town: Maskew Miller, Ltd., n.d.) n.p.

THIS is an attempt to compress a protean subject into 316 small pages, and, on the whole, a successful one. The fact that a well-chosen and comprehensive bibliography of 52 works follows the 16 chapters shows that the author recognises that his "Introduction to Psychology" is an introduction and nothing more, but it is no mere summary of what is already known, being very definite as to points of agreement with, and dissent from, other authorities.

The introduction of new terminology, always to be feared when opening a work on psychology, is avoided, and where there would otherwise be the possibility of doubt as to the application of any term, the context renders the meaning intended unmistakable.

Prof. Reyburn defines his subject as "the science of immediate experience." He does not, however, deal with objective manifestations to the neglect of the subjective, but attaches a good deal of importance to introspection. All that is most valuable in modern psychological schools of thought has been utilised or incorporated, but the extremist views of Freud and the behaviourists are not supported. A fear is expressed in the preface that the section containing an account of the nervous system may prove too long, but a closer condensation than the succinct summary given would scarcely be possible. Indeed, an amplification of the paragraph dealing with the cerebral cortex would be a desirable addition to future editions. It is rather remarkable that in a work on psychology containing much clear reasoning and sound judgment, the terms reasoning and judgment are not given even an indical reference.

Isis: International Review devoted to the History of Science and Civilisation; Official Organ of the History of Science Society. No. 21, Vol. VII (i.), 1925. Pp. 168. (Soc. Anon. M. Weissenbruch, 49 rue du Poinçon, Bruxelles.) Annual subscription, 26*s*.

ALTHOUGH *Isis* has become the official organ of the recently founded History of Science Society, it is happily still edited by Dr. George Sarton, its originator. The present number maintains the high standard which has been set by its forerunners, and the width of its appeal may be judged from the fact that it includes contributions from Essen, Rome, Madison, Belgrade, Amherst, and Montpellier.

Two articles of special interest are those by Prof. A. J. Hopkins on "A modern theory of alchemy," and Prof. Émile Turrière on the history of glass-making in western and central Europe from the Middle Ages to the end of the eighteenth century. Prof. Hopkins's theme is that the alchemists, far from failing in their quest, were successful, since their conception of "gold" was very different from ours. "The reason why we cannot follow the alchemistic theory or look upon those conceptions with sympathy is that the alchemist, like the artist, was stressing the changeable Aristotelian qualities where we stress weight and fixed qualities. . . . The alchemist fitted theory to practice and succeeded far beyond the realm of probability. According to his definition of 'gold' transmutation *was effected*. The alchemist obtained what he wanted." Although this theory of alchemy is not so novel as Prof. Hopkins appears to imagine, it has never received proper consideration. Yet it obviously explains much that is obscure, and Prof. Hopkins is to be congratulated upon having set it forth so clearly and logically.

Narcissus: an Anatomy of Clothes. By Gerald Heard. (To-day and To-morrow Series.) Pp. 156. (London: Kegan Paul and Co., Ltd.; New York: E. P. Dutton and Co., 1924.) 2*s*. 6*d*. net.

THREE mottoes face the table of contents of this book, two from "Sartor Resartus" and one from Michael Angelo. The analogies they draw between life and clothes, the body, and architecture and its products, are worked out in detail. The author takes the line that psychology having resolved to treat nothing in its province as insignificant, clothing, now regarded as unimportant, may be assumed to be of racial significance, as a phase of the evolution which started on new lines when man emerged. Mr. Heard regards both clothes and architecture as parallel manifestations of an evolutionary force, tracing them from the beginning of weaving and the use of woven wattle for walls in the neolithic age, through Egypt, Mesopotamia, Crete, the classical period and historical times, down to the ferro-concrete building of to-day and modern costume, where development apparently has ceased. Fanciful though the analogy may seem, it is perhaps not extravagant to assume that racial character manifesting itself in two media so entirely different may still exhibit a certain convergence in style so far as conditions allow. After a certain stage, however, the standardising, more or less, of all modern communities is unlikely to offer much play for racial individuality, however either clothing or architecture may develop.

Tales from Nature's Wonderlands. By Dr. William T. Hornaday. Pp. xii + 235 + 24 plates. (New York and London: Charles Scribner's Sons, 1924.) 12*s*. 6*d*. net.

FORTUNATE indeed are the children who can claim the author of this book as grandfather and exact from him, as a grandchild's privilege, the charming stories here published. The author has covered a wide range of subjects, from the origins of the American fauna to life in the deep sea, from the American mammoths to the lung fishes of Australia, from giant monster reptiles of Hell Creek to the penguins of the Antarctic Continent, from the forests and jungles of India and Borneo to the mountain crags of the Canadian Rockies and the ice-bound Polar Seas. In all he is equally happy, interesting and vivid, telling his story in simple compelling language well calculated to stir the imagination of children. It was a happy thought to publish these stories from Nature's book, so simple and so scientifically accurate, and we would wish, with Dr. Hornaday, that all our young people should become acquainted with them. The photographic illustrations are good, and materially help towards a proper understanding of the text.

Chambers's Encyclopædia: a Dictionary of Universal Knowledge. New edition. Edited by Dr. David Patrick and William Geddie. Vol. 6: Hume to Manche. Pp. iv + 872. (London and Edinburgh: W. and R. Chambers, Ltd.; Philadelphia: J. B. Lippincott Co., 1925.) 20*s*. net.

THE latest volume of this convenient encyclopædia maintains the high standard of the work. The articles have been revised or re-written, and many new articles have been added. References to books published within the last few months are not infrequently included. There is a liberal allowance of excellent coloured maps, besides a number of smaller black and white maps, and many illustrations and diagrams. The encyclopædia is to be completed in ten volumes.

Outlines of a Philosophy of Art. By R. G. Collingwood. (The World's Manuals.) Pp. 104. (London: Oxford University Press, 1925.) 2*s*. 6*d*. net.

IF this manual has a fault, it is not that it is ill-done but that it is done too well. The author has instilled into his account of art a complete philosophy of life. Perhaps it was impossible to separate the two, but it demands of the reader a more than usual concentration of his attention. On the other hand, any one who wants a clear and concise account of Croce's æsthetic doctrine will find it admirably presented in the first chapter.

Traité de psychologie. Par Prof. Georges Dumas. Tome 2. Pp. 1173. (Paris: Félix Alcan, 1924.) 60 francs.

THIS is M. Dumas' second volume of an extensive survey of recent work in psychology. Though named a treatise, it is in effect an encyclopædia. It is a collaboration of the leading French psychologists, each of whom has been invited to write a dissertation on the special subject matter of his own research. It is a valuable work of reference, with a detailed bibliography attached to each section.

Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Preliminary Note on the Transmutation of Mercury into Gold.

THE experiment on the transmutation of mercury was begun in September 1924, with the assistance of Messrs. Y. Sugiura, T. Asada and T. Machida. The main object was to ascertain if the view which we expressed in NATURE of March 29, 1924, can be realised by applying an intense electric field to mercury atoms. Another object was to find if the radio-active changes can be accelerated by artificial means. From the outset it was clear that a field of

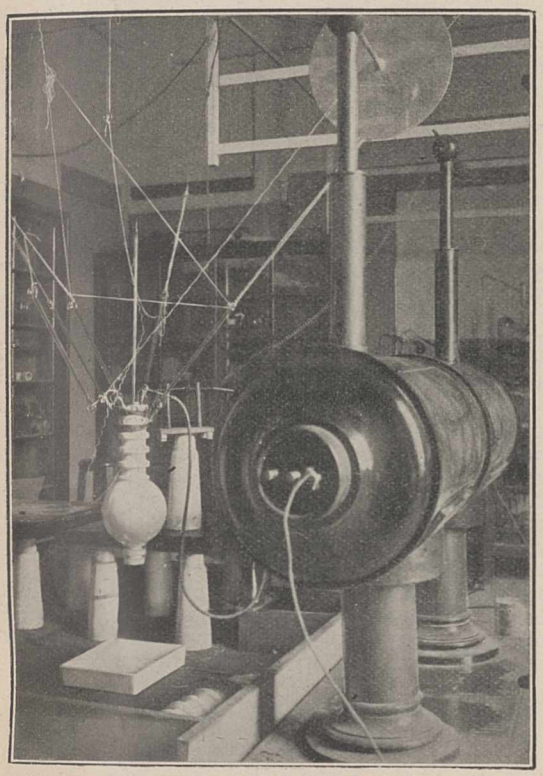

FIG. 1.—Apparatus for the electric discharge. Discharge vessel is supported on four glass insulators.

many million volts/cm. is necessary for the purpose. From our observation on the Stark effect in arcs of different metals (*Jap. Journ. Phys.*, vol. 3, pp. 45-73) we found that with silver globules the field in a narrow space very near the metal was nearly 2×10^5 volts/cm. with terminal voltage of about 140. The presence of such an intense field indicated the possibility of obtaining the desired strength of the field for transmutation, if sufficient terminal voltage be applied. Though the above ratio of magnification would be diminished with high voltage, the experiment was thought worth trying, even if we could not effect the transmutation with the apparatus at hand.

Fortunately an induction coil of 120 cm. spark length, made by Klingelfuss, was available for the purpose (Fig. 1). For keeping the terminal voltage between the electrodes sufficiently great with a short spark gap, the discharge was conducted in paraffin oil, in which a potential difference of about 15×10^4 volts/cm. can be maintained. With iron and purified mercury as electrodes, the discharge appeared at first as arcs, and the spectrum was continuous; it gave rise to abundant production of gases and carbon particles from the oil; the mercury gradually turned into fine globules, until the oil and mercury were mixed into a black pasty mass. We cannot definitely say whether the intense field observed during the experiment on the Stark effect was present during the discharge or not, but it is probable that mercury atoms have been acted upon by strong electric force during the violent bombardment, as the discharge is of an analogous nature. Continuing the discharge for about four hours, the product was examined chemically for gold by the test of Cassius'-purple; the result was decidedly positive. This experiment was performed on September 15, 1924; on succeeding days experiments were repeated, and two days after, Mr. Yasuda, an expert in gold assaying, showed us minute gold specks extracted from the black mass obtained in the experiment of the previous day. Grave doubts were, however, expressed by critics as to the purity of the mercury and also as to the possible presence of traces of gold in the chemical laboratory, due to frequent treatment of the metal.

To clear away these doubts, the mercury to be used in the experiments was first purified by ordinary chemical means, and then subjected twice or thrice to vacuum distillation, care being taken not to raise the temperature above 200°. The mercury, oil and chemical reagents used in the experiments were carefully examined by making blank tests. A room in the physical laboratory was allotted to the chemical experiments. Succeeding experiments confirmed the result, but the glass vessel was too fragile to pass the heavy condensed discharge, and it exploded during the process. Bushing insulators were tried, but the tube was too narrow, and the discharge passed into the walls. A discharge vessel of about 2 litres capacity with walls of 2 cm. thickness, provided with a long neck and a short tail for inserting the electrodes, was designed and made ready for experiment in the beginning of May. During these intervals, minor tests were made with the porcelain flask on the mode of discharge, the oil to be used for the process, the material of one of the electrodes, and easy means of detecting the presence of gold.

As we found in our investigation on the Stark effect, it is always advisable to insert condensers in the discharge circuit. We used bushing condensers of many glass plates with thin lead plates between them, the total capacity being about 0·002 microfarad. As the discharge potential is very high, the condenser plates are apt to break, and must be so large that discharge between the end plates does not take place in air.

As iron contains many impurities, we found that tungsten wire, free from thorium oxide, which we obtained through the courtesy of the Tokyo Electric Company, is the best on account of the small corrosion during the discharge.

As to the method of testing, the formation of ruby glass is delicate and in most cases accompanied by the separation of gold particles at the centre or outside boundary, which can be observed with a metallographic microscope, by using reflected light.

A special distilling flask was designed for the purpose of separating carbon, oil, and mercury from the residue in the discharge vessel, after bombarding the mercury for 10 to 15 hours. Paraffin, kerosene, and transformer oil can be used, but the last seems to be the most suitable.

The gold obtained from mercury seems to be mostly adsorbed to carbon. Ruby glass is formed by heating small pieces of glass with the carbon; in the process now used it is formed in numerous spots on the walls of the distilling flask by repeatedly heating it to about 600°. We have often separated mercury by washing the oil with benzene and ether, and after separating it from carbon by centrifugal separator, distilled it in vacuum and examined the

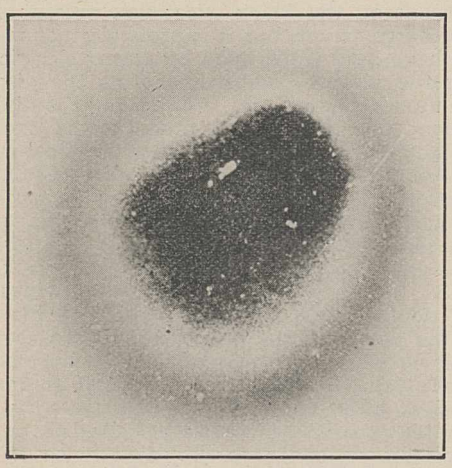

FIG. 2.—Ruby glass by transmitted light. ×150.

residue, which generally contained no gold, but a minute quantity of white metal, which may probably be another product of heavy discharge; it was, however, too small to be tested chemically.

The accompanying illustration (Fig. 2) shows a spot of ruby glass photographed with transmitted light and magnified 150 times. The central dark portion contains gold particles distributed as shown in Fig. 3 taken with reflected light and magnified

FIG. 3.—Ruby glass by reflected light. ×2500.

2500 times. It represents only a small part near the boundary of the central spot. The white ring is greenish blue, and the lightly shaded one is rosy; these colours are characteristic of gold colloids. Numerous spots of this kind are obtained in the bottom of the distilling flask during the after-treatment of a mixed mass of carbon and mercury after heavy condensed discharges. Sometimes ruby glass is apparently covered with a thin film of gold; on microscopic examination it is found to consist of fine particles of gold very densely distributed. The primary current in the induction coil in such experiments ranges from 25 to 30 amp., and the spark length in air is more than 1 m.

Probably we could produce the same effect by using lower voltage, if sufficient capacity were inserted, but the resistance of the vessel is not great enough to withstand the heavy discharge, especially when carbon and mercury are intimately mixed together. The construction of a proper discharge vessel seems at present to be a difficulty in getting an amount of gold sufficient to determine its atomic weight. Which of the isotopes of mercury is changed into gold can perhaps be inferred from the atomic weight. Spectroscopic examination will be started so soon as we can obtain sufficient material for the purpose.

The process taking place may be looked upon as due to commotion in the nucleus by intense electric force. If we assume that Coulomb's law ceases to hold within the nuclear boundary, the positively charged protons form a compact core, and the electrons within the boundary surround it. On applying an external electric field the motion of the core is opposite to that of the electrons, so that if the field be sufficiently strong, it is possible that some of the electrons may pass out of the nuclear boundary, and if the core be not very stable, some of the protons constituting it may get out. The commotion thus introduced by the external force will have some resemblance to radio-active disintegration, which must be attributed to the internal commotion of the nucleus. An experiment was made with ferro-uranium, to see if the radio-active process cannot be accelerated by applying a strong field, but owing to the ionisation it was difficult to maintain the field for a sufficient length of time. An investigation of the process of accelerating the disintegration must, therefore, be reserved for future experiments.

The experimental procedure here sketched cannot be looked upon as the only one for effecting the transmutation; probably different processes will be developed and finally lead to industrial enterprises. At present, there is no prospect of producing gold economically from mercury. Experiments with various elements may lead to different transmutations, which will be of significance to science and industry. Meagre as is the result, I wish to invite the attention of those interested in the subject so that they may repeat the experiment with more powerful means than are available in the Far East.

H. NAGAOKA.

The Institute of Physical and Chemical Research,
Komagome, Tokyo, May 26.

The Quantum Explanation of the Zeeman Triplet.

IN his letter published in NATURE of June 27, p. 978, Prof. W. M. Hicks raises some interesting points in connexion with the quantum theory of the simple Zeeman effect. As Prof. Hicks points out, the theorem of Larmor's usually taken as the basis of the theory does not define in any manner the relation between the orbits on which the rotation is superposed in the presence of the field on one hand, and the corresponding orbits before the imposition of the field on the other. The supposition that these two sets of orbits are identical is, therefore, in no way justified on the basis of Larmor's theorem alone. It can, however, be shown from purely classical considerations (see G. A. Schott, "Electromagnetic Radiation," Cambridge University Press, 1912, §302, p. 317) that, to the first order in terms involving the field, the two sets of orbits are identical. Schott's proof takes into consideration the induction

forces which act on the moving charges during the period of establishment of the field, whereas Larmor's theorem confines itself to the so-called Coriolis forces which, as Prof. Hicks points out, act transversally on the moving charges, and hence cannot alter their energies.

Prof. Hicks proves in a simple case that the application of the Wilson-Sommerfeld quantum conditions to the Bohr hydrogen atom with reference to fixed axes (instead of the special rotating axes employed in the usually accepted theory) leads to no Zeeman effect at all as a first approximation. A more general proof of this was given in a paper of mine about two and a half years ago (Roy. Soc. Proc., A, vol. 102, 1923, p. 529) in which I also put forward an alternative theory of the simple Zeeman effect which seems to me to answer Prof. Hicks's purpose. The theory is based on a slightly extended form of the quantum conditions which was first suggested by Prof. William Wilson (Roy. Soc. Proc., A, 102, 1923, p. 478), namely,

$$\int_0 \pi_i dq_i = n_i h, \qquad (i = 1, 2, \ldots)$$

where $\pi_i = p_i + eA_i$,

p and q being the usual Hamiltonian co-ordinates, e the charge on the particle in question, and A the generalised magnetic vector potential. These conditions are applied both in the absence and in the presence of the field, thus defining the orbits and their energies in both cases, and the frequencies are then obtained from the energy relation $\Delta W = h\nu$. It is also shown that the relation between corresponding orbits defined by the extended conditions (*i.e.* orbits for which the quantum numbers are the same) is in complete accord with Schott's theorem; in fact the latter is derived as a necessary consequence of the quantum conditions themselves.

A. M. MOSHARRAFA.

The Manor House,
Alphington, near Exeter, June 28.

THE objection of Prof. Hicks to the use of Larmor's principle (NATURE, June 27, p. 978) is well founded, but the Zeeman triplet effect can be made to fit into the quantum theory by keeping strictly to dynamical principles. The phase-integral $\int pdq$, for a variety of reasons, is, for the case of a magnetic field, to be replaced by $\int(\delta L/\delta\dot{q})dq$, where L is the Lagrangian function. For the hydrogen atom

$$L = \tfrac{1}{2}m(\dot{r}^2 + r^2\omega^2) - \tfrac{1}{2}Her^2\omega/c + e^2/r.$$

Hence, on quantising,

$$mr^2\omega - \tfrac{1}{2}Her^2 = nh/2\pi.$$

From this, for radial quantisation,

$$m^2\dot{r}^2 + n^2h^2/4\pi^2r^2 = 2e^2m/r - 2mC',$$

where $C' = C + nhe/4\pi mc$, $-C$ being the energy and H^2 being neglected. Hence the "permitted" value of the energy is

$$-(2\pi^2me^4/h^2)/(n+n')^2 + nhe/4\pi mc,$$

where n, n' are the azimuthal and radial quantum numbers. ARTHUR W. CONWAY.

Abbeyview, Dalkey, Co. Dublin,
June 27.

The Oogenesis of Lumbricus.

IN a letter to NATURE (June 27, p. 979) Prof. J. B. Gatenby objects to certain comments upon his work made recently by Mr. L. A. Harvey in a paper on yolk-formation in the earthworm (*Q.J.M.S.* 69, p. 291). Mr Harvey is a student working in this department and it is on his behalf that I wish to protest against the tenor of Prof. Gatenby's letter. It is quite evident that Prof. Gatenby has not comprehended clearly the contents of Mr. Harvey's paper; for his letter contains misstatements, and these may do a considerable amount of harm unless speedily contradicted.

Prof. Gatenby accuses Mr. Harvey of having been discourteous in saying that a glance at a paper of his (Prof. Gatenby's) summarising what is known about the formation of yolk shows that "really very little is known" on the subject. Mr. Harvey was perfectly justified in making this statement—it is simply a statement of his opinion—and on this point I am in complete agreement with him. The fact that Prof. Gatenby disagrees with the statement does not make it discourteous. The paper referred to, Prof. Gatenby complains, is an "old one." Its actual date is 1920, and if the advance since then is represented in Dr. Brambell's paper (1924) on "Yolk," to which Prof. Gatenby refers, it can safely be said that any advance made has been extremely small.

The remarkable objection is then made that Mr. Harvey, in studying yolk-formation in Lumbricus, is not justified in inferring any conclusions as to the similar process in Limnæa—a form studied by Prof. Gatenby. He gives no reason in making this statement. However, he previously refers to a paper by a student of his as containing an account of *Molluscan* oogenesis. Actually it deals with two forms and those both gastropods, and hence any general conclusions drawn must have been inferred from the study of those two forms.

Prof. Gatenby suggests that before criticising his work Mr. Harvey should have repeated it. While I admit that repetition might be desirable, it is obvious that Prof. Gatenby has failed to grasp Mr. Harvey's criticism, which is, not that his observations are at fault, but that his deductions are. This is made perfectly clear on p. 292.

Prof. Gatenby's next point is that it was unfortunate that the egg of Lumbricus was chosen for the study of yolk-formation, as it contains no "real yolk." This is incorrect. Yolk *is* present in the egg, and the criteria used for the recognition of that yolk were those advocated by Prof. Gatenby himself. This is fully explained on p. 299. Further, Prof. Gatenby objects that Lumbricus is a "special atypic annelid" and yet refers to Saccocirrus (apparently) as a typical annelid.

It is the static conception of the cell to which Mr. Harvey objects. He regards it essentially as a dynamic concern—an equilibrium system in which the constitution of each constituent is a function of its surroundings—and because of this he considers that the technical methods and the reasoning adopted in modern cytological investigations into the question of yolk-formation are wrong. If Prof. Gatenby had read more carefully the introduction to Mr. Harvey's paper he would have grasped this, and, in that event, it is to be hoped, would not have written his letter.

H. GRAHAM CANNON.

Zoology Department,
Imperial College of Science,
South Kensington, July 2.

Transmission of a Rosette Disease of the Ground Nut.

THE important part played by insects in the dissemination of the virus diseases of plants is now recognised, and experimental proof of transmission by particular insects exists in a number of cases. As a result of investigations during the past season, we are able to add one more to the list of those diseases of which the insect vectors are known.

During recent years the cultivation of the ground nut or peanut (*Arachis hypogea*, L.) in parts of South Africa has been seriously handicapped by outbreaks of a disease locally known as "rosette." The leaves of an affected plant are small, twisted and closely crowded, owing to the non-elongation of the internodes of the stem, giving the plant a bunched or rosetted appearance. These leaves are generally yellow, but in many cases show definite mottling. No seed is set by a plant diseased at an early stage of growth; and the yield is materially reduced by late infection.

We believe this rosette disease to be identical with the East African "krauselkrankheit" of Zimmermann ("Der Pflanzer," 1907 and 1913), with the Javan "krulziekte" of Rutgers (Dept. Landbouw, Nijv. en Handel in Nederl. Indie, Meded. v/h Instituut voor Plantenziekten, 1913), and with the "bunching" or "clumping" recorded from West Africa and India.

All investigators of this disease failed to attribute it to any parasitic organism or in fact to any definite cause, and its nature remained little understood. Zimmermann (1907) directed attention to a similarity between this disease and tobacco mosaic; more recently, the comparison was rendered the more obvious by extensions in our knowledge of the plant virus diseases, so that pathologists generally assumed that the peanut rosette disease belonged to the virus group. Support to this view is now afforded by experimental transfer of the disease. Work carried out under our direction at Pretoria and independently at Durban has demonstrated the ability of *Aphis leguminosæ*, Theo., to transmit the disease. In these experiments aphids, removed from rosetted peanut plants, were allowed to feed upon a single mature leaf of a healthy plant, suitably protected from the feeding of any other insects. The characteristic rosette symptoms appeared afterwards in the young leaves of a large proportion of these plants. Control plants, receiving identical treatment but protected from the feeding of any insects, remained healthy.

During the course of this work, collections were made of all the suctorial insects occurring upon diseased peanuts in the field. Tests of more than two hundred individual jassids and fulgorids belonging to at least eight species afforded no single infection of the experimental plants.

H. H. STOREY.

Natal Herbarium, Durban.

A. M. BOTTOMLEY.

Division of Botany, Pretoria.

X-ray Stimulation of Phosphorescence of Fused Silica.

WITH reference to the recent correspondence in NATURE on the properties of silica, the following experiments on its phosphorescence after exposure to ultra-violet and X-rays may be of interest. In the course of experiments to test the supposed fluorescence or phosphorescence of castor oil after exposure to ultra-violet light, it was found, working independently, that a photographic plate was blackened when exposed to the oil if the vapour were allowed to come in contact with it. If, however, the vessels containing the oil were carefully sealed no blackening was obtained, even when the oil had been previously exposed to ultra-violet light. The vessels containing the oil were sealed glass jars having polished natural quartz lenses as windows, the exposure to ultra-violet radiation being carried out in these vessels.

A fused silica weight thermometer exposed to the X-rays from a "Shearer" tube for periods varying from half an hour to several hours, and then placed in contact with a photographic plate, produced considerable blackening whether containing oil or not, the fused silica being responsible for the whole of the effect, since oil exposed to X-rays, and then transferred to a quartz vessel after treatment, would not produce blackening.

The polished lenses of natural quartz previously employed could not be stimulated with X-rays or ultra-violet light to actinic phosphorescence, but experiments have shown that various specimens of fused silica can be made to phosphoresce, and, moreover, may be seen in a dark room to fluoresce a faint green under the direct action of the X-rays, the luminosity apparently ceasing with the cutting off of the radiation.

The silica continues, at room temperature, to give off radiations for periods up to three weeks or a month after the original exposure to X-rays, but the phosphorescence is removed by heating to redness for two minutes.

F. L. HOPWOOD.
W. V. MAYNEORD.

Physics Dept.,
Harvey Laboratories,
St. Bartholomew's Hospital, E.C.1.

The Sound of Lightning.

SINCE my letter on the above subject in NATURE of May 23, several other instances have been brought to my notice. Mr. W. H. Dines has heard the sound six times certainly, and probably more; Mr. J. S. Dines has heard it once, as has also my brother, Capt. A. L. Cave, in London, when he was indoors; two other correspondents also write to say that they have heard the sound, one of them three times. But perhaps the most remarkable case is that given in the *Marine Observer* for July (page 112); Capt. J. Burton Davies of s.s. *Hurunui* reports that from 10 P.M. on July 30, 1921, to 3.45 A.M. on July 31, when in about lat. 38 N. and long. 71 W., "a terrific electric storm was playing about the ship. . . . On three occasions the officer of the watch and myself were momentarily completely dazzled by flashes, and it appeared that immediately before the flash we heard a tearing noise as of canvas being ripped violently; in fact, after the first of these flashes I caused the quartermaster to inspect the boat covers on boat deck to see if any were torn. This noise interested me very much." The fact that the noise was heard before the flash seems to indicate that it may have been caused by a brush discharge. In any event, it proves that the noise must be real, and not an illusion like the rushing noise that some have imagined they have heard when watching a bright meteor, or the rustling sometimes attributed to the aurora.

C. J. P. CAVE.

Stoner Hill, Petersfield,
July 2.

Ether Drift and the Relativity Theory.

IN reply to Prof. Eddington's letter in NATURE for June 6 (vol. 115, p. 870), it will be enough to state that the type of ether motion alluded to in my first letter on this subject is, in spite of appearances, strictly *irrotational*. For all details and the literature of the subject the reader may be referred to my paper on "Stokes-Planck's Aether" in the *Phil. Mag.* for February 1920, p. 161. The irrotationality of Lorentz's solution to which the said motion corresponds is there sufficiently emphasised.

LUDWIK SILBERSTEIN.

Rochester, N.Y.,
June 29.

The Royal Observatory, Greenwich.

THE Royal Observatory was founded in the reign of King Charles II. to assist in the solution of the important and difficult question of determining longitude at sea. The use of the method afterwards known as "lunars" had been suggested. As the moon moves round the sky in a month, its position among the stars changes rapidly: if, then, an almanac can be prepared giving the position of the moon among the stars according to the time of some fixed place, say Greenwich, the navigator can by observation of the moon determine the Greenwich time. It is an easy matter to determine his local or ship time, and the difference gives the longitude. In the seventeenth century the movement of the moon was not known with nearly sufficient accuracy for this method to be available, and even the positions of the fixed stars were very imperfectly charted. The Royal Observatory was founded to remedy these defects, and Flamsteed, the first Astronomer Royal, was charged to make observations for "rectifying the tables of the motions of the heavens and the places of the fixed stars so as to find out the so much desired longitude at sea, for perfecting the art of navigation."

At the suggestion of Sir Christopher Wren the site for the Observatory was chosen on a hill in Greenwich Park. A grant of 500*l*. was made by the King, bricks were obtained from a disused fort at Tilbury, and the Observatory was built according to the design of Wren by Sir Jonas Moore, Master-General of the Ordnance. The foundation was laid on August 10, 1675, and the building completed in the following year.

The Rev. John Flamsteed was appointed Astronomer Royal at a salary of 100*l* a year, but he was not provided with any instruments. He brought with him an iron sextant of 6 ft. radius, and Jonas Moore lent him a smaller one and two clocks. The use of clocks as part of an observatory equipment dates from about this time. Flamsteed made repeated appeals, but in vain, for money to erect an instrument in the meridian, which, he was convinced, would give greater accuracy and was essential for referring the position of the stars to the equinox. In 1683 he erected a mural circle at his personal expense, dividing it with his own hands. This instrument was not very satisfactory, but in 1688, as he was in better circumstances, he had a larger one constructed for him by Abraham Sharp, at a cost of 120*l*. Sharp was his friend and assistant, and the two worked together for several years, determining the position of the equinox, the obliquity of the ecliptic, and the positions of sun, moon and stars. The "Historia Coelestis," which contains an account of his methods and results, was published partly by himself and completed after his death by Abraham Sharp in 1725. It may be noted that Flamsteed was one of the first astronomers to use telescopic sights in his observations, as he was one of the first to make use of clocks. His observations were a great advance on those of earlier astronomers, though they are now only of historical interest. His catalogue of the positions of more than 3000 stars was corrected early in the nineteenth century by Francis Baily, who remarks that Flamsteed's British Catalogue is one of the proudest productions of the Royal Observatory.

On the death of Flamsteed in 1719, he was succeeded by Halley, the friend of Newton, who secured the publication of the "Principia." He rendered many services to science, but is best known for his prediction of the return of the comet to which his name was afterwards given. When Halley came to the Observatory, it was without instruments, as Flamsteed's executors had claimed those which he had used. In 1721, Halley installed a small transit instrument. Although the design is open to criticism, the instrument is of interest as the earliest specimen of a very important type. In 1725 he had a large iron mural quadrant constructed by Graham. With his instrument he made many observations, particularly of the moon.

Bradley succeeded Halley in 1742. From his observations at Wanstead he had discovered the aberration of light in 1729. He continued his observations for many years and announced the discovery of nutation of the earth's axis in 1748. With the help of his nephew, who was appointed his assistant, he commenced observations with Halley's instruments. He applied for funds for new instruments, and on the recommendation of the Board of Visitors, seconded by the Council of the Royal Society, was granted 1000*l*. by King George II. With this money he obtained an 8 ft. brass quadrant, and a transit instrument of $4\frac{1}{2}$ ft. focal length and an object glass of 2·7 inches. These were both made by Bird. He also obtained a clock by Shelton, which is still in use at the new magnetic station at Abinger.

With these instruments, Bradley laid the foundations of modern astronomy of position. His skill in the design and use of his instruments rendered his observations far more precise than those of any of his predecessors. The observations were collected and reduced after his death by his friend Hornsby. They were later re-reduced by Bessel in his "Fundamenta Astronomiae," and again late in the nineteenth century by Auwers. Our present knowledge of the direction of the sun's motion in space, and the existence of two star streams, is largely dependent on proper motions derived by comparing later observed positions of stars with those found by Bradley.

Bradley's successor, Bliss, lived only two years after his appointment and was succeeded by Maskelyne in 1764. Maskelyne had been sent at Bradley's suggestion to observe the transit of Venus at St. Helena in 1761. He made practical application during his voyage of methods of determining longitude at sea by lunar observations, and soon after his return published the "British Mariner's Guide," the forerunner of the "Nautical Almanac," which commenced in 1767. These works gave precise directions and presented astronomical data in the simplest and most suitable forms for their application to navigation. During the forty-four years of his tenure of office, he was very assiduous in the observation of sun, moon, planets and a small number of the brighter stars, being specially attracted by the problem of determining the position at sea, to which the Observatory owed its origin. His famous expedition to Schiehallion to determine the mean density of the earth was made in 1774. Towards the end of his life he found that the quadrants of Graham

and Bird needed to be replaced. Pond, from observations made at Westbury in 1801–1806, had shown the advantage of using a complete circle instead of a quadrant. Maskelyne gave instructions to Troughton for the construction of an instrument of this form, but did not live to see the completion of this beautifully designed and excellently divided circle.

On the death of Maskelyne in 1811, Pond was appointed Astronomer Royal. The mural circle made by Troughton, and the transit instrument made by the same great artist in the year 1816, were the greatest improvements in astronomical instruments since the time of Bradley. A second circle by Jones was added in 1825. Pond introduced the method of observing stars by reflection in mercury with one instrument while they were being observed directly with the other. On the following night the rôle of the two instruments was changed. Pond's observations were of a very high order of accuracy, so much so that Chandler traced in them the small changes caused by variation of latitude. His Catalogue of 1112 stars was a most valuable contribution to the accurate determination of stellar positions. Pond was also able with these instruments to show that several alleged discoveries of parallax of stars of the order of about 1″ were incorrect. Another benefit which the Observatory derived from Pond was an increase in the number of assistants from one to six, resulting in a considerably increased output of observations.

Airy succeeded Pond in 1835 and retired from his post in 1881 at the age of eighty. His contributions to optics, tides, metrology and many practical questions are outside the scope of this article. He introduced into the Observatory very orderly and business-like methods of reduction of observations and their regular and prompt publication. Of the new instruments which he installed, the transit circle erected in 1851 has been the most valuable. Its use led to a great increase in the number of observations. He introduced the use of registration on the chronograph, a method invented in the United States. He also introduced the system of telegraphic transmission of time daily from the Observatory to the General Post Office for distribution over Great Britain. The great equatorial, erected in 1860, with a 12·5-inch object glass by Merz, was for a time the largest refractor in England. Airy's reduction on a uniform system of the lunar and planetary observations made by his predecessors since the time of Bradley was a great contribution towards the formation of accurate tables of the movements of sun, moon and planets. He extended the scope of the Observatory by the introduction of magnetic and meteorological observations.

Christie succeeded Airy in 1881 and retired in 1910. During his tenure of office, photographic observations became a part of the regular work of the Observatory. The daily photography of the sun, and measurement of the position and size of the spots, was actually begun in Airy's time but was developed considerably by Christie. A share was taken by Greenwich in the photographic chart and catalogue of the heavens, and for this purpose the astrographic telescope was obtained. Additions to the equipment were made in the 28-inch visual equatorial, used mainly for observations of double stars; in the altazimuth, essentially a transit instrument which can be placed in any azimuth; and in the Thompson equatorial, consisting of a 26-inch photographic refractor and a 30-inch reflector, the gift of the eminent surgeon Sir Henry Thompson. The large increase in the buildings and instruments made in Christie's time were very necessary for the Observatory to maintain its high position. A great extension took place in the output of the Observatory in meridian astronomy. The part assigned to Greenwich in the astrographic chart and catalogue was carefully carried out. A thorough determination was made of the solar parallax by observations of Eros. Valuable series of double star observations were made with the 28-inch telescope, and the two telescopes of the Thompson equatorial were employed on a variety of problems.

In conclusion, it may be truly said that the original intention of the founders of the Observatory has been carried out consistently for 250 years. The pursuit of the practical problem of the determination of longitude has involved long series of observations which have contributed very largely to our knowledge of the movements of sun, moon and planets. At the present time a larger share is given to questions of purely astronomical interest, but the practical applications of science are still interwoven with them in observations of position of sun and stars, the distribution of time, the care of the Navy chronometers and the compilation of magnetic charts. F. W. D.

Problems of the Rhone Delta.[1]

By R. D. OLDHAM, F.R.S.

IV.

WHEN, in 1711, the Rhone broke away from its former course to the sea, it more and more adopted the new channel until, in 1724, the older one was definitely closed to navigation; the river, following the course it still maintains, had established its channel to the sea-face, and in 1725 the town of Arles complained of the difficulties of the new mouth, where extensive sand-banks had formed. The river, in fact, having reached the open sea, was subject to conditions which are described in reports of the nineteenth century; the deposit of silt, where the current is checked on reaching the sea, combined with the effect of the waves in sorting and casting back the coarser grained material, together with the absence of any tidal scour, led to the formation of low sand-banks, known as *they*, barely emerging from the water when the sea-level was low, and submerged when it was raised by a river flood or an onshore wind. The main channel of the river was blocked by a well-defined bar, on which the water might reach a depth of a couple of feet, but was mostly under a foot, and through this bar a narrow and constantly changing pass admitted, in favourable circumstances, vessels of up to 6 feet, but usually not more than 4½ to 5 feet, in draft. Only in fine weather was this

[1] Continued from p. 54.

narrow channel practicable, and for 120 days in the year the passage was too dangerous to allow of any vessel entering or leaving the river; even when the channel was otherwise clear, vessels might find that it had shoaled too much to admit them, and have to tranship their cargo into lighters of shallow draft.

Various attempts were made to overcome these difficulties. The first was the construction of a canal from Arles to Port de Bouc, but the dimensions of the canal were too small to render it serviceable. The next scheme was to restrict the river to a single narrow outlet, in the hope that the scour of the current would

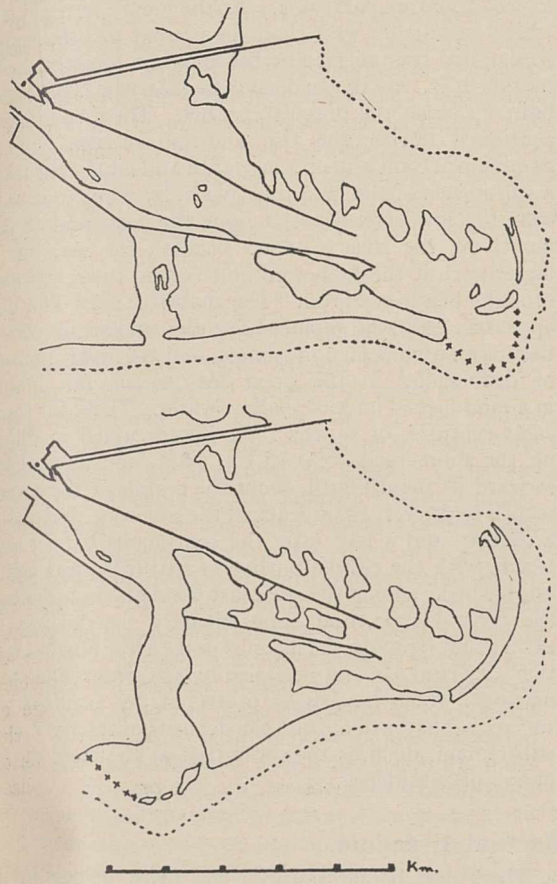

FIG. 5.—Mouth of the Rhone in 1893 and 1913. Dotted line marks the contour of 5 m. depth of water.

maintain a deep channel, and in 1852–55 embankments were carried along both banks to the mouth, the last of the lateral outlets being closed in 1856. At first, success seemed to have been attained, the channel deepened to 12 feet, but in a couple of years a new bar had formed, further out, and the channel shallowed to its old depth of 4 to 6 feet. This plan having proved a failure, it was decided to cut a ship canal from the Gulf of Fos and form a port on the river near the Tour St. Louis, and by 1871 the port and canal, with its locks, were completed. This proved a modified success, the Port of St. Louis established itself as one of the principal of the minor ports on the Mediterranean coast of France, and would doubtless have attained greater prosperity but for malaria, with which this part of the delta is infested.

Meanwhile the mouth of the Rhone had been advancing south-eastwards at a rate of about 60 metres a year, and threatened to block the fairway to the Port of St. Louis, so it was decided to reopen the Grau de Roustan, which had been the principal lateral outlet of the river on the western side. In 1893 the embankment with its stone revetment was removed, and a narrow cut opened to the river through the land which had been formed since the embankment was made. This cut, as was expected, was widened by the river, which rapidly adopted this channel as its main outlet to the sea, the previous main channel becoming more and more blocked with sand-banks. At the end of twenty years a complete change had come over the mouth of the Rhone. The channel of 1893 had been almost completely filled up, only a narrow and shallow channel remaining; the low *theys*, the bar at the mouth, had been washed away by the sea, and a continuous barrier of dry sand, crowned with sand dunes, formed at about 700 metres behind the previous position of the mouth. The old Grau de Roustan had become the sole outlet of the river, which had built up new land to 1200 m. in advance of the old shore-line, and the mouth was blocked by a row of *theys* and a bar, like that which had formerly blocked the mouth of the river, and such as will always be formed where a silt-bearing river enters an almost tideless sea.

It is of some interest to compare this description of the conditions at the mouth of the Rhone, in the nineteenth century, and the measures undertaken to overcome the difficulties, with the accounts which we have of the campaigns of Caius Marius in 103–102 B.C., in the course of which he encountered the same difficulties and adopted similar measures to overcome them. Plutarch, in his life of Marius, says that the mouth of the Rhone being barred and almost filled up with sand and mud, the passage became narrow, difficult, and dangerous for the ships which brought provisions; so Marius, bringing his army, drew a great trench and, by turning a great part of the river, brought it to a convenient point on the shore where the water was deep, and this still retains the name it took from him. To this account Strabo adds that, after the defeat of the barbarians, Marius gave the canal to the people of Marseilles, who derived great revenue from tolls on ships passing along it, notwithstanding the entrance continued difficult to navigate, on account of the deposits and the flatness of the country, so that in foul weather the land could not be discerned, even when one was quite close.

The account which these writers give of the entrance to the Rhone shows that conditions were the same as in the nineteenth century, and suggests that what Marius did was analogous to the solution arrived at some 2000 years later, when the St. Louis canal was dug; and Strabo's account of the difficulties which arose, in later times, is matched by the formation of sand-banks, and a bar, across the Grau de Roustan, when that became the main channel of the Rhone. The digging of a canal a mile and a half long, or very likely less, would not have been too great a work for an army to undertake in the time at his disposal; once dug, access would be made easier for a while, but in course of time, as the river abandoned its old course and adopted the new one, all the difficulties and dangers of the entrance to the river would reappear. That no trace of this canal

remains is not to be wondered at; the river continued to bring down silt and extend the delta for eight centuries after it had been dug, and then came the subsidence which caused any trace of the work of Marius, necessarily lying near sea-level, to be buried under twelve to fifteen feet of silt or water.

During the last two centuries, in which the river has been building up the projection from the old sea-front of the delta, which has reached a length of about 9 kilometres, and has added nearly 40 square kilometres to the area of the delta, changes of a different character had been taking place farther west. The river, during the period in which it had flowed in the channel of the Vieux Rhône, had built up a prominence of some four or five kilometres, but as soon as the course of the river had changed, and the transport of fresh material had ceased, this prominence was attacked by the waves of the sea, and rapidly removed. Opposite the Faraman lighthouse, the recession of the sea-front amounted to about 4·5 kilometres between 1710 and 1870, after which equilibrium seems to have been nearly established and recession became slow. The material removed from this part of the coast was mainly swept to the westwards, where part of it went to form the projection of the Pointe de Beauduc, but part was drifted round the point, to form the continuous barrier and sandy beach which borders the Golfe de Beauduc. Maps of the seventeenth and early eighteenth centuries show no trace of this, the Pointe de Beauduc is not indicated, and the Golfe is bordered by an archipelago of islands, separated by channels, open to the sea and penetrating inland to the Étang de Vaccarès. The date at which these conditions were altered, by the formation of a continuous beach and barrier along the coast, cannot be determined with precision, but in the Cassini map, constructed in the 'seventies of last century, the barrier is shown, and the sea-face is almost as mature in form and outline as on the most recent maps, so we may put the transition, from the immature to the mature form of the existing sea-coast, as having taken place round about the close of the eighteenth and the commencement of the nineteenth centuries.

This completes the cycle of changes which this region of the Rhone delta has undergone, since definite information commenced with the advent of the Romans. At the outset, the extent and outline was not materially different from that of the present time, but the land stood about fifteen feet higher above sea-level than nowadays, the extensive salt lakes and marshes were all dry land, and the Camargue was a fertile, populous, and prosperous region. Along the sea-coast there were probably lagoons, separated from the sea by a continuous barrier, sand dunes and sandy beach, which swept round the coast in smooth and even curves, characteristic of a mature coast-line. At the mouth of the river, which lay farther west than the present mouth, a projection had been formed by the alluvium brought down by the river, exactly analogous to that which has been built up along the present channel. These conditions continued during the rise and fall of the Roman dominion in Gaul until, in the eighth and ninth centuries, a subsidence of the land took place, by which not only were the low level deposits along the coast and at the mouth of the river plunged beneath the sea, but a larger part of the higher ground behind them was also brought below sea-level. The matured coast-line disappeared and was replaced by the immature condition of an archipelago of islands, and the river, instead of debouching in the open sea, ended far inland in a land-locked inlet of shallow water. Then, for some eight centuries or so, the river was occupied in filling up the submerged areas of the delta, and in pushing forward its mouth until, about the middle of the seventeenth century, it again reached the sea-front, and about a century and a half later the continuous barrier and beach, with the curved outline of maturity, was again established. Along the sea-coast the delta had resumed the general type, and approximately the outline, of earlier times, but, in the interior, large areas of what was then dry land are still occupied by salt water lakes and marshes, which have been protected, by accidents of surface configuration, from the deposits of the river, and still remain much as they were left at the close of the period of subsidence.

Evolution and Intellectual Freedom.

SINCE going to press last week, we have been favoured with several further messages on the subject of the campaign in the United States against the teaching of the principle of biological evolution. We are glad to be able to publish these expressions of opinion upon the attempt thus being made to restrain intellectual freedom and progressive thought. As to the trial now being held at Dayton to test the validity of the anti-evolution law of the State of Tennessee, there can be no question that leaders in all departments of intellectual activity in Great Britain regard it with amazement. It is not for us to suggest that a teacher was justified in breaking the law of a State of which he was the paid servant, but what does astonish us is that the citizens of the State should tolerate a law which makes references to evolution and the descent of man illegal. So far as actual teaching of these subjects in schools is concerned, most men of science would not insist upon attention being devoted to them; but when the ban extends to colleges and universities, the matter becomes of prime importance.

There can be no research for truth in Nature if natural truth, including that of the creation of the universe, the earth, and man, has to be regarded as revealed, once for all, in the Biblical record. It would be impossible for any teacher of science to be true to his intelligence and yet give instruction under such conditions. There is, fortunately, no probability of limitations of the kind advocated by Mr. W. J. Bryan and the Fundamentalists being placed upon biological teaching in Great Britain; and for the sake of human progress, we trust that the reactionary movement which they represent will fail of its object. The attack has come from the advocates of traditional doctrine and not from workers in scientific fields, who ask only to be free to extend natural knowledge by research and instruction, without being bound by the words of any master. No one supposes that the problem of organic evolution has been solved, but of the fact of evolution there is not the slightest doubt, and only by further inquiry can we understand fully its course and significance. Whatever Mr. Bryan and his followers may

insist upon as regards belief, science declines to accept finality in the position of natural knowledge at any epoch, or to construct a standard which all discoverers must follow. As Huxley said, when unveiling Darwin's statue in the Natural History Museum, South Kensington, in 1885, science "commits suicide when it adopts a creed."

We need scarcely say that it is not our wish to have a discussion in NATURE upon Genesis and modern science, or religious belief and scientific evidence. Our sole object in taking up the subject of the prohibition of the teaching of evolution in certain States of the United States, and in inviting opinions upon this action from a number of leading authorities, has been to afford support to our colleagues fighting for scientific truth and progress against dogma and stagnation. We trust that the additional messages subjoined will give them the strength and courage they need to secure for them the position of intellectual freedom established in Great Britain many years ago, and existing unchallenged to-day.

Prof. J. GEORGE ADAMI, M.D., F.R.S.,

Vice-Chancellor of the University of Liverpool.

NOTWITHSTANDING "Main Street," it is difficult for us in the old country to realise the state of public opinion throughout the greater part of the United States outside the larger cities: difficult to realise how the minister (be he Methodist or Baptist, Congregationalist or Lutheran) and the Sunday School dominate the community. In the small country town—and every village aspires to be a town—there is no society, and no public opinion, save that centring round one or other church. He is out of society who is not a church member, and it is a commonplace for "Aunt Susan," a representative of one of the oldest families in the town, to conduct the Sunday School class, she being close upon seventy, and her class consisting of the elderly farmers of the locality and their wives and associated elderly spinsters, who have, as it were, grown up under her wing. Visit the farms and other houses of the town and you will find no solid literature that is not theological of an approved type, and of that but some three or four books. Read the local papers and you will see in them little beyond local news, of church teas and picnics, of auctions, of local weddings and funerals in most intimate detail, with a long column of notes upon the doings of local personages, how this one has left for New York or that one returned from Chicago, with, of course, full information regarding local and league doings in baseball. They contain absolutely no news about the outer world, no discussion of topics outside the range of the Sunday School. Save personal gossip and local happenings, all other topics are taboo.

The "Aunt Susans" and their elderly classes in their turn dominate the minister. For his peace of mind—and bread and butter—he dare not venture beyond the bounds of the teaching delivered over long years by Aunt Susan. All the leaders of the community would be scandalised and up in arms. They pay him, and he has no security of tenure. As a consequence an intellectual stagnation and aridity, a narrowness of outlook and a supreme confidence that opinion in Pumpkin Corner is the only possible and only right opinion, unbelievable as they are to us, are actualities throughout Tennessee and agricultural North America.

It is this that makes possible and that explains the proceedings which have led to the Dayton trial. It is this state of affairs that explains the lack of theological progress which in itself is adequate to explain the situation in Tennessee, Oklahoma, Florida, and many other States.

It is eminently likely that in the trial at Dayton the arguments for and against evolution will not be reached. There is a matter yet more fundamental, politically speaking, than that upheld by the Fundamentalists, namely, the constitutional right to fetter liberty of thought. It is a question of supreme moment whether in the "Land of Freedom" the Tennessee decision does not contravene the Declaration of Independence and the basal right of every citizen of the United States to a reasonable liberty.

Prof. C. LLOYD MORGAN, D.Sc., F.R.S.,

Emeritus Professor of Psychology, University of Bristol.

THROUGH the courtesy of the Editor of NATURE I am permitted to enrol my name among those who wish to express their sympathy with advocates of the free and untrammelled spread of evolutionary teaching throughout the length and breadth of the United States of America.

I am one of those who believe that all advance in the order of Nature of which we ourselves, body and mind, are constituent parts exemplifies evolutionary progress. This may be true or it may be false. If it be true, no legislative authority can suppress it; if it be false, it will not be through legislative authority that its falsity will be demonstrated.

But I am also one of those who believe that there are thousands in America and elsewhere who find in evolution a stay and support of their deepest religious convictions. If this be so—if, as I think, it be plain matter of history vouched for by these thousands of religious people—the position, as I see it, is this: by excluding evolutionary teaching in the schools and colleges of this or that State, an avenue to the full and free development of religious faith and observance is arbitrarily barred by legislative enactment.

Unless those who attend these schools and colleges differ markedly from those young folk with whom I have been for many years acquainted in England, there will always be a certain percentage who will find that the form of theological doctrine, whatever it may be, that is prescribed under authority is such as they cannot honestly accept. In my experience a large proportion of these honest and perplexed young people scarcely know what evolution means. When they have learnt what light it may throw on the problems that perplex them, they rejoice in their new sense of freedom from the bondage that has been enforced by authority.

The Right Rev. H. HENSLEY HENSON,

Lord Bishop of Durham.

IT is difficult for an educated Englishman, and *a fortiori* an educated English clergyman, to regard the proceedings in Tennessee without astonishment and contempt. The scientific theory of evolution, popularly associated with the name of Charles Darwin, has

established itself so firmly in the acceptance of all serious students in Great Britain as to be rather an axiom of thinking than a specific doctrine. Of course the concept of development is far older than Darwin. Theologians and historians discovered very quickly that the biologists were proclaiming a truth which, in other connexions, they had necessarily recognised; and the conflict between religion and science which in the middle of the last century agitated Great Britain has, so far as the issue of evolution is concerned, completely died away. Literalist theories of Biblical interpretation and irrational beliefs as to ecclesiastical authority do from time to time occasion friction between religious people and men of science, but such theories and beliefs are evidently losing their hold on the minds of thoughtful Christians, and now move more annoyance than reverence in the general mind.

Freedom of thought is the condition of sincere religion. Freedom of research and teaching is the first principle of academic life. It is incredible that such freedom should be prohibited in American universities. The accounts of Fundamentalism which come to us across the Atlantic indicate nothing more respectable than the injustice and absurdity of religious panic, such as was familiar enough in England at the time of the controversies occasioned by "Essays and Reviews." Mr. Bryan's pronouncements belong to the pre-scientific age, both in temper and substance. They are not creditable to the United States, and will be remembered as the vehement protests of a bigotry which is equally self-confident and obsolescent. They can have no permanent effect on American thought and life.

Rev. R. J. CAMPBELL, D.D.,
Holy Trinity Church, Brighton.

THAT a ban should be placed upon the teaching of evolution in publicly supported educational institutions in the United States or elsewhere is a puzzling fact. Probably it is in some degree the outcome of what is called the "Fundamentalist" controversy in religious circles in America, a controversy which has had few repercussions over here and is not likely to have many in the future. That such crises should be possible is evidence of what competent observers have long known, that American mentality, taken on the whole, differs considerably from that of Great Britain. I do not mean that it is necessarily inferior; in fact we know it is not; in some ways it is fresher, more alert, more productive, and there are certain fields of research and enterprise in which the American intellect leads the world.

Nor need we assume that the attitude taken by the authorities who exclude the teaching of evolution from the educational curriculum is wholly obscurantist. It is not. There is no country in the world wherein a generous idealism is more earnestly cherished than in the United States, nor, appearances notwithstanding, one wherein a soul-deadening materialism meets with more energetic protest. Probably, therefore, it is less the teaching of evolution than its supposed materialistic implications that an influential section of public opinion disapproves of; and this is not a bad sign.

All the same, it is an impossible position to take up. Neither religion nor morals can be safeguarded by proscribing free inquiry in any department of human interest. It is sure to defeat itself and to produce the opposite of what is intended. There can only be one issue to the present conflict of opinion. The assured results of modern science must and will become accessible to civilised mankind everywhere.

Prof. J. W. GREGORY, D.Sc., F.R.S.,
Professor of Geology, University of Glasgow.

THE struggle in the United States over the teaching of evolution is the newest form of the age-long contest for freedom of scientific opinion. It is a warning of the dangers of elementary education becoming a State monopoly. Whether the American Constitution can be interpreted to declare the proscription of Darwinism in State schools illegal seems to be doubtful. The only relative clause appears to be an addition to the first Article of the Constitution; that addition enacted that there should be "no establishment of religion or prohibition of the free exercise thereof" and there should be no "abridging the freedom of speech." Freedom of speech in the schools is as important in the intellectual development of a nation as is the freedom of public discussion of political issues.

Evolution is now essential to the understanding of science and of natural and moral philosophy, and the prohibition of its teaching in the schools would be as fatal to sound education as would be the prohibition of the multiplication table and the axioms of geometry to the study of mathematics. In any State wherever education is compulsory, interference in teaching is a most serious abridgment of freedom of speech. Such a State has no moral right to compel its public school teachers to teach what they regard as error or to adopt a system which renders satisfactory education impossible. Hence the Article in the Constitution that guarantees the United States "no abridging of freedom of speech" may justly be applied to public school teaching and to the prevention of exclusion from the schools of the essential foundations of education.

Rev. J. O. F. MURRAY, D.D.,
Master of Selwyn College, Cambridge.

THE object of those who are promoting the prosecution of Mr. J. T. Scopes is to safeguard faith in the divine inspiration of holy scripture. Sympathising with their object, I would plead with them most earnestly to consider whether the right way to attain it is to prohibit the teaching of any conclusions that seem at first sight inconsistent with it.

If we believe that "by the word of the Lord were the heavens made," must we not believe that patient study of the stars will help us to think God's thoughts after Him? Ought we not to listen to what He is saying to us through the works of His hands? May we not hope to attain thereby to a clearer understanding of what He is saying to us through the written word? Dare we forbid any astronomer to make any suggestion as to the constitution of the universe unless he can make it fit with what we regard as the plain meaning of particular texts of holy scripture? In so doing is it really the infallibility of holy scripture that we are trying to maintain or the infallibility of our interpretation?

The method has, no doubt, been tried. The Roman Inquisition tried it with Galileo. Is that an encouraging precedent?

R. R. MARETT, D.Sc.,

Fellow, Tutor, and Dean of Exeter College, Oxford.

I AM sure that, without help from me, the citizens of the United States are quite capable of suppressing their own obscurantists. Theirs is not the country to go back on the principle of the freedom of thought. Hence I would excuse myself from testifying to the doctrine of organic evolution, and incidentally from having to consider which particular version of it I am prepared to support at the present moment. Rather I would remind my scientific brethren over the water, lest they take the matter too seriously, and hold themselves to be shamed in the face of the world, that there are plenty of worthy folk over here just as narrow in their outlook. I have myself been invited to lecture on anthropology to a denominational congress—held, I am glad to say, not in the British Isles but in a neighbouring country—on condition that nothing should be said about evolution. For the rest, I have had to do at Oxford with Rhodes scholars coming from the obscurantist States, and have found them apparently as well educated as the rest; whence it is perhaps to be inferred that the rising generation will not limit the circuit of their musings to suit the antiquated prejudices of their elders.

Obituary.

PROF. B. GRASSI.

THE death of Prof. B. Grassi, at Rome, on May 4, robs zoology of an ardent devotee and Italy of her most famous zoologist.

Giovanni Battista Grassi was born at Rovellasca (Province of Como, in Northern Italy) on March 27, 1854. He received his early education at a private school, and then entered the University of Pavia as a medical student. But after qualifying in medicine he threw himself whole-heartedly, for the rest of his seventy-one years of life, into the study of zoology—a subject for which he had evinced, even at an early age, a singular aptitude. (He always called himself—and posterity will endorse his definition—*zoologo*, and not *medico*.) He studied first at Messina (with Kleinenberg) and afterwards in Germany—at Heidelberg (with Bütschli and Gegenbaur) and at Würzburg (with Semper). In 1883 he was appointed professor of zoology in the University of Catania (Sicily), where he remained until 1895, when he was promoted to the chair of comparative anatomy in the University of Rome. In 1897 he was elected a national fellow of the Royal Society of Italy (R. Accademia dei Lincei), and in 1908 he was made a Senator of the Realm: until the day of his death he was—scientifically—one of the most productive members of the University, the Academy, and the Senate. Our own Royal Society bestowed the Darwin Medal upon him in 1896, but never elected him a foreign member.

Grassi's contributions to zoology are so many, so varied, and so great, that they cannot be adequately reviewed in a few words. He began his researches while still a student, and continued them unremittingly until the end of his life—despite his multifarious cares of office. (He could boast, but a year ago, that he had always given more lectures every year than the University required, and had never once missed a sitting of the Senate.) Though a man of apparently feeble physique, and handicapped from childhood by defective eyesight, he was possessed of immense energy and ardour: and he never spared himself. He used to say that mankind is composed of those who work, those who pretend to work, and those who do neither; and there can be no doubt that he himself belonged to the first class. An accomplished field naturalist, with expert morphological and systematic knowledge of many groups of animals, he was also an accurate and original observer and an indefatigable experimenter—and one, moreover, who was always master of the literature of his subject. Consequently, his best works already rank among the zoological classics.

Many of Grassi's outstanding researches were done in collaboration with pupils and colleagues, among whom may be particularly mentioned Bastianelli, Bignami, Calandruccio, Feletti, Anna Foà, Noè, Rovelli, Sandias, and Topi. Since many of the problems which he successfully attacked—either alone or with the help of others—are not only of great zoological, but also of great medical and economic importance, and therefore bound up with various vested interests, it is scarcely surprising that his own restless research and unquenchable thirst for knowledge sometimes brought him into sharp conflict with opponents and rivals, and occasionally even with his fellow-workers: and unhappily the controversies aroused by some of his investigations have gained wide publicity, and have even tended—in certain quarters—to obscure the indisputably great merits of these investigations themselves. He recently remarked, publicly, that he "would have led a tranquil life if he had not engaged in the study of malaria and other burning questions which have a practical application." This is pathetically true, though one may be permitted to question it.

Of Grassi's works there is space to mention only some of the greatest. His earliest studies of the life-histories of intestinal worms and protozoa—begun in 1876 and continued for some dozen years—are familiar to all specialists, and contain many important observations and discoveries. He gave, for example, the first accurate account of Giardia (Lamblia), and was the first to ascertain (partly by experiment upon himself) the method by which *Entamœba coli* and *Ascaris lumbricoides* are transmitted from man to man; and he was also the first to show that the cestode Hymenolepis completes its development without passing through an intermediate host. Curiously enough, it is only within recent years that these and others of his early observations have been verified and finally accepted.

In 1883 Grassi published his classical Naples Monograph on the Chætognatha, a peculiar group of marine animals: and ten years later (1893) he published (with

Sandias) his famous observations on "The Constitution and Development of the Society of Termites"—one of the finest entomological works ever written. In the course of this work he was led to make a detailed study of the peculiar protozoa with which many termites are infested; and these studies—begun in 1885, and ending with his extensive and beautifully illustrated memoir of 1917—are scarcely less important than those which he has published on the termites themselves.

In 1887 he began (with Calandruccio) a very different investigation which ultimately yielded results no less remarkable—his study of the life-history of the eels. The development of the eel is a problem which had puzzled biologists from the time of Aristotle; but in 1896 Grassi was able to announce that he had solved it, in its general terms, though full details of his work were not made known until 1913, when his magnificent monograph on "The Metamorphosis of the Murænoids" appeared.

From about 1890 until 1892 Grassi was also occupied (with Feletti) in studying the malarial parasites. In 1898 he returned to this subject with renewed energy, and succeeded in 1898 and 1899—with the collaboration of Bignami and Bastianelli—in solving once for all the problem of the mode of transmission of human malaria. He was then able to demonstrate that certain mosquitoes (Anopheles), and these mosquitoes only, convey malaria from man to man; and he worked out, for the first time, the entire life-history of the human malarial parasites in these insects. The importance of these discoveries needs neither emphasis nor advertisement. His great monograph—"Studies of a Zoologist on Malaria"—was published in 1900. It is still unsurpassed, and is universally acknowledged by protozoologists as one of the classics of their science.

About 1905 Grassi turned his attention to another organism of vast economic importance—Phylloxera, an insect which has done incalculable damage to the vineyards of Europe since its accidental introduction from America some sixty years ago. With various collaborators (Foà, Topi, and others) he continued to labour at the biology and control of this insect until the end of his life. His most important publication on the subject—issued by the Italian Ministry of Agriculture in 1912—has recently been described by a distinguished entomologist as "a milestone in the history of entomology."

Another important entomological work by Grassi is his memoir on the sand-fly (Phlebotomus). In this he gave (1907) the first good account of the structure and life-history of an insect which has recently attracted much medical notice, owing to the part which it appears to play in the dissemination of more than one human disease. During the last few years of his life Grassi returned again to the study of malaria and its prevention, and published—among other works—a series of most interesting papers on the biology of mosquitoes.

These are some of the works for which the name of Battista Grassi will ever remain famous in zoology—both pure and applied—and in medicine. Severally his contributions to helminthology, to entomology, to protozoology, or to ichthyology, would be sufficient to establish the reputation of a lesser man in any one of these sciences: taken together, as the work of a single individual and his assistants, they constitute a record of achievement almost unparalleled in the history of zoology.

CLIFFORD DOBELL.

WE regret to announce the following deaths:

Commendatore Giacomo Boni, director of the excavations in the Forum, Rome, and on the Palatine, where he made important archæological discoveries in the Temple of Vesta and on the site of Domitian's Palace, respectively, on July 7, aged sixty-six years.

Dr. Charles Forbes Harford, a founder and the first Principal of Livingstone College, Leyton, on July 4, aged sixty years.

Dr. Felix Klein, For. Mem. R.S. and Copley medallist of the Society, professor of mathematics in the University of Göttingen, who has added to our knowledge of non-Euclidean and carried out researches in the theory of functions, on June 22, aged seventy-six years.

Current Topics and Events.

IN 1915 a new chapter was opened up in the cancer mystery by the discovery of Yamagiwa and Ichikawa that cancer can be successfully induced in rabbits by the prolonged application of gas works' tar. This result was soon confirmed, and during the last ten years a large number of tumours have been produced in mice, rabbits, and even in fowls. In addition to cancer in the strict sense, other malignant tumours have developed as a result of the application of tar products. There is no longer any doubt that the induced tumours are true blastomata. They possess every attribute which has been associated with the idea of malignancy. Tar is, of course, not the only chemical irritant which produces tumours, but it is the one that most readily does so under experimental conditions. It is also known that different tars vary greatly in their cancerogenic properties. The actual agent in the tar has been sought, and although not yet completely identified, a large body of knowledge has already grown up on the subject. Apparently the acids and bases of tar can be removed while the cancerogenic agent remains.

A SHORT time ago, E. L. Kennaway, of the Cancer Hospital Research Institute, London, obtained results which pointed to the conclusion that isoprene compounds prepared at about 820° C. are more active than the original coal tar from which they are obtained. In a more recent paper (*Brit. Med. Journ.*, 1925, i. p. 1, July 4) Kennaway has made a further important contribution to the cancerogenic properties of "tars," by showing that acetylene heated to 800°-900° C. is capable of producing tumours. A Californian petroleum, in itself apparently incapable of producing cancer, became so when heated to 800° C. in a current of hydrogen. More extraordinary still, he found that human skin or yeast dried and heated to 920° C. produced malignant tumours in mice. Although these products, up to the present, can only be produced at

high temperatures, "it is possible," as Dr. Kennaway says, "that the body at its own temperature takes months or years to produce a quantity of some substance sufficient to influence the growth of a few cells only"; whether this is so or not, it seems probable that we are getting definitely nearer the solution of the cancer problem.

YET another step in the progress of our knowledge of cancer is promised in the announcements which have appeared of a paper by Dr. W. E. Gye, to appear in the *Lancet* of July 18. At the time of writing no details are available, but it would seem that Dr. Gye, who has been supported by the Medical Research Council and assisted by Mr. J. E. Barnard and Dr. J. A. Murray, the latter of the Imperial Cancer Research Fund, has discovered a filter-passing organism in cancers of birds, rodents, and other mammals, including man. The organism itself, however, does not give rise to cancer when injected into healthy animals; it requires the presence of a so-called specific factor obtained by injecting a tumour extract from the species of animal which is being used for experiment. In the presence of extract of a sarcomatous tumour freed from the newly discovered organism, the organism itself, whatever its source, is able to cause sarcomatous growth in an animal of the species from which the extract has been made. Extracts of carcinomatous growths would appear to be ineffective. Mr. Barnard's work on the use of ultra-violet light and other short-wave radiation for photographing, under the microscope, objects of very minute size, is well known, and his share in the present work has apparently been concerned with photographing the organism. If the discovery is fully substantiated, it should mark an important advance in medical knowledge.

ON Monday, July 13, the King, who was accompanied by the Queen, opened the new house of the British Medical Association, Tavistock Square, London, in the presence of an assembly of medical representatives from the Dominions and Colonies, from many organisations in Great Britain, and from the continental countries of Europe, and a special delegation from the American Medical Association. Shortly before the arrival of the King and Queen, the memorial gates at the entrance of the courtyard of the building were dedicated by the Archbishop of Canterbury to the memory of the 574 members of the Association who lost their lives in the War. The King and Queen were attended by Mr. Neville Chamberlain, Minister of Health, and proceeded to the Great Hall of the new building, where the chairman of the Council of the Association, Dr. R. A. Bolam, read an address outlining the origin and aims of the British Medical Association. Throughout its existence, the Association has striven to maintain the traditions of the medical profession and to keep its members alive to the advance of the science and art of medicine. Medical men, he said, have a duty not only to their patients but also to the community in the protection of public health. Reference was also made to the fact that there are now no less than 2250 women members of the Association. In his reply, the King remarked on the great increase in membership and usefulness of the Association since its foundation in 1832. The importance of qualifying examinations and prescribed training as a preliminary to admission to the Medical Register was emphasised, with the warning that "vigilance must always be exercised in order that your profession may keep abreast with the advance of science." In this connexion reference was made to the value of post-graduate study. Passing on to the relation of the medical practitioner to public health, the King said that the welfare of the peoples of the British Empire "depends largely upon an efficient and well-organised health administration," and referred to the medical practitioner as a "missionary and teacher of public hygiene and of personal health."

ON Thursday, July 9, the Sargant Laboratory of Plant Physiology at Bedford College for Women, London, was opened by Lord Justice Sargant. The Principal, in introducing Lord Justice Sargant, spoke of the sympathetic interest Miss Alice Sargant had shown towards Bedford College and of the important share she took in furthering the acquirement of the present unique site in Regent's Park. Upon her death Miss Sargant had bequeathed a sum of 1000*l.* for the furnishing of a library and herbarium in the Botany Department and for the erection of a physiological greenhouse. The War intervened before the latter project was carried out and post-War conditions rendered the unexpended balance inadequate for the purpose intended. Recently, however, as the result of a legacy, the Council of the College has been able to provide a sufficient additional sum to permit the erection of a small laboratory and experimental greenhouse.

IN declaring the new Sargant Laboratory of Plant Physiology open, Lord Justice Sargant acknowledged the kindly thought that had connected his sister's family name with the laboratory. He pointed out that Alice Sargant's contact with botany was artistic and literary rather than scientific, and that in his own mind he would always associate with the building the memory also of his other sister, Ethel Sargant, who took a keen interest and an active part in scientific botany. A vote of thanks was moved by the chairman of Council, Sir Wilmot Herringham, and seconded by the head of the Botany Department, Prof. W. Neilson Jones, after which the new laboratory was inspected. Among the exhibits were a collection of portraits of botanists and others after whom plant genera had been named, together with specimens of the plants concerned, demonstrations of researches carried out by various members of the Department of Botany, apparatus for the study of plant physiology, and a number of interesting plants. The Botany Department of Bedford College is fortunate in possessing a small but well-stocked botany garden, inspection of which provided an attractive item in the entertainment of those who attended the ceremony on July 9. The position of the new laboratory in close proximity to the garden ensures a supply of suitable plant material for work in plant physiology.

AN influential and representative deputation waited on Mr. L. C. M. S. Amery, Colonial Secretary, at the Colonial Office on July 7 to urge the claims of the Imperial College of Tropical Agriculture to continued Government assistance on an extended scale. It comprised several members of Parliament of both Houses, eminent men of science, and representatives of the principal organisations associated with the Dominions and Colonies in Great Britain. Lord Burnham, who introduced the deputation, read a letter from Mr. Ramsay MacDonald expressing interest in the movement and his hopes for its success. Sir Arthur Shipley then briefly reviewed the history of the College, and, referring to the financial position, pointed out that funds were urgently needed to enable the Governing Body to proceed with the erection of hostels and the provision of an estate. Thus the College might be placed in a position to provide for the requirements of the students, who would be proceeding to it under the scheme prepared by the Committee of which Lord Milner has been chairman, for the training of officers for the Agricultural Departments throughout the Empire. The cost of the hostel he placed at 25,000*l.* and that of the estate for research work and the practical study of farming in all its branches at 25,000*l.* Mr. Amery in reply stated that the case of the College has already been before the Committee of Civil Research, and that he hopes now to take the matter up more definitely and directly with the Chancellor of the Exchequer with the view of seeing what financial support is possible. He has, he said, the greatest faith in the future of the College, which he believes will develop into an Imperial University of Tropical Agriculture.

A MEMORANDUM regarding the probable amount of monsoon rainfall in 1925 was issued early in June by Mr. J. H. Field, Director-General of Observatories of the Meteorological Department to the Government of India. The rainfall of India is affected by previous weather conditions over various parts of the earth. For the Peninsula the indications from Java, the Cape, South America and Dutch Harbour are slightly unfavourable this year, but their combined effect on monsoon prospects is small. For north-west India a prejudicial influence exists this year from the very large excess of rainfall in south Rhodesia, and this receives some little support from conditions at Dutch Harbour ; the effect of the other factors is negligible. For the Bay monsoon current the only indications as yet discovered are those from the wind and rainfall of Seychelles ; the rain has been normal, but the strength of the wind is a favourable feature. Monsoon rainfall would appear to be likely to be normal or in defect in the Peninsula, normal or in excess in north-east India, and in defect in north-west India.

SIR RICHARD REDMAYNE, formerly chairman of the Imperial Mineral Resources Bureau, which has recently been amalgamated with the Imperial Institute, South Kensington, has been appointed director of the Imperial Institute. He has accepted the appointment on the understanding that it will be for a short period only, in order that he may supervise the amalgamation of the two bodies.

AT the ordinary meeting of the Royal Society of Edinburgh held on July 6, the Makdougall Brisbane Prize for the period 1922–1924 was presented by the president to Prof. H. Stanley Allen, professor of natural philosophy in the University of St. Andrews, for his investigations in theoretical physics, particularly for his communication to this Society on the magnetic character of the quantum, and on static molecular models of hydrogen and helium.

THE Chalmers Memorial Gold Medal was presented at the recent annual general meeting of the Royal Society of Tropical Medicine to Prof. Warrington Yorke, professor of parasitology in the University of Liverpool and Liverpool School of Tropical Medicine, in recognition of his work on trypanosomiasis, malaria, and other subjects. The medal is awarded biennially to persons less than forty-five years of age for "researches of outstanding merit contributing to our knowledge of tropical medicine and hygiene."

M. A. F. DINA and his wife have given the Paris Academy of Sciences a sum of a million francs, the income from which is to be devoted to the manufacture or purchase of astronomical instruments for observatories concerned with astronomy, meteorology, or geophysics, together with an astronomical library for such observatories.

PROF. W. M. DAVIS, emeritus professor of geology at Harvard University, and Dr. G. Holm, Geological Survey of Sweden, Stockholm, have been elected foreign members of the Geological Society. Prof. P. Lemoine, professor of geology in the National Museum of Natural History, Paris ; Dr. V. Madsen, of the Royal Library, Copenhagen ; Prof. P. Niggli, professor of mineralogy and petrography in the University of Zürich ; Prof. J. F. Pompeckj, professor of geology in the University of Berlin ; Dr. T. W. Vaughan, of the United States Geological Survey ; and Dr. M. D. Zalessky, Leningrad, have been elected foreign correspondents.

THE Summer Meeting of the Royal Cornwall Polytechnic Society will be held on July 21-24 at the Polytechnic Hall, Falmouth. An exhibition of Cornwall art and handicraft will be opened on July 21 by the president, the Right Hon. Viscount Falmouth, who will give an address on "Recent Developments of Physical Science," which will be followed by a paper by Mr. Henry Jenner on "The Holy Wells of Cornwall." Other papers to be read during the meeting are : "Boulton and Watt in Cornwall," A. K. Hamilton-Jenkin, and "The Mining Coinage of Cornwall," E. W. Newton. On Friday, July 24, a lecture will be given by Dr. W. D. Prendergast on Cornwall and the ceramic industry.

A MEDAL for archæological research has been instituted, and attached to the Board of Archæology in the University of London. The first presentation was made at University College, on July 7, by Prince Arthur of Connaught, to Sir Flinders Petrie in recognition of his half-century of work for archæology. The medal bears Sir Flinders Petrie's bust on one side, and on the other the searching ibis, the hieroglyph of

"finding," placed before the head of Khufu, which was found by Sir Flinders. In returning thanks for the presentation Sir Flinders compared the expansion of the knowledge of man by the methods of archæology, to the extension of our knowledge of the universe by spectrum analysis, two movements which had grown simultaneously within his memory.

THE following are among the Civil List pensions recently granted:—Miss Maria Birch, in recognition of the services rendered by her father, the late Dr. Walter de Gray Birch, to the science of archæology, 100*l.*; Mr. J. T. Cunningham, in recognition of his services to zoological science and economic zoology, 100*l.*; Prof. Patrick Geddes, in recognition of his public and educational services, 100*l.*; Mrs. Amelia Sarah McLeod, in recognition of the services rendered by her husband, the late Prof. Herbert McLeod, F.R.S., to science, 45*l.*; Mrs. Emily Rambaut, in recognition of the services rendered by her husband, the late Dr. A. A. Rambaut, to astronomical science, 50*l.*

FOLLOWING a highly successful conference held at High Leigh, Hoddesdon, in September 1924, of those interested in special libraries and agencies for the collection, treatment and distribution of information, a representative standing committee was appointed to ensure continuity of the work. Assistance has been obtained from the Carnegie United Kingdom Trustees, and the proceedings of the first conference have just been issued. The committee has decided to name the body thus called into being "The Association of Special Libraries and Information Bureaux." The second conference of the Association will be held at Balliol College, Oxford, during the week-end September 25-28; full particulars can be obtained from the Organising Secretary at the Offices of the Association, 38 Bloomsbury Square, London, W.C.1.

Observation, of which we have recently received Part 3, is a periodical intended for readers of secondary school and training college age. It is issued by Leplay House, London, and as might, therefore, be expected, its keynote is the cultivation of the faculties of observation in everyday life. Its articles record the results of first-hand observations of peoples, activities, and places. Those in the present number deal, among other matters, with Sarawak, this by Mrs. Charles Hose, the Scillies and their bird life, London and its buildings, place names, wild flowers, and typical Norwegian farms. The articles are well illustrated.

WE have received from the Mellon Institute of Industrial Research of the University of Pittsburgh the list of publications and patents by members of the Institute during 1925. This gives evidence that the wide variety and practical utility of the subjects investigated in the Institute still continues. Laundry work, refrigeration, fire-extinction, smoke-abatement, and the design of ventilators are a few of the subjects of publications or patents. The subject "Jewelry from Fish Scales" recalls the famous experiment for extracting sunshine from cucumbers, to which the discovery of vitamins has given a new meaning. It is evident from the list that industrial research as understood at the Mellon Institute embraces all the experimental sciences.

THE April issue of the Journal of the Franklin Institute contains two interesting papers, one, by Prof. Haber, on the practical results of the theoretical development of chemistry, and the other, by Prof. Donnan, on the influence of J. Willard Gibbs on the science of physical chemistry. Dr. Haber commences with a consideration of the "structural" period in chemistry, a period in which dyestuff investigation was developed. This was followed by the "thermodynamic" period. The application of thermodynamics to solution phenomena and the advent of the electrolytic dissociation theory fall within this period. In this connexion, nitrogen fixation and the use of catalysts in general are discussed. The third period is that through which we are now passing, namely, one in which atomic structure is being interpreted electrically. Capillary chemistry falls in this class, and the theories of adsorption are described in detail, simple explanations being given for Szyszkowski's empirical law and for Freundlich's adsorption isotherm. Prof. Donnan's lecture shows how firmly Gibbs laid down the foundations of thermodynamics, and an excellent account of Gibbs's method is given. The phase rule is given prominence, and Prof. Donnan shows throughout how much indebted are modern workers in this field to the fundamental researches of the great American physicist.

WE have received from Messrs. Adam Hilger, Ltd.; a pamphlet entitled "Applications of X-Ray Spectrography and Crystallography to Metallurgy and to Chemical Problems," supplementary to the small volume on optical methods in research issued by the same firm. The pamphlet contains useful hints on the methods and limitations of X-ray spectroscopy, followed by suggestions as to the use of this method for the solution of practical problems in metallurgy. In illustration, examples are quoted from recent authors, showing how the deformation of crystalline aggregates as well as of single crystals produces characteristic changes in the X-ray pattern given by a metal, as in the work of Taylor and Elam, Polanyi, Bain, and others. An excellent bibliography is appended, from which, however, we miss any reference to the work published in *Stahl und Eisen* or in the *Mitteilungen der Institut für Eisenforschung*. Work of this kind has, among other things, shown the remarkable similarity between the structure of natural fibres, such as cotton and silk, and that of cold-drawn metallic wires. The mechanism of deformation of crystals is still a matter for controversy, and it seems probable that some refinement of X-ray technique will be necessary before this method can be expected to give results quite free from ambiguity. The evidence already available is, however, of the highest interest, and no metallurgist who is interested in the problem can afford to disregard it.

A SHORT but useful catalogue of second-hand science books has reached us from Messrs. W. and G. Foyle,

Ltd., 121 Charing Cross Road, W.C.2. It gives particulars of nearly four hundred works dealing with zoology in general, with separate sections relating to ornithology, entomology, and botany. The list is sent free upon request.

MESSRS. Dulau and Co., Ltd., 34 Margaret Street, W.1, have recently issued two useful catalogues (Nos. 129 and 130). No. 129 contains some 1300 books and papers on entomology, conveniently classified under the names of the insect orders, economic and general entomology, serial publications, and Arachnida. In No. 130 are listed upwards of 2000 works classified under the headings of ornithology, mammals and sport, reptilia, fish and fishing industries, conchology, general zoology, biology, Darwinism, evolution, heredity and Mendelism. The catalogues can be obtained free upon application to the publishers.

WE have received the annual booklet issued by Messrs. Burroughs Wellcome and Co., which gives instructions and formulæ for photographing with the aid of their tabloids and Photographic Exposure Calculator. It includes the technique of desensitising, and a page of plate speeds which brings the speed tables in the Exposure Calculator up-to-date. The booklet, "Photographic Signposts," is sent post free on application to Messrs. Burroughs Wellcome and Co., Snow Hill Buildings, London, E.C.1.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned: A full-time teacher for mining courses under the County Council of the West Riding of Yorkshire—The Technical Branch, County Hall, Wakefield (July 23). An assistant master to organise biological teaching in Campbell College, Belfast—The Headmaster (July 25). An assistant lecturer in mathematics in the University of Manchester—The Internal Registrar (July 31). A junior demonstrator of anatomy in the University of Birmingham—The Secretary (July 27). An assistant lecturer in engineering in the University of Manchester—The Internal Registrar (August 1). A demonstrator in physics in the University of Leeds—The Registrar (August 6). Lecturer in physiology in the University of Birmingham—The Secretary (August 24). The Dutton Memorial professorship of entomology in the University of Liverpool—The Registrar (October 1). The Ormond professorship of music in the University of Melbourne; the senior lectureship in philosophy in the University of Melbourne—The Agent-General for Victoria, Australia, Melbourne Place, Strand, W.C.2 (October 15). A full-time lecturer in mathematics at University College, Southampton—The Registrar. Lecturer on tropical hygiene at the London School of Hygiene and Tropical Medicine—The Secretary, 23 Endsleigh Gardens, N.W.1. A demonstrator in physics in the University of Toronto—Prof. J. C. McLennan, Athenæum Club, Pall Mall, S.W.1. Senior physics master at the Cowley Boys' School, St. Helens—Secretary for Education, Education Office, St. Helens.

ERRATUM.—In the issue of July 4, p. 22, col. 2, line 22, for "South American" read "South Italian."

Our Astronomical Column.

THE DELPORTE OBJECT.—M. Delporte has issued a notice of erratum in his telegram announcing the finding of this object. The figures $+1^m\ 48^s$, N. 14′ were really the motions in R.A. and Decl. in 2 days, not 1 day. Making this alteration, it was soon found that the object is not new, but is identical with the minor planet 29 Amphitrite, which is in opposition next October, some six months before its perihelion. It had already been perceived that Amphitrite was close to the position given by M. Delporte, but the original statement of its motion seemed fatal to identity.

Amphitrite is one of the brighter members of the family, and was discovered by Mr. A. Marth in London in 1854.

THE NEAR APPROACH OF EROS IN 1931.—Dr. G. Witt, who discovered Eros in 1898, has been studying its perturbations for many years, and gives in *Astr. Nach.*, 5375, an ephemeris from October 1, 1930 (parallax 12·2″), to May 5, 1931 (parallax 16·4″). It is nearest to the earth (parallax 50·3″) on January 30, fifteen days after perihelion. Its magnitude will then be 7·1, so that it will be easily visible in a field-glass.

The declination is +44° on October 1, −3° on January 30, −22° on May 5.

The same issue of the *Astr. Nach.* contains a list of stars for comparison with Eros. Very few of them are fainter than 9·0 mag., so observations with meridian instruments are desired. Each plate of 2° × 2° will contain about eight of these stars. Fainter stars will be necessary for instruments with long focus, but their places can be photographically determined, using the stars of this list as a basis. The present list contains 419 stars and follows the place of Eros for October 1 to January 8. A second list will be issued for the remainder of the apparition.

CARBON BANDS IN COMET TAILS.—M. F. Baldet has studied the effect of pressure on the band spectrum of carbon in a thermoelectronic tube (*C.R. Acad. Sci.*, Paris, April 20). He finds that at low pressures the second and third positive groups of bands and the new group recently discovered by him disappear, leaving only the third negative group, or comet tail spectrum, and the first negative (ultra-violet) group, which remain well developed. Under these conditions the emission of light is due to electronic shocks, while at higher pressures the shocks of ionised molecules with one another and with neutral atoms are concerned, giving the other band systems mentioned above. This seems to confirm Deslandres' theory of corpuscular or electronic radiation from the sun, which produces the coronal streamers and the polar aurora. So far only the negative group of nitrogen in the comet Morehouse has been ascribed to the action of this electronic radiation; but from the work of M. Baldet and others it now appears probable that the carbon bands observed in comet tails are due to the electronic bombardment of oxides of carbon at exceedingly low pressure.

Research Items.

ARCHAIC SCULPTURE, GORGONA ISLAND, SOUTH AMERICA.—Mr. James Hornell, who is the official ethnologist of the *St. George* Expedition, organised by the Scientific Expeditionary Research Association, gives in *Man* for June a detailed account of the archaic sculptures which were discovered on Gorgona Island, off the coast of Colombia. These sculptures were on two groups of boulders, the majority of the older examples being below present tidal level. On many of the stones it can only be discerned that designs have existed, but on four they are comparatively well preserved. These form an ordered group around a huge, roughly quadrangular boulder bearing upon its upper surface the representations of a pair of rude ungainly human figures, male and female, each with a number of rays around the head in the shape of a halo. The figures stand side by side. The male measures 1 ft. 10 in. in height. The outlines are formed by broad, shallow, rounded grooves. On another stone is a rudely sculptured stepped pyramid of four superimposed platforms, progressively decreasing in size. Six circular depressions or cups occupy the face of the third storey and the upper half of the second. This pyramid may be a representation of an early form of the Mayan and Aztec temple of the sun, the six cups representing astral deities. Of the other two boulders, each has a representation of a monkey of crude and childish design. Other sculptures, belonging to another and later group, and pottery and stone implements were also found.

AUSTRALIAN AND MELANESIAN AFFINITIES IN SOUTH AMERICA.—Dr. Paul Rivet, in a communication to the Académie des Sciences et Belles Lettres, which appears in the *Comptes rendus* covering the session 1924, discusses the evidence for concluding that certain of the peoples of Central and South America exhibit affinities to the Australians and Melanesians. Up to the present, all efforts to establish a connexion between the languages of America and of the Old World have failed except in the case of the Eskimo, whose language probably belongs to the Ural-Altaic group. Now, however, it appears that the Hoka group, comprising a great number of tribes, extending with some interruptions along the Pacific coast from the south of Oregon to Tehuantepec, shows marked similarities in vocabulary to the Melaneso-Polynesian languages. A second, known as the Tson group, which includes the Patagonians and the Ona, in like manner exhibits affinities with the Australian languages. It is remarkable that those resemblances are found among the rare words which are common to the highly differentiated Australian dialects. In each case the similarities are the more noteworthy because the Australian and Melanesian vocabularies, from which the material for comparison has been taken, contain a comparatively small number of words. In 1909, ten Kate and de Quatrefages both pointed out that a Californian people and the Lagoa Santa race presented affinities in osteological characters with the hypsisteno-cephalic race of Melanesia, and this has recently been confirmed by R. Verneau; while Graebner, Nordenskiöld and P. Schmidt have pointed to the remarkable similarities in South American and Melanesian material culture. In the case of the Australian, Verneau has pointed to the existence of a platy-brachycephalic type in Patagonia which is Australoid, and recently Lebzelter has described an Ona cranium in which this character is even more marked.

USES OF INTELLIGENCE TESTS.—The Bureau of Education, Washington, has issued a leaflet (City School Leaflet, No. 20), dealing with the uses of intelligence tests in 215 cities. A questionnaire was sent to all superintendents of schools in cities of 10,000 or more population with the request that they should indicate the various purposes for which they are using tests in the elementary, junior, and high schools. The replies show that group intelligence tests are chiefly used in the schools for the purpose of classifying the pupils into homogeneous groups and for supplementing the teachers' estimates of pupils' ability, and to a much less degree for vocational guidance. Individual intelligence tests are chiefly used for dealing with subnormal children and for classification purposes; standardised educational tests are used for supplementing the teachers' estimates of the pupils' ability and for comparison with other school systems. Among the other purposes are: diagnosis of causes of failure, promotion, vocational guidance, establishment of classes both for subnormal and supernormal children. The three tables supply some interesting and valuable information. It is surprising to find that they are utilised for vocational guidance purposes to a relatively small extent.

"WATER SHUT-OFF" IN OILFIELDS.—Mr. F. G. Rappoport read a paper on this important subject before the Institution of Petroleum Technologists on May 5, wherein he demonstrated the necessity for close co-operation between chemist, engineer, and geologist in dealing with this problem. Little more than arbitrary methods of prevention, usually confined to a particular well, used to be adopted, with the result that though the well might temporarily benefit, it ultimately formed the means whereby water gained access to upper oil-bearing sands over a large area. Experience, however, has taught the lesson; so much so that to-day in many countries not only is there co-operation between the various operators concerned, but Government regulations also exist in order to enforce those measures essential to the control of water flow throughout the oilfields, for example, in California, Burma, Rumania, and the Dutch East Indies. From a chemical point of view the differentiation of waters associated with petroleum is a specialised analytical process which has developed greatly during the past few years; such differentiation is to some extent a means of sub-surface correlation of water sands, and hence often a key to the disposition of related oil sands. Cementation, the universal panacea for all water ills, implies chemical research on the particular cement used. The mechanical means of preventing water encroachment concern the field-engineers, who are not only responsible for the process of cementation or other method employed, but also, acting in consultation with chemist and geologist, are careful to ensure that proper and systematic casing of the well is carried out for water shut-off, as much as for lining the well, as a factor in production.

ESTONIAN OIL-SHALE INDUSTRY.—The Estonian oil-shale or "kukersite," as it is known, was first discovered by Engelhardt some 135 years ago, but its exploitation on a commercial scale only dates from 1919, after the Estonian Government had taken over the original shale mine from the Germans, following their occupation of the country in 1918. There are now two mines, one at Kohtla (open cut mining), the other at Kukruse (underground system); a third mine at Vanamoisa has lately been developed by a syndicate operating with British capital. For 1923 there was an output from the State mines of 206,000

metric tons, while 13,140 metric tons were produced in the same year by private companies. Some diamond drill boring has been carried out for the purpose of testing the extent of available resources of kukersite, and the high reserve of 3800 million tons has been estimated; to this must be added the resources of unexplored areas, which brings the estimated total up to 5000 million tons. Experimental distillation of the shale on a commercial scale, using a continuous producer-retort, has resulted in a throughput of about 8 tons in twenty-four hours, the yield of crude oil amounting to 20 per cent. of the weight of the raw shale. The ultimate composition of this oil is carbon 81·26 per cent., hydrogen 10·15 per cent., oxygen 7·26 per cent., sulphur 1·08 per cent., and nitrogen 0·25 per cent. According to Mr. P. N. Kogerman, from whose paper before the Institution of Petroleum Technologists on April 23 these facts were gathered, this oil is at present used mainly as a fuel oil, little fractionation being attempted, though steam distillation at 100° C. yields a light oil suitable for motor cars, while a heavier fraction of "motor oil" for oil-engines distils over between 280-300° C. The residue is a high quality "shale asphalt." The success of this experimental work has led to the erection of a large oil distillation plant, consisting of a battery of six retorts with a 200-ton shale capacity in twenty-four hours, capable of yielding 40 tons of oil per day.

THE CAUSES OF GLACIAL PERIODS.—Geological evidence leads to the conclusion that there has been a more or less regular series of glacial periods, alternating with warmer interglacial ones, in the history of the earth, but the theories advanced to explain their causes have been inadequate. A well-known Russian meteorologist, P. J. Brounov, has recently put forward in *Priroda*, a periodical of the Russian Academy of Sciences, 1924, No. 7-12, a theory based on astronomical and meteorological data. Formation of glaciers, according to him, depends not so much on coldness of climate as on the quantities of snow falling in a certain country. The main factor causing snowfalls are the ascending currents of air which are characteristic of cyclones. There are two zones of cyclones in the northern hemisphere—the northern, where the cyclones have a N.N.E. direction and bring snowfalls, and the southern, with warm, rain-bringing cyclones. The two zones are separated from each other along the zone of barometric maximum, which runs around the globe between latitudes 33° and 35°. The latitudinal position of this zone plays a most important part in determining the climate of the two cyclone zones. Its position, however, depends to a great extent on the velocity of rotation of the earth, since this influences deviation in the direction of cyclones. There is extensive astronomical evidence that the velocity of rotation of the earth undergoes fluctuations dependent on various causes. These fluctuations must result in corresponding shiftings of the zone of barometric maximum, that is, in considerable changes of climatic conditions in the cyclone zones. Acceleration of the velocity must result in shifting the zone of barometric maximum towards the equator, and that would mean a corresponding extension southwards of the northern zone of cold cyclones with snowfalls; on the other hand, when the rotation of the earth becomes slower, the zone of maximum is shifted northwards and warmer conditions prevail in the middle latitudes. During the last glacial period, according to Prof. Brounov, the zone of barometric maximum ran in Europe, roughly speaking, along the Mediterranean Sea; after that period it shifted northwards, which resulted in a relatively dry and warm period; at present the zone is apparently shifting southwards, and Europe is threatened with a new glacial period.

A NEW PENTAMEROID BRACHIOPOD FROM ALASKA.—Mr. E. Kirk has published a description of Harpidium, a new pentameroid brachiopod from the Upper Silurian of south-eastern Alaska (Proc. U.S. Nat. Mus., vol. 66, art. 32). So far as at present known the genus is not represented elsewhere. It resembles Conchidium in its general proportions, and Pentamerus in being nonplicate, but Harpidium and Conchidium seem much closer genetically than either is to Pentamerus. No true Pentamerus has as yet been found in faunas of the north Pacific type, but in the interior of Alaska what appears to be a Pentamerus has been met with. The interior region of Alaska, however, has closer affinities with the Rocky Mountain geosyncline and the interior of America than it has with the true Pacific region. The more or less complete separation of Pacific and interior faunas seems to have held up to the time of the high middle Devonian, when there appears to have been fairly free communication between the two faunal regions. The author describes and figures three new species of Harpidium.

UPPER AIR IN EGYPT AND THE SUDAN.—The Ministry of Public Works, Egypt, has issued a Physical Department Paper, No. 17, on "The Upper Currents of the Atmosphere in Egypt and the Sudan," by Mr. L. J. Sutton, Director of the Meteorological Service. Pilot balloon observations were commenced at the Observatory of Helwân, 25 kilometres south of Cairo in 1907, and daily ascents have been made except on Fridays, during the four years 1920–1923. Other observations were made at Wadi Halfa, Khartoum, Mongala, and Roseires on the Blue Nile. The object of the paper is not only to find mean values of the wind velocity and direction at various heights but also, when possible, to associate these values with recognised types of pressure distribution at the surface; thus a study of the daily weather map will provide better assistance in anticipating the upper winds than can be obtained from mean values calculated without respect to the surface pressure. Eleven different types of weather in Egypt are considered, and the accompanying pressure and winds are illustrated by the several maps covering the surrounding neighbourhood for each. The frequency of occurrence for each type is given for the several months and for the year. The discussion will without doubt prove very helpful for aviation, and much valuable information is given of the upper air changes for the several stations and for the different types of weather.

A STUDENT'S THEODOLITE.—The teaching of practical surveying is often hampered by the fact that the number of instruments available for instructional purposes is small in relation to the number of students in the class. The cost of the apparatus is usually the cause of the scarcity. A Student's Theodolite, which has recently been placed on the market by Messrs. C. F. Casella and Co., Ltd., 49 Parliament Street, London, S.W.1, should help to overcome this difficulty. The tribrach, upper horizontal plates and standards are made of seasoned mahogany. The circles are of hard white celluloid, 6 inches in diameter, and engine machined to 1°. The telescope, which gives a magnification of about 4 diameters, has a fixed diaphragm, and both object-glass and eye-piece can be focussed. A graduated bubble and a trough compass are provided, and the instrument is mounted on a twofold tripod. The accuracy obtainable is not of the same order as that of a professional model, but the instrument reproduces all the essential features of a standard

transit theodolite. The outfit should prove of service not only in assisting students to obtain an acquaintance with the broad principles of survey work, but also in preparing them to use instruments with vernier or micrometer scales and other fine adjustments.

THE SPECTROSCOPIC DETECTION OF ISOTOPES.—In line spectra, due to electronic jumps in the atoms, the effect of isotopes is exceedingly minute, since the energy changes are governed by the amount of the nuclear charge, and the mass of the nucleus is of very little importance in determining the frequency of the emitted light. In a paper in the March issue of the *Physical Review*, Dr. R. S. Mulliken gives the results of an investigation of the band spectrum of boron monoxide, having shown in a previous paper that, in the case of a compound, one of the elements of which consists of two isotopes, two similar superposed band systems are to be expected, on somewhat different scales, and with intensities proportional to the relative amounts of the two isotopes in the element. The band spectra are due in part to electronic jumps, but also very largely to vibrations and rotations of the molecule, in which the masses of the nuclei are of importance, and the isotopic effects are considerable. Two such band systems exist in the spectrum of boron monoxide, the weaker and larger scale system being apparently due to the less abundant isotope, B^{10}, and the other to B^{11}. At certain positions in the spectrum, differences of more than 40 Å.U. were observed between the wave-lengths of corresponding band heads. The measurements agree in a remarkable manner with the theory.

MEAN FREE PATH OF NEUTRAL SILVER ATOMS IN NITROGEN.—Dr. F. Bielz describes, in the *Zeitschrift für Physik*, April 28, a series of measurements made with an apparatus similar to that previously employed by Prof. Born and Fraulein Borman. A stream of silver atoms passed from a chamber, which was heated in an electric oven, through a narrow tube, into a space containing cool nitrogen at a low pressure, forming a narrow "beam." Three small glass plates at different distances from the entrance tube could be shifted in turn into the path of the beam by means of a magnetic arrangement, the times of exposure of the three plates being nearly equal. The thin layers of silver deposited were treated with iodine vapour to convert them into silver iodide, and their thicknesses, which varied with the distance from the entrance tube, were measured, using an Abbe microspectroscope and the Wiener interference method. The mean free path of the silver atoms was then calculated by means of a formula derived by the author, and it was found that the product of pressure and mean free path was constant, within the limits of experimental error, for pressures of 1 to 7×10^{-3} mm. Hg. The radius of the neutral silver atom calculated from this product is 1·0 Å.U.; values ranging from 0·57 Å.U. to 1·78 Å.U. have been found by other observers using other methods. Dr. Bielz states that no source of error occurs in his experiments which would make his value too low.

OPTICAL PHENOMENA AND THE QUANTUM THEORY.—In the April number of the *Physical Review*, Dr. J. C. Slater puts forward a detailed theory of optical phenomena, based on suggestions already made by him in conjunction with Bohr and Kramers (*Phil. Mag.*, vol. 47, p. 785). The atoms are supposed to radiate and absorb during the stationary states, and the transitions from orbit to orbit influence radiation only by terminating the radiation characteristic of the first state and commencing that of the second. The strict law of conservation of energy does not hold, since the atoms do not change their energy while radiating, though the energy in the field of radiation increases during this interval; the atomic energy changes discontinuously during the transitions. There is, however, conservation of energy and of momentum, considering both the atomic energy and that of the radiation field, when an average is taken over a great number of atomic processes. The new suggestion is made that resonance radiation is to be identified with the radiation of the spherical wavelets which, by their interference with the external field, also produce absorption. Einstein's statement of the probabilities of the transitions of atoms is used, and the probability of interruptions of coherent vibrations is discussed. Detailed descriptions of the fields emitted, which consist of spherical wavelets with the frequencies of the various quantum lines which the atom can emit or absorb in its existing stationary state, are given, and it is shown how dispersion results. The assumptions made satisfy the correspondence principle, and the radiation field is essentially like that of the classical theory, which is known to agree generally with experiment. The theory gives a minimum value for the breadth of emission and absorption lines, which is the same for both classes and depends on the finite life of the wave-trains; Kirchhoff's law also holds for these lines. The applications of the new theory to emission of light by bombardment with electrons at the resonance potential, to resonance radiation and its quenching by foreign gases, and to absorption, scattering and dispersion are dealt with in a satisfactory manner.

TOTAL HEAT OF SUPERHEATED STEAM.—The electric lighting industry is looking forward to great improvements in steam generation in the boiler-house. During recent years the standard working steam pressures have risen from 200 lb. per sq. in. to 450 lb. per sq. in.; but much higher pressures are in use. The Edison Co. of Boston has boilers supplying steam at a pressure of 1200 lb. per sq. in. to a high back pressure turbo-generator. The exhaust steam is reheated to 700° F., and then enters a second turbine which is of ordinary construction. Engineers are contemplating even higher pressures. In the June issue of *World Power*, a valuable report by Prof. H. L. Callendar to the Electrical Research Association on the total heat of superheated steam at high pressures is published. Many conflicting tables have recently been published in Germany of the total heat at saturation. As a rule these have been obtained by extrapolating empirical formulæ representing small uncertain deviations at comparatively low pressures, little regard being paid to the well-known properties of fluids in the critical region. In this report Prof. Callendar describes a direct method of measuring the total heat which has already been applied successfully at moderate pressures and, provided the difficulty of regulating the pressure can be surmounted, there is no reason why it should not give with equal facility accurate results at the highest pressures obtainable. There are many advantages in the steady flow method of calorimetry which he adopts over the more ordinary methods. The difference of temperature to be measured is steady, and admits of direct observation by a single reading with a differential pair of platinum thermometers. No correction has to be applied for the water-equivalent which is so great a source of uncertainty at high temperatures. The flow of the fluid itself supplies sufficient stirring, and each part of the apparatus can be jacketed with its own flow. A discussion is given of the effect of time-lag in evaporation of nuclear drops. The primary object which the author has in view is the verification of the tables of the total heat near saturation, and his results will be of great value to the electrical industry.

Southampton Meeting of the British Association.

LOCAL ARRANGEMENTS.

THE week from Wednesday, August 26, to Wednesday, September 2, will see the British Association for the Advancement of Science at Southampton for the third time in its long history of ninety-five years. Twice in the past, in 1846 under the presidency of Sir R. I. Murchison, and also in 1882 under Dr. (afterwards Sir) Charles Siemens, has it met there, and this year will see it once again in Britain's premier passenger port under Prof. Horace Lamb, formerly of the University of Manchester. Arrangements have been made with British railways so that members of the Association attending the meeting may obtain return tickets to Southampton at the price of single fare and a third.

The Reception Room will be the King Edward VI. Grammar School, which is conveniently and centrally situated, facing the open space called the Marlands, on one side of which is the public stance for charabancs, while close behind it is the West Station on the main Southern Railway line from Waterloo to Weymouth, at which most of the visitors to the meeting will alight from their trains. For the convenience of the members it has been arranged with the railway authorities for a special train to be run from Waterloo on the day before the opening of the meeting (Tuesday, August 25). Within easy distance of the Grammar School are to be found the shops and restaurants of Above Bar Street, and an agreement has been reached with a firm of local caterers to take for the week of the visit the Coliseum, a hall capable of seating 1600, and run it as a restaurant at which lunches and teas may be had.

At the town end, within a short radius—half a mile at most—of the Reception Room, sections A, B, C, F, G, and M have found suitable accommodation. In the Free Library across the park from the Grammar School, C (Geology) comes nearest; opposite it, at the far corner of Brunswick Place and Dorset Street, A (Mathematics and Physics) occupies the Lamb Memorial Hall; farther up the street from the Free Library on the London Road we find in order B (Chemistry) at the Kell Hall, corner of Bellevue Road, and M (Agriculture) at the Friends' Meeting-House in Ordnance Road, immediately opposite the main entrance to the Ordnance Survey Office. In the opposite direction from the Reception Room, at the bottom of East Street, F (Economics) and G (Engineering) are housed in the new Wesleyan Central Hall, the auditorium of which will be the place of meeting for the presidential address on the evening of Wednesday, August 26, and also for the Children's and Citizens' Evening Lectures. The Royal Pier, in the pavilion of which the mayoral reception will be held on the evening of Thursday, August 27, is at a tramcar terminus not far from the south end of the High Street, which, passing northwards as Above Bar Street, London Road, and the Avenue, is the principal thoroughfare of the town. About the middle of the Avenue, section H (Anthropology) is located at the Avenue Hall, attached to the Avenue Congregational Church. The ordinary tramcar service passes by or very close to all these meeting-places, the last mentioned of which, the Avenue Hall, is the most distant, being about one mile from the Reception Room.

The remaining sections, D, E, I, J, K, and L, meet at the University College, Highfield: D (Zoology) in the main corridor to the right of the south entrance on the ground floor next to the Women's Common Room; E (Geography) in the Engineering block—associated with this section is the important exhibition of maps belonging to Sir George Fordham; I (Physiology) at the opposite end of the main corridor to D on the ground floor opposite the Men's Common Room; J (Psychology) in the Library and Senior Common Room on the first floor above I; K (Botany with the subsection of Forestry) on the first floor above D; and L (Education) in the newly built Assembly Hall opposite the College Refectory, where luncheons and teas may be had. This grouping of half the sections at the University College, which is rather remotely placed from the central Reception Room and is a good ten minutes' walk from the tramcar termini at either Bassett or Portswood, has necessitated for the convenience of the members a special bus service past the College buildings to join up with the rest of the town.

The University College has put its three hostels at the disposal of the Association. The largest, South Stoneham House, a Queen Anne mansion surrounded by beautiful grounds, will house the Secretariat; the next, Highfield Hall, will accommodate some sixty members as a hostel, and in the same way South Hill, a former residence of the Bishop of Southampton, about half that number. South Hill is situated some ten minutes' walk from the Bassett tramcar terminus or from the University College. Highfield Hall is on the Common, not far above the Avenue Hall; while South Stoneham, a former residence of Lord Swaythling, is at Swaythling, close to the car terminus and railway station of that name. It is fully two miles distant from the Reception Room and almost three miles from the Wesleyan Central Hall, though connected to both by electric tram service of some half an hour's duration.

Garden parties have been offered by Lord and Lady Swaythling at Townhill Park; Lord and Lady St. Cyres at Walhampton, near Lymington; and Mr. W. Collins at Westend; while the Cunard and White Star Companies, with their wonted generosity, have invited as many members as may care to go to see over one of their ships.

Southampton is remarkable for its fine open spaces, which stretch from the lower part of the town almost without break to the Southampton Common, the latter covering an area of more than 360 acres of virgin land. Its immediate environs include many places of great natural beauty. General excursions are being arranged to visit old Southampton, the Docks, New Forest, Stonehenge, and other places of interest in the neighbourhood. The full list of excursions, including sectional ones and visits to works, will be given later in detail. While tickets for the general excursions will be obtainable at a counter in the Reception Room, those for all the sectional excursions may be had from the local sectional secretaries at the various rendezvous of the sections during the week of the visit. The committee of the Royal Yacht Club has very kindly extended hospitality of honorary membership to the visiting members of the British Association.

Southampton, rich in historical associations, favoured by its geographical situation at the confluence of the rivers Itchen and Test, and unique in its modern commercial development, awaits the advent of the British Association into its midst with great interest. It is fully conscious of the honour conferred on it by such a visit, and is determined to make it the signal success which the occasion demands.

W. RAE SHERRIFFS.

Meteorology in the Republic of Colombia.

ON the occasion of the establishment of a new observatory at Bogotà, capital of Colombia, in connexion with a general reorganisation of official geophysics in the Republic, the director, the Rev. S. Sarasola, *S.J.*, is anxious that attention be directed to the first publication of the new institution (Notas Geofisicas y Meteorologicas, No. 1, Bogotà, 1924). This comprises a description of the new observatory, a history of previous observatories, in the work of which Baron Humboldt interested himself a century or so ago when travelling in South America, an account of the physical geography of Colombia, and a discussion of climatic, magnetic, and seismic conditions, together with copious meteorological statistics for Bogotà, at an altitude of about 9000 ft. on the eastern ridge of the Cordillera, and other cities.

Father Sarasola desires especially to make known that neither at Bogotà nor other places in this quarter of the globe does observation establish anything in the nature of a constant upper wind from the S.W. answering to the "anti-trade" of the text-books. It appears from the data relating to upper-cloud movements which are given, not only for Colombia, but also for neighbouring countries, including the West Indies, that the most prevalent direction of the upper current is S.E. rather than S.W. This, we would observe, is in conformity with the view that the real direction of the return or counter-trade in the northern hemisphere, at the equatorial limit, is S.E., becoming S.W. towards higher latitudes (see, for example, W. R. Blair's paper on the planetary circulation in the *Monthly Weather Review* for April 1916). But however this may be, we are really not surprised at Father Sarasola's failure to observe a constant anti-trade over Colombia, and we think that he may possibly be under some misconception as to the extent to which European meteorologists nowadays really believe in the *fixity* of the so-called trades and anti-trades. The fact of the matter is that these terms, though useful and proper generalisations from the facts of wind and pressure distribution as shown on mean or average charts, should not be applied too rigorously to actual momentary distributions without first of all formulating a definition of what a trade or anti-trade really is. Not only do the conventional trades moving round the flanks of the subtropical anticyclones shift their latitudinal limits with the seasons, but they also vary their position with changes in the day-to-day distribution of pressure, so that the task of identifying a given air-current as a "trade" would not always be possible without an exact definition which would be difficult to frame. We are therefore the more convinced, from the unfruitful search in Central and South America for the *stereotyped* anti-trade of the text-books, that the terms "trades" and "anti-trades," like "westerlies" of higher latitudes, should only be used in a generalised sense to denote the average trend of the circulation of the atmosphere within certain belts of latitude. At the same time we are fully aware that there are certain ocean tracts where unmistakable "trades" do blow very steadily for weeks on end in a way that the highly variable "westerlies" do not.

Since climate cannot be properly portrayed by statistics alone, which can never render local colour, it is pleasing to find Father Sarasola quoting a vivid description of a writer, Señor Caldas, of climatic conditions on the west coast of Colombia, which, with a mean annual rainfall of about 200 in., is one of the wettest regions of the globe. We render the passage from the Spanish: "It rains for the greater part of the year. Legions of clouds hurl themselves against the sky from the direction of the Pacific. The west wind, which reigns constantly over those seas, flings the vapours on to the continent where the Andes arrest them in full career. There the clouds accumulate and give the mountains a dark and menacing aspect. The sky vanishes, and on all sides appear nothing but heavy black clouds threatening all living creatures. An oppressive calm supervenes marking a terrible moment; then a hurricane of wind uproots immense trees, to the accompaniment of electrical explosions with dreadful crashes of thunder; the rivers leave their channels; the infuriated sea inundates the coast with gigantic waves; sky and earth are confused, and all seems to herald universal destruction. In the midst of so much turmoil the traveller turns pale; but the native of the Choco stays quietly at home in the bosom of his family, for long experience has taught him that the results of such convulsions of Nature are seldom mournful, that it is all nothing but light, water, and noise, and that within a few hours equilibrium and calm will be restored."

L. C. W. BONACINA.

Chlorocruorin.

THE study of the pigments occurring in Nature has shown that from both the hæmoglobin of animals and the chlorophyll of plants, substances of similar chemical constitution can be derived under the influence of appropriate reagents. These bodies are known as the porphyrins and are made up of pyrrol groups: but from this point the resemblance between hæmoglobin and chlorophyll ceases, since the former contains iron in its molecule, while magnesium is present in the latter; also the other groups present in the respective molecules and the functions of the substances themselves are different. How far the resemblance between these two pigments is significant is uncertain, since the details of the synthesis of hæmoglobin in the animal body are unknown, but it is possible that the pyrrol rings have some special property which serves as a useful basis on which to build up more complex substances with the peculiar properties of hæmoglobin and chlorophyll respectively. In this event the difference in their functions will be largely due to the other constituents of their molecules.

There appears to be no reason, however, why other substances derived also from the porphyrins should not be found in Nature, if compounds with similar, or possibly even dissimilar, properties to hæmoglobin or chlorophyll are required in the economy of the organism. An example is chlorocruorin, the green pigment in the plasma of certain polychætes (the Chlorhæmidæ and the Sabelliformia). H. Munro Fox (Proc. Cambridge Philosophical Society (Biological Sciences), 1924, vol. i. p. 204) has recently given an account of some of the properties of this substance. The specimen examined was obtained from the blood of *Spirographis Spellanzanii*: and although green in colour it is related to hæmoglobin, in that the porphyrin from which it is derived is the same as, or closely allied to, hæmatoporphyrin. The pigment exists in both the oxidised and reduced forms, and from it a series of derivatives can be obtained which resemble those obtained from hæmoglobin. The spectra of these derivatives are in many cases very similar to those of the parallel derivatives of hæmoglobin but with the bands shifted towards

the red end of the spectrum: in a few cases the resemblance between the derivatives is less close. Even when the protein part of the molecule has been removed, leaving the hæmatin derivative, the two hæmatins are not the same, so that although each consists of porphyrin + iron, the method of combination must be different. Further divergence occurs when the protein is added to the iron-containing part of the molecule.

The chemical similarity between chlorocruorin and hæmoglobin suggests a similarity of function also. Indeed the author shows that chlorocruorin can act as a respiratory pigment, in that the oxidised form can be reduced by exposure to a vacuum or by living tissues. The amount of oxygen in the blood of Spirographis appears to be about one-third of that found in a similar quantity of human blood. The function, however, of this pigment in the economy of the worm is uncertain, since the blood does not undergo a complete circulation. Although it may not convey oxygen from the surrounding medium to the body tissues as hæmoglobin does, yet it may permit of a more active gas exchange and perhaps, at times, make the worm less dependent on the oxygen in the surrounding water. Chlorocruorin thus appears to be "a unique case of the parallel evolution of a substance resembling hæmoglobin."

University and Educational Intelligence.

ABERDEEN.—Applications are invited from graduates of the University of Aberdeen for the Wilson Travelling Fellowship, which is for archæological and anthropological research in the near East, including the Balkan Peninsula, Asia Minor, Palestine, Egypt, and Mesopotamia. The fellowship is of the annual value of 300*l.*, with a possible increase, and is tenable for two years. Applications must be received before August 1 by Mr. A. Martineau, 1 Golden Square, Aberdeen.

BELFAST.—At the Summer Graduation Ceremony of the Queen's University, held on Friday, July 10, Prof. F. G. Donnan of University College, London, received the degree of D.Sc. *honoris causa*. After a very distinguished career as an undergraduate of Queen's College, Belfast, Prof. Donnan obtained his degree with the highest honours in the late Royal University; and as professor of chemistry in the University of Liverpool and in University College, London, he has done work which has gained for him a foremost position amongst chemists. The degree of D.Sc. *honoris causa* was also conferred upon Prof. E. W. MacBride, professor of zoology of the Imperial College of Science and Technology, London. Prof. MacBride was a student and scholar of Queen's College, Belfast. He entered St. John's College, Cambridge, of which he became a fellow, and he also graduated with the highest honours in the University of London. His work as a zoologist at McGill University, Montreal, and the Imperial College, London, is well known.

BIRMINGHAM.—Sir Oliver Lodge has been appointed Huxley lecturer for session 1925–26, the subject of his lecture being "Difficulties of the Ether."

Dr. G. F. Still has been appointed Ingleby lecturer for 1926, and Dr. Leonard G. Parsons for 1927.

Prof. Leonard Gamgee has presented to the University a sum sufficient to provide a gold medal to be awarded annually to the candidate who passes the summer final examination for the M.B., Ch.B. degree and who gains the highest marks for surgery. The medal is to be called the Sampson Gamgee medal and is in memory of Prof. Gamgee's father, who worked for many years in the Birmingham Medical School.

Prof. T. Turner has been elected Dean of the faculty of science in succession to Prof. F. W. Burstall, his term of office beginning on September 1.

At the recent degree congregation there were conferred, among others, the following degrees:—D.Sc., 3; Ph.D., 5; M.Sc., 11; B.Sc. with Honours, 80; B.Sc. (Ordinary), 58.

EDINBURGH.—Prof. Shield Nicholson has resigned the chair of political economy, to which he was appointed in 1880.

The University Court at its meeting on June 15 approved the terms of an ordinance for the foundation of the Abercromby chair of archæology.

The resignation of Mr. J. F. Rees, reader in economic history, was received and was accepted with regret. The University Court congratulated Mr. Rees on his appointment to the chair of commerce in the University of Birmingham, recently vacated by Sir William Ashley.

Intimation was received of a legacy by Miss Catherine S. Howden of 5000*l.* to found a scholarship for research work, preferably in the domain of nervous diseases, and of a gift of 50*l.* by Mrs. John Harrison, to be applied in assisting the printing of research papers by members of the University.

Dr. J. M. Woodburn Morison of Manchester has taken up the duties of lecturer in electrical therapeutics and radiology, which is part of a new course in clinical pathology.

LONDON.—Prof. E. A. Gardner has been re-elected Vice-Chancellor for the year 1925–26.

The title of professor of mycology in the University has been conferred on Mr. E. S. Salmon in respect of the post held by him at the South-Eastern Agricultural College. The title of reader in mycology in the University was conferred on Mr. Salmon in 1912, and since that date he has published numerous papers on fungous diseases of plants and on fungicides.

The title of emeritus professor of hygiene and public health in the University has been conferred on Sir William J. R. Simpson, as from the end of the present session, on his retirement from King's College, after twenty-seven years' service, on the closing of the Department of Bacteriology and Public Health.

ST. ANDREWS.—M. Étienne Gilson, Professor of the Philosophy of the Middle Ages at the Sorbonne, Paris, has just published a text of René Descartes' "Discours de la Méthode" with a commentary. The volume is dedicated to the University of St. Andrews, which has recently bestowed the degree of LL.D. upon M. Gilson.

We learn from *Science* that Mr. G. E. Merrick has given 160 acres of land and a sum of 5,000,000 dollars towards the establishment of a university in Miami, Florida. The university, which was granted a charter on April 5, will be non-sectarian and co-educational.

APPLICATIONS are invited by the Royal College of Physicians for the Streatfeild Research Scholarship in medicine and surgery, the annual value of which will probably be 250*l.* and the tenure three years. Applications must reach the Registrar of the College, Pall Mall East, S.W.1, not later than October 1.

THE Dickinson Travelling Research Scholarship in medicine, which is open to students of the University and Infirmary, Manchester, has been awarded by the Trustees of the Manchester Royal Infirmary to Dr. Raymond Williamson and to Mr. Leslie J. Witts.

THE London School of Hygiene and Tropical Medicine is prepared to consider from qualified medical practitioners applications for four research

studentships in tropical medicine and hygiene. The studentships are each of the value of 250*l.* yearly and will normally be for two years. The latest date for the receipt of applications, which should be sent to the Secretary of the School, 23 Endsleigh Gardens, N.W.1, is August 31.

APPLICATIONS are invited by the council of the University College of the South-West of England, Exeter, for the Andrews Simons research studentship, value 120*l.*, for the furtherance of experimental research in physics, chemistry, or other branch of science. The applications must be received by the Registrar not later than August 1.

THE Royal Commissioners for the Exhibition of 1851 have made the following appointments to Senior Studentships and Overseas Scholarships for 1925:—*Senior Studentships*: Mr. O. M. B. Bulman, Imperial College of Science and Technology (Geology); Mr. P. A. M. Dirac, Cambridge (Mathematical physics); Mr. I. R. McHaffie, University College, London (Physical chemistry); Mr. H. W. B. Skinner, Cambridge (Physics); and Mr. D. L. Thomson, University of Aberdeen (Bio-chemistry). *Overseas Scholarships*: Mr. C. L. Huskins, Alberta (Cytology); Mr. A. R. Fee, British Columbia (Biology); Mr. C. S. Hanes, Toronto (Biology); Mr. J. G. Wood, Adelaide (Botany); Mr. V. M. Trikojus, Sydney (Organic chemistry); Mr. S. W. Watson, South Africa (Physics); Mr. R. S. Allan, New Zealand (Geology); and Mr. J. J. Lennon, University College, Dublin (Organic chemistry).

THE Ramsay Memorial Fellowships for chemical research are administered under a scheme framed on an international basis, the participating countries being Great Britain and Ireland, Canada, Denmark, France, Greece, Italy, Japan, the Netherlands, Norway, Spain, Sweden, and Switzerland. The fellowships, sixteen in number, are tenable in any university or other place in the United Kingdom possessed of the requisite facilities for research. In a speech made in response to the toast of the trustees of the Ramsay Memorial Fellowships proposed by Sir William Bragg at a dinner given at University College, London, on July 3, Sir Robert Hadfield expressed the opinion that the bringing into our midst of young chemists selected from other countries to undertake research work has been a great success in promoting friendly relations and mutual understanding between men of science of different countries. He quoted with approval a suggestion made by a former fellowship holder, Prof. Henri Weiss of the University of Strasbourg, that the fellowships should be extended and young British skilled research workers should be sent to foreign universities. This theme—the rôle of the *savant* abroad as not only purveyor of light but as promoter of peace and goodwill—is one on which quite a number of public pronouncements have been made in Great Britain during the past six months by eminent men of science, and it was discussed at length at the annual conference of the Universities of Great Britain and Ireland on May 9. In the United States likewise it has been much discussed and large sums of money have been appropriated to translating aspirations into actualities, such as the John Simon Guggenheim Memorial Foundation, to which a "preliminary" gift of 3 million dollars has been made, to provide annually from forty to fifty fellowships for "advanced study abroad." The American Council on Education has published in the *Educational Record* for April a list of seventy-six organisations interested in such relations, and proposes to invite them all to a conference to be held at Washington in the autumn.

Early Science at Oxford.

July 21, 1685. Mr. President being in the Chair acquainted the Society that in Northamptonshire about two or three miles from Astrop, there is dug a heavy black earth, which being calcined comes to a black sand, some of which he was pleased to shew us, almost as heavy as ye earth: A Magnet being applied to this sand, was seen to attract it.

A letter of Mr. Leewenhoeck's concerning ye Generation of man &c: from an insect was read.

Dr. Bernard presented some papers of Mr. Greaves giving an account of some experiments made at Woolwich in ye year 1651 for ye triall of great guns.—The Doctor also presented ye Society with a *Cornu Ammonis*, some *Belemnites*, *Lignum fossile*, *Ostracites*, all which were dug out of a well on a hill near Faringdon.

A Letter from Mr. Aston dated July 15 was read; it affirmes ye true Zaffer is nothing but Kobalt calcined, ye comon Zaffer being adulterated with pebbles.

Dr. Plot presented a Persian wood, which was observed to sink in water; and a Hen's egge sent him from out of Yorkshire, having a round hole at one end of about half an inch diameter: this hole was exactly fitted by a little cap of ye same matter with ye rest of ye shell, but more protuberant, than ye end of an Egg-shell is naturally, and full of wrinkles; the Cap is said not to have been continued to ye main body of ye shell, but sticking close by its inner side to ye membrane, was by these meanes kept as a cover on ye hole.

A letter from Mr. Cole of Bristoll, dated July 16th, was communicated by Dr. Plot and read.

July 22, 1684. Two Letters from Mr. Aston, one dated July ye 10, ye other 17, were read: An Abstract of a Letter from Dr. Huntingdon sayes, that Mr. Tennant, a gentleman in Ireland, has lately invented an Engin for ye throwing of water, far exceeding that of Sir Samuel Moreland.

Some of ye curiosities lately presented to ye University by Mr. Cole of Bristol, were communicated to ye Society by Dr. Plot; as first, Sal Gemmæ from St. John de Port Rico, one of ye Leeward Islands near Jamaica. It breaks generally into squares; is transparent near four inches thick, so that at that thickness ye motion of a finger, playing up and down, may easily be discerned. Secondly, Silk Grass of three yards long found in ye swomps, or moorish grounds, in Virginia, growing upon a tall plant from which it is strip't like Hemp. Thirdly Neopolitan black writing sand, which applyed to ye Magnet in great quantitys, and much more readily than ye *ferrum Noricum*, or any other ore we have yet seen. Some of this sand being calcined by Dr. Plot, ran into a mass, which, when cold, was very brittle. Other experiments will be tried on this sand by ye Doctor, of which we are promised an account.

Mr. Conningham affirms, that Sal Gemmæ is commonly thrown up by ye Lammas floods within six miles of St. Andrews, and used by ye poor people instead of common salt.

A letter from Mr. Flamsteed to Mr. Caswell, concerning ye late eclipse of ye Sun, and ye *Maculæ Solis* observed by him, was read. This great Astronomer does, in this letter, seem to question, whither these spots, seen by him, were not two differing spots, rather than revolutions of ye same spot; altho ye manner of their course along ye disc of ye Sun, seems to be much alike, and therefore argues ye latter.

Societies and Academies.

LONDON.

Royal Meteorological Society, May 20.—F. W. **Harmer** and C. E. P. **Brooks**: Further remarks on the meteorological conditions of the Pleistocene epoch. The chief difference between the North Atlantic and North Pacific Oceans is that the former is open to the north, while the latter is practically closed to the north. Hence in the Atlantic the Gulf Stream travels north-eastward into the Arctic Ocean, while in the Pacific the Japan current is forced to turn south-eastward along the coast of America. This difference causes differences in the pressure distribution; both oceanic and atmospheric circulation combine to give western Europe a more genial climate than the west of North America. The closing of the Greenland-Europe channel would bring about changes in the oceanic and atmospheric circulations which would suffice to cause a glacial epoch in Europe. The diversion of the storm tracks and the consequent alteration in the direction of the prevalent winds are probably even more important than the changes in the currents. The second part of the paper deals with the climatic changes in the Mediterranean region during the glacial period; the crowding together of the isotherms in southern Europe caused a great increase of storminess there, to which was due the torrential rains of which we have evidence.—Sir Gilbert T. **Walker**: On periodicity. Proposals that have been made in recent years for modifying Schuster's periodogram; a new criterion for the reality of a period, with some applications to meteorological data, is given.—Harold **Jeffreys**: On fluid motions produced by differences of temperature and humidity. It has been shown that the maintenance of a difference of temperature between parts of the same level surface in a fluid will necessarily maintain a permanent motion of the fluid, and that heating or cooling a fluid at an internal boundary will also maintain a permanent movement. A corresponding theorem is true for the supply of new constituents instead of heat. This result appears to contradict a theorem given by Sandstrom and Bjerknes, to the effect that a permanent motion is possible only if the place where the heat is supplied is at a lower level than that where it is removed; but the arguments of these authors involve an unstated assumption, which seems to be untrue. Sandstrom's experiment, in which no motion was observed in a tank under conditions suited to the production of a circulation, is capable of a dynamical explanation based on the slowness of conduction and the consequent confinement of the currents to narrow regions where they would be very difficult to observe. It appears unlikely that it will often be possible to proceed by analogy from this experiment to the dynamics of wind, for radiation and turbulence will always redistribute the heat in such a way as to produce general currents; but there may be some applications to ocean currents.—A. H. R. **Goldie**: Gustiness of wind in particular cases. Deals particularly with examples from the anemograph records of Falmouth Observatory during periods of S.W. wind. It was found that the time interval of the rise and fall of the anemograph pen and of the breaking of the waves on the shore approximated to seven seconds. A further investigation at Lerwick showed that the normal relation between "range of gusts" and "hourly mean wind," in the case of equatorial currents, is about one-third and nearly independent of velocity.

SHEFFIELD.

Society of Glass Technology, May 25 and 26.—W. E. S. **Turner**: The nature and constitution of glass. The abnormal properties recently observed in glass when heated in the annealing range (such as greatly increased thermal expansion, heat absorption, and modification of specific electrical conductivity; and the changes of density and refractive index on heat treating glass) have their counterpart in the changes of plasticity which glass exhibits when remelted or when the raw materials have considerable quantities of moisture or of certain salts present. Two fundamental factors are involved; molecular complexity and the presence of compounds in glasses.—G. **Tammann**: On glasses as supercooled liquids. A discussion of the influence of degree of undercooling, nucleus number, viscosity and other factors on the production of the glassy state. The customary soda-lime-silica glasses may be regarded as ternary mixtures of Na_2SiO_3, $CaSiO_3$ and SiO_2. The two components Na_2SiO_3 and $CaSiO_3$ crystallise readily, as do their mixtures, from which mixed crystals separate. With an excess of silica the nucleus number of these mixed crystals is reduced extraordinarily, so that mixtures with an excess of 8 per cent. of silica or more solidify as glasses.—A. Q. **Tool** and E. E. **Hill**: On the constitution and density of glass. A glass is intermediate between the liquid and solid states. Its condition at ordinary temperatures may be considered as undercooled, not alone with regard to the process of crystallisation, usually known as the true solidification, but also with respect to the completion of many processes normal to the vitreous condition. The maximum density change observed was 1·10.—G. W. **Morey** and N. L. **Bowen**: The ternary system sodium metasilicate-calcium metasilicate-silica. The following new compounds have been found and their properties determined. The compound $2Na_2O$, CaO, $3SiO_2$, which melts incongruently, forming a liquid richer in Na_2SiO_3 and Na_2O, 2CaO, $3SiO_2$; the compound Na_2O, 2CaO, $3SiO_2$, which has a congruent melting point at 1284°; and the compound Na_2O, 3CaO, $6SiO_2$, which melts incongruently at 1045°, forming a mixture of wollastonite and a glass containing approximately 15 per cent. CaO, 67 per cent. SiO_2.—R. W. G. **Wyckoff** and G. W. **Morey**: X-ray diffraction measurements on some soda-lime-silica glasses. (A preliminary note.) In some instances the broad bands thought to be characteristic of glasses have been found. In others narrow bands or lines have been obtained which are as sharp as the lines produced by crystals of colloidal dimensions.—Sir W. H. **Bragg**: The structure of quartz. Quartz changes its structure on passing through 575°. The high-temperature quartz is more symmetrical than the low, but the change is not severe. The four unknown quantities in low-temperature quartz reduce to one on passing to the high-temperature form; the silicon atoms are fixed, and the oxygen atoms must lie on certain straight lines. Attempts to fix the positions of the oxygen atoms can be made, based on intensity measurements. The most probable value shows, somewhat unexpectedly, that each silicon atom is at the centre of a regular tetrahedron of which the four corners are occupied by oxygen atoms. Assuming that the low-temperature quartz is not very different from the high-temperature quartz, the various twinnings of quartz are readily accounted for.—Vaughan H. **Stott**: The viscosity of glass. Final relations between viscosity and composition, in which errors due to impurities or inaccurate compositions generally are not considerably greater than the errors of the viscosity determinations

themselves, cannot be obtained unless the glasses are prepared from materials of known purity and melted without contamination. This at present precludes the melting of large pieces of glass, and limits the design of viscosimeters.

PARIS.

Academy of Sciences, June 15.—The president announced the deaths of Louis Gentil and Dr. Depage.—A. **Haller** and René **Lucas**: The rotatory powers of certain derivatives of camphor. Seven derivatives of camphor were studied. The specific rotatory powers were measured for seven wave-lengths (γ=6708 to 4358) in four solvents (alcohol, benzene, carbon disulphide, cyclohexane). The rotatory power varied considerably with the solvent. —J. **Costantin**: An old asymbiotic culture at the *Muséum*.—Louis **Lumière**: Concerning the invention of the kinematograph. A claim for priority.—J. **Haag**: The probability in a circle.—Bertrand **Gambier**: Surfaces of which a finite or infinite number of asymptotics belong to a linear complex.—Maurice **Fréchet**: Abstract point transformations.—N. **Lusin**: The properties of projective ensembles.—P. J. **Myrberg**: Automorph functions.—B. **Galerkin**: The tensions of a prism having a rectangular isosceles triangle as base.—Paul **Woog**: Measurements of oily friction. Data are given for various oils, either alone or with the addition of fatty acids.—André **Metz**: A relativist definition of simultaneity.—T. **Peczalski** and G. **Mokrzycki**: Study of chemical compounds of salts in the electric arc. The distance between the electrodes of the arc and the intensity of the current were kept constant. Mixtures of oxides were placed in a crater on the positive electrode and the fall of potential measured. The curve obtained by plotting composition of the salt mixture against the volts indicated the formation of compounds.—N. **Pariselle**: Contribution to the study of the rotatory power and dispersion in the terpene series.—N. **Pauthenier**: The rotating arc between carbon electrodes.—Marcel **Peschard**: The magnetisation of ferro-nickel: saturations and atomic moments. —Jean Jacques **Trillat**: Study of soaps and fats by means of the X-rays.—A. **Boutaric** and Mme. Y. **Manière**: The influence of very small quantities of foreign substances on the stability of colloidal solutions. The addition of a small quantity of an electrolyte to a colloidal suspension may protect the solution against the flocculating action of an electrolyte, may accelerate the flocculation, or may be without effect. The results of experiments with two different electrolytes on a colloidal solution of sulphide of arsenic are given in the form of a table.—A. **Damiens**: An artificial magnesium silicate.—V. **Auger** and T. **Karantassis**: Researches on the complexes of stannic iodide. The compounds Rb_2SnI_6, Cs_2SnI_6, and $[As(CH_3)_4]_2SnI_6$ have been isolated.—P. **Lebeau** and P. **Marmasse**: The estimation of carbon dioxide and carbon monoxide. The carbon dioxide is removed by cooling with liquid air, which at the same time removes higher homologues of methane, ethylene, acetylene, and other gases likely to interfere with the iodine pentoxide reaction. The gas is then passed over iodine pentoxide at 150° C. and the carbon dioxide resulting from the oxidation of the monoxide again removed at −190° C. The method has been applied to the determination of carbon monoxide in commercial hydrogen and also to the search for carbon monoxide in gases from borings at Pechelbronn: the results in the last-named gases were negative. Air gave traces of carbon monoxide (less than 5 parts per million).—Paul **Pascal**: New complexes of iron derived from the triazines.—Charles **Prévost**: Methylphenylbutadiine.—P. **Gaubert**: The spherolites of reamurite.—Louis **Longchambon**: The polymorphic transformations of silica.—Jacques de **Lapparent**: The relations between the hydrocarbons and carbonates in silex and the phtanites.—Maurice **Jean**: The nature of the internal liber of the seedling of *Convolvulus tricolor*.—A. **Tronchet**: Polycotyly and schizocotyly in *Dimorphotheca pluvialis*.—M. **Bridel** and P. **Picard**: The preparation and properties of monotropitoside. 60 grams of this glucoside have been extracted from 20 kilograms of bark of *Betula lenta*. Full details of its physical and chemical properties are given. It furnishes methyl salicylate, glucose, and xylose on hydrolysis.—René **Jeannel**: The homologies of the articulations of the leg in insects.—Stéphane **Dombrowski**: The permanent regimes of concentration in a convection current and its application to physiology.—Alphonse **Labbé**: The curves of growth of *Artemia arietina*.

ROME.

Royal Academy of the Lincei, April 4.—Leonida **Tonelli**: Problem of primitive functions.—Gabriella Armellini **Conti**: Observations of the position of the planet Uranus on the occasion of its conjugation with 96 Aquari.—O. M. **Corbino** and E. **Persico**: Secondary oscillations in a generator with a three-electrode lamp. —A. L. **Herrera**: Photomicrographs showing karyokinesis figures in metaformaldehyde crystals.—F. **Sbrana**: Characteristic property of polyharmonic functions and solutions of the equation of vibrating membranes. — Umberto **Crudeli**: Rutherford-Bohr triangular systems in relative equilibrium.—D. J. **Struik**: Irrotational waves in channels.—G. **Ponte**: Vulcanological investigations. Vulcanism causes a gradual impoverishment on the earth, not only of atmospheric oxygen but also of water vapour, similar to that which seems to have taken place with greater intensity on the moon.—E. **Adinolfi**: Influence of X-rays on the crystallisation of bismuth. X-rays exert on bismuth, during its crystallisation, an effect similar to, but distinct from, that caused by impurities, and varying with the hardness of the rays used.—Enrico **Fermi**: Relation between the constants of the infra-red bands of triatomic molecules. For these molecules, the three atoms of which must lie in one plane, the expression

$$\frac{1}{\Delta\nu_1}=\frac{1}{\Delta\nu_2}+\frac{1}{\Delta\nu_3}$$

is deduced for the relationship between the constant frequency differences of the lines in the infra-red band. The only triatomic molecule for which the necessary data are available is that of water vapour, and in this case the above equation holds within the limits of experimental error.—U. **Sborgi**: Electronic theory of the anodic behaviour of metals, especially of those exhibiting passivity phenomena.—G. **Malquori**: Mixed silver-copper basic salts. Investigation of the system $Cu(OH)_2-AgNO_3-H_2O$ indicates the existence of only one mixed basic salt, which has the composition $3\,Cu(OH)_2, 2AgNO_3, 3H_2O$, and is stable in the presence of silver nitrate solution of concentration not lower than 0·78 per cent.—Luigi **Settimj**: Transformation of nitrogen compounds (proteins) in preserved food produce. In food materials, whether tinned or in contact with the air, the insoluble nitrogen compounds undergo gradual transformation with production of an equivalent quantity of soluble nitrogen compounds. —P. **Pasquini**: Further considerations on the formation of the pecten in the development of the eye of *Gallus domesticus*. The evolution of the pecten in the development of the fowl's eye consists in a gradual lamination of the original pecten with consequent increase in its height in the vitreous humour; further, the lamina develops longitudinal folds, which increase its surface of contact with the vitreous body.—Umberto **D' Ancona**: Nerve endings in the somatic muscles of the decapod crustaceans.

Official Publications Received.

Annales de l'Observatoire Royal de Belgique. Troisième Série, Tome 2, Fascicule 1. Publié par P. Stroobant. Pp. 74. (Tournai: Imprimerie des Établissements Casterman S.-A.)

Studies from the Plant Physiological Laboratory of Charles University, Prague. Edited by Prof. Dr. B. Němec. Vol. 2, 1924. Pp. 106+5 plates. (Prague.)

Carnegie Institution of Washington: Eugenics Record Office. Bulletin No. 24: Body Build; its Development and Inheritance. By C. B. Davenport. Pp. 42. (Cold Spring Harbor, Long Island, N.Y.)

City and County of Kingston upon Hull, the Third Port of the United Kingdom. By T. Sheppard. (British Empire Exhibition, Wembley, 1925: Hull Civic Fortnight, July 7th to 20th.) Pp. 40+10 plates. (Hull.)

Memoirs of the National Academy of Sciences. Vol. 20: The American Oaks. By William Trelease. Pp. v+255+420 plates. (Washington: Government Printing Office.) 3.25 dollars.

Statens Meteorologisk-Hydrografiska Anstalt. Årsbok, 6, 1924. 2: Nederbörden i Sverige. Pp. 159. (Stockholm.) 5 kr.

Annals of the (Mededelingen van het) Transvaal Museum. Vol. 11, Part 2, containing: Native Dolls in the Transvaal Museum, by A. Radcliffe Brown; 1: Initiation of Girls in the Masiyeni District, Portuguese East Africa, 2: Note on the Decorations on Carved Wooden Food-Bowls from South Chopiland, Portuguese East Africa, 3: On some Ritual Objects of the Vandau in South Chopiland, Gaza, Portuguese East Africa, by E. Dora Earthy; On the Development of the "Epipubis" of *Xenopus*, by Dr. C. G. S. de Villiers. Pp. 99-135+plates 9-26. (Cambridge: Printed at the University Press.)

Department of the Interior: U.S. Geological Survey. Bulletin 751: Contributions to Economic Geology (Short Papers and Preliminary Reports), 1923-24. Part 2: Mineral Fuels. Pp. vi+321-326. Bulletin 760-C: Erosion by Solution and Fill. By Willis T. Lee. (Contributions to the Geography of the United States, 1923-24.) Pp. ii+107-121+plates 23-30. Bulletin 780-A: The Melrose Phosphate Field, Montana. By R. W. Richards and J. T. Pardee. (Contributions to Economic Geology, 1925, Part 1.) Pp. iv+32+2 plates. Water-Supply Paper 520-F: Temperature of Water available for Industrial Use in the United States. By W. D. Collins. (Contributions to the Hydrology of the United States, 1923-1924.) Pp. ii+97-104+plates 8-11. Water-Supply Paper 520-G: Some Floods in the Rocky Mountain Region. By Robert Follansbee and Paul V. Hodges. (Contributions to the Hydrology of the United States, 1923-1924.) Pp. ii+105-129+iv. Water-Supply Paper 523: Surface Water Supply of the United States, 1921. Part 3: Ohio River Basin. Pp. vi+316+2 plates. 30 cents. Water-Supply Paper 531: Surface Water Supply of the United States, 1921. Part 11: Pacific Slope Basins in California. Pp. vii+304+2 plates. 25 cents. Water-Supply Paper 536: Surface Water Supply of the New-Kanawha River Basin, West Virginia, Virginia and North Carolina. Pp. iv+282+2 plates. 35 cents. Water-Supply Paper 539: Geology and Ground-Water Resources of Townsend Valley, Montana. By J. T. Pardee. Pp. iv+61+2 plates. 15 cents. (Washington: Government Printing Office.)

Spisy vydávané Přírodovědeckou Fakultou Masarykovy University (Publications de la Faculté des Sciences de l'Université Masaryk). Čis. 47: Systém vodních toků na základě odtoku (Le système des eaux courantes d'après leur débit d'eau). Napsal Dr. Fr. Kolářek. Pp. 97. Čis. 48: Bromonoyakain (La brome-novocaïne). Napsali J. Frelka a J. Vitha. Pp. 22. Čis. 49: On the Growing Reactions, produced by the Change of Hydrogen-Ion Concentration in Germinating Roots of *Pharbitis hispida* Choisy. By Ferd. Heršik. Pp. 21. Čis. 50: Sur les probabilités géométriques. Par B. Hostinský. Pp. 26. Čis. 51: Výklad vzniku krátkých elektromagnetických vln v elektronových lampach (An Explanation of the Origin of Short Electromagnetic Waves in Valves). Napsal Dr. Josef Sahánek. Pp. 28. Čis. 53: La valeur osmotique et la réaction actuelle de l'eau du Golfe de Villefranche, à quel point sont elles constantes? Par Vladimír Morávek. Pp. 11. Čis. 54: Studie o inteligenci kočky, 2 (Studies on the Intelligence of the Cat, 2). Napsal Dr. Vladimír Teyrovský. Pp. 48. (Brno.)

British Museum (Natural History). Famous Naturalists. Series No. 1, Set H.2. 10 post cards in monochrome. (London: British Museum (Natural History).) 1*s*.

Bulletin of the American Museum of Natural History. Vol. 52, Art. 2: Scientific Results of the Expedition to the Gulf of California in Charge of C. H. Townsend, by the U.S. Fisheries Steamship *Albatross*, in 1911. 15: The Amphipoda collected by the United States Fisheries Steamer *Albatross* in 1911, chiefly in the Gulf of California. By Clarence R. Shoemaker. Pp. 21-61. (New York.)

The Iwata Institute of Plant Biochemistry. Publication No. 1: Untersuchungen über den Japanlack. Von Prof. Rikō Majima. Pp. x+154+3 Tafeln. (Tokyo.) 2.50 dollars.

Scientific Papers of the Institute of Physical and Chemical Research. Nos. 24-25: X-ray Analysis of the Solid Solutions of Potassium Chloride and Potassium Bromide, by T. Sasahara; X-ray Analysis of Electrolytic Brass, by H. Nakamura. Pp. 277-292. 35 sen. No. 26: On the Mercury Line 2270A ($1S$-$2p_1$). By T. Takamine and M. Fukuda. Pp. 293-298. 25 sen. No. 27: Condensation of Nitriles with Thiamides. 4: Thiamide with Aniliminochlorides. By S. Ishikawa. Pp. 299-304. 25 sen. (Tokyo: Komagome, Hongo.)

Meddelelser fra Kommissionen for Havundersøgelser. Serie Fiskeri, Bind 7, Nr. 7: On the Fishery of the Greenlanders. By Ad. S. Jensen. Pp. 39. 3 kr. Serie Fiskeri, Bind 7, Nr. 8: On the Influence of the Currents upon the Frequency of the Mackerel in the Kattegat and adjacent parts of the Skagerak. By Dr. A. C. Johansen. Pp. 26. (København: C. A. Reitzel.)

New South Wales. Department of Mines: Geological Survey. Mineral Resources No. 33: The Gypsum Deposits of New South Wales. By Leo J. Jones. Pp. 45+14 plates. 2*s*. 6*d*. Bulletin No. 13: Chromium, Cobalt, Nickel; Zirconium, Titanium, Thorium, Cerium. By H. G. Raggatt. Pp. 17. 1*s*. Bulletin No. 14: Asbestos, Emery, Fluorspar, Fuller's Earth, Graphite, Phosphates, Talc, and Soapstone. By H. G. Raggatt. Pp. 31. 1*s*. Bulletin No. 15: Diatomite; Siliceous Earths and Sands. By E. J. Kenny. Pp. 18. 1*s*. (Sydney: Alfred James Kent.)

Lady Minto's Indian Nursing Association. Report for 1924. Pp. 167. (Simla.)

Year-Book of the Department of Agriculture, Ceylon, 1925. Pp. ii+52+8 plates. (Peradeniya, Ceylon.)

University of Illinois Engineering Experiment Station. Bulletin No. 147: Investigation of Antennae by Means of Models. By Prof. J. Tykocinski-Tykociner. Pp. 60. (Urbana, Ill.) 35 cents.

New York Zoological Society. Report of the Director of the Aquarium. (Reprinted from the Twenty-ninth Annual Report of the New York Zoological Society.) Pp. 15. (New York.)

The Scientific Proceedings of the Royal Dublin Society. Vol. 18, N.S., Nos. 5-9. 5: The Interpretation of certain Empirical Standards in their Application to Irish Butter, by George Brownlee; 6: The Theory of Variation of Flow in Pipe-lines with Surge Chambers consequent on Variation of Load on Hydraulic Turbines operated Therefrom, by H. H. Jeffcott; 7: The Variations in the Quantity of Food required by Cattle for Maintenance and Fat Production with different Kinds of Rations, by James Wilson; 8: The Identity of Vitamin A. The Comparative Effects of Human and Cow's Milk, by Harold Pringle; 9: On the Photo-electric Measurement of Submarine Illumination, by H. H. Poole. Pp. 49-115. (Dublin: Royal Dublin Society; London: Williams and Norgate, Ltd.) 5*s*.

Report of the Fourth International Seed Testing Congress: Compte rendu du 4me Congrès international d'essais de semences: Bericht über den IV Internationalen Kongress für Samenprüfung: in/à Cambridge England), 7-12 VII 1924. Pp. 227. (London: H.M. Stationery Office.) 11*s*. 6*d*. net.

Diary of Societies.

SATURDAY, JULY 18.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS (at Town Hall, Folkestone), at 11 A.M.—A. E. Nichols: Municipal Works at Folkestone.—E. C. Fawcett: Folkestone's New Sea Outfall Works.

BIOCHEMICAL SOCIETY (jointly with the Agricultural Education Association) (at University College, Reading), at 5.—Prof. R. H. A. Plimmer: The Action of Nitrous Acid upon Amides and some Amino Compounds.—W. J. N. Burch: Some Esters of Phosphoric Acid.—Mattick and Wright: The Influence of Administration of certain Salts on the Inorganic Constituents of Milk.—E. Ponder and W. W. Taylor: The Conductivity of Cell-suspensions.—G. D. Thacker and J. R. Marrack: The State of Calcium in Body Fluids.

MONDAY, JULY 20.

ROYAL SANITARY INSTITUTE (at Edinburgh), at 5.—Sir John Gilmour, Bart.: Inaugural Address.

TUESDAY, JULY 21.

ROYAL SANITARY INSTITUTE (at Edinburgh), at 10 A.M.—Meetings of Sections and Conferences: Sanitary Science, Industrial Hygiene, Engineers and Surveyors, Sanitary Inspectors.—At 8 P.M.—Sir Leslie Mackenzie: The Problem of Psycho-physical Fitness (Lecture).

BRITISH MEDICAL ASSOCIATION (Annual Meeting) (at Bath).

WEDNESDAY, JULY 22.

ROYAL SANITARY INSTITUTE (at Edinburgh), at 10 A.M.—Meetings of Sections and Conferences: Sanitary Science, Personal and Domestic Hygiene, Representatives of Sanitary Authorities, Medical Officers of Health.

BRITISH MEDICAL ASSOCIATION (Annual Meeting) (at Bath).

THURSDAY, JULY 23.

ROYAL SANITARY INSTITUTE (at Edinburgh), at 10 A.M.—Meetings of Sections and Conferences: Engineering and Architecture, Maternity and Child Welfare (including School Hygiene), Port Sanitary Authorities, Veterinary Inspectors, Health Workers.—At 8 P.M.—Dr. C. Porter: The Citizen and the Citizen's Health (Popular Lecture).

BRITISH MEDICAL ASSOCIATION (Annual Meeting) (at Bath).

FRIDAY, JULY 24.

ROYAL SANITARY INSTITUTE (at Edinburgh), at 10 A.M.—Meetings of Sections and Conferences: Engineering and Architecture, Maternity and Child Welfare (including School Hygiene), Veterinary Inspectors, Health Visitors.

ROYAL ASTRONOMICAL SOCIETY, at 4.30.—Special General Meeting.

ARISTOTELIAN SOCIETY, MIND ASSOCIATION, AND OXFORD PHILOSOPHICAL SOCIETY (Joint Session) (at Balliol College, Oxford), at 5.—Annual General Meeting of the Mind Association.—At 8.30.—Prof. H. Wildon Carr, Prof. A. Wolf, and Prof. C. Spearman: Symposium: The Nature of Intelligence.

BRITISH MEDICAL ASSOCIATION (Annual Meeting) (at Bath).

SATURDAY, JULY 25.

ARISTOTELIAN SOCIETY, MIND ASSOCIATION, AND OXFORD PHILOSOPHICAL SOCIETY (Joint Session) (at Balliol College, Oxford), at 10 A.M.—C. R. Morris, Dr. Dorothy Wrinch, and Prof. L. J. Russell: Symposium: The Concept of Energy.—At 2.30.—Dr. Ivy Mackenzie: The Biological Basis of the Sense of Time.—At 8.30.—Prof. J. A. Smith, Prof. A. D. Lindsay, and Dr. F. C. S. Schiller: Symposium: Croce's Theory of the Practical Nature of Science.

SUNDAY, JULY 26.

ARISTOTELIAN SOCIETY, MIND ASSOCIATION, AND OXFORD PHILOSOPHICAL SOCIETY (Joint Session) (at Balliol College, Oxford), at 2.30.—P. E. More, Prof. W. D. Ross, and Prof. G. Dawes Hicks: Symposium: Plato and Aristotle.—At 8.30.—J. MacMurray, C. E. M. Joad, and A. H. Hannay: Symposium: Is Art a form of Expression or of Apprehension?