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Empire Cotton Supply and Needs.

THE Lancashire cotton industry is, as is well known, in a somewhat parlous condition; and one important factor involved is that it has not control over its supplies of raw material. About one-third is grown in Egypt and South America, and two-thirds are from the United States; but the cotton of these two sections is so different that two separate industries deal with it in Lancashire. The first appears to be fairly prosperous; but the larger industry, dependent on the United States supply, is in trouble. This supply fluctuates enormously, and demands from elsewhere are increasing rapidly. During the past five years the crop has varied from 11 to 18 million bales; cotton mills are springing up in many countries, and those in America alone now require about half the crop. These figures indicate sufficiently how precarious is the position of the bulk of the Lancashire cotton mills.

This state of affairs has, however, been long predicted; and more than twenty years ago a British Cotton Growing Association was formed, to encourage growing American cotton within the Empire, chiefly by assistance in marketing the produce. Since the War, matters have become acute; and about five years ago a much more ambitious scheme was launched, namely, the Empire Cotton Growing Corporation, which sought to stimulate the mill owners to united action, by a levy of 6*d.* on each bale of cotton entering Great Britain. When the participation of a large proportion of the mill owners was secured, the Government endowed the movement with close on one million pounds, saved through the control of the Egyptian cotton during the War; and an Act of Parliament was passed sanctioning the levy for five years. This period is now terminating; and the Lancashire industry concerned is about to be sounded as to whether the levy should be continued.

It will be of interest to note how this Corporation, mainly composed of business men, has set about its task. A central office was opened in London, a library collected, and an excellent quarterly journal started. Senior officers were sent on surveys of various parts of Africa, India, and Australia, and their reports have been freely circulated. In Africa the transport problem dominates, and large sums of money have been spent on improving communications. In India a large model estate has been assisted and financed in the Punjab, for the encouragement of growing American cotton; and in Australia £3000 a year has been given for five years for founding cotton stations.

The most interesting point, however, is the appreciation of the Corporation of the need for scientific work. A central Research Institute has been built in Trinidad, and the local College liberally subsidised. A number of post-graduate scholarships have been given on a generous scale to encourage recruitment, and four research institutions in Great Britain have received £1000 a year for five years, to assist in training these men. Senior officers, largely with Indian cotton experience, were engaged to start the work in the colonies, and the trained men have been drafted out in succession. In the circumstances, judging by the annual reports now coming in, progress has been remarkably rapid; although it is recognised that it will be many years before the goal is reached—of making the Empire self-sufficient as to its cotton requirements. It is to be hoped that the Lancashire mill owners will vote for a further five-year period of the levy. The ball has been set rolling, but there are many obstacles in its path; and the co-operation of this powerful and broad-minded Corporation cannot be overestimated.

C. A. B.

Biology and Birth-Control.

(1) *University of London: Galton Laboratory for National Eugenics.* Eugenics Lecture Series, 14: *The Right of the Unborn Child; being a Lecture delivered on November 13, 1926, to Teachers from the London County Council Schools.* By Karl Pearson. Pp. 26 + 3 plates. (London: Cambridge University Press, 1927.) 3*s.* net.

(2) *Contraception (Birth Control), its Theory, History, and Practice: a Manual for the Medical and Legal Professions.* By Dr. Marie Carmichael Stopes. New and enlarged edition. Pp. xxvi + 480 + 5 plates. (London: John Bale, Sons and Danielsson, Ltd., 1927.) 15*s.* net.

THE two works which are the subjects of this review both arrive at the conclusion that birth-control is a necessity, but whereas Prof. Karl Pearson desires it in the interests of the future generation, Dr. Marie Stopes demands it in order to relieve the over-harassed mother.

(1) Prof. Karl Pearson's pamphlet is a reprint of a lecture delivered to elementary school teachers; we congratulate him heartily on his descent from the clouds of the higher statistics, and his determination to talk plain common sense which every one can understand. He shows in the most convincing manner that certain repulsive deformities like 'lobster-claw,' and certain dangerous weaknesses like hæmophilia or bleeding, are handed on from generation to generation; he says that in a primitive state of society individuals afflicted with these taints would never have been allowed to survive, much less to marry. He points out that such weaklings are only preserved in the mawkish atmosphere of sentimental sympathy which is developed in our civilisation, and that in the history of humanity advance has come not from the persistence of old civilisations, but from the irruption of virile races reared in 'a hard cradle' who had overwhelmed the effeminate civilisations which they encountered and appropriated as much of their culture as they saw fit.

Prof. Pearson is less happy in his remarks on the relation of religion to eugenics. It is true, as he says, that the biological function of religion is to assure the solidarity of the tribe, and that the powerful taboos of primitive religion concerned themselves largely with the three great events in human life—birth, marriage, and death. He thinks, with the late Sir Francis Galton, that eugenic principles will never prevail until they have behind them the driving force of religious sentiment; he calls therefore for a modification of religious sanctions which will make the marriage of those marred with physical and mental defect to be as great an offence against religion as murder and adultery, unless those so married consent to have no children. Prof. Pearson, however, forgets that primitive man obeyed the taboos not so much from fear of his fellow-tribesmen as from dread of the supernatural intervention of the higher powers in whom he fervently believed. From Prof. Pearson's contemptuous remarks about God it is clear that he does not share this belief, and without it religious sentiments are impossible. The idealistic and high-minded may have regard to the interests of the race when their individual interests collide with them, though personally we doubt it, but the hope that the lazy and self-indulgent will pay any attention to the interests of posterity, if to use an American phrase 'they can get away with it,' is idle. Least of all will they be deterred by a make-believe religious sentiment if they have ceased to believe in God.

While in general we agree with Prof. Pearson's views, certain difficulties occur to us. Hæmophilia, for example, manifests itself in men but is transmitted through women. Now could we seriously expect a healthy, vigorous young woman to abstain from marriage with an equally healthy young man because her great-great-great-grandfather had suffered from hæmophilia and she might be a transmitter of the taint? Again, whilst we cordially admit that to prevent defectives from having children would be a great gain, these defectives constitute at the worst a small percentage of the population: the really great menace comes from the over-propagation of the idle and thriftless, who would not be classed as either physically or mentally defective. To support the children of this class the thrifty are taxed to the bone. The birth endowment for which Prof. Pearson calls is already in full action in this case; it seems to us that the compulsory sterilisation of the thriftless when they bring into the world more children than they can support, would do more for society than the segregation of defectives.

(2) Dr. Marie Stopes's book consists in a history of the various varieties of birth-control and especially of contraception. She recalls to our memory the fact emphasised by Prof. Carr-Saunders that birth-control in the form of infanticide and abortion has been practised by all races of men since time immemorial, and that even drugs which prevented conception were known in antiquity. She does a useful service in demolishing the legend, sedulously propagated by a certain coterie, that the legality of birth-control was established by Bradlaugh's fight for it. She shows convincingly that the very pamphlet in connexion with which Bradlaugh was prosecuted had been sold for years without let or hindrance, and that the police only interfered when the publisher added to it several indecent illustrations. Bradlaugh's intervention, so far from helping the cause of birth-control, really hindered it, since it caused it to be associated in the minds of the public with his unpopular atheistic views.

Dr. Stopes seems to think that Carr-Saunders has disposed of the arguments of Malthus. Never was there a greater illusion—Malthus's main position stands to-day as an impregnable rock, and has indeed since Darwin's time become a commonplace of biology. The fact that Malthus did not foresee the expansion of our food-supply by the exploitation of then undiscovered agricultural areas is irrelevant; this merely postpones for a limited time the advent of the crisis which he predicted and which has already arrived in overpopulated countries like India and China.

Dr. Stopes gives an elaborated and detailed account of the physiology of sexual intercourse and of the relation to it of the various methods of birth-control now in use, giving of course prominence to that which she recommends. It would be entirely out of place to discuss these methods in the columns of Nature, but Dr. Stopes raises several points of considerable physiological interest which may be mentioned here. She maintains that the male sexual discharge, in addition to the fertilising spermatozoa, contains a hormone the absorption of which is most beneficial to a woman's health. *A priori* this seems not unlikely, but it is an exceedingly difficult matter to prove, and when one views the healthy, vigorous unmarried women around one, it is rather difficult to believe. Then Dr. Stopes stresses the fact that in the emotions accompanying coition, there is a female crisis which is reached later than the male crisis, and that when this is not attained the woman is left in an unsatisfied and irritated condition which, often repeated, leads to marital unhappiness and makes a shipwreck of the marriage.

Whilst the normal reader must experience a shock in finding these intimate matters discussed in such detail and in such plain language by a woman, and whilst the reviewer must admit that he sympathises with this feeling of shock, there are certain considerations which give him pause before he indulges in condemnation of the author. Some years ago, in the common-room of a certain college, the reviewer happened to be the only biologist present when one of Dr. Stopes's books ("Married Love") was discussed. He was immediately challenged to give his opinion on it, and he replied that while it seemed to him that this book could only have been written by a person entirely devoid of reticence, yet that it would do good in giving information about physiological matters such as the female crisis, which could be obtained nowhere else. To his amazement and stupefaction, two of his questioners, both scientific men and both married, confessed an utter ignorance of the very existence of a female crisis!

Dr. Stopes gives figures to show that the chances of survival of the children decrease with the rapidity of succession of pregnancies, and the cases selected from her records give ample evidence of the fearful wreckage of women's health which results from overbearing. Part of the book is given up to incisive replies to the various attacks which have been made on Dr. Stopes, and the reviewer must confess that in these replies she has his entire sympathy. When the urgent necessity of birth-control by some method is becoming evident not only to biologists but also to economists and even to politicians, it can only be described as hypocrisy on the part of the Church to condemn practicable methods and recommend abstinence and self-control to the ordinary man in the street who lives with his family in cramped quarters. That there is inherent wickedness in the sexual process itself is a superstition worthy only of the darkest Middle Ages and reflecting an outlook on the world which no rational man can now uphold.

In conclusion, we can only say that Dr. Stopes's book is a compendium of most valuable theoretical and practical information on the all-important subject of birth-control. E. W. MacBride.

A Treasury of Learning.

Introduction to the History of Science. By George Sarton. Vol. 1: *From Homer to Omar Khayyam.* (Published for the Carnegie Institution of Washington: Publication No. 376.) Pp. xi + 839. (Baltimore, Md.: Williams and Wilkins Co., 1927.) 10 dollars.

CONFRONTED with this volume, for which the only adjective at all appropriate is 'colossal,' one can appreciate the feelings of the rustics before Goldsmith's schoolmaster:

> "And still they gaz'd, and still the wonder grew
> That one small head could carry all he knew."

Dr. Sarton's amazing erudition, equalled only by his energy, is fittingly accompanied by a breadth of sympathy and interests due in part to his personal history, of which he gives some details. A Belgian by birth, of mixed French and Flemish ancestry, he married an Englishwoman and has since become American by adoption. His work on the history of science was begun near Ghent, but on the outbreak of war in 1914 he was forced to abandon his home and to bury all his manuscripts in the garden. Fortunately, the invader overlooked this buried treasure, and the papers were safely recovered in 1919. To the mind's eye, the vision of Dr. Sarton digging up buried knowledge from its hiding-place is symbolic, for he has devoted his whole life to this very task, and the first-fruits of his labours are now presented to us.

'First-fruits' may seem a particularly inept word to describe the book now before us, which many a scholar would be more than content to have to his credit as the sole product of his working years. Yet to its author it is but the foundation-stone of an imposing building the plan of which he sketches as follows. There are to be altogether three series of books. The first series will consist of a purely chronological survey of the history of science (a term which, as interpreted by Dr. Sarton, has a wide significance), from the earliest times to the present day, in units of half a century. The present volume is the first of this series, and seven or eight more of the same size are projected. The second series will give surveys of different types of civilisation and will run to about eight volumes. The third series will deal with the evolution of special sciences, in eight or nine volumes, namely, (1) logic and mathematics; (2) physical sciences; (3) biological sciences; (4) sciences of the earth; (5) anthropological and historical sciences; (6) medical sciences; (7) educational sciences; (8) philosophy; and (9) general index. Of this vast field, Dr. Sarton hopes himself to cover the first series down through the eighteenth century, parts of the second series dealing with Semitic and Far Eastern civilisations, and the second volume of the third series. If this ambitious programme is realised, as every one will hope it may be, Dr. Mellor will have to look to his laurels! Not content with his linguistic attainments, Dr. Sarton light-heartedly undertook, as a mere trifle in passing, the study of Arabic under Prof. J. R. Jewett and Dr. D. B. Macdonald: "there were giants in the earth in those days."

The chronological survey in this introductory volume begins with the dawn of Greek and Hebrew knowledge in the ninth and eighth centuries B.C., and ends with the time of Omar Khayyam (second half of eleventh century A.D.). Each half-century, from the fourth century B.C. onwards, is given a separate chapter and is christened with the name of its most representative man; thus 250–200 B.C. is called "The Time of Archimedes," while A.D. 800–850 bears the name of the mathematician Al-Khwārizmī. This simple device is remarkably efficient in helping the memory to assimilate the chronological sequence, and its adoption must be regarded as a stroke of genius. Especially for medieval times, our memory of dates is too often lamentably vague, and yet we must acquire an adequate sense of the succession of men and events if our mental pictures of the progress of science are to be accurate. Dr. Sarton rightly insists upon the essential importance of strict chronology, so far as it can be ascertained, and has chosen his chapter titles for mnemonic purposes; "we should find it difficult," he justly says, "to remember that such or such a man flourished in the first half of the ninth century, and such or such another in the second half of the same century, but we can more easily recall that the former flourished at about the same time as Al-Khwārizmī, while the other will naturally cling in our memory to the personality of Al-Rāzī." It has seemed necessary to dwell upon this point, because a casual glance at the book might give the impression that it is solely a work of reference, whereas in point of fact it contains much to be read and remembered.

Each section is provided with a brief introduction or summary and a critical review of the relevant literature. The wealth of bibliographical detail is frankly stupendous, and in those sections which we have tested, very little of real importance has been omitted; though we noticed, for example, that H. H. Joachim's article on "Aristotle's Conception of Chemical Combination" was not mentioned in the list of authorities quoted in the paragraph on Aristotelian chemistry. Such occasional lapses are inevitable, and serve merely to throw into higher relief the sound and careful scholarship and painstaking industry which Dr. Sarton has brought to bear upon his researches.

Of especial value are those sections devoted to Chinese science. Hitherto, information respecting the scientific attainments of this people has been very difficult to collect, and even when collected its value and trustworthiness could not always be properly estimated. It is probable that a fuller knowledge of early Chinese work would cause us radically to modify some of our present opinions on the development of the sciences—particularly chemistry, as urged by Prof. Partington—and a systematic survey of the subject is urgently required. Dr. Sarton has provided an excellent starting-point in his collation and valuation of the critical literature available, and perhaps European or Oriental scholars may now be stimulated to undertake the necessary labour. It seems certain that such labour would be well repaid.

Similar care has been bestowed upon the accounts of Muslim science, about which more is known, but of which there has been no comprehensive synthesis, most investigators having chosen particular topics for intensive study rather than a broad survey of all the various aspects. Dr. Sarton gives us the materials for such a survey and has pointed out the salient features. He has also taken pains to transliterate proper names accurately, a merit which is conspicuous by its absence in most histories of science, and the lack of which is not merely provoking but often seriously misleading.

The history of politics and that of art have been deliberately omitted on the ground that these subjects have already been adequately treated by others. Prehistoric times are also omitted for the present, since the rapid advance of archæology in recent years suggests that a short postponement may enable a much more satisfactory account to be given later.

Dr. Sarton expresses the hope that his sketch of the vast panorama of two thousand years of intellectual progress may help to guide the activity of a large number of scholars, by allowing them to undertake special investigations of particular topics without losing a sense of proportion and perspective. That his hope will be realised cannot be doubted, but we believe he will do more than prevent a loss of sense of perspective: he will convey it to those who have never possessed it and will render applicable to the history of science the words of the Pervigilium Veneris:

> "Cras amet qui nunquam amavit;
> Quique amavit cras amet."

E. J. HOLMYARD.

Modern Astronomy.

Astronomy. A Revision of Young's Manual of Astronomy. By Dr. Henry Norris Russell, Dr. Raymond Smith Dugan, and Dr. John Quincy Stewart. Vol. 1: *The Solar System.* Pp. xi+470+xxi. Vol. 2: *Astrophysics and Stellar Astronomy.* Pp. xii+471-932+xxx. (Boston, New York, Chicago and London: Ginn and Co., 1926-1927.) 2.48 dollars each vol.

THIS much-anticipated book is described as a revision of Young's "Manual of Astronomy," although, as stated in the preface, "the scope of the new work is somewhat more extensive than that of the former 'Manual,' and intermediate between this and the 'General Astronomy.'" The classical works of Young have long been the best volumes of their kind, except for the fact that they have been out-of-date on the physical side, and no more appropriate task could have been undertaken by their illustrious author's successors at Princeton than that which they have now brought to fulfilment. So numerous and radical have been the advances of the last few decades that it has been found necessary practically to re-write the book, with an inevitable increase in length. The result, it may be said at once, is worthy of its prototype.

The two volumes deal respectively with "The Solar System" and "Astrophysics." This is probably the most satisfactory method of dividing the subject of astronomy for treatment as a whole, although the more minute classification given in the introduction to the book is inconsistent with it, in the sense that it is impossible to assign each of the six branches mentioned therein definitely to either the solar system or astrophysics. No method of dividing and subdividing astronomy is entirely satisfactory, for astronomy deals with a universe and not a multiverse, and the science has progressed far enough for that fact to emerge and confound the would-be analyst. The present cleavage into two volumes cannot evade a number of phenomena—notably the sun, which it has to split into two parts. In the first volume the treatment of this body is mainly descriptive; it is chiefly an account of the sun as seen through the telescope. The second volume deals with the examination of the sun by the spectroscope and bolometer.

The contents of the first volume may be summarised as follows. After a brief introduction, astronomical systems of measurement are described, leading up to astronomical instruments and the problems of practical astronomy. The earth, moon, and sun are then discussed, with a separate chapter on eclipses. Between the consideration of "the planets in general" and the separate consideration of individual planets, a chapter of 49 pages, on celestial mechanics, is interpolated. The final chapter deals with comets and meteors and the origin of the solar system. Volume 2 begins with a chapter on the analysis of light, after which the solar spectrum and the sun's light and heat are dealt with. A chapter on atomic theory and astrophysics makes possible a general consideration of the stars and their various characteristics, including double and variable stars. Then follows a discussion of star clusters, the milky way, and the nebulæ, and the work concludes with two chapters on the constitution and evolution of the stars. An appendix to each volume contains useful data, and each chapter includes a number of exercises for the student.

It is intended that the first volume shall be mastered before the second is approached—a plan which "has been adopted as a result of many years' experience in lecturing." It is with diffidence that one ventures to question the conclusion of the distinguished authors on this matter, but it should perhaps be said that the reviewer has found it more satisfactory to introduce all the principles and instruments of investigation before dealing with the bodies to which they are applied. In the treatment here adopted the spectroscope and its applications are not introduced until the second volume is reached, with the result that the accounts of several phenomena, begun in the first volume, have to be completed in the second. Perhaps no general rule can be laid down in the matter, and in any case both volumes are available together for the teacher to deal with as he pleases.

The treatment is comprehensive, clear, and, needless to say, accurate. The book is suitable for the beginner with only an elementary knowledge of physics and mathematics, but includes, nevertheless, a little mathematical work (printed in smaller type) in the astrophysics volume which the elementary student is invited to omit. The use of the calculus has been completely avoided. The book appears to us to be undoubtedly the best text-book of general astronomy now available. The only criticism of a general character which we can make is that there are occasional lapses in English, of which two examples, taken from volume 1, will be sufficient. On p. 53 we read: "In the *coelostat* the plane of the mirror is parallel to that of the polar axis." The words "that of" should, obviously, be removed. Again, on p. 164, a paragraph is headed "Method of Determining the Size of the Moon's Orbit, that is, its Distance and Parallax." The distance and parallax dealt with are, of course, the moon's, not those of its orbit. We have, however, noticed no serious ambiguity arising from this cause.

The book is clearly printed and well and copiously illustrated, although the reproduction (Fig. 190) of Sir Norman Lockyer's flash spectrum, obtained in India in 1898, is very disappointing.

H. D.

Our Bookshelf.

Pernicious Anæmia, Leucæmia, and Aplastic Anæmia: an Investigation from the Comparative Pathology and Embryological Point of View. By Dr. J. P. McGowan. Pp. vii + 116 + 5 plates. (London: H. K. Lewis and Co., Ltd., 1926.) 7*s.* 6*d.* net.

Dr. McGowan's investigation of these blood diseases originated from a series of observations on leucosis in fowls and iron deficiency as it occurs in pigs. The similarity between the former condition and the pernicious anæmia-myelogenous leucæmia group of diseases in human beings was apparent, and it was considered that their common association with iron deficiency in morbid conditions of the hæmatopoietic system might shed light on some of the problems of human blood disease. Commencing with the demonstration of leucosis as a definite pathological syndrome with several different causal factors, it is postulated that the similar syndrome in human beings has likewise a fundamental pathogenesis. It is considered that this is a modified hyperplasia due to an irritative condition and ending in some cases in sclerosis or aplasia of the bone-marrow. In those cases of pernicious anæmia in which no definite irritative factor, such as tapeworm or specific poison, is recognised, it is suggested that there has been some general infection which has damaged the bone-marrow.

The association with iron deficiency is through the metabolic function of the liver in preparing iron and fat for the production of erythrocytes. The aplastic form of anæmia has its cause in the failure of the poisoned liver to carry out this function, apart from the toxic changes in the bone-marrow. Iron deficiency is considered to be due to deficiency in milk of iron relative to protein or growth-stimulating substance and to the growth potential of the young animal.

The whole subject is presented with unusual lucidity, and Dr. McGowan's conclusions will be of considerable interest to students of pathology and comparative medicine.

The Commerce of Agriculture: a Survey of Agricultural Resources. By Prof. F. A. Buechel. (The Wiley Agricultural Series.) Pp. ix + 439. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1926.) 18*s.* 6*d.* net.

The framework of this book is ambitious. The agricultural resources of every part of the globe are explored, with, in some cases, disappointing brevity. Under 'resources,' aspects are considered which do not, as a rule, find a place in agricultural text-books. For example, there are sections on climate, soils, origin and development of trade, agricultural organisation, and so forth. The matter is so encyclopædic that a considered review is not possible here. As a test we turned to the section on 'Rice,' and would query the accuracy of the statement that "rice is *by far* the most important crop" in India. Again, under the heading of potato diseases it is disappointing to find that only two are mentioned, 'scab' and 'blight.' The botanical names should have been given, for, under the latter, two, 'early' blight and 'late' blight, are mentioned as if they were distinct diseases, whereas both, presumably, are *Phytophthora infestans*.

These criticisms should not, perhaps, detract from the real value of the book, which under one cover presents a really informative survey of world agriculture. We commend in particular the excellent statistical maps showing crop distribution in various countries, selected from the admirable series published by the U.S. Government.

The Credibility of Herodotus' Account of Egypt in the Light of the Egyptian Monuments: being a Lecture delivered at the Fifty-fifth Congress of German Philologists and Schoolmasters at Erlangen. By Wilhelm Spiegelberg. With a few Additional Notes by the Translator, Aylward M. Blackman. Pp. iv + 40 + 2 plates. (Oxford: Basil Blackwell, 1927.) 2*s.* 6*d.* net.

A translation of Prof. Spiegelberg's lecture on the credibility of Herodotus as a recorder of Egyptian history will doubtless be welcome to many whose acquaintance with the language of the original is limited. Much of what he has to say is new, while his intimate acquaintance with the monuments has enabled him to give greater precision to views already put forward in general terms on the sources of the information recorded by the 'father of history.' His approach to the problem is by way of two inquiries. First, what was the state of Egyptian civilisation at the time Herodotus visited the country? Secondly, in what circles of society did he move during his visit? His conclusion is that the intense preoccupation of the Egyptians in their own past had produced a number of popular ætiological legends evoked by the monuments, and that these were related to Herodotus by interpreters and members of the inferior ranks of the priesthood. The application of this theory to the story of the escape of Sesostris from the fire over the bodies of his two sons is certainly ingenious and more than probably correct.

Wave Mechanics: an Introductory Sketch. By H. F. Biggs. Pp. 77. (London: Oxford University Press, 1927.) 4*s.* 6*d.* net.

Mr. Biggs has rendered a distinct service to physicists by preparing this short account of Schrödinger's theory. Beginning with the hypotheses of Louis de Broglie, out of which the subject has developed, he traces the evolution of the idea that wave-mechanics bears to classical mechanics the same relation as wave-optics bears to ray-optics, and obtains the partial differential equation for the ψ-waves, proceeding then to its applications in spectroscopy. The style is lively and readable, the points are well made, and altogether no better introduction to the latest phase of the quantum theory can be desired. We may perhaps offer two slight criticisms: the translation of *Eigenwerte* by "special values" seems particularly unfortunate—for those who dislike "characteristic values" or "autovalues," the term "double numbers" may be suggested: and the mathematical treatment of the hydrogen-atom problem is greatly simplified, as Prof. Eddington pointed out some time ago in a letter to Nature, by referring to the known properties of the $W_{k,m}$ functions.

Local Geology: a Guide to Sources of Information on the Geology of the British Isles. By Dr. A. Morley Davies. Second edition. Pp. 16. (London: Thomas Murby and Co., 1927.) 1*s.* net.

It is a pleasure to be given a second opportunity of directing attention to Dr. Morley Davies' extremely useful little pamphlet, partly because it is intrinsically of great educational value, and partly because the call for a second edition indicates that it is adequately serving its purpose. Our splendid series of geological maps are not nearly so well known as they should be. Dr. Davies has done the Geological Survey of Great Britain a service as well as the general public by providing this simple and interesting guide. An appendix has now been added listing new maps and leading references. One sentence is worth quoting in the hope that the Geological Survey may be encouraged to remove what is a common source of annoyance in the north of England and south of Scotland: "Unfortunately, sheets 1, 2, and 11 cover very small portions of England and much larger portions of Scotland, but they treat Scotland as a *terra incognita.*"

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.*]

The "Palæolithic Implements" from Sligo.

Having regard to the apparent importance of the discovery recently announced in letters from Messrs. J. P. T. Burchell and J. Reid Moir (Nature, Aug. 20 and Sept. 24, 1927), and to the publicity which the matter has received in the Press, we considered it advisable to examine the several localities indicated. This we have now done. We had no difficulty in identifying the various sites, although some inaccuracies in the descriptions suggest that these were written from memory, and not from adequate notes taken on the spot.

The western or seaward side of the promontory called Rosses Point, the site of Mr. Burchell's "rock-shelter," has three projections of limestone jutting into the sea, with areas of sand between. Mr. Burchell does not state on which of these projections his "rock-shelter" is situated, but says that it "has a south-westerly aspect." We found on the middle projection a small undercutting of the cliff, facing south-west, which might conceivably have been a fallen-in rock-shelter; it is about 100 yards to the south of the lighthouse. But in no other way does it correspond to Mr. Burchell's description; there are no "fallen blocks" upon its floor. The only hollow which agrees with the description in this respect, and in dimensions, is on the southern projection; but it faces magnetic north. It is about 100 yards north of the ladies' bathing-place.

Mr. Burchell describes an "Early Neolithic Raised Beach," consisting of "powdered shells to a depth of one foot" as "covering what remains of the roof" of his rock-shelter. No such feature exists above the roof of either of the rock-hollows just referred to. Indeed, there is no Raised Beach of any date in the district. The only covering above both of the hollows is a layer of gravelly soil, formed by disintegration of the limestone *in situ*, mixed with wind-borne sand and occasional fragments of shells. These shells were doubtless carried up by gulls, as is still being done. They are of species now common in the bay (*Mya arenaria, Solen siliqua, Ostrea edulis, Mactra solida*). About twenty yards to the south of the hollow on the middle projection there is a flattened heap of fragmentary oyster-shells, possibly accumulated by human agency; these are within reach of high waves, and certainly do not form a "raised beach."

We could not detect any trace of the "boulder-clay" in a hollow of which "the outer margin" of the "Raised Beach" is said to lie. Boulder-clay occurs on the northern end of the Rosses Point promontory, where, however, there are no "shelters"; and also on its southern shore, under the modern village.

The "large cave four feet high" on Coney Island lies underneath the lower of the twin beacons at the north corner of the island. We consider that its existence is clearly due to recent undermining of the massive limestone of the low cliff, by erosion of the softer underlying shales. The masonry foundation of an earlier beacon (not more than fifty years old) now overhangs the face of the cliff above the cave by about three feet, and the beacon has had to be moved inland in consequence. This shows that the process of erosion is still actively in progress.

It is inconceivable that caves of this kind and in such a situation could have persisted from Mousterian times. They are in an area that was severely glaciated by ice passing from the land out to sea. The pronouncedly jointed and bedded character of the rocks would in these circumstances give rise to excessive plucking, as is indeed evidenced by the sections below the houses of the village, where the thick masses of boulder-clay are crowded with large angular blocks of limestone. Any pre-glacial cave would thus have been obliterated. Moreover, there is abundant evidence, all along the coast, of rapid marine erosion; and any such "shelters" would have been washed away, even since Neolithic times. Similar hollows are still in process of formation: indeed, it seemed to us doubtful whether the hollows under consideration were in existence at all a hundred years ago. Their floors are at such a level that they are uninhabitable, as the sea invades them at every tide; and there is no evidence that they were ever at a higher level.

We see no reason to accept the statement that any of the countless stones littered upon the beach of Coney Island were "drifted out" of the cave. Among the infinity of shapes which these stones present, there are some resembling choppers, scrapers, and other tools; but in no greater proportion than might be seen on any other limestone beach.

As to the "implements" described by Messrs. Burchell and Moir, we offer the following observations. In the first place, "Mousterian" is not "Early Palæolithic"; and Mousterian implements are not, as a rule, "of impressive size." Moreover, we are at a loss to understand the meaning of the term "patination" as applied to limestone. Weathering produces a change of surface colour, but this is not patination.

Secondly, we find it impossible to understand why the hypothetical cave-dwellers made their implements of so unsatisfactory and unusual a material as limestone, when an inexhaustible supply of chert was available. Beds of chert, in many places up to six inches in thickness, form at least half of the bulk of the rocks about Rosses Point.

Thirdly, limestone, as is well known, and as we confirmed by experiments on the spot, does not break with a conchoidal fracture.

Fourthly, although we found some stones which closely resembled in outline those illustrated by Mr. Burchell, careful search in all of the sites failed to reveal a single object which could be accepted as undoubtedly a human artefact of any kind whatsoever, or of any date. There was nothing in any of the sites but ordinary beach material, derived from the splintery rock of the neighbourhood.

At Ballyconnell we found two sites agreeing generally with Mr. Burchell's description. In each of these the boulder-clay is excessively stony, containing hundreds of thousands of fragments of all shapes and sizes. These are broken with sharp angular fractures, especially in the lower part of the deposit: and it would not be difficult, if any one chose to spend a few hours on the unprofitable task, to collect a large number of fragments bearing a superficial resemblance to artificially formed implements. But having regard to the geological history of the area, and to the nature of the boulder-clay deposits themselves, we could not admit the possibility of any of the stones thus collected being artefacts.

In view of the serious nature of the claims made by Mr. Burchell, we feel that he should be called upon to substantiate them on the spot—preferably in the presence of a competent jury of geologists and archæologists, selected by some neutral body. We feel also that Mr. Reid Moir should be requested to demonstrate to the same jury the possibility of manufacturing, from the material available at Rosses Point, Levallois scrapers (or any other sort of tool) by the complicated process which he describes.

Until these things have been done, we must express and maintain a complete disbelief in the authenticity of this alleged discovery.

R. A. S. MACALISTER.
J. KAYE CHARLESWORTH.
R. LLOYD PRAEGER.
A. W. STELFOX.

Dublin, Oct. 8.

I HAVE to thank Mr. Burchell for the generosity of his personal attitude towards the problem of the stone flakings that he has found at Rosses. I regret that I cannot accept his views, but as I am not acquainted with the site, I will refer only to the flakings themselves, judged on their own merits, which I have had good opportunities of examining.

It is not easy to describe differences of technique, nor the differences of intention, or the lack of any intention, that one senses behind the technique. It is largely the personal equation of judgment.

At the moment, I will only say that I can see no suggestion of prehistoric technique in this collection of flakings; neither can I see any example of intentional secondary working. For myself, I can see no passable resemblance in any one of these flakings to any form of prehistoric implement, either palæolithic or neolithic.

S. HAZZLEDINE WARREN.

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Essex.

The Habits and Economic Importance of the Rough Whelk-Tingle (*Murex erinaceus*).

IN 1925 I reported to an oyster company that "in 1924–25 the whelk-tingle (*Ocinebra* (*Murex*) *erinacea*) was very abundant and very destructive. In my experiment 'A,' fully half of the brood of 1924 were found bored by the whelk-tingle, and it was obvious that most of the young oysters had been attacked in the early summer of 1925, since many of those bored had put on new growth."

The results obtained in the experiment quoted may be taken as roughly representative of what had happened in the beds. In the following year, 1926, there were strong indications that quite 50 per cent. of a good spatfall on the beds had been eaten by the whelk-tingle. Murex is fought on the beds by the dredgermen bringing in—on extra payment—clumps of spawn, as well as the living adult animal, but the rate of destruction is probably much less than the rate of increase, so that the pest is growing worse. Relief from this pest cannot, therefore, be obtained economically by oyster-producers in the present state of knowledge.

It is common knowledge, however, among experienced practical oyster-producers that the whelk-tingle—and it is interesting to record *Echinus miliaris* also—is almost annihilated on beds after a severe winter. Unless, therefore, a new method of capturing Murex can be found, those oyster-producers who are handicapped by swarms of the pest, cannot expect abatement of the damage they cause until a very hard winter is experienced.

It occurred to me that if one knew enough about the habits of Murex, it would be possible to estimate its negative economic value as an oyster-destroyer, and offset this against the increased cost of production of oysters, *i.e.* expenditure on extra wages, incurred in its destruction. For example, if individual Murex eat on the average one brood oyster a month during nine months of the year, and brood oysters are being bought at one penny each to lay on the beds, then the negative value of a Murex at the beginning of the period of nine months is about ninepence per annum. If Murex eats on the average more or less than one oyster brood per month, its negative value will be more or less than that amount. Suppose the negative value be sixpence per annum, then a man catching Murex at the rate of 40 per day, and being paid wages at the rate of 10*s*. per day, would be increasing the potential value of the stock of the beds. In order to obtain some information on this subject, I carried out a few experiments this year to confirm a few previous ones made in 1922. The results of these experiments show that (*a*) of 15 oysters bored and eaten by Murex, the average time taken was about 5·7 days; (*b*) of 10 brood oysters bored, but not eaten, the average time taken was 4·1 days, but if one case of 13 days be omitted, the average time works out at about 3·1 days; (*c*) of 8 brood oysters nearly bored through and abandoned, the average time taken was about 4·5 days. These latter cases were probably special ones, where the shell was too thick or the borer became too weak to complete its work. These preliminary experiments show that Murex can attack and devour an oyster brood —from 1 to 2 inches long—in 5 to 6 days. In the sea, or under better conditions than are possible in a laboratory removed from the oyster beds, this period will probably be reduced by reason of the better average condition of the borer, and the probability that once the oyster is bored, and—consequently—opened in the sea, other animals will share in the feast with the borer.

I have not had the opportunity of finding out how frequently one and the same Murex attacks and destroys oysters, and suggest that this problem, as well as that of finding a new and efficient and cheap method of capture on the beds, may be advocated as a special piece of economic research. If Dr. Dodgson, at the Government Fisheries Experimental Station at Conway, is eventually successful in producing oyster spat by the million, these will have to be put out in the sea to grow, and to withstand the attacks of natural enemies. Unless, therefore, beds can be found where Murex is a negligible factor, it may be anticipated that the spat produced under artificial conditions will be destroyed in greater numbers than natural spat. The problem is thus an important one in oyster culture.

In the experiments mentioned above it was found that Murex attacks small oysters at almost any place on either the flat or convex side; the borer may sit on the oyster, or it may successfully attack it by lying on its 'back' with the prey firmly held over it by means of the foot. (See the photo reproduced in Fig. 1, for which I am indebted to Mr. A. J. Smith.) Oysters are frequently attacked and abandoned; they may be abandoned for unknown reasons when partly bored, or after a complete boring if either a chamber, or a loose horny layer (see Orton and Amirthalingam, *J.M.B.A.*, **14**, 4; 1927), is encountered; or if the oyster is in a poor or pathological condition. There is probably a limit to the depth beyond which Murex of a given size cannot use its mechanical boring apparatus, but this limit is greater than 3 millimetres. The shells of oysters rarely attain a thickness of 3 millimetres at even the age of three or four years.

In 1922 Murex attacked brood oysters throughout the period of the experiments from the end of January to the middle of March; this year similar results were obtained from July to the middle of October, the whole period of the observations.

Murex, however, like *Purpura lapillus*, feeds on barnacles as well as oysters, and some individuals in my experiments have preferred to attack and eat barnacles when there were oysters in the same dishes. In this year's experiments it was found that Murex attacked *Balanus perforatus*, a large species of barnacle (see Fig. 1 on the right), *Balanus crenatus*, and another unidentified barnacle, either by boring a hole through the shell or directly through the operculum, and the time taken to destroy *B. perforatus* was similar to that spent on boring and eating oysters. The smaller balanids are eaten at a much quicker rate. In the sea Murex probably eats all kinds of acorn barnacles. Thus barnacles, when present in abundance on oysters, a condition so frequently deplored by oyster cultivators, protect the more valuable animal by offering

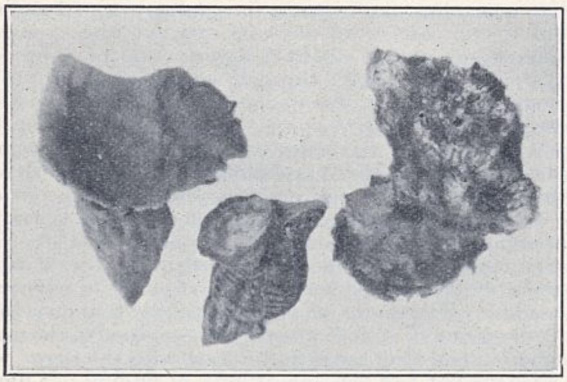

FIG. 1.—Two living Murex boring oysters and one eating Balanus.

The middle West Mersea Murex is laid on its 'back' holding by its sucker-like foot and boring an oyster spat. The left-hand Murex is also on its 'back' holding and boring an oyster brood; both are from West Mersea. The right-hand Murex, from the Fal estuary, is itself covered with small barnacles and is eating, after having bored, a Plymouth *Balanus perforatus*. (Photo of the living animals in sea-water by Mr. A. J. Smith.)

themselves as a first source of food to either Murex or *Purpura lapillus*, the smooth whelk-tingle. One individual of Purpura attacked and ate an oyster in my experiments, but this species clearly prefers barnacles, without confining itself, however, to either oysters or barnacles.

Murex will also attack Crepidula, as I have found by experiment, but it is either unaware from strangeness of the value of Crepidula as food, or incapable of attacking it easily ; a few bored shells of Crepidula have been picked up from oyster beds, but in these instances the borer may have been either Murex or Purpura. It might, however, be possible to introduce into the Thames Estuary oyster beds a natural borer enemy of Crepidula as a means of keeping down that pest, but it would be necessary first to discover whether that particular borer attacked oysters, *i.e. O. edulis.*

It is an interesting fact that Murex may return to complete its work of boring an oyster, time after time, even after it has been forcibly removed from its prey. In one case I removed an individual from its boring four times, and laid it on its 'back' each time not less than 1 cm. away from the boring ; it returned to the same boring each time like a dog returning to a bone. In other cases individuals have returned to their boring after respectively two removals and one removal from both oysters and barnacles, while in some few instances the Murex has not returned after being removed.

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The Manoilov and other 'Chemical Sex Reactions.'

SINCE 1924, Joyet-Lavergne,[1] working with plants and Protozoa, has been developing the view that in general female sexual cells are more reducing than male as judged by their effects on the colours of dyes ; recently [2] he considers that they contain more reduced glutathione because they give the colour reactions of this substance more strongly. In 1922, Manoilov [3] developed a 'test for sex' in plants by an elaborate treatment of dyes of the rosaniline series as a result of which the female side was made to display the deeper colour, that is, the reverse of the Joyet-Lavergne effect ; Satina and Demerec [4] have confirmed and developed this test, applying it to animal tissues, and amongst others to the cladoceran Crustacea Moina and Daphnia.[5] More recently, Falk and Lorberblatt,[6] working again with animals (mammalian ovary and testis), have demonstrated that the test depends on an oxidation phenomenon, the more complicated Manoilov technique being replaceable by the oxidation of colourless *p*-leucaniline in the presence of sufficient ferric chloride by which the female side again produces the deeper colour of *p*-rosaniline and is therefore apparently more oxidising than the male ; Falk and Lorberblatt also report an 'interesting parallelism' in that the extract of testis which they used was found to have considerable reducing power as shown by Tunnicliffe's method of estimating glutathione [7] whilst the ovarian extract had none, and Sir Frederick Hopkins tells me that this disparity has been long familiar to him.

In 1923 (unpublished work) I myself found that the shore-crab Carcinus when inflicted with the parasite Sacculina (in which case the males are apt to assume a feminine appearance) suffered a diminution of sulphur and the nitroprusside reaction distinctive of glutathione, and have since demonstrated the same phenomenon in several ways. Although I have never found clear evidence of a normal sexual difference in the content of glutathione in Carcinus, it has become apparent that the assumption of feminine characters by the male goes hand-in-hand with the decrease of its nitroprusside reaction and is therefore perhaps associated with the removal of a substance of a disulphide type which may be of considerable importance in tissue oxidations. On applying the Manoilov, and the Falk and Lorberblatt, and other tests of the same nature described below, I find that parasitised male crabs invariably display a relatively female reaction whether their external morphology be modified or not ; at the same time it was evident from the first that glutathione is not solely responsible for the reactions, because they can be procured from the blood in which the nitroprusside test fails to indicate the presence of reduced glutathione.

The dye tests for sex which I have employed on various crustacea, Cancer and Carcinus (Brachyura), Homarus, Pandalus 2 spp., and Crangon (Macrura), Gammarus (Amphipoda) in various physiological states, sexual immaturity, parasitism (by Sacculina, Portunion, or Phryxus), and hunger, as well as on the diœcious plant *Mercurialis annua*, may be summarised as follows :

(1) The direct action of an extract on the dye (*p*-rosaniline). The female side is typically the more reducing, that is, the Joyet-Lavergne effect.

(2) Oxidation of the reduced dye (*p*-leucaniline)

[1] P. Joyet-Lavergne, *C.R. Ac. Sci.* Paris, **179**, 1212 ; 1924.
[2] P. Joyet-Lavergne, *C.R. Ac. Sci.* Paris, **184**, 1088 ; 1927.
[3] E. O. Manoilov, *Bull. Appl. Bot. Plant-Breeding*, **13** (2), 503 ; 1922.
[4] S. Satina and M. Demerec, *Science* (New York), 1925, p. 225.
[5] S. Satina, *Proc. Soc. Exp. Biol. Med.*, **22**, 466 ; 1925.
[6] K. G. Falk and I. Lorberblatt, *Brit. Jour. Exp. Biol.*, **4**, 305 ; 1927.
[7] H. E. Tunnicliffe, *Bioch. J.*, **19**, 194 ; 1925.

by a minimal quantity of oxidising agent (ferric chloride or hydrogen peroxide) in the presence of tissue extracts. The extracts are inhibitory to the oxidation, apparently through combining with the oxidising agent, and female extracts are typically more effective than male, *i.e.* the Joyet-Lavergne effect produced with the leuco-dye. This test is more obvious than the Joyet-Lavergne and more constant than the remainder.

(3) Oxidation of *p*-leucaniline by excess of oxidising agent in the presence of extracts. The inhibitory effect observed under (2) is now destroyed, and the female side usually presents the deeper colour of dye. Evidently there are at least two factors which set up the oxidation conditions of the extracts, and a reducing factor which is present in greater force in females is destroyed by the oxidising agent. This is the Falk and Lorberblatt test.

(4) Destruction of *p*-rosaniline by potassium permanganate in the presence of tissue extracts. Potassium permanganate enters into combination with the extractives, quantitatively more so in female extracts which may therefore be considered the more reducing, the remainder is free to destroy the dye, and does so more rapidly in the case of males probably because they remove less permanganate. It is necessary to destroy the excess of permanganate by introducing a reducing agent, sodium thiosulphate or allyl thiocarbamide (thiosinamine)—but these apparently do not themselves decolorise such dye as may be unacted upon, except on very long standing or heating.

This is the Manoilov test; it is, in general, the most brilliant of the series.

(5) Schiff's rosaniline and sulphur dioxide test for aldehydes. Minute quantities of aldehydes (which restore the colour to this colourless compound) are very rarely present in fresh extracts, and then usually in males. If the solution be heated, the colourless compound dissociates and the full colour of the dye appears, to disappear again by recombination on cooling if the whole of the sulphur-dioxide be not boiled away; in the presence of tissue extracts the same phenomenon takes place, but (typically) on the male side the colourless compound is reformed much more slowly and less readily, which may possibly indicate that a factor which is capable of combining with and so removing sulphur-dioxide is more predominant in the male sex.

The tests may be applied either to aqueous (trichloracetic acid) or alcoholic extracts, but with the exception of No. 5 they are more successful when the reaction is strongly acid; I have failed to confirm Falk and Lorberblatt's observation that the presence of protein greatly enhances the disparity between the sexes, at least in trichloracetic acid extracts. Alcoholic extracts still exhibit differences after keeping for eighteen months, but dried tissues do not keep well.

It must be clearly understood that the tests are so delicate that some noticeable difference between two extracts is almost always observed, and that equally differences can often be discovered between two samples of the same extract as a result of faults in technique; moreover, biological conditions such as nutrition and maturity themselves produce profound effects and may be compared by these tests one with another, so that the distinction between a pair of extracts which differ only in sex is occasionally not at all obvious and still more frequently is 'reversed.'

I cannot subscribe to the view that these methods are 'tests for sex'—they are tests for certain oxidising or reducing properties in the setting up of which more than one chemical factor plays a part, although they are undoubtedly closely associated with sex and also with other biological conditions.

MICHAEL PERKINS.

School of Biochemistry,
Cambridge, Oct. 4.

Metallurgical Photomicrographic Apparatus.

THE article on Metallurgical Photomicrographic Apparatus which appeared in NATURE of Oct. 8 can scarcely be considered satisfactory to those who desire to know the essential requisites of such an apparatus.

While certain engineering details are minutely discussed, scarcely any attention is paid to the essential requirements of such instruments, namely, the quality of the optical train and the methods of illumination.

In photographing the extremely fine structure of metals, methods of illumination have been recently introduced which require adjustments on the apparatus which are not always provided. The method employed by Mr. Harold Wrighton in revealing structure of the order of 140,000 lines to the inch, and the new method of illumination devised by Prof. Carl Benedicks, are examples, and certain of the British instruments referred to are better equipped with these adjustments and are to be preferred.

With regard to the mechanical points which are discussed, the author, discussing the form of the optical bench, states that with the elongated triangular prism "freedom of movement and accuracy of adjustment might be obtained," and then makes the very definite statement that "it is impossible to machine the surfaces with the desired degree of accuracy to avoid shake." This is not the case if the triangular bar is machined with ordinary engineering accuracy, and the saddles bear on suitable surfaces unless the clamp is badly designed. The lathe bed type of a 'V' and a flat is an equally good design if the clamp is properly applied, as is also the parallel bar when properly constructed.

The geometric design depends for its accuracy on the accuracy of the bar, but the principle is not preserved when the apparatus has to be clamped securely in position. It must also be borne in mind that the design should be such that the apparatus can withstand wear, and to secure this sufficiently large bearing surfaces must be provided. The substitution of surfaces for points in a geometric design practically cuts out the geometric principle.

With regard to the focussing adjustments, it is difficult to see a convenient design in which both of the two focussing adjustments can be made without an overhanging weight, and as the coarse adjustment can be clamped and the fine adjustment cannot, it is much more desirable that any overhanging weight should be avoided on the fine adjustment. In a well-made fitting it does not cause any noticeable sag, but it has a marked tendency to cause 'sticking' in a fine adjustment, due to the lubricant being squeezed out from certain portions of the slide, causing metal to metal contact.

After all, there are various ways of providing convenient and efficient movements and adjustments for employing the optical equipment, all of which if properly made are satisfactory in use.

CONRAD BECK.

69 Mortimer Street, W.1.

IT is, of course, well known that for satisfactory work in any branch of microscopy, excellence of the optical parts of the apparatus is a prime essential.

In the article referred to, however, it was intended, as was suggested near the beginning of the article, to discuss only the mechanical construction of the various instruments. Any detailed reference to the method of illumination, which is undoubtedly an item of considerable importance in metallurgical microscopy, was also thereby excluded. When referring to items to which the user might attach importance because they suited his particular method of working, the writer had in mind the various methods of illumination employed, including the universal vertical illuminator fitted to the Beck instrument, which permits of the use of various types of transparent and of opaque reflectors which are easily interchangeable and easily adjustable in every required direction. Reference was also made in the article to the wide range of adjustment of the elements of the illuminating system provided by the British instruments. These adjustments facilitate the use of the methods of illumination mentioned by Mr. Beck; but, as was suggested, the method of obtaining the adjustments might be improved.

In the production by ordinary engineering methods of the optical bench of the elongated triangular prism type, a certain manufacturing tolerance is necessary on the angle of the prism. A manufacturing tolerance is necessary also on the angle of the saddle. If shake is to be avoided, no such tolerance can be permitted on either of these components. The geometrically mounted saddle will fit the triangular prism at any part of its length without shake, even though a reasonably large manufacturing tolerance has been allowed in the angle of the prism. When the saddle is in use, the forces brought to bear on it are not great; the relative movement of the saddle and the prism is not great; and the wear is thus not severe. The area of the contact surfaces need therefore not be at all large. A properly designed clamp for the saddle should produce a pressure uniformly distributed amongst the five points. The only result of this departure from the geometric principle is to set up strains in the saddle. For effective clamping these strains need not be great, and the ordinary saddle is sufficiently robust to withstand them without perceptible deformation.

With regard to the focussing adjustments, it may be pointed out that the stage is subjected to varying loads. Frequently, fairly heavy objects are placed on it. These loads are effective on an overhanging stage whether the coarse adjustment is clamped or not.

There are, certainly, various ways in which the necessary movements and adjustments of the several parts of the photomicrographic apparatus may be obtained. The method selected should be such as is likely to be most efficient in use, and the design such as to be capable of being satisfactorily made at a reasonable cost. The Writer of the Article.

Science and Philosophy.

Permit me two comments on the references to my Huxley Lecture in the leading article in Nature of Oct. 22.

In my judgment the writer put the cart before the horse when he suggested that philosophy had been changing the "fundamental conceptions of science." By the ordinary methods of science, prodigious advances in knowledge have recently been made, especially in mathematics and physics, and it is philosophy that is engaged in trying, in her usual way, to bring herself up-to-date.

The writer refers to an "emergent theory" as if it had been an important principle, by overlooking which my "polemic against vitalism had missed its mark." He may not agree with me, but so far from overlooking that odd theory, I described its origin and explained how in my opinion it was a conspicuous example of the interpolation of an imaginary principle in an unfinished scientific story.

P. Chalmers Mitchell.

My intention was not to exalt philosophy at the expense of science, but to plead for co-operation between the two. I cannot agree with Dr. Mitchell that the recent great advances in mathematics and physics have come about solely through the ordinary methods of science. Equally important has been the critical investigation of the fundamental concepts, for example, of time and space, which has gone on side by side with the discovery of new facts. Such criticism of concepts is generally regarded as a main function of philosophy, and if it be carried out—as it should be—by the scientific worker himself, it remains none the less philosophy. In the sphere of biology we urgently need, it seems to me, this same combination of observation, experiment, and the critical study of fundamental conceptions.

I have not accused Dr. Mitchell of overlooking the theory of emergence, and I even agree with him that in some of its forms it is regrettably vague. My point was rather that he appears to treat all forms of non-mechanistic doctrine as if they were based upon dualistic vitalism. This is obviously not true, for example, of Dr. J. S. Haldane's views, or of Prof. A. N. Whitehead's 'organic' theory of nature.

The Writer of the Article.

An Aspect of the Biochemistry of Sugars.

In reply to Mr. Levene's letter in Nature of Oct. 29, I would direct attention to the following points:

(1) Even if the hypothesis of inversion in the hydrolysis of sugar phosphates in Nature is correct, it may well be difficult to find the conditions for the imitation of the process in the laboratory. Mr. Levene has recently contributed a striking example in which inversion occurs with one reagent but not with another.

(2) The behaviour of glucose-3-phosphoric acid (or is it allose-3-phosphoric acid ?) is highly interesting and important, but the glucose-galactose change involves position-4, where the stereochemical conditions are different. We know many cases—some are in the camphor group—in which direct replacement occurs as the result of steric influences, although analogies indicate that inversion should be regarded as the normal event in these reactions.

(3) The evidence that the pentose-phosphoric acid from inosic acid (Levene and Jacobs, 1911) is *d*-ribose-5-phosphoric acid is inconclusive, because a δ-xylonolactone-phosphoric acid *might* be stable in acid solution at 40°. Admittedly the evidence favours the view of Levene and Jacobs, but it needs to be supplemented by methylation methods.

(4) Assuming that the pentose-phosphoric acid is *d*-ribose-5-phosphoric acid, that does not dispose of the main thesis, for the possibility exists that, in the original nucleic acid, the phosphoric acid is attached to the sugar molecule at more than one point (compare Thannhauser). Moreover, the migration of the phosphoric acid residue from one position to another in the chain is a possibility that must be kept in mind.

In short, the subject bristles with so many theoretical and experimental difficulties that it is doubtful whether a full discussion is possible at the present time.

Finally, my suggestions were not put forward as firm conclusions; I thought it worth while to advance them in order to indicate what seemed to be a useful working hypothesis.

R. Robinson.

Sept. 29.

Study and Research in Physics.[1]

By Sir ERNEST RUTHERFORD, O.M., P.R.S.

IT is little more than fifty years since special laboratories began to be built, generally on a small and modest scale, for study and research in experimental physics and for the practical instruction of students. During this period, physics in Bristol has been represented by three professors, first for a short time, by the late Prof. Sylvanus Thompson, whose contributions to science will long be remembered, then by Prof. Chattock, who is held in high esteem by all his students for the efficiency and inspiration of his teaching. On his retirement he was succeeded by his pupil, Prof. Tyndall, and I am sure that it is not entirely an accident that this splendid laboratory, which we open officially to-day, had its inception and completion during his tenure of office.

I have always felt a certain bond of union with the University of Bristol, partly because your Council has thought fit to select as your teachers some of my friends and colleagues of other days, and partly also because I have always had a special interest in certain lines of research that have been carried on in the Physics Department. I refer to the investigations made here on the passage of electricity through gases, with special reference to the nature and life history of the charged ions which transport the electric current.

In my youthful days, when I was working as a research student in the Cavendish Laboratory in Cambridge, one of my first essays in investigation, under the guidance of Sir J. J. Thomson, was a study of the way in which a current passes through a gas which is made temporarily conducting by the action of X-rays. It was found that this weak conductivity could be ascribed to the production in the electrically neutral gas of positively and negatively charged carriers, or ions, as they were termed, which moved in opposite directions in an electric field. Information on the nature of these ions was obtained by observing the average speed of these ions when acted on by an electric field.

Although my work in later years has been in other directions, I have always retained a lively interest in this subject, and I well remember my excitement and pleasure when I read in the *Philosophical Magazine* for 1899 a paper by Prof. Chattock giving an account of an ingenious and powerful method for studying the mechanism of the discharge from electrified points, which is always accompanied by the long-known phenomenon of the electric wind. He was able to show definitely for the first time that the discharge was carried by a stream of charged ions, identical in character with the ions produced in the same gas by the action of X-rays. These experiments not only disclosed the mechanism of the simplest form of electric discharge, but also showed us in a convincing way that the nature of the ions was the same, whatever the process causing the ionisation.

If time permitted, I should have liked to direct your attention to the extraordinarily interesting and varied phenomena which underlie the discharge of an electroscope by the action of X-rays or radium rays. Since 1896 this subject has been investigated by a large number of workers in all parts of the world, and no one has contributed more to our knowledge in the early days than my old friend, Prof. Langevin, whom we welcome as our guest to-day. I must also particularly mention the researches in recent years on the life-history of an ion, the avidity with which it seizes on the molecules of water added to a dry gas, and the still greater avidity for the heavy molecules of alcohol and the consequent sluggish movements of the loaded ion. On this aspect of the almost human behaviour of the gaseous ion, the researches of Prof. Tyndall and his students have given us most valuable information.

At first sight, it might well be thought that a study of the mechanism of the discharge of a gold-leaf electroscope under the influence of ionising radiations, however interesting it might prove to the scientific investigator, could be of little importance to the advance of science as a whole and of no obvious practical application. I have, however, taken this example of pure scientific research to illustrate the remarkable consequences that may sometimes follow the detailed study of an apparently trivial and small-scale phenomenon, made with no other object than to understand the processes of Nature, and I am sure in most cases with little idea of the important results that were ultimately to accrue both to science and industry.

In the first place, the ionisation of a gas by radium and X-rays gave into our hands a weapon of great power and range for studying quantitatively the nature of X-rays and the rays from radioactive bodies. This has been largely instrumental in unravelling the wonderful sequence of transformations that occur in radioactive matter, and has led to the discovery of more than thirty new unstable elements. In the second place, the information obtained of the mechanism of the passage of a current under the simplest condition could be at once applied to more complicated forms of electric discharge. It was soon recognised that the beautiful and varied phenomena which are observed when an electric discharge passes through a gas at low pressure was a consequence of the ionisation of the gas by the strong electric fields, similar, but more complicated than the discharge from a needle point. One of the first results of this study was the discovery of the electron, that mobile entity which we now know is one of the ultimate units in the structure of all atoms. Nor must we omit to mention the remarkable consequences that have followed the detailed analysis of the positively charged ions or positive

[1] Address delivered on Oct. 21 in opening the Henry Herbert Wills Physics Laboratory, University of Bristol.

rays that are always present in the discharge. In the hands of Sir J. J. Thomson and Dr. Aston, this has given us a method of precision for studying the isotopic constitution of the elements and for measuring the relative weights of the individual atoms with a certainty and an accuracy that would have appeared quite impossible a few years ago.

It would take me too long to attempt to enumerate to you the great additions to knowledge that have been gained by a study of the effects of swiftly moving electrons and ions produced in a vacuum tube in exciting radiations visible and invisible. Indeed, it is true to say that a large part of the scientific advance in physics in the last thirty years may be traced as an almost direct consequence of the observations on the ionisation of a gas by X-rays. I must, however, refer in passing to the great importance to science and industry of the emission of electrons from glowing bodies—a type of unipolar ionisation—that has resulted in the development of electric oscillators for radio-telegraphy of wonderful power and flexibility, and receivers for magnifying weak currents which have rendered possible the remarkable advances in wireless and broadcasting in recent years. In another direction, too, the effect of light in causing the emission of electrons from bodies—the so-called photo-electric effect—is the foundation of methods for transmitting pictures to a distance, and no doubt before long will give us television on a practical scale.

I hope I have made clear to you by this example the importance of encouraging in our laboratories fundamental research quite apart from any question of their possible application to practical ends. We live in an age when not only do many of the great industries, but also the Government, recognise the importance of the application of scientific methods for the rapid development of industry. Fortunately in Great Britain the Department of Scientific and Industrial Research is alive to the importance of fundamental research in our university laboratories, and by grants and other ways encourages the training of promising students in research method. It also in some cases assists—and I hope will long continue to assist—some of our university laboratories in prosecuting important fundamental researches which are on too costly a scale to be undertaken without financial strain on the slender resources of our universities and other scientific institutions.

Since the War there has been a notable increase in the number of scientific men who are engaged either in fundamental research or in applied research with special reference to industrial problems. The question thus naturally arises as to the nature of the research work that should be carried out in a laboratory like this. Should the spare time of its teachers and research students be devoted to investigations on the fundamental problems of physics, quite apart from any question of immediate practical bearing, or to researches of a character likely to be useful in industry? This is an important question, but I should unhesitatingly say that our pure science laboratories should in the main be set aside for fundamental research. Apart from the interest and importance of adding to our knowledge of the processes of Nature, experience has shown that discoveries of the greatest significance to mankind, whether in the practical or intellectual sphere, are generally the outcome of fundamental research undertaken purely with the aim of adding to knowledge. Industrial research should be undertaken by manufacturers or the Government in special laboratories where the research workers can come into close contact with manufacturing conditions. This does not exclude the desirability of occasionally conducting applied researches in university laboratories, especially where one or more of the staff may have a special knowledge of the problems involved. In general, however, I should view as an unmitigated disaster the utilisation of our university laboratories mainly for research bearing on industry.

When I look back over the thirty or more years of my connexion with research, I am conscious that I have always been looking for a breathing-space when, for a few years, no advances of consequence would be made; when I should gain an opportunity for studying in more detail, at my leisure, the ground already won. Alas, that breathing-space has never come, and I am sure will never come in my time. It seems to me that the remarkable period of advance in physics, which began thirty years ago with the discovery of X-rays, shows no sign of retardation but rather of an ever-increasing acceleration. It is becoming more and more difficult for the scientific man to keep in close touch with the advances in even a relatively small branch of his main subject, much less to read more than a fraction of the papers that are published in an ever-increasing stream.

This is especially the case at the present moment, when there is not only a rapid advance in experimental knowledge and technique but great activity in theoretical physics. The advent of the new or wave mechanics, with special reference to atomic problems, which promises to give an entirely new orientation to our ideas of the relation between radiation and matter, has much increased the difficulty, for the scientific man has to learn a new mathematical alphabet and language to keep in touch with this remarkable development, for which we owe so much to our visitor, Prof. Born of Göttingen.

While this difficulty is common to all scientific workers in a rapidly advancing subject, it is especially felt in comparatively small and isolated institutions in this country and still more in our distant Dominions. There arises, in many cases, a hopeless feeling that it is impossible to keep abreast with the flood of new scientific results and ideas, or to distinguish the wheat from the chaff. This reacts on the energy and enthusiasm of the scientific worker and diminishes the efficiency of his teaching and research.

This real danger can in part be surmounted by the co-operation and goodwill of our university authorities. If the scientific man is to maintain his intellectual activity and enthusiasm, it is in most cases important that he should be given leave of absence at regular intervals, and encouraged to visit other scientific centres, whether at home or abroad, and to get into personal contact with the workers in his special field. The value of such 'refresher' intervals is difficult to exaggerate, whether to the individual or the institution which he serves. I am sure that there are few scientific men that would not benefit by such opportunities.

At no time in the history of physics has there been a closer co-operation and sympathy between the two great branches of physics, the experimental and theoretical. With the ever-growing complexity of experimentation and technique, it is rare in these days that a scientific man can claim to be proficient in both of these branches. There has thus arisen the need that these complementary divisions should be adequately represented in a Department of Physics. I am very glad to see that this has been recognised in your University by the appointment of Prof. Lennard-Jones as professor of theoretical physics. In addition, the institution of research fellowships to attract to the laboratory young men who have shown marked ability for research is a step in the right direction, and I hope that it will be possible in the near future to add to their number. Under such excellent conditions we may confidently anticipate that this laboratory will fulfil the wishes of the donor by developing into one of our most important centres of training and research.

The University owes much to the public spirit shown by the city of Bristol and to the wise generosity of its citizens. I am sure that all scientific men are grateful to the University and to the donor, Mr. Henry Herbert Wills, whose generous benefactions have made possible the erection and endowment of this splendid laboratory dedicated to the pursuit of scientific knowledge.

Marcelin Berthelot.[1]

By Prof. Henry E. Armstrong, F.R.S.

The highest testimony we can give to the genius of a departed colleague is to study his work and its bearings, as in such exercise we are bound to find food for thought and gather inspiration for the future. As one of the older chemists, I would fain bear such slight witness as I may to the effect and value of Berthelot's achievements, being the more inclined to this task from having noticed, in the younger generation, a strange lack of interest in the pioneers who laid the foundations of the science they would master, now so mighty a structure—even a failure to understand the language these pioneers used. Continuity with the past is desirable, if only in order that we may understand the mental attitude of inquirers at the time they undertook their labours and be in a position to evaluate the mental development of their ideas.

Berthelot himself, who seems to have been extremely well read even at an early age, through his studies of the alchemists endeavoured to shed light upon the beginnings of chemistry and has thereby made clear the extraordinary difficulty of the task. Few to-day can appreciate his own rigid attitude towards atomic weights—how it was that he wrote C = 6 and O = 8 almost up to the last. If his intimate story could be written, it would probably be one of a mind ever striving to be scientific, yet held in the thrall of that superhuman force we term conservatism: the force by which our human society is held together and bound—the instinct of the herd—through the exercise of which we alone survive. On the other hand, it also separates us and especially from the past—as each new faith tends to antagonise the mind of its holder against an earlier form.

The rising generation has little if any understanding of the language spoken even so recently as in Berthelot's early days. There are, however, men still alive who knew him, though not at the beginning of his career. Let us hope that these will give us of their best—the details that will enable us to follow his psychological development as a worker. For Pasteur we apparently have this information; the lessons we gain from it are invaluable. We seem to have the clearest understanding of his temperament and to be able to follow the gradual unfolding of his powers: to appreciate the masterly logic of his disposition: to see one continuous line of thought pervading all his labours, above all, his desire to serve his fellows. Berthelot offers a surprising contrast: we know so little of the man. His seems to have been a more universal genius. We are in sore need of some thread of continuity to guide us through the maze of his mind.

No episode in the history of chemical science is of greater interest than that of the discovery of dephlogisticated air by Priestley and the instant appreciation of its value by Lavoisier—conveyed in the magic word 'oxygen,' a word, however, the magic of which is not heard by young ears to-day, even in France. We can, in a measure, put ourselves into Lavoisier's position—our habit of thought still being largely that which he introduced in raising chemistry from an empiric art to a philosophy. We can no longer enter into the spirit of Priestley's work—we cannot even read his language with understanding. He has been commonly regarded as a pure empiric, but it is impossible to give credit to such estimate of his character. Berthelot, indeed, has questioned the truth of his representation of himself as an empiric. There are numerous passages in his works which may be interpreted as proof that behind all his inquiries there was both method and logical purpose, though maybe the purpose of intuition only. In the preface to his collected works (1790), he himself advocates philosophical studies in the following most remarkable passage:

[1] The English original of an 'appreciation' contributed to *Chimie et Industrie* in connexion with the centenary celebrations of Marcelin Berthelot.

I am sorry to have occasion to observe that natural science is very little, if at all, the object of *education* in this country, in which many individuals have distinguished themselves so much by their application to it. And I would observe that, if we wish to lay a good foundation for a philosophical taste and philosophical pursuits, persons should be accustomed to the sight of experiments and processes *in early life.* They should more especially be initiated in the theory and practice of *investigation* by which many of the old discoveries may be made to be really their own—on which account they will be much more valued by them. And, in a great variety of articles, very young persons may be made so far acquainted with everything necessary to be previously known as to engage (which they will do with particular alacrity) in pursuits truly original.

Nowhere, in our schools, have we yet acted up to these recommendations: we pay faint heed to them even in our colleges.

It is my good fortune to be able to overlook the period from 1865 to the present time—an interval of more than sixty years. I still remember how greatly, at the beginning of my career, I was fascinated by Berthelot's achievements, especially by reading his book on organic synthesis (1860). English chemists, I may say, have always been accustomed to pay close attention to the work of their French colleagues, especially that published in the *Comptes rendus de l'Académie des Sciences.* Not only is the concise form in which work is there presented eminently attractive but also, almost invariably, the force of genius is apparent in each communication, some new idea being stated, some advance recorded. Moreover, Berthelot compelled attention by his persistent appearance on the boards week after week. "What has he to say this week?" was the unconscious question we asked ourselves, as each new number came to hand. Some point he always made. His method had the advantage that he made his points singly, so they went home.

Marcelin Berthelot.

Myself a student under Hofmann, Frankland and Kolbe, three of the great pioneers of our science on the organic side, I was specially prepared to appreciate Berthelot's early successes in synthetic chemistry. Few to-day will realise how great was the impression he made by his production of alcohol from ethylene and water, of formic acid from carbonic oxide and soda, of acetylene from carbon and hydrogen—this last a particularly striking discovery at the time when we were beginning to specify organic chemistry as the chemistry of hydrocarbons and their derivatives. The barrier between the living world and the laboratory had indeed been broken down, in 1828, by Wöhler's achievement in preparing urea from ammonia and cyanic acid, but this was a case of Berzelian metameric change, not synthesis. Berthelot went much further and fired our imagination by showing how two and two might be put together to make four and in ways which were extraordinary in their directness and simplicity. Not only was our vision greatly extended but our ambitions also became boundless. We saw that the pass over the heights was won and that the conquest of the great kingdom beyond was a mere matter of time. We now seem able to make what we will, when once we know what we are called upon to do. No plant is safe from our imitation. The world is arrayed in laboratory products. Where our forefathers used woad as a source of indigotin, we use the pure pigment, made by thousands of tons in our factories. The purple used by emperors in the past, laboriously extracted from multitudinous shell-fish, is now a relatively inexpensive laboratory product. We all but laugh at Nature—in fact, we can do more than she elects to do and arrogantly wear two gloves where she is content with but one ; this, her prime secret, however, is her security, it seems, one for which Berthelot did not allow when he suggested that, in the future, perhaps we should live on synthetic food—an unpardonable suggestion for a man belonging to a gastronomic nation to make, a clear blot upon his shield. Chemists, it is true, are cooks but the French cook is by heredity an artist and his art one to be held in reverence, not interfered with by science and spoilt—as is brewing.

Still, the example which we perforce have followed, in our mad career of wresting so much of her prerogative from Nature, is that set by Berthelot. His methods of producing alcohol and formic acid long remained in abeyance—there was no call for their application ; in recent years, however, they have been developed on the large scale. That of acetylene may be ranked as the most fruitful of his discoveries. Produced by the calcium carbide process, which in its essence is Berthelot's, this gas is now used not only as an illuminant but also in the form of the acetylene blowpipe, in welding and cutting steel. Acetylene is also used as the primary material in the production of acetic acid on the large scale. If, to-day, though we do not despise Nature, we are tending to put her aside and make coal the universal raw material, the initial fault was Berthelot's ; if to do so be a virtue, the credit lies equally with him.

Regarding Berthelot, as we must, as the parent of synthetic organic chemistry, we need to be clear in our definition of synthesis, in view of the too general tendency to attach loose meanings to the terms we use and of the danger we run, especially at legal hands, of our terms being misinterpreted by those who have no feeling for their use.

We do well to remember the caution given by Gerhardt in the preface to his " Introduction à l'étude de la chimie " (Montpellier, Fév. 1848):

> J'ai cherché, autant que possible, à joindre, dans l'explication des phénomènes, la précision à la clarté, prenant en cela pour modèle les mathématiciens qui ne se servent jamais d'un terme sans en avoir préalablement établi le sens. Il faudra bien un jour arriver à écrire les livres de la chimie comme on écrit une géométrie ou une algèbre ; c'est alors seulement que la chimie se répandra davantage dans les masses.

In the following passage Gerhardt uses synthesis as the antithesis of analysis :

> Les opérations de la chimie sont de deux espèces : elle détermine les métamorphoses, soit par *analyse*, soit par *synthèse* ; elle sépare de la matière toutes les parties dissemblables, ou, par un procédé inverse, elle unit ces parties entre elles ; elle décompose ou elle récompose. L'activité inhérente à la matière est son moyen ; le chimiste la provoque par le contact immédiat des corps hétérogènes ; il la renforce ou l'affaiblit par l'intermédiaire des agents physiques, chaleur, électricité, lumière.

The word synthesis can only be given its proper verbal meaning : that of putting together, in the fashion so perfectly set by Berthelot, by working upwards from simple to complex. To give an example, oxalic acid may be made analytically by oxidation of sugar ; it may be synthesised through cyanogen, NC . CN. We have reason, however, to believe that in no case are compounds formed directly merely from their atomic constituents. The production of acetylene, in fact, is a highly complex process, involving as it does not only the resolution of the diatomic hydrogen molecule but also that of the carbon complex C_x, where x is an unknown but probably very high value. The equation may be written

$$xH_2 + 2C_x = xC_2H_2.$$

In result only is the synthesis simple. If we accept Faraday's teaching, the process is still more complex, involving other factors which make the occurrence of change possible by the inclusion of the interacting materials in an electrolytic circuit. The same may be said of calcium carbide. There is good reason to believe that, in preparing this substance, by heating carbon with lime, in an electric arc, we are but producing calcium *in situ* and that the carbide is formed by the interaction of carbon and the metal—again under the influence of factors which together with these constitute an electrolytic circuit. The argument is equally applicable to the synthesis of alcohol from ethylene and of a formate from carbonic oxide.

The germ of Berthelot's synthetic achievements is already forecast in his first chemical essay—" Action de la chaleur rouge sur l'alcool et sur l'acide acétique " (*Annal. de Chimie*, **33**, 295 ; 1851). This inquiry was undertaken to ascertain what would happen if *simple* substances were submitted to a red-heat, as nearly all organic substances of high atomic weight gave similar products, coal-tar being an example. His experiments proved that the hydrocarbons benzene and naphthalene, phenol and various other complex compounds were equally obtainable from the simple substances and so laid the foundation of pyrogenic synthesis. In his essay he insists, in the most definite manner possible, that the *synthesis* of benzene, naphthalene, etc., from their elements could henceforth be regarded as a *fait accompli*, inasmuch as acetic acid, from which he had prepared them, had already been produced synthetically, by Kolbe, commencing with carbon bisulphide.

Berthelot, therefore, from the outset, was prepared to give a wide definition of the term synthesis and obviously interpreted it in the sense of the passage quoted above from Gerhardt, whose writings will have been known to him. Moreover, he clearly recognises that Kolbe was his forerunner. The essay is striking testimony to the early development of his genius.

Milestones remain from which we may infer the state of knowledge at the time when his synthetic work was begun. The volume of Liebig's *Annalen* (**81** ; 1852) in which Berthelot's essay is reprinted from the *Annales de Chimie* also contains Alexander Williamson's celebrated memoir on the formation of ether. In this, as is well known, the long standing dispite over the relationship of alcohol and ether was finally settled and the constitution of the two compounds made clear. The student of to-day has difficulty in picturing the crudity of belief and the slight body of knowledge of his forerunner of those by no means far away times. Williamson's interpretation was a master stroke of genius but an absolute 'bolt from the blue,' taking into account the uncertainty, if not confusion, which prevailed. We know that when he undertook the inquiry, he had not in mind the problem of which, as he ultimately saw, it gave the solution. I have vainly sought for a clue to his mental development up to the stage when he suddenly took so great a step forward and defined for all time the alcoholic and etheric functions. The nearest approach to an explanation which may be offered is, that he was under the spell of Gerhardt's logical genius, as may be inferred from the consistent manner in which he (also his friend Kekulé) made use of 'typical' formulæ from this time onwards. The alcohol-ether problem was ripe for solution, in fact, owing to the publication of Gerhardt's advanced theoretical views.

Another article of special historical interest, in connexion with Berthelot's work, in the volume of Liebig's *Annalen* referred to, is a letter from Hofmann to Liebig on "The Application of Organic Chemistry to Perfumery." Hofmann prefaces his account by directing attention to Cahour's work on the oil of *Gaultheria procumbens*, showing it to be a compound ether. He sees proof of the influence this had upon perfumers in the appearance in our first English Exhibition (1851) of numerous fruit ethers and describes the results of his examination of various samples which he had collected as a juryman—he had found the 'pear oil' to be amylic acetate, the 'apple oil' amylic valerate, the 'pine-apple oil' ethylic butyrate, etc. To-day, such synthetic materials are used not only in perfumery but also, on a huge scale, as solvents in the cellulose and varnish industries. Berthelot soon afterwards became interested in the more complex etheral salts and, in fact, began his synthetic campaign by building up fats artificially from glycerol and fatty acids, thus crowning the work of his great countryman Chevreul.

The inquiry that has received more attention perhaps than any other published under his name and probably is the most esteemed is that on etherification, in which he was associated with Pean de St. Gilles. Carried out with exceptional care and finish, dealing with a fundamental problem of the highest interest, akin to that which Williamson had dealt with in his interpretation of the conditions of metallic salts in aqueous solution, the inquiry excited the widest interest and was the prototype of many similar inquiries—none the less, even now, we are not fully informed nor agreed as to the precise nature of the process.

A branch of Berthelot's work which appealed to me in my early days was that upon oil of turpentine, in which again he appeared as a pioneer. He was the first to distinguish between the oils from various sources and especially to note the distinctive differences in optical properties.

Acetylene, if not his discovery, was first characterised by him and eventually synthesised from its elements. As this is the most fundamental of all syntheses and the gas is of great technical importance, his name will always be indissolubly linked by chemists with this hydrocarbon and its direct conversion into benzene.

Persulphonic anhydride and persulphonic acid are probably to be ranked as his most important primary chemical discoveries.

The most difficult chapter in Berthelot's work to appraise is the thermochemical, including that of explosive combustion. Ever a fundamentalist at heart, in this, as in all his other work, he sought for primary values. Commencing in 1865, it covers a wide range. The earlier data are probably uncertain in not a few cases. In this, as in most other sections of his work, he was opening up a new field of inquiry and methods had to be devised and developed. Such work, moreover, was scarcely suited to his imaginative temperament and impetuous mode of attack. It needs not only a highly developed sense of accuracy but also a persistence and patience and a self-denial which few possess. He came into conflict with Julius Thomsen, who was making thermochemical measurement his life work; usually, in the end, they were in agreement. Berthelot probably derived his interest in such work from the example set by his great countrymen Lavoisier and Laplace. He sought to generalise and so was led to formulate his well-known three principles. Ultimately he rendered a service which it is difficult to overestimate by his invention of the calorimetric bomb, one of the most powerful engines of research yet devised. Maybe the principle embodied in its use will some day be utilised in the internal combustion engine, when oil is no longer available as a cheap fuel. Hitherto it has been used chiefly in estimating the calorific value of fuels but it has also been of service in analysis.

In fact, thermochemistry seems almost to be a subject of the past. Few to-day will realise how great was the interest we took in Berthelot's and Thomsen's results as they were published. Testimony to my own interest in the subject is to be found in the article "Chemistry," which I wrote for the "Encyclopædia Britannica" (vol. 5, ed. 9), published in 1876. I then quoted characteristic thermal data for most of the elements.

It is unfortunate that chemists now so rarely take thermochemical values into consideration. When this is done, interpretations which on the surface may seem plausible are often precluded. An example may be found in the enigmatic behaviour of carbonic oxide. As H. B. Dixon was the first to show, this gas in admixture with oxygen is incombustible when dried, although if the mixture be moistened it explodes, the rate of combustion being more rapid the more moisture is present up to a certain point. This behaviour has been interpreted as proof that combustion takes place through the agency of 'water' in accordance with the equation

$$CO + OH_2 = CO_2 + H_2.$$

This interpretation is precluded, however, by the fact that the heat of combustion of hydrogen to liquid water is greater than that of carbonic oxide.

Wieland has shown that such an interaction apparently does take place under the influence of palladium black but he goes further: having observed that traces of formic acid are present in the liquid, he argues that formic acid is the first product:

$$CO + OH_2 = H_2CO_2,$$

and that this is deprived of hydrogen by the action of the palladium

$$CO_2H_2 = CO_2 + H_2.$$

As formic acid has a higher heat of combustion than carbonic oxide, the formation of the acid from the gas would be an endothermic process. On this ground, Wieland's modified interpretation of the combustion process must equally be ruled out of order.

On thermo- and electro-chemical grounds we may go even further and premise that carbonic oxide cannot be burnt by ordinary oxygen, even when all other necessary determinative conditions are realised. On the assumption that every chemical interchange is an electrolytic process, whenever 'conducting water' is present as a necessary element in the circuit in which interchange is effected, no action should take place at any potential below that developed in the formation of water from hydrogen and oxygen. To burn carbonic oxide, it is necessary therefore to use an oxidising agent of higher potential than ordinary oxygen, the heat of combustion of carbonic oxide being below that of hydrogen. Hydrogen peroxide is such an agent. This oxide is a product of the primary interaction when hydrogen is burnt

$$\begin{array}{c|c|c} H & HO\ldots H & O \\ \cdot & & \cdot\cdot \\ H & HO\ldots H & O \end{array} = \begin{array}{c|c|c} H_2O & \ldots & HO \\ & & \cdot \\ H_2O & \ldots & HO. \end{array}$$

To explain the fact that a moist mixture of carbonic oxide and ordinary oxygen is explosive, we therefore need only to assume that on firing the mixture a minute quantity of water is decomposed: that the liberated hydrogen is then at once *peroxidised* and that the hydrogen peroxide thus produced serves to oxidise the equivalent amount of carbonic oxide. All the peculiarities in the behaviour of carbonic oxide on combustion are accounted for by these assumptions.

The halting use hitherto made of thermochemical data is due, in no slight measure, to a suspicion that the values, in not a few cases, are of doubtful accuracy. The difficulty of interpreting the observed values is a still greater bar. These are all based upon the study of molecular interactions, often complex in character, the direct determination of atomic values being impossible. The difficulty has been in part met, in recent years, by resort to thermo-dynamical reasoning and the introduction of 'electrolytic' methods.

We are in face of this difficulty especially in the case of carbon. Julius Thomsen's numerous calculated values for carbon compounds were all based upon Favre and Silbermann's determination (1842–43) of the heat of combustion of charcoal carbon, made at a time when the methods were but imperfectly developed.

Berthelot, with Petit, made use of his calorimetric bomb in redetermining the value of carbon in its reputed three forms. They give as the means of closely accordant determinations the 'atomic values'

Diamond	94,310	gram-degree Centigrade units
Graphite	94,810	,, ,,
Charcoal	96,960	,, ,, .

Apart from the question as to which of the forms the theoretical heats of formation of carbon compounds may properly be referred, we have yet to show that there are forms of carbon other than the diamond. Now that there is reason to suppose, in view of Sir Charles Parsons's inquiries, that diamond has never been produced artificially, the problem is raised to an acute stage. The probability is that the reported allotropes of diamond (graphite and charcoal) are hydrocarbons containing the minute proportion of hydrogen needed to prevent the carbon atoms from lapsing into the highly stable condition they present in diamond, owing to the symmetrical, uniformly tetrahedral arrangement of the atomic units. The very small difference between diamond and graphite, the relatively large difference between graphite and charcoal are both surprising. We cannot accept even Berthelot and Petit's determinations as final.

A worthy monument to Berthelot's memory and genius would be an institute charged with the duty of placing beyond question all the fundamental thermal values and of extending thermochemical study in general. A vast field of fruitful inquiry lies open in the hydrocarbons especially.

It is impossible to contemplate the long list of titles—about 1500—to which his name is attached without feeling that justice remains to be done to his phenomenal activity. We need a studied, critical analysis of his work, in which the logic of his progress is fitly displayed. The work of poets is considered line by line: their critics seek to reconcile the miracles they have wrought in words with the peculiarities, if not deficiencies, of their moral character. The characters of statesmen, of soldiers, sailors and explorers are often discussed in considering their deeds. Little has been done to analyse the psychology of the scientific mind, to define the special features of the scientific spirit, yet even poets have foreseen that it is the spirit of the future. With most wonderful prescience Shelley has said of man:

"All things confess his strength. . . .

. . . .

The lightning is his slave; heaven's utmost deep
Gives up her stars and like a flock of sheep
They pass before his eye, are numbered and roll on!
The tempest is his steed, he strides the air
And the abyss shouts from her depth laid bare,
'Heaven, hast thou secrets? Man unveils me; I
have none!'"

Of such order was Berthelot. We need to have the strength of the scientific mind fully unveiled: its weaknesses too, so that we may seek to combat them in the future service of the world.

Obituary.

Mr. H. M. Taylor, F.R.S.

Henry Martyn Taylor, at the time of his death the senior on the roll of fellows of Trinity College, Cambridge, was born at Bristol on June 6, 1842, the second son of the Rev. James Taylor, D.D. After being educated at Wakefield Grammar School, of which his father had become headmaster, he was sent to Cambridge, being elected to a scholarship at his college. He graduated as third wrangler and was awarded the second Smith's Prize in 1865; in that year the late Lord Rayleigh was senior wrangler and first Smith's prizeman, and the well-known economist Alfred Marshall was second wrangler. In the year of his graduation, Taylor was appointed vice-principal (with H. J. Purkiss, the senior wrangler of 1864, as principal) of the newly established Royal School of Naval Architecture and Marine Engineering at South Kensington, afterwards the Royal Naval College at Greenwich. Taylor's most distinguished pupil was Sir W. H. White, later Naval Constructor; the relation, there begun, lasted until the death of the younger man in 1913.

In the last century, Cambridge men of high degrees often looked to the Bar for a career; among mathematicians, the names of Alderson, Pollock, Rigby, Stirling, Webster, Moulton, Levett, readily occur as men who made their mark. So Taylor read for the Bar; and he was called by Lincoln's Inn in 1869. He does not appear to have practised; for, elected a fellow of Trinity in 1866, he returned in the year of his call as an assistant tutor of his college. The rest of his life was spent in Cambridge. He was tutor of Trinity from 1874 to 1884, the ten-year period having been established. He remained on the staff as a mathematical lecturer until 1894, thus completing the normal maximum of twenty-five years' service in the college.

The 'seventies were an active time of academic reform in Cambridge. The old Elizabethan statutes had been partially modified by the first Victorian statutes in 1858; but a comprehensive change was made by the Universities of Oxford and Cambridge Act of 1877. Under that Act, each college framed its own statutes for submission to the Privy Council. Accordingly, Trinity proceeded with that duty in a long succession of meetings: it was at one of these that the master (Dr. W. H. Thompson) relieved the momentary tension by informing a distinguished very junior fellow, still living, that "we are none of us infallible, not even the youngest." When decisions had been completed, the final drafting of the statutes was entrusted to three of the fellows: Prof. Cayley, whose reputation as a draughtsman long survived his retirement from practice at the Bar: Rev. Coutts Trotter, conspicuous for his share in the organisation of the University, especially in the domain of natural science: and H. M. Taylor, whose legal training proved of high value. Then, and for many years to come, Taylor had a prominent (if not foremost) part in giving effect to the necessary changes in the old system. Independent in thought, and scrupulously just, he maintained the even tenor of his views, devoted to progress yet mindful of the ancient ways, fair in constructive act, and straight in opposition. Those statutes are now under repeal; their actual initial working owed much to the prudent wisdom of a band of reformers, among whom Taylor held a not unworthy place.

From the beginning of his career, Taylor was interested in research, particularly in subjects of a geometrical character. His two earliest papers date from 1866, and deal—one with interpretations of planetary formulæ (unwittingly, a return to the ancient Greek cycles), the other with inversion. Later, he wrote on the algebraic theory of envelopes and developable surfaces: and he manifested a productive interest in problems of algebraic distribution, applied to chess and to probability. Gradually, his work converged upon the theory of plane curves and of surfaces: thus he discussed the centre of an algebraic curve (1890), and cubics and quartics (1897–98). Perhaps his most important paper is one dealing with cubic surfaces and a diagram of their twenty-seven lines (*Phil. Trans.*, 1895).

Moreover, Taylor did much work for his friends by helpful criticism of the proof-sheets of their books in passage through the press: particular mention may be made of Rayleigh's "Theory of Sound," Lamb's "Hydrodynamics" (the latest edition of which is dedicated to Taylor), and Forsyth's "Differential Equations" and "Theory of Functions." He produced one volume of his own, the "Pitt Press Euclid": it is too extensive for a schoolbook, and now too conservative for a modern practice which sometimes tends to an anarchic freedom from proof. He also wrote the "Encyclopædia Britannica" article on Newton.

When Taylor's college work came to an end, it seemed as if he would be free to proceed in the range of original work belonging to the theory of algebraic curves and surfaces. But misfortune seized him at the approach of leisure. In 1894 the sight of one eye failed, through detachment of the retina; and, soon, the sight of the other eye failed also. Though he did succeed in continuing mathematical research for a time with the help of amanuenses, and indeed produced several papers after the loss of sight, so that he was elected a fellow of the Royal Society in 1898, it soon became clear that this form of activity had to be abandoned. He had found the Braille volumes a solace within their range; but the comparative lack of scientific books in Braille type stirred a new idea, the realisation of which opened a new life for him.

Taylor set to work and developed the Braille alphabet; he devised amplications which rendered possible the reproduction of mathematical formulæ, figures, and diagrams, even some illustrations of books. He worked in connexion with the association which produces Braille books; but its funds could not bear the high charges necessarily entailed. So some friends, admiring Taylor's courage, collected a small fund to subsidise the association.

The result was a fine success. Volume after volume was translated into Braille; text-books on geometry, algebra, conic sections, trigonometry, astronomy, geology, the foundations of mathematics, metaphysics, physiology, sound, music, and mechanics—a list that is not complete—were published by the help of the fund. Every symbol on every page of every volume was stippled out by Taylor's own hand, with a cheerfulness and a patience that were amazing. His work is a real contribution to the life of the blind. Financial aid for the work, thus initiated, has been placed on a permanent basis; for his friends gathered funds which, under the name of the Embossed Scientific Books Fund, have been accepted as a trust administration by the Royal Society.

This bond of communication with the world that lives by sight gave Taylor new interests. He remained a member of the council of his college, under the new statutes, being re-elected time after time. He was made a university member of the borough council of Cambridge, served as mayor in 1900–1, and for some subsequent years was chairman of the finance committee of that council. Also he was nominated a borough magistrate, and discharged the duties with characteristic regularity and fairness.

In later years, the burden of age told; and, for nearly two years, Taylor had been practically confined to his house. Unmarried, he made a home for his mother—who, in her nineties, chaffed him when he was mayor—and for his sister who survives him. At that house, The Yews, set in the college backs, he died on Sunday, Oct. 16th last; and on the succeeding Wednesday, after a funeral service in the College Chapel, he was interred in the Huntingdon Road Cemetery.

Taylor's record, from 1894 onwards, is one of rare patience: of serene courage: and of unflinching cheerfulness under calamity, without a word of complaint. He leaves behind him the memory of a man who, for over thirty years, fought his

One fight more,
The best and the last.

A. R. F.[1]

Dr. B. Daydon Jackson.

A long life of useful work was closed by the death in Westminster Hospital, on Oct. 12, as the result of a street accident, of Dr. B. Daydon Jackson, who since 1880 had been actively associated with the conduct of the Linnean Society.

Born on April 3, 1846, in Stockwell, then *near* London, Jackson was educated in private schools. Though he seems to have had no special training, he was much interested in natural history; he was one of the early members of the Quekett Microscopical Club, and in 1868 was elected a fellow of the Linnean Society. His interest in our British flora brought him into touch with the botanists at the British Museum and Kew, and his special aptitude for bibliographical work was soon apparent. In 1876 he edited, with the addition of notes and references and a life of the author, "A Catalogue of Plants cultivated in the Garden of John Gerard, in the Years 1596–1599"; and in the following year a similar reprint and edition of William Turner's "Libellus de re herbaria novus," originally published in 1538. In 1881 the Index Society published his "Guide to the Literature of Botany"—a classified selection of botanical works, which, though nearly fifty years old, it is still worth while to consult. This was followed in 1882 by "Vegetable Technology," a contribution towards a bibliography of economic botany, also published by the Index Society. Meanwhile, in 1880, Jackson had been elected to the botanical secretaryship of the Linnean Society, for which he worked devotedly during the rest of his life, for twenty-two years (1880–1902) as botanical secretary, and then as chief of the permanent staff, with the style of general secretary, until last year, when he retired from active participation in the conduct of the Society, though his services were retained as curator of the Linnean collections. Jackson's work for and association with the Linnean Society is so well known as to need no comment here. Successive generations of botanists and zoologists will gratefully remember the ready help and advice which was always at their service at the Society's rooms in Burlington House. A permanent expression of their feeling was the presentation of Dr. Jackson's portrait to the Society on the occasion of his resignation of the secretaryship at the anniversary meeting in 1926.

Jackson's most important literary work was the "Index Kewensis"—an enumeration of the genera and species of flowering plants from the time of Linnæus to 1885, the expense for the compilation of which was contributed by Charles Darwin. The work of compilation was begun in February 1882 and the final part was published in 1895. Of the first supplement, bringing the Index up to 1895, Dr. Jackson and Dr. T. Durand, of Brussels, were the authors.

Another invaluable book of reference was the "Glossary of Botanic Terms with their Derivation and Accent," which he issued in 1900; subsequent revised editions appeared in 1905 and 1916.

The Linnean Society is the home not only of the herbarium but also of the library, manuscripts, etc., of Linnæus; an intimate knowledge of these brought Dr. Jackson into touch with workers, especially taxonomists, at home and abroad. His various publications on the Linnean collections, and his recent English edition of Prof. Fries's "Life of Linnæus," may be mentioned. So highly was this aspect of his work appreciated in Sweden that at the Linnean bicentenary celebrations at Upsala in 1907 he received special honour, including a knighthood (R.N.O.), and the Hon. Ph.D. and A.M. of the University. His last important work was the recently issued catalogue of the Society's library.

The remarkable vigour of Jackson's constitution —he had never missed a meeting of the council during his forty-seven years' continuous service,

[1] Some passages in the foregoing are taken from the writer's obituary notice which appeared in the *Times*, Oct. 17.

and only one general meeting—gave hope that he would for some years more be able to fulfil the light duties assigned to him as curator of the Linnean collections. It has been ordered otherwise and he has fallen, literally almost, at his post.

A. B. R.

PROF. A. MAIR.

PROF. ALEXANDER MAIR, whose death occurred on Oct. 7 at the comparatively early age of fifty-seven years, had occupied the chair of philosophy at the University of Liverpool since 1910. Although he made no direct contribution to purely scientific research, he was always keenly interested in recent developments of scientific theory, and extremely appreciative of their wider philosophic implications. He was the author of the articles on "Hallucination" and "Belief" in "The Encyclopædia of Religion and Ethics," of "Philosophy and Reality" (published 1911), and of "Immanence and Transcendence," and "The Idea of Transcendent Deity," in recent volumes of the *Proceedings of the Aristotelian Society*.

Prof. Mair was born in Glasgow, and pursued his studies at Edinburgh, the Sorbonne, and Marburg. He exercised a marked influence both within the University and in connexion with many extra-mural educational institutions, being also the first president of the recently founded Liverpool Psychological Society and active in promoting the Liverpool Branch of the British Institute of Philosophical Studies; while his philosophy seminar was attended by a growing number of post-graduate students. His intellectual ability, combined with his generous disposition and patent sincerity, gained for him a wide sphere of appreciation.

WE regret to announce the following deaths:

Rev. H. N. Hutchinson, author of "Prehistoric Man and Beast," "Extinct Monsters," and other popular books on scientific topics, on Oct. 30, aged seventy-two years.

Dr. J. R. Leeson, mayor of Twickenham and author of "Lister as I knew him," who also interested himself in several aspects of natural science, on Oct. 23, aged seventy-three years.

News and Views.

SIR ALFRED MOND'S address on the chemical industry, read by Dr. F. A. Freeth before the Central Economic League on Oct. 20, ought to receive wide publicity, for it tells the plain man in plain terms how that industry, particularly in Great Britain, stands in relation to his own daily needs, his protection, his future requirements, and, in fact, his very life. Such a pronouncement, coming as it does from the chairman of Imperial Chemical Industries, Ltd., the great merger of Brunner, Mond and Co., Ltd., Nobel Industries, Ltd., British Dyes, and the United Alkali Co., Ltd., with a total of seventy-five constituent and associated companies, cannot fail to merit the closest attention of economists and of all those interested in the different aspects of the social welfare and development of the race. An analysis of the ordinary doings of the ordinary man throughout the twenty-four hours has shown that all the objects with which he deals, and most of the food he eats, have at some time or other come within the province of chemical industry. Chemicals, in fact, form the foundation of the world's industries, and hence are to be found at the very root of Imperial security and prosperity. It is of course not only the chemist who carries the technical responsibility in these concerns; as Sir Alfred Mond remarked, good engineering can also turn an unprofitable chemical process into a profitable one, notwithstanding that the same chemical reaction has been used under comparable conditions in each case. The new fertiliser process at Billingham, for example, depends for its success on the application of extremely high gas pressures. The development of an industrial technique of high pressures not only leads to commercial success in one branch of the industry, but also opens up new avenues of research and application of immeasurable national and Imperial significance.

PROBLEMS relating to agriculture, to the ultimate dependence of the food supply on the production of fertilisers from the atmosphere, to the new realisation of the value of systematically fertilised grassland, to the possibility of the synthetic production of vitamins, were all brought under review, and attention was directed to what may be termed the 'fuel problem.' Sir Alfred Mond views with equanimity even an exhaustion of the world's timber supplies, believing that, if necessary, chemical industry would undoubtedly come to the rescue with a substitute. More remarkable still is the movement by centralised industry in repairing the deficiencies of that local chemical works which each one of us possesses in his own body. Synthetic insulin, for example, as effective in its action as its natural counterpart, is at least a vision of the early future. In speaking of industrial peace, Sir Alfred Mond referred to the fortunate happy and friendly past of the chemical industry, and outlined the plans which had been laid within the organisation of which he is chairman, with the view of promoting personal contact, improved status, increased security, co-partnership in profits, and co-operation. In the concluding words of the address: "The achievement of industrial peace cannot be hastened merely by the desires of enthusiastic amateurs or disillusioned politicians. It can be secured only by the competence and good will of those in whose hands are placed the responsibility for industrial organisations, whether on the side of direction or on the side of labour. There is a new spirit and a new science in the management of chemical industry. That new spirit and new science is the broad avenue to industrial prosperity and industrial peace."

MR. J. E. WILLIAMS, whose interesting book, "In Search of Reality," was reviewed in NATURE of June 5, 1926, writes with reference to the leading article, "Science and Philosophy," which appeared on Oct. 22, to protest against any mechanistic explanation of evolution being accepted as firmly established. His criticism is directed mainly against Sir Arthur Keith's address to the British Association, in which it was stated that evolution has been accomplished "under the action of forces which can be observed and measured." Mr. Williams considers that the public have taken this statement to mean an endorsement of the mid-Victorian belief in the sufficiency of natural selection, and generally as a pronouncement in favour of a mechanistic explanation of the evolutionary process. It is, he believes, " such unwarrantable materialistic dogmatism regarding the cause of evolution which has given rise to the resentment against the whole theory so manifest in religious circles at the present time." No doubt Mr. Williams is right in his diagnosis of the cause of this resentment; we would, however, point out that the leading article which was the immediate occasion of his letter expressly advocated a reconsideration of biological conceptions, and in no way proposed as sufficient or final any mechanistic views, whether of life or of evolution.

THE movement of a mountain, Monte Arbino, 5560 feet in height, is giving rise to such anxiety in the neighbourhood of Bellinzona, three miles to the east of which it is situated and not very far from the northern end of Lago Maggiore, that the authorities of the Ticino Canton in which it lies (the Italo-Swiss frontier crossing the northern end of the lake at Brissago) have ordered the evacuation of the zone of danger. The mountain has been moving horizontally since 1888, and in 1905, when the Federal Geological Survey directed attention to it, the summit had moved eastwards more than six feet in the interval. Since then it has been moving at an increasing rate per year, until during last year, 1926 alone, it had moved a foot. It has simultaneously lowered in height to a little more than the same extent, fourteen inches in 1926. The moving mass covers 2520 square yards. The movement has now reached such proportions, and such large and numerous cracks and crevasses have developed which have widened rapidly in the last few months, that the neighbouring hills of La Monde and Chiara are ordered to be evacuated, and all building operations or the felling of trees are prohibited. On account of the movement trees on the slopes of the mountain are leaning very considerably and more and more out of the perpendicular, and from time to time large falls of earth and rocks are occurring. The Survey experts believe that the mountain will before long crash down into the valley of Arbedo, and that nothing can be done to avert the fall, which, while the town of Bellinzona is itself happily protected by a granite ridge, would overwhelm the picturesque villages and farms with their groves of chestnut trees and firs, together with a large area of forest land and valuable pasture meadows.

IT was announced in the *Times* of Oct. 29 that the Nobel Prize for Physiology and Medicine for 1926 had been awarded by the Karolinska Institute, Stockholm, to Prof. Johannes Fibiger, of the University of Copenhagen, and that for 1927 to Prof. Julius Wagner von Jauregg, of the University of Vienna. The award for 1926 has, however, already been announced (see NATURE, Nov. 27, 1926, p. 778). Prof. Fibiger is perhaps best known by his work on the experimental production of cancer in rats. The behaviour of an animal with a transplanted cancerous growth may not be the same as that of one in which a tumour spontaneously develops. Filiger succeeded in producing growths of the stomach and tongue in rats by feeding them with cockroaches infested with a small nematode worm, which may be the cause of similar tumours developing, apparently spontaneously, under natural conditions. The method has enabled material for the study of the development of cancer to be obtained under experimentally controlled conditions. Prof. Wagner von Jauregg is well known as the originator of the malarial treatment of general paralysis of the insane. The treatment is based on old observations that the disease is frequently benefited by prolonged suppuration or fever. The first development of these observations was the production of pyrexia by means of injections of tuberculin or typhus vaccine, but more striking improvements occurred in patients who had fortuitously developed some infection. Wagner von Jauregg therefore began treating patients in 1917 by inoculation with benign tertian malaria, and the method has now been used extensively both by him and by workers in other countries. Apparently permanent remissions occur in about half the cases, and many of the remainder are considerably benefited. The patient is allowed to have about a dozen typical malarial attacks and is then cured by the administration of quinine, to which the inoculated disease readily responds. If the initial remission is complete, it appears to last for several years and the future may prove it to be permanent, at any rate in certain cases.

THE earthquake of Oct. 24, of which a brief notice was given in our last issue (p. 630), seems to have originated somewhere off the Alaskan coast. From the seismograph records at Oxford, Kew, and Helwan, Prof. Turner suggests that it may belong to the same focus as a much weaker earthquake on Nov. 29, 1920, or in lat. 59° N., long. 149° W. This position, which is about 50 miles south of the Kenai Peninsula and 320 miles west of Yakutat Bay, agrees fairly with the estimates of the distance of the origin from the University of California (1500 miles) and Ottawa (2615 miles). The evidence, so far as it goes, is somewhat conflicting. The shock seems to have been felt most strongly in the south-east of Alaska, and but slightly in northern Alaska. The telegraph cable was broken in two places, near Wrangell and between Juneau and Skagway, that is to say, in the narrow sounds of the Alexander Archipelago. Moreover, no sea-waves were recorded at Honolulu, and none have been reported from San Francisco, and these might have been expected with a submarine earthquake of this magnitude. On Sept. 3 and 10, 1899, two of the greatest of recent earthquakes occurred in Yakutat Bay. They were accompanied by the most remarkable uplifts (of so much as 47 ft. 4 in.) known to us, measured six years later by the height of dead barnacles still adhering to the rocks. The epicentral area crossed narrow sounds, and, on account of the small volume of water raised, the sea-waves, though observed on the surrounding coasts, were not perceptible at great distances. It is possible that the epicentre of the recent earthquake may have occupied a somewhat similar position among the channels of the Alexander Archipelago.

INTERESTING records of the Alaskan coast earthquake of Oct. 24 were obtained at Kew Observatory. The direct longitudinal waves (*P*) arrived at 16 hr. 10 min. 39 sec. G.M.T., and the direct transverse waves (*S*) 525 seconds later. This time interval corresponds with an epicentral distance of 7320 kilometres. First and second reflections of both *P* and *S* were recognisable. The direct surface waves were well developed, as also were those which had travelled by the long path (that is, via the antipodes). These return waves arrived 2¼ hours after the *P* phase. The largest earth displacement recorded on the east-west component seismograph during the surface phase amounted to 220 microns. For the Japanese earthquake of Mar. 7, 1927, and the Chinese earthquake of May 22, 1927, maximum displacements of about 500 microns were recorded.

DURING the recent visit of the Imperial Agricultural Research Conference to Edinburgh the delegates inspected the Animal Breeding Research Department of the University, the Animal Diseases Research Association, the Royal (Dick) Veterinary College, the Plant Breeding Station, and the Board of Agriculture Seed Testing and Plant Registration Stations. On Oct. 28, the Right Hon. Sir John Gilmour, Bart., Secretary of State for Scotland, received the honorary degree of LL.D. and delivered his address as Lord Rector of the University to the students. He emphasised the clamant need for men fitted to engage in research, and said that for these they must look to the universities. The finding of satisfactory answers to two great questions—" How can we improve production ? " and " How can we secure for the product the most complete immunity from the onset of disease ? " —is a matter of vital concern to the home country. The extent of the British Empire and the bewildering variety of climates and soils and of animals and plants place it in a unique position as regards opportunities for research. Peculiar importance attaches to that part of the Empire which lies in the tropics, for there Nature holds out the largest promise of adding to the economic wealth of the world and thereby raising the standard of comfort for mankind in general. He urged those who have the qualifications for research to realise the new opportunities which are presenting themselves and, in weighing up the prospects of a career, not to leave out of account what may be waiting beyond the seas.

AT the luncheon in honour of the Lord Rector, which followed, the Earl of Balfour referred to the great advances due to those who ardently pursued knowledge without the least idea that that knowledge was going to make any material difference either to their own fortunes or to the fortunes of the world. He pointed out the difficulty of apportioning the amount of support which ought to be given to researches which seem on the face of them completely useless, and to others in which principles are applied to the actual work of the world. A great discoverer cannot be made, but every university ought to try to give such men the chances which will enable them to make use of their unique gifts. Lord Balfour said it is not easy and is not going to be easy to find enough persons with the education and the capacity to turn discoveries to the best account, but every university must set itself to do its best. The expansion of the whole apparatus of university education is a most expensive business, and the gifts of new chairs and laboratories place pecuniary obligations on the university, so that such gifts are in themselves the reason why more money is required.

A CHADWICK Public Lecture on " Tropical Vegetation and some of its Uses to Man," was delivered by Mr. W. Hales, Curator of the Chelsea Physic Garden on Oct. 27. Mr. Hales was granted leave of absence by the Trustees of the Garden for the purpose of seeing tropical vegetation under natural conditions, and described in his lecture the salient features of the native vegetation and agricultural crops seen in his visit to Ceylon, the Straits Settlements, Malaya, and Java. The work of the Royal Botanic Gardens, Peradeniya, Ceylon, was referred to, and the cultivation of tea in that country was described. At Penang, the waterfall gardens are famous for their beauty, and large numbers of rare plants have been distributed from there to other gardens. From Taipang, Malay, a tour of inspection of the mangrove swamps was made; these swamps yield a large revenue to the Government from the sale of wood. Kuala Lumpur and its agricultural station were next visited. The introduction of rubber into Malaya was alluded to, and some of the research work done on rubber growing was described, In Java, the principal crops are rice, sugar-cane, and cinchona for quinine, 90 per cent. of the world's supply of this drug coming from Java. The botanic gardens of Buitenzorg contain the richest collection of plants of any garden seen by Mr. Hales in the East, and as a scientific institution it ranks next to the Royal Gardens at Kew.

LECTURING on " Eugenics in the Future " at Bedford College, University of London, on Oct. 25, Major Darwin protested against the attack on eugenic reform as materialistic. It is not materialistic to use the history of the past to supply guidance for conduct in the future. Science affords no clue to the ultimate meaning and aim of the universe—these are the problems of religion and philosophy—but a scientific study of the laws of Nature enables one to form reasonable expectations as to the result of processes affecting the mental and physical development of man. Study of evolutionary principles affords the surest guide to the betterment of the race. Eugenists are in favour of schemes for social amelioration, but are convinced that they are not enough to secure social progress. The disproportionate birthrates of the more and less valuable strains at present show that all is not well with society: decrease in racial quality may coincide with an increase in material prosperity which obscures the underlying causes of eventual deterioration. The public is not ripe for drastic eugenic legislation, even where it is desirable, but patriotism and enlightened public opinion can help to increase the birthrate of the better stocks. Self control on the part of those with such family taints as insanity; segregation of the mentally deficient; some form of pressure applied to persons in chronic receipt of relief who have proved unable to maintain themselves or their families; and more enlightened treatment of habitual criminals, would curtail the birthrate among the less desirable strains.

MR. ARCHIBALD PAGE, president of the Institution of Electrical Engineers, gave his inaugural address on Oct. 20. As Mr. Page is the engineer and manager of the Central Electricity Board, his address was looked forward to with great interest. He pointed out that our progress would have been more rapid had it not been for the rivalry between large electrical undertakings and the overzealous display of local patriotism by the smaller municipal undertakings. There is no infallible remedy for the present state of things, but methods of generating electricity must be altered. In particular, electrical stations must be interconnected by a system of high-tension lines. These lines will be supported on towers eighty feet high and sixteen square feet at the base. Their design was settled after consultation with Sir Reginald Blomfield. The conductors, the pressure between which will be 132,000 volts, will be spaced at a distance of 12 feet apart. The lines will be made of aluminium with a steel core to strengthen it mechanically. The step down transformers will vary in size from 10,000 to 75,000 kilowatts, and the voltages will be varied to suit the requirements of the distributing stations. Amongst the advantages claimed for 'the grid' scheme is that it will allow of the aggregate amount of spare plant to be considerably reduced, and that it will enable 'blocks' of waste heat from blast furnaces, coke ovens, and other sources to be transformed into electricity and thus usefully employed. In his last Budget speech, the Chancellor of the Exchequer said that there were signs that the centre of gravity of industry in Great Britain is moving south. By means of the grid, power can be given to facilitate the development of industry wherever it is wanted. The new scheme, however, will not appreciably affect the cost of lighting in our big cities which have modern power stations.

PRITZEL'S *Iconum Botanicarum Index*, which is a list of references to illustrations of flowering plants and ferns in botanical, horticultural, and other publications, has been a standard work of reference since its completion in 1865. In 1917 the Council of the Royal Horticultural Society decided to undertake the revision and continuation of Pritzel's *Index*, and the work has been carried out at Kew under the editorship of Dr. Otto Stapf, late Keeper of the Herbarium, with the help of the facilities of, and material already to hand in, the Kew library. Pritzel's *Index* contained more than 107,000 references; the new edition, which bears the title *Iconum Botanicarum Index Londinensis*, will contain 450,000 references, including those in the original work, to illustrations of flowering plants, ferns, and fern allies published in botanical, horticultural, and other works and journals between the years 1753 and 1920. It is also proposed to issue periodic supplements. The *Index* will be as complete as it has been possible to make it by consultation of the libraries at Kew, the Natural History Museum, and elsewhere, and with the help of assistance from botanists on the continent of Europe and in America. The first portion is ready for press, and a circular has been issued by the Royal Horticultural Society announcing its appearance. The Oxford Press is printing the *Index*, which will have the same size and form as the *Index Kewensis*, the references being arranged in three columns on a quarto page, alphabetically under the genus name. It will appear in six volumes, two of which will be issued in each of the years 1928, 1929, and 1930. The subscription price is £25. Intending subscribers should apply to the secretary of the Royal Horticultural Society; it is stated that the edition will be strictly limited.

ALTHOUGH the front of Faraday House Electrical Engineering College suffered considerable damage by the crane which fell in Southampton Row on the night of Oct. 28, it has been found possible to carry on the work of the College. The testing laboratories received but little damage, and the work of the Standardising department is proceeding normally.

THE following have been elected office-bearers of the University of Durham Philosophical Society for the session 1927–1928:—*President*, The Chancellor of the University—The Earl of Durham; *Hon. Sec.*, Dr. D. A. Allan; *Hon. Treas.*, J. W. Bullerwell; *Editor of Proceedings*, Prof. G. W. Todd; *Chairmen of Sections*—Chemical and Physical, Prof. W. E. Curtis; Geological and Biological, Prof. J. W. Heslop Harrison; Mathematical, The Rev. F. H. Jackson; Archæological and Historical, Prof. J. W. Duff; Applied Science, Dr. J. Morrow; Philosophical, Prof. J. W. Harvey.

THE third annual Norman Lockyer Lecture—established by the British Science Guild as a means of periodically directing the attention of the public to the influence of science upon human progress—will be given by The Very Rev. Dean Inge, in the Goldsmiths' Hall, Foster Lane, E.C.2 (by permission of the Goldsmiths' Company), on Monday, Nov. 21, at 4.0 P.M., the Right Hon. Sir Alfred Mond, Bart., president of the Guild, in the chair. The subject of the lecture is "Scientific Ethics." Tickets may be obtained from the secretary of the British Science Guild, 6 John Street, Adelphi, W.C.2, if application is made not later than Monday, Nov. 7.

THE Institute of Physics announces the thirteenth lecture of its series, 'Physics in Industry,' which is to be given at 5.30 P.M. on Monday, Nov. 14, 1927, in the rooms of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2. The lecturer on this occasion is Sir William Hardy, Director of Food Investigation at the Department of Scientific and Industrial Research, and his subject, "Physics in the Food Industry." The application of physical methods to the conservation of food resources is a subject of national importance, and the lecture should be of considerable interest to a far wider public than the membership of the Institute of Physics. The Board of the Institute wishes it to be known that the lecture is open to the public, without charge. Admission is by ticket, and tickets may be obtained on application to the secretary of the Institute of Physics, 1 Lowther Gardens, Exhibition Road, London, S.W.7.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—Two junior assistants (engineering) for research work at the Fuel Research Station, East Greenwich. Special knowledge of mechanical engineering in the case of one vacancy, and of physics and mathematics in the other case, is desirable—The Secretary, Department of Scientific and Industrial Research, 16 Old Queen Street, S.W.1 (Nov. 14). A head of the building department of the Leeds Technical College—The Director of Education, Education Offices, Leeds (Nov. 14). A bacteriologist at the Devonshire Hospital, Buxton—The General Superintendent and Secretary, Devonshire Hospital, Buxton (Nov. 15). A plant physiologist and a plant pathologist at the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, for banana research—The Secretary, Imperial College of Tropical Agriculture, 14 Trinity Square, E.C.3 (Nov. 30). A professor of pathology and bacteriology at the Welsh National School of Medicine—The Registrar, University College, Cardiff (Dec. 1.) A dairy research bacteriologist at the Research Laboratories, New Zealand—The High Commissioner for New Zealand, 415 Strand, W.C.2 (Dec. 17). A lady tracer at the Admiralty Engineering Laboratory, West Drayton, Middlesex—The Superintendent, Admiralty Engineering Laboratory, West Drayton, Middlesex. A signal inspector for the Engineering Department of the Egyptian State Railways, Telegraphs and Telephones—The Chief Inspecting Engineer, Egyptian Government, 41 Tothill Street, S.W.1.

Our Astronomical Column.

MAGNETIC DISTURBANCES AND SUNSPOTS.—On Oct. 22, a magnetic disturbance commenced sharply at $6\frac{3}{4}^h$ and continued until 10^h on Oct. 23 with an intervening diminution between 16^h and midnight. During the first phase the excursion shown by the Greenwich declination magnetograph traces was $\frac{3}{4}°$, and during the second about 40′. The disturbance is worth comment on account of its being one of those instances in which it does not appear possible to ascribe a connexion between a pronounced magnetic disturbance and a particular sunspot. A small stream of spots crossed the sun's central meridian on Oct. 22-26, but in general appearance it was but one of many which are now of frequent occurrence. An examination by Mr. Evershed of spectroheliograms taken at his observatory at Ewhurst, Surrey, also failed to show any unusual solar activity (the daily record at Ewhurst, as elsewhere in Great Britain, was, however, broken by cloudy weather).

It may perhaps be noted that at the time of the commencement of the magnetic disturbance the longitude of the sun's central meridian was 282°, and that this particular longitude was the position of three very large spots seen successively on the central meridian on May 12, June 8, and July 5 respectively. At the time, attention was directed to the absence of corresponding magnetic disturbances which might reasonably have been expected in view of the size and nature of the spots (*see* NATURE, June 18, p. 903, and *Proceedings of the Astronomical Society of the Pacific*, August, p. 246).

Another instance this year of the occurrence of a magnetic 'storm' and the apparent absence of any solar activity of note was afforded on July 21-22.

THE TRANSIT OF MERCURY ON NOV. 10.—The British Isles have been favoured as regards visibility of transits of Mercury in recent years. In the period since 1861 there have been nine transits, 3 in May, 6 in November, of which only one, that of 1881, was wholly invisible here, while those of 1907, 1914 were wholly visible, the middle occurring at noon. There will be a transit on the morning of Thursday, Nov. 10, of which the end will be visible in Great Britain, the sun rising at Greenwich at $7^h\ 8^m$, and internal contact at egress occurring at $8^h\ 28^m$. The transit is a nearly central one, Mercury being 2′ 9″ south of the sun's centre at $5^h\ 46^m$.

Now that accurate time can be obtained so readily by radio signals, it is well to point out that amateurs can do most useful work by carefully timing the contacts, both internal and external. Such observations have a double value. First, it was largely through observations of transits that the anomalous motion of the perihelion of Mercury was detected, which was afterwards explained by Einstein. The amount of the advance of the perihelion is not yet known with absolute precision, and more observations are desirable. Secondly, it is suspected that the unexplained irregularities in the moon's motion are due to changes in the rate of the earth's rotation. This suggestion can best be checked by observing the other rapidly moving bodies in the solar system, of which Mercury takes the first place.

Another desirable research is to examine whether any ring of light can be discerned round the portion of the planet outside the sun's disc. Such a ring was plainly seen at the last transits of Venus, being due to sunlight refracted by the planet's atmosphere. It is known that Mercury's atmosphere must be rare, but it is desirable to test whether it has any that can be detected.

The next three transits are in Nov. 1940 (invisible here), Nov. 1953 (beginning visible here), May 1957 (invisible here). Most of the text-books indicate a transit in May 1937. There will be a near approach, when Mercury will probably be discernible in the spectroscope, projected on the chromosphere, but no actual transit.

THE ASTROGRAPHIC CATALOGUE.—Several more volumes of this catalogue have lately been published, and the end seems to be nearly in sight. The Cape volume for −49° is the last volume but one of the zone undertaken by that Observatory. It consists of 452 pages with 180 stars on each full page. Further instalments of the Catania Catalogue have lately appeared, containing 0^h to 3^h of +47°, and 3^h to 6^h of +49°. They give right ascension and declination for every star, which is undoubtedly convenient, but was rejected by most observatories as adding too much to the labour and expense of publication.

Research Items.

MEDICINE AND SURGERY IN ANCIENT EGYPT.—In *Science Progress* for October, Dr. Warren R. Dawson maintains, as the result of a direct study of Egyptian medical texts, that the generally accepted accounts of Egyptian medicine consist of a series of generalisations, many of them quite erroneous and based upon incorrect readings which have been copied from book to book for the last fifty years. There are a number of medical papyri in existence, of which the best known is the Ebers. Egyptian medical knowledge was clearly based upon magic, as is shown by the use of incantations by the object of the treatment, as indicated by the form of its title in the papyrus, such as 'against,' or 'to banish,' or 'to drive out' the disease, which was evidently conceived as a possession, and by the fact that even effective remedies were used magically. Some of the remedies were deliberately made disgusting or unpalatable to the possessing spirit. Surgery, however, the recently discovered Edwin Smith papyrus, which deals with the treatment of wounds, shows to have been based upon exact and scientific knowledge. This was due to the practice of mummification which early gave the Egyptians a knowledge of comparative anatomy. The hieroglyphic signs for the organs of the body are pictures of the organs themselves, but the fact that they are animal and not human organs is evidence that the Egyptians were first acquainted with the structure of the lower animals. The practice of mummification again also gave them a knowledge of physiology—the Ebers papyrus contains several sections dealing with the heart and its functions. Although the meaning of the terminology is not always clear, owing to lexicographical difficulties, and drugs, symptoms, and diseases, all alike are obscure at times, several diseases have been identified and the mummies themselves have furnished evidence of certain pathological conditions. Generally speaking, the diseases are those which attack the fellahin to-day, —intestinal troubles due to bad water; worms and other parasites; ophthalmia and other infections of the eyes; boils, bites, skin diseases, bilharzia infection, and mastoid disease among others.

THE BIOLOGY OF A WHEAT JOINTWORM PARASITE.—The Wheat Jointworm (*Harmolita tritici*) belongs to a family of chalcids which includes many plant feeders. This habit is unusual, since most members of the Chalcidoidea are parasites of other insects. The Harmolita is extensively parasitised by another chalcid, *Eurytoma parva*, which curiously enough belongs to the same family (the Eurytomidæ) as its host. The life-history of this parasite has recently been worked out in the United States by Mr. W. J. Phillips, who contributes an interesting paper on the subject in the *Journal of Agricultural Research* (vol. 34, 1927, pp. 743-758). It appears that the female Eurytoma prefers to oviposit in wheat stems containing Harmolita larvæ in their first instar. Having consumed its host, the Eurytoma then apparently proceeds to complete its development by feeding upon the plant sap. There is evidence also that, if a Eurytoma, on hatching from the egg, finds itself outside a cell containing its host, it feeds straight away on plant sap and does not seek out the Harmolita. In one instance Mr. Phillips mentions that a larva of the Eurytoma that had evidently consumed a Harmolita larva and had begun to feed on plant sap, was reared to maturity upon a fully grown larva of Harmolita. It is evident that the feeding-habits of the Eurytoma are in a plastic condition and that the insect is gradually forsaking its normal parasitic mode of life and becoming a plant-feeder.

VARIATIONS IN THE PROTEIN CONTENT OF WHEAT.—W. F. Gericke (*Journal of Agricultural Research*, vol. 35, p. 133) brings forward some explanation as to why applications of nitrogen to land may cause either an increase or decrease in the protein content of wheat. Starting with experiments on wheat grown in nutrient solutions, he showed that in a series of plants initially supplied with a complete culture solution, but later transferred to one from which a different essential element was omitted in each case, those deprived of calcium or nitrogen alone had the protein content of the grain affected; a decrease occurred in both cases. Tests were also made with a number of different wheat varieties grown in soil, the plants either receiving no nitrogen or dressings of sodium nitrate at different stages of development. The later applications (after 90 days' growth) invariably resulted in the production of high-protein grain, whereas a dressing of nitrogen at the time of planting gave a low-protein grain, and in some cases even decreased the protein content below that of the untreated sets. These varieties of wheat also showed widely different degrees of response to the nitrogen treatment in respect to tiller formation, due to the physiological and genetical properties of the plants. Some tillered freely only after a late dressing of nitrogen, while others tillered equally well whether the nitrate was supplied late or at the time of planting. The explanation suggested from the correlation of these results is that where early tillering occurs, the relatively large vegetative growth gives inception to more grain than would result from a plant tillering later and further utilises most of the available nitrogen; the low-protein content of the grain in such cases is accordingly attributed to a shortage of nitrogen at the critical period. It is, therefore, possible to produce high-protein grain by supplying nitrogen to the soil during the later growth stages or by curtailing excessive grain production. Further, such experiments emphasise the fact that the properties of different wheat varieties may have an important bearing on the efficiency of any fertiliser treatment.

AMPULLARIIDÆ OF JAMAICA AND CUBA.—Dr. H. A. Pilsbry publishes a revision of the Ampullariidæ of Jamaica and Cuba (*Proc. Acad. Nat. Sci. Philad.*, vol. 79). Though the members of this family present in the Greater Antilles are not rare and have been known for a long time, the literature relating to them has remained in confusion. The author uses "the generic term Ampullaria in connexion with these species because being customary it will be generally understood." This departure from orthodox methods in a systematic treatise is the more regrettable when made by one who has a world-wide reputation for systematic work and elsewhere has employed the more correct name of Pila, though he misattributes it to Röding, the editor, and not the author of Bolten's Catalogue. Dr. Pilsbry is unable to separate, as others have done, the commonest one of the Cuban forms from the *Ampullaria paludosa*, Say, of Florida and Georgia, and has had to change the name in the case of another species.

NEW FOSSIL PRIMATES FROM INDIA.—In *Palæontologia Indica* (vol. 4, new series), Dr. Pilgrim has published an account of a fragment of a palate of a new species of the important genus Sivapithecus (*S. himalayensis*). The paper also describes other primate material, there being further new species of Sivapithecus, of Palæopithecus; and two new genera;

Hylopithecus, of which only a single tooth is preserved, and Pondaungia, the true affinities of which are still in doubt. The author also discusses the evolution of the Anthropoidea in view of this new material and with reference to criticism of his already published views.

Primitive Artiodactyla.—Miss Pearson has given an account (*Trans. Roy. Soc.*, B, vol. 215, 429) of the skulls of early Tertiary Suidæ and other primitive Artiodactyla, paying particular attention to the structure of the otic region. This interesting work is the outcome of a tour round most of the important university and public collections of Europe. Any endeavour to disentangle the relationships of the primitive artiodactyls by an examination of the structure of the dentition alone results in great confusion. Miss Pearson, wisely confining herself to an intensive study of the basicranial and otic regions as likely to be more conservative in their evolution than teeth, has made a survey of every specimen well enough preserved for the purpose of this investigation. Although such material is none too common, results of undoubted value and interest have emerged. It can be shown, for example, that, although the North American Perchœrus and the European Palæochœrus of the same period are at first sight so similar, the former is a primitive peccary and the latter a primitive true pig. Cebochœrus is suggested as being close to the ancestral line of the hippopotamus, and light is thrown on the position of other early artiodactyl genera. The paper is well illustrated with more than fifty line drawings, and is a valuable contribution to the study of extinct mammals.

Radium D, E, and F.—A number of track photographs obtained by S. Kikuchi with a Wilson expansion apparatus, which are described in the *Japanese Journal of Physics* (vol. 4, p. 143), throw some light on the mode of disintegration of these elements. The source used was a silk fibre, which had been activated by contact with the surface of an old emanation tube, and was stretched across the cloud chamber. In addition to the α-trails of radium F, two distinct sets of β-trails were found to be present, the long group being attributed to radium E, and the short group to radium D. Within the limits of the probability fluctuations, the total numbers of α-trails and of fast β-trails which appeared on 80 plates were equal, thus confirming an earlier result that radium E emits one β-particle on disintegration. No pairs of tracks were found which could be regarded as those of rays emitted from the same atom. It is suggested that the primary rays of radium D leave the atom with too little energy to be recorded, and that its β-radiation which has been observed is all of secondary origin.

Specific Heats.—The well-known technical method of heating by bombardment with cathode rays has been applied quantitatively by H. Klinkhardt to the measurement of specific heats (*Annalen der Physik*, vol. 84, p. 167). A specimen of the substance to be investigated is supported on quartz in an evacuated enclosure, and brought to any desired temperature between 100° C. and 1000° C. in an electric oven. It is then made the anode for an electron discharge at a few hundred volts from an oxide coated filament, and its subsequent change in temperature is followed by means of an embedded thermo-junction. The rate of supply of energy is known from the current and voltage, due allowance being made for contact differences of potential, and after applying the usual calorimetric corrections, the final results are claimed to be correct to within 2 per cent. Insulators and liquids can be studied inside a hollow metal electrode. Measurements of the specific heats and of latent heats of change of phase are recorded for ammonium chloride and for a number of metals and alloys, and particular interest attaches to the behaviour of iron and nickel at their Curie points, where the specific heat was found not to fall abruptly to a value characteristic of the unmagnetised material, but merely to pass continuously and reversibly through a sharp maximum.

The Protection of Aluminium and its Alloys against Corrosion.—A paper by H. Sutton and A. J. Sidery, read before the Institute of Metals on Sept. 8, contains a full account of the process of anodic oxidation of aluminium devised by Bengough and Stuart. Sutton and Willstrop, by volatilising the metal in a stream of dry hydrogen chloride, have shown that the film produced consists of a coating of aluminium oxide of the order of 1 μ thick. Especially when a grease such as lanoline is afterwards applied, the anodic oxidation affords an excellent means of protecting the metal and its alloys from sea-water corrosion. As a result of the great 'throwing power' of the anodic process, samples of irregular shape can be satisfactorily treated without special arrangements. Parts in contact with other metals, however, cannot be treated, and the process must be used prior to the assemblage. Further, there may at times be difficulties as a result of the insulating properties of the film where good electrical contact is required. Electrolytic coatings of zinc and cadmium 0·0005 in. thick afford good protection to the metal and its alloys with the exception of cadmium on aluminium itself. Nickel coatings of the same thickness, however, were found not to give adequate protection.

Catalyst Poisoning in the Oxidation of Methyl-Alcohol.—The *Chemiker-Zeitung* of Oct. 12 contains an account of some investigations into the causes of catalyst poisoning in the oxidation of methyl-alcohol to formaldehyde. Since poisoning has been found to be due to a considerable extent to impurities in the air supply, it is advisable to draw pure air from an area quite outside the range of factory products. The cost of the necessary installation is rapidly counterbalanced by the increased yield, which under good conditions has been found to amount to 92 per cent. of the theoretical value and to be easily maintained at that figure.

An Oxide of Fluorine.—No compound of fluorine and oxygen has hitherto been described, and hence the communication by Messrs. P. Lebeau and A. Damiens in the *Comptes rendus* of the Paris Academy of Sciences for Oct. 3, demonstrating the existence of such a compound, will arouse considerable interest. In the preparation of fluorine by the electrolysis of acid potassium fluoride, it was noticed that at the commencement of the operation some substance other than fluorine was present, and the cause of this was traced to the presence in the liquid of a small quantity of water. The new gas has not been obtained pure, but only in admixture with oxygen. From the density of the mixture and the chemical reactions, the formula of the gas has been established as F_2O, and it is noteworthy that it is more stable towards a rise of temperature than the corresponding chlorine compound, Cl_2O, since it remains unaltered when heated to 125° C. in contact with glass. It can also be kept unchanged for several days in contact with water and glass. With alkalies it forms fluorides, setting free oxygen; free iodine is produced by interaction with potassium iodide.

Across Canada with Princeton.

THE Princeton 'Summer School of Geology and Natural Resources,' led and organised by Prof. R. M. Field, has completed its second annual excursion. We started from Princeton on July 15 and returned on Aug. 24. Meanwhile, we traversed and retraversed the North American continent by routes that very seldom intersected. Except for two nights on the steamer between Vancouver and Victoria, we slept on the Pullman that bears the arms of the School. This car has been specially constructed with kitchen, shower-bath, lecture-lantern, screen, etc. Most of our travelling was done at night, to leave the days free for geology. Of twenty-five main halts, one at Bellefonte introduced us to the Pennsylvanian Appalachians and another to the southern side of the Niagara gorge; the rest were in Canada. Last year's trip was wholly in the United States. Next year's is planned for intensive study of the Appalachians. For 1929, there is talk of a motor-car raid upon Scotland and Switzerland.

This Summer School is interesting as typical of modern America. In Europe it would be unthinkable. In America, at the present time, if a project is original, striking, and 'worth while,' it can be achieved. British readers will grasp the scope of the Princeton organisation when they find the Director of the Geological Survey of Great Britain among the eighteen members of Council. Of the others, two are Canadian, while a third of the total are acknowledged leaders in the world of transport.

Obviously, the success of the undertaking depends equally upon transport and guidance. Railway facilities were supplemented by motor-cars and occasionally by steamers; and it is characteristic of the lavish hospitality of the land that the motor-cars were in many cases supplied by well-wishers whose names even we cannot hope to remember. The indispensable guides were arranged for by the Director of the Geological Survey of Canada, by the Universities of Toronto, Winnipeg, Vancouver, and Harvard, and by various mining companies and private individuals. Our debt to them is fundamental, and it is proper to pay tribute to the glorious freedom of discussion which was extended to us wherever we went.

Two important *motifs* have actuated Prof. Field in bringing this wonderful Summer School into existence. He wished to arrange for an annual international congress of comparative geology and to have it attended by young and old together. It is part of the constitution that every year a citizen of the British Commonwealth and another from the outside world shall be invited as guests. On the present occasion, I had the great good fortune of accompanying my old friend, Prof. L. W. Collet, of Geneva, across the Atlantic to learn far more than we had even dared to hope. The party, all told, was twenty-seven men, ranging from professors to undergraduates. The interest of the latter was strengthened by the thought of an examination at the end of the course; and from their questions we others learnt many a lesson.

Perhaps, as British 'observer,' I may be permitted to record some of the impressions of the trip. In the first place, the North American Continent is, broadly speaking, a magnified mirror image of much of Europe. North America has three major divisions: (1) an Atlantic border of Palæozoic mountains (Appalachian System); (2) an immense central region (Laurentia of Suess) that has suffered no mountain-making deformation since the dawn of the Cambrian; and (3) a Pacific Cordillera (Rocky Mountains, etc.) characterised by Mesozoic and Tertiary compression. Both the Atlantic and Pacific mountains have been folded and thrust over the margins of the intervening stable element. The latter is seldom spoken of as Laurentia, but its main pre-Cambrian exposure is familiarly styled the Canadian Shield, while its Cambrian and later systems are for the most part included in the Great Plains. If now we turn to Europe, we find: (1) a Palæozoic border chain that runs through Scandinavia and Britain; (2) a central region that we may christen Baltica, a region of Cambrian and post-Cambrian tranquility; and (3) a Mesozoic-Tertiary cordillera (Carpathians, Crimea, Caucasus). Here again the mountain elements (1) and (3) are folded and thrust upon the margins of the buffer state (2). Moreover, in the latter we find a Baltic Shield to match the Canadian Shield, and a Russian Platform, extending through Denmark into East Anglia, to serve as counterpart of the Great Plains of North America.

The pivot of our comparison is furnished by the mountain chain of Scandinavia. This chain is markedly symmetrical. On one side, in Sweden, it is carried forward along the Törnebohm thrust-zone on to undisturbed early Palæozoic rocks of Baltica. On the other side, as exposed in the north-west Highlands, it has travelled along the Moine thrust-zone on to undisturbed early Palæozoic rocks recognised by Suess as part of Laurentia. Across the Atlantic, the Scotto-Scandinavian mountains reappear in Newfoundland and Nova Scotia, and the Moine thrust-zone is represented by the well-known dislocation-belt of St. Lawrence and Lake Champlain.

Beyond this point the reader must proceed warily. It is only a part of the Appalachian System that corresponds with the Scotto-Scandinavian chain. The Appalachian System is a complex of two of the important mountain systems of Europe. In fact, the geology of the Atlantic States of North America is summarised in the words: *Where mountains cross.*

Let us join Marcel Bertrand's pupils and define for tectonic purposes Caledonian as meaning early Palæozoic, Hercynian as late Palæozoic, and Alpine as Mesozoic and Tertiary. Bertrand, after reading Dana in 1887, recognised part of the Canadian and New England Mountains of the Appalachian System as Caledonian, while he separated the Pennsylvanian Appalachians as Hercynian. The data have been greatly clarified of recent years, and the progress of knowledge as presented by authors like Clark (1921), Collins (1924), and Young (1926) has immensely strengthened Bertrand's comparisons with Europe. Young's account is particularly explicit. "Before the close of the Devonian period," he says, speaking of the eastern mountains of Canada, their strata "were folded and faulted, and invaded by granite batholiths" (Geol. and Econ. Mins. Can., p. 89; 1926). In Pennsylvania, of course, the folding is post-Carboniferous.

Many thoughts spring to the mind of the European geologist who finds himself standing in Pennsylvania on Hercynian mountains *outside* the line of the type Caledonian chain.

(1) The westward convergence of the two Palæozoic chains—so far apart in Poland and Lapland, already in contact in South Wales and Ireland—has led to their actual crossing in the United States.

(2) Not only have the mountains crossed, but also the stratigraphy. In Pennsylvania there is an immense concordant succession from Cambrian to

Carboniferous. In the anticlines we find our Durness Limestone (Beekmantown) as if we still stood in the north-west Highlands of Scotland. In the synclines we discover Upper Carboniferous Coal Measures (Pennsylvanian) derived from the waste of a growing Hercynian chain, and our thoughts are transferred at once to South Wales, the Ruhr, and Poland.

(3) In much of the Canadian part of the Appalachian System, a limestone facies within the Lower Carboniferous serves as a punctuation mark between Caledonian and Hercynian movements, just as it does in the British Isles and in Belgium.

(4) It is as if the Atlantic did not exist or, in other words, as if Wegener, after all, were a true prophet.

and Potsdam sandstones (Upper Cambrian), in a post-Potsdam sandstone near Ottawa (Lower Ordovician), in the St. Peters and Winnipeg sandstones (Middle Ordovician), and in the basal Trenton limestone at Montmorency Falls, Quebec (also Middle Ordovician). There is a sufficiently close analogy between all this and the chalk and desert-sand association of the Franco-British Cretaceous (*Geol. Mag.*, p. 102; 1924). The Cambrian to Middle Ordovician deposits of Laurentia may be interpreted as having accumulated in a warm shallow sea that bathed the shores of a low desert continent. The same facies extends into the Pennsylvanian Appalachians, where the carbonate rocks may reach as much as 8000 ft. in thickness. It is called the

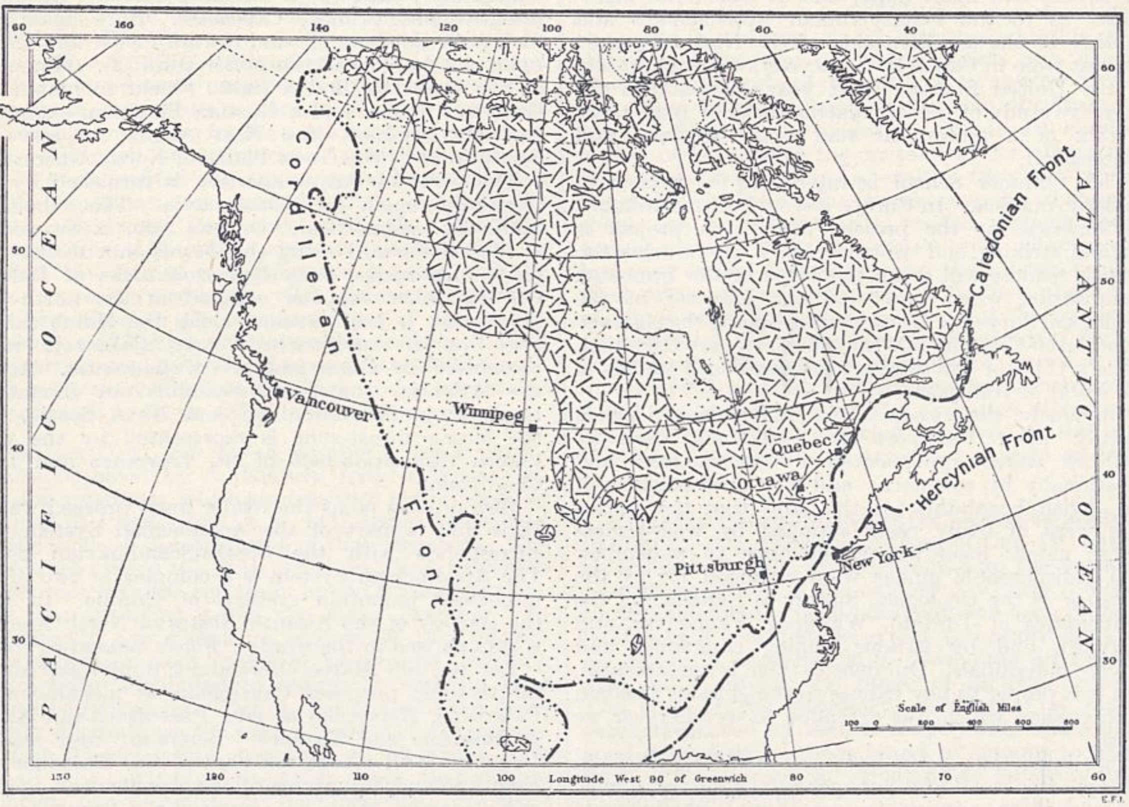

FIG. 1.—Tectonic map of North America. The interior region (Laurentia of Suess) has remained unaffected by mountain folding since pre-Cambrian times. Its pre-Cambrian outcrops are shown by strokes, its Cambrian and later by stipple. Modified after M. Bertrand (1887), Bailey Willis and G. W. Stose (1911), E. Blackwelder (1912), W. H. Collins (1924), G. A. Young (1926).

The thrust-zone of St. Lawrence has been mentioned as a continuation of the Moine thrust-zone of the north-west Highlands. Its interest is intensified by the fact that the thrusts have involved a transport of facies comparable with that so famous in the Alps. This last point is clearly set out in Raymond's guide for the 1913 International. Collet and I were able to add details here and there, simplifying the mapped course of certain thrusts, complicating others by recognition of successive slices—but this has only increased the charm of the story.

According to plan, the excursion maintained frequent contact with Ordovician rocks so far east as Winnipeg. The Cambrian to Middle Ordovician facies of Laurentia differs profoundly from that of the Caledonian Atlantic border. In the former district, one finds a wealth of pure carbonate rocks (marine limestones and dolomites), and there is little contamination except for wind-rounded sand. Such sand is represented, for example, in the Croixian

American facies; and in our own country it has long been recognised as characteristic of the Durness succession of the north-west Highlands.

The Caledonian facies is, on the other hand, commonly spoken of as Atlantic, British, or European. It consists of muds and sands, washed down by rivers from the rain-swept heights of the growing Caledonian chain. Its fossils are graptolites, and other creatures, including species familiar in Wales, southern Scotland, and Scandinavia.

Conglomerates or breccias, varying in age from Cambrian to Middle Ordovician, are frequent in Canada and the northern States along the frontal part of the Caledonian chain. They are often interbedded among shales of British facies, but their boulders are mostly limestones of American facies. These boulders are fossiliferous; and while many of them are about the same age as the associated shales, others are distinctly older—for example, Cambrian boulders frequently occur in breccias interbedded among Ordovician shales. The matrix, too, of every breccia that we examined near Quebec contains quartz sand that is absent from the accompanying shales. Altogether, there can be no doubt that these breccias have been correctly determined as sedimentary deposits. Exceptionally, a bed of breccia contains, or at any rate accompanies, a mass of limestone so large that the tendency has been to interpret it as a relic of a bed still *in situ*. One such limestone mass, in a quarry near Lévis, opposite Quebec, measures 60 ft. in length and 30 ft. in height. Collet and I returned to this exposure after the excursion was over. We satisfied ourselves that the mass had ploughed into the underlying shales and splattered them through the accompanying breccia. We felt that we were looking at a submarine landslip that had travelled down a steep slope subject to earthquakes; and standing there we thought of Schardt and of his interpretation of the *blocs exotiques* of the Alpine Tertiary. The comparison, however, must not be pushed too far, since at Lévis the boulders are of foreland rather than of mountain facies. It is extremely interesting that one has to travel hundreds of miles to match the material of these boulders at the outcrop. It seems necessary to accept Raymond's suggestion that their source is hidden under overthrusts.

Space forbids more than a mention of our visit to Niagara, to the vent agglomerates associated with the peridotites of Quebec, to the Pleistocene interglacial beds near Toronto, to the pre-Cambrian glacial beds at Cobalt, to the flat pre-Cambrian of Port Arthur and Fort William on Lake Superior, to the Keewatin and other folded pre-Cambrian formations of the same region, Rainy Lake and Porcupine, to the late Glacial lakes that drained to the Mississippi and New York while ice blocked escape to Hudson Bay and the St. Lawrence, to the Turner Oil Field on the first anticline of the foothills of the Rockies. In the Rockies themselves, thanks to our guides, Kindle, Mackay, and Raymond, we saw thrust after thrust in the districts of Jasper and Banff. We also examined, near Walcott's famous fossil quarry above Field, a spectacular example of secondary dolomitisation. In a cliff face, showing horizontal bedding, an abrupt wavy line runs nearly vertical for several hundreds of feet and separates black limestone from pale buff dolomite. As the bedding goes through the line without any change, it is clear that the dolomitisation has been affected by circulating magnesian solutions. I can only suggest that the portion which has remained limestone was, at the critical time, charged with oil.

In the interior Plateaux of the Cordillera we saw granite intruded into folded Tertiary tuffs at Copper Creek, Lake Kamloops—so far as we know, a new observation. At Vancouver we were shown the great post-Jurassic granodiorite of the Coast Range, with late Eocene conglomerates and sands overlying its weathered top. In Victoria we were particularly interested in a complicated thrust-zone that brings (?) Carboniferous slates over Eocene pillow lavas.

A few words must be added regarding Sudbury, Ontario. Here an elliptical annular outcrop of plutonic igneous rocks surrounds an exposure of the pre-Cambrian White Water Series of sediments, an exposure that measures no less than 34 miles in length and 11 miles in breadth. The igneous girdle varies from 1 to 4 miles in width. The outside country consists of a pre-White Water complex. According to the orthodox reading, the igneous rocks of Sudbury were intruded flatly as a sill along the unconformable bottom of the White Water Series, and then the whole was bent into a basin. Knight, however, in 1917, pointed out that a sill of such extent would surely show transgressive relations. Since no trace of the White Water Series has been found anywhere along the outer boundary of the Sudbury intrusion, Knight interprets this sedimentary series as preserved within a cauldron-subsidence and the intrusive girdle as a ring-dyke. He was delighted to hear that similar phenomena on a smaller scale have been fully established in both Scotland and Norway during the last twenty years. It is scarcely necessary to point out that those who accept Knight's interpretation must dispense with the particular gravitational differentiation hypotheses that have grown out of the sill conception of Sudbury structure. These hypotheses have been much criticised on quite other grounds.

The advantage of international comparisons was further illustrated by the recognition of 'flinty crush-rock' at Harvard, and by Tanton's demonstration to us of Grout's principle (*Bull. Geol. Soc. Am.*, **36**, fig. 5, p. 358; 1925) for elucidating the order of deposition of folded strata. This rather elusive principle was independently employed in an isolated case in the Scottish Highlands in 1913, but there now seems hope of its fairly frequent application—in which case extremely important discoveries are certain to result.

The account given is unrepresentative, in that it has not touched upon economic problems. This is merely due to consideration of space. The gold of Porcupine and Hedley, the silver of Cobalt, the nickel of Sudbury, the asbestos and chromite of Black Lake, the coal of Brule, and the oil of Turner Valley were all examined with the greatest interest; and time was found at Port Arthur, Iroquois Falls, and Vancouver to watch timber ground into pulp or sliced into planks. For a Britisher, it was certainly an inspiring sight to see the new 4000 ft. shaft in the Porcupine gold field entirely equipped with English machinery.

E. B. BAILEY.

The Storage of Fruit.

IT is estimated that in 1924 the value of the fruit and vegetables consumed in Great Britain approximated to £100,000,000, imported fruit accounting for nearly half of this figure. The importance of this industry, with its especial liability to wastage of the products dealt with, is sufficient justification for researches into the factors which affect the keeping qualities of fruit and vegetables, apart from the purely scientific interest of such investigations. In its Report for the years 1925 and 1926[1] the Food Investigation Board describes the results of a number of researches into the various factors favouring or preventing deterioration of fruit on storage, the work including both chemical studies of apples and pears of different types during ripening and storage as well as investigations into the suitability of various kinds of store.

In the case of apples, and the conclusion is presumably applicable to similar types of fruit, it has been found that the best keeping varieties contain the least nitrogen and the most sugar, and exhibit the lowest respiratory activity. The inference is that the life-expectation of gathered fruit depends upon the amount of living protoplasm it contains and upon the extent of the accumulated sugar

[1] Department of Scientific and Industrial Research. Report of the Food Investigation Board for the years 1925, 1926. Pp. vi+80+2 plates. (London: H.M. Stationery Office, 1927.) 2s. 6d. net.

reserves: death ensues when the sugar available for combustion is exhausted, and this occurs the earlier the larger the amount of protoplasm present. Working with Bramley's Seedling apples from three different soils, F. Kidd and C. West have shown that the nature of the soil has a marked influence on the nitrogen content of the fruit, and hence on its keeping quality. In general, specimens from silt soil survive much longer than those from fen or gravel soil, at storage temperatures of both 1° C. and 8° C. At about the latter temperature it was found possible to double the storage life by storing in an atmosphere of 9·2 per cent. carbon dioxide and 11·8 per cent. oxygen instead of in air. The apples from the silt soil have a low nitrogen content but a high sucrose content, those from fenland a high nitrogen and a low sucrose content, whilst those from gravel have a low content of both constituents: their keeping qualities agree with the inference given above that the life of an apple depends on the demands the living protoplasm makes upon the sugar stores. The latter and the acid present in the fruit appear to be the sole source of respirable material. Death of the fruit stored at 1° C. is accompanied by a browning of the flesh, a condition known as 'internal breakdown': in its early stages, its respiration is increased whilst the acidity decreases rapidly; but in the final stage all respiration ceases. Stored at 8° C., wastage is caused by disease, 'fungal rot,' and not by internal breakdown.

The chemical changes occurring in fruit on storage are not exactly the same in different types: thus although the respiratory processes of pears as well as apples depend on the sucrose and acid content, yet the softening occurring on ripening and storage, due to breakdown of the cell-wall and loss of pectin, is much more rapid in pears stored at 12° C. and 4° C., although at 1° C. the process is less retarded in the apple (A. M. Emmett). Caution must then be exercised in applying the knowledge obtained from experiments on one type of fruit to another: optimum storage conditions will vary slightly from fruit to fruit and even from one type of the same fruit to another, although certain general principles will doubtless hold good in the majority of cases. This is well exemplified by an investigation of the same authors into the efficiency of different types of store, in which they found that variety plays an important part in the determination of optimum storage conditions. Thus the Newton Wonder, which is very resistant to internal breakdown, has a longer storage life the lower the temperature, at any rate to 30° F., whilst the King Pippin, very susceptible to this form of deterioration, stores best at 40° F. When the storage life is ended by 'superficial scald,' and not by 'internal breakdown,' wrapping the fruit in oiled paper wrappers has a marked effect in prolonging it.

The problems of storage as affecting ships have been investigated by A. J. M. Smith. The chief difficulty is to obtain an efficient equalisation of temperature throughout the fruit, even when air is forced through the cargo. The simplest plan appears to be to apply the refrigeration at the top of the cargo, which is so arranged as to have vertical air spaces between the cases of fruit: in this way the distance to be travelled by the cold air is minimised and full advantage taken of its gravitational tendency to move downwards.

This brief account gives an insight into the type of work carried out by the Food Investigation Board. The ultimate result of these and similar researches is clearly to improve the food supply of a nation which relies for the major part on food products brought from overseas.

The Centenary of Berthelot.

MARCELLIN BERTHELOT was born in Paris on Oct. 25, 1827, and the centenary of his birth was celebrated by a series of sumptuous functions and by the inauguration of an enterprise which is to form a permanent memorial to one of the most eminent of the French chemists. For some time past committees have been in course of formation throughout France and in some sixty foreign countries for the collection of the funds required for carrying out a scheme for erecting and endowing in Paris a Maison de la Chimie associated with the name of Berthelot; the sum of about sixteen million francs has been thus collected and, during last week, some six hundred foreign delegates assembled in Paris to take part in the celebration of the centenary.

The proceedings began with a reception at the Sorbonne on the evening of Sunday, Oct. 23, by M. Charléty, the rector of the University of Paris. On Monday morning, in the presence of representatives of the French Government, a museum of apparatus and manuscripts relating to Berthelot was opened at the Faculty of Pharmacy by Prof. Radet; the visitors were next received at the Collège de France by M. Croizet; after speeches by the president of the German Chemical Society, Prof. Schlenk, and Prof. Bogert, of Columbia University, Berthelot's former laboratories and apparatus were inspected. Later, a memorial tablet was unveiled on the wall of Berthelot's early residence, 113 Rue Saint Martin, and speeches were made by M. Boujou, Préfet de la Seine.

The chief meeting was held in the large amphitheatre of the Sorbonne on the evening of Oct. 24; discourses were pronounced by Prof. Ch. Moureu on the work of Berthelot, and by Prof. Lacroix, secretary of the Academy of Sciences; M. Georges Lecomte, director of the Académie française; M. Gley, president of the Academy of Medicine; M. Wéry, president of the Academy of Agriculture; M. Hodza, Minister of Education for Czechoslovakia; and by M. Paul Painlevé. Addresses were presented on behalf of numerous academic bodies; it is indicative of the widespread interest in the celebration that the first addresses handed in were those from Abyssinia and Afghanistan.

A commemoration ceremony took place at the Panthéon on Tuesday morning, Oct. 25, when speeches were made by M. Raymond Poincaré, and by M. Galliardo, Minister of Foreign Affairs of the Argentine Republic. This was followed by a lunch in the Galérie des Batailles at Versailles, which was attended by some 1200 guests, and discourses were delivered by M. Herriot, Minister of Education; Prof. Amé Pictet, of the University of Geneva; and M. Lunatcharsky, Minister of Education to the Union of Socialist Soviet Republics.

On Wednesday morning, Oct. 26, the foundation-stone of the new House of Chemistry was laid in the Place d'Iéna by M. Herriot; M. Donat-Agache, president of the French Society of Chemical Industry; M. Zumeta, the Venezuelan Minister; and Prof. Ernst Cohen, of Utrecht, spoke, and the party adjourned for lunch to the Château belonging to the French Academy at Chantilly, where discourses were pronounced by M. Lecomte, director of the French Academy, and Prof. H. E. Armstrong. In the evening the delegates were received by the President of the Republic, M. Gaston Doumergue, at the Palais de l'Elysée.

It is proposed to issue a commemorative volume giving a full account of the proceedings of the Berthelot centenary celebrations.

W. J. P.

University and Educational Intelligence.

CAMBRIDGE.—Dr. Ernest Clarke has been elected to an honorary fellowship at Downing College. Mr. V. B. Wigglesworth, Gonville and Caius College, has been awarded the Raymond Horton-Smith Prize for a thesis, "Studies on Ketosis: with special Reference to the Relation between Alkalosis and Ketosis." *Proxime accessit*, Dr. A. E. Roche, Magdalene College, with a thesis on "Pyelography; its History, Technique, Uses, and Dangers." D. Barber, Trinity College, has been awarded the Adam Smith Prize for an essay on "The International Aspect of Wages." Miss A. McC. Bidder, Newnham College, has been nominated to the University table at the Zoological station at Naples for three months from Feb. 15, 1928.

The managers of the Arnold Gerstenberg studentship in philosophy have issued an interesting list from which candidates may select an essay subject: they are, "The ultimate data of physics, philosophical aspects of the theory of relativity, the philosophical bearings of the quantum theory, technical explanation and the problems of biology, heredity, and memory, *Gestalt*-psychology, and the logical basis of induction."

N. Feather, H. J. J. Braddick, and N. A. de Bruyne have been elected to Coutts Trotter studentships at Trinity College.

OXFORD.—Sir Archibald Garrod has tendered his resignation of the office of Regius professor of medicine as from Dec. 31 next. Sir Archibald succeeded Sir William Osler in 1920.

The Burdett-Coutts Scholarship for geology has been awarded to Mr. Partick Murray Threipland, of Christ Church.

Mr. John Mason has been elected to a Fereday fellowship at St. John's College, under the obligation of pursuing a special course of research in natural science. Mr. Mason has been engaged in research work on chemical bacteriology under Dr. Ashley Cooper at Birmingham.

A research fellowship in natural science and a lectureship in chemistry are being offered at Exeter College. The elections will be made on Dec. 12.

THE following appointments have been made at the London School of Hygiene and Tropical Medicine: Mr. Reginald Lovell, research assistant in comparative pathology; Mrs. M. M. Smith, demonstrator in bacteriology; Miss H. M. Woods, assistant lecturer in epidemiology and vital statistics.

THE following free public lectures have been arranged for by the Armourers and Brasiers' Company: "X-rays and Metals," by Dr. G. Shearer, at the Royal School of Mines, at 5.15 on Nov. 8, 15, and 22; "The Deformation of Metals," by Prof. C. H. Desch, at the Chelsea Polytechnic, at 8 on Nov. 30, Dec. 7 and 14.

MR. GEORGE FLETCHER, who since 1904 has been assistant secretary of the Technical Instruction Branch of the Department of Education, Dublin, has just retired from that post. He has rendered valuable service to educational science throughout his career, and takes with him the best wishes of many friends both in England and in Ireland.

THE North of Scotland College of Agriculture announces in its prospectus for 1927–28 university degree courses in agriculture, national diploma courses in agriculture and in dairying, a special farmers' course (one winter), and a planters' certificate course (two winters and one summer). The last-mentioned is designed as a preparation for service on estates in tropical and sub-tropical countries. Research is being carried on by members of the college staff in soils and drainage and in bee diseases.

Calendar of Discovery and Invention.

November 7, 1631.—The first observed transit of Mercury took place on Nov. 7, 1631. It had been predicted by Kepler and was observed at Paris by Gassendi, who admitted the solar light into a dark chamber through a small aperture in a window.

November 7, 1857.—In a letter of this date, Helmholtz, writing to the oculist Graefe, described the ophthalmoscope. Of the discovery Lummer wrote: "He wondered at the glare of the cat's eyes in the darkness, and studied this curious phenomenon until he learned how the light enters the eyes and is returned from the retina in such a way that it may be observed. Thus he became the inventor of the ophthalmoscope . . . and thus all our technical industries profit by the original research of investigators who are not inspired by dreams of wealth, but who must think and work in order to satisfy their inquiring natures."

November 8, 1887.—The invention of the gramophone was due to Emile Berliner and was patented by him on Nov. 8, 1887. The essential difference between the gramophone and phonograph is that in the former the engraving tool vibrates from side to side, while in the phonograph Edison employed the 'hill and dale' method. Berliner was born in Hanover in 1857, but emigrated to the United States in 1870 and played a conspicuous part in the development of the telephone.

November 8, 1907.—The art of telegraphing pictures with the aid of selenium cells was developed by Prof. Korn, of Berlin, in 1904, and on Nov. 8, 1907, he transmitted photographs electrically between Paris and London.

November 10, 1619.—Descartes in 1617, at the age of twenty-one, joined the army of Prince Maurice of Orange, and the following year, at the commencement of the Thirty Years' War, volunteered for service in the Army of Bavaria. However, he continued his mathematical studies and was afterwards accustomed to date the first ideas of his new philosophy and of his analytical geometry from three dreams which he experienced on the night of Nov. 10, 1619, when bivouacked at Neuberg on the Danube. He regarded this as the critical day of his life, and one which determined his whole future.

November 10, 1845.—Leverrier's investigations leading to the discovery of Neptune were contained in three memoirs communicated to the Paris Academy of Sciences on Nov. 10, 1845, June 1, 1846, and Aug. 31, 1846, respectively. In the first he proved the inadequacy of all known disturbances to account for the vagaries of Uranus; in the second he demonstrated that the observed effects must be due to an exterior planet; and in the third he assigned the orbit of the disturbing body, and announced its visibility as an object with a sensible disc about as bright as a star of the eighth magnitude.

November 11, 1572.—It was on Nov. 11, 1572, that Tycho Brahe discovered in Cassiopeia a new star of great brilliance. At first refusing to believe his own eyes, he got others to confirm what he saw, and continued to observe the star until the end of January 1573. He made accurate observations of its distance from the nine principal stars in Cassiopeia, and proved that it had no measurable parallax. His researches on this object were the occasion of his first appearance as an author.

November 12, 1906.—Three years after the Wright brothers had flown in America, success was achieved in Europe by the Brazilian, Santos Dumont, who first flew on Aug. 22, 1906, and also on Nov. 12, 1906, at Bagatelle, travelled a distance of 100 metres. E. C. S.

Societies and Academies.

EDINBURGH.

Royal Physical Society, Oct. 17.—J. **Stephenson**: Eastern adepts and Western science.—A. C. **Chaudhuri**: A study on the pigmentation of the Himalayan rabbit. By controlling the temperature of the environment, Himalayan rabbits can be made to grow pigmented hair in place of white. Low temperature probably stimulates the epithelial cells of the follicles to secrete an oxidase which in combination with a chromogen produces the pigment granules.—P. **McIsaac**: Blood serum calcium and parturition in the rabbit. Seven to ten days before parturition in the rabbit there is a fall in the serum calcium content, and one day before parturition there is a further and sudden fall to a minimum. After parturition the calcium content is restored to normality, but on the nineteenth day or thereabouts of the lactation period there is a second sudden fall.

MANCHESTER.

Literary and Philosophical Society, Oct. 4.—E. J. **Williams**: The number of Compton recoil electrons. Comparison of the observed values of the ratio N_r/N_p, where N_r and N_p are the numbers of 'Compton' electrons and the photo-electrons respectively, with the corresponding observed values of the ratio σ_m/τ where σ_m and τ are the coefficients of 'modified' scattering and photoelectric absorption respectively, shows that to within a few per cent. (which can be due to experimental error) the theoretical assumption of a one-to-one correspondence between the 'Compton' electrons and the modified scattered quanta is valid —at least statistically. If we assume the absolute validity of this assumption, $\tau N_r/N_p$ and σ_m are identical quantities, and the values of $\tau N_r/N_p$ can be regarded as experimental values of σ_m.—A. J. **Bradley** and C. H. **Gregory**: The structure of certain ternary alloys. Copper and zinc form five different kinds of alloy, known respectively as the α, β, γ, ϵ, and η phases; the α phase has a face-centred structure like copper, β-brass is body-centred cubic, γ-brass has a remarkably complex cubic structure. It consists essentially of four atom types A, B, C, D, combined in proportions corresponding to the formula A_2 B_2 C_3 D_6. On the whole, B and C atoms are copper atoms, A and D atoms zinc, but the atoms are not completely sorted out, and there is usually a surplus of zinc atoms. In view of the similarity between the γ phase of copper-zinc and the γ phase of copper-aluminium it was decided to test the possibility of forming mixed crystals of the two phases. Alloys corresponding to the formulæ Cu_5 Zn_8 and Cu_9 Al_4 were made up and were then melted together in different proportions. Three such alloys were thus made up, and the structures in each case were identical with the structures of the binary alloys; the alloys were quite homogeneous in character. The similarity between these different structures is independent of the chemical composition but is closely related to the electron distribution. There is in each case the same ratio of valency electrons to atoms, namely, 21 : 13.

PARIS.

Academy of Sciences, Sept. 26.—A. **Lacroix** and F. **Delhaye**: The existence of nephelinic syenites in Rutshuru region (Central Africa).—G. **Urbain** and **Pulin Bihari Sarkar**: The analogies of scandium with the elements of the rare earths and with the trivalent elements of the iron family. The resemblances between scandium and the rare earths are mainly analytical; even from this restricted point of view, scandium most resembles thorium, in spite of the difference in the valencies. The study of the acetylacetonates, the complex fluorides and thiocyanates all show the close relations between scandium and the trivalent metals of the iron group.—Jacques **Chokhate**: Mechanical quadratures and the zeros of Tchebycheff in an infinite interval.—Henry **de Laszlo**: The absorption of the ultra-violet rays by the ten isomers of dichlornaphthalene. The positions and intensities of the absorption bands of the ten dichlornaphthalenes are given in tabular form.—E. **Bruet**: The upper Pliocene of the Aujon valley.—F. **Bordas** and A. **Desfemmes**: The distribution and transport of chlorides in the atmosphere. From analyses of rain water at places at different distances from the sea, it is concluded that the atmosphere may carry in suspension quantities of chlorides which, carried down by rain, represent a fall of 8·41 grams of sodium chloride per square metre. These chlorides may be carried much greater distances inland than has been admitted hitherto.—J. **Dumont**: The influence of prolonged cultivation without manure on the nitrogenous richness of the soil: A continuation of the work of P. P. Dehérain. The nitrogen losses found, which are in agreement with the earlier results of Dehérain, are small and can be rendered insignificant by the periodic cultivation of a leguminous crop.—Pierre P. **Grassé** and Mlle. Odette **Tuzet**: The chromatic rod and the head of spermatozoids.—**Raymond-Hamet**: The influence of yohimbine on the intestinal action of adrenaline and of ouabaine.—L. **Barthe** and E. **Dufilho**: The estimation of chlorine and of sodium in the milks of some mammalian females. In human milk, and also in that from mares, the chlorine found does not correspond with the sodium directly determined; calculation of the sodium from the chlorine gives altogether erroneous results. The chlorine varies with the period of lactation and reaches a minimum value on about the sixteenth day. Sodium is present in negligible quantity up to the forty-fifth day, and hence is probably not required by the newly-born.—**Swigel** and Théodore **Posternak**: The nucleus containing phosphorus of ovovitelline. A quantitative analysis of the products of hydrolysis of β-ovotyrine is given, including phosphoric acid, pyruvic acid, ammonia, arginine, histidine, lysine, and *l*-serin, the amount of the last-named being 28 per cent. of the original material.—**Kohn-Abrest**: Atmospheric diffusion of the smoke of Paris. Samples of air were taken simultaneously on the Eiffel Tower at heights 0, 57, 115, and 288 metres above the ground. The results of the determinations of carbon monoxide and dioxide are given. The purity of the air does not increase with the height, as might have been expected.—Jules **Amar**: The parasitic origin of cancer. The facts summarised by the author all support the parasite theory of cancer.—F. **Dienert** and P. **Etrillard**: The action of free chlorine upon micro-organisms. Determinations of the amounts of free chlorine per litre required to sterilise nine species of organisms. The proportions required vary from 0·1 mgm. per litre to 8 mgm. per litre. The results appear to be best explained by the chemical theory of Barker.

VIENNA.

Academy of Sciences, July 7.—F. M. **Exner**: The dependence of the turbulence factor of the wind on the vertical distribution of temperature. Theories founded on observations at the Eiffel Tower.—M. **Kohn** and H. **Karlin**: (1) Dibromo-*o*-anisidin and tribromo-*o*-anisidin (28th communication on bromophenols). (2) A molecular transformation accompanying the formation of tribromo-*o*-anisidin from *o*-nitroanisol (29th communication on bromophenols).—**H. Swiatkowski** and **J. Zellner**: Contributions to comparative plant chemistry (18). *Carex flacca*. This plant contains more fat and protein in its seeds but less starch than other Gramineæ.—**J. Zellner** and others (19). Chemistry of barks. *Salix purpurea*, *Robinia Pseudacacia* and *Ceratoma siliqua* contain ceryl alcohol and other substances.—**E. Huppert, H. Swiatkowski**, and **J. Zellner**: (20) Chemistry of laticiferous plants.—**N. Fröschl** and **P. Bomberg**: The representation of proto-catechu-aldehyde and of vanillin.—**A. Kailan** and **L. Lipkin**: The velocity of esterification of nitro-benzoic acid in glycerine. An equation is given.—**E. Haschek**: Quantitative relations in the theory of colours.—**A. Smekal**: The behaviour of the ions of insulating crystals in electric fields. Electric strains in the crystal lattice work produce alterations in the distance apart of the ions comparable to mechanical strains. The work of other experimenters on the spongy structure of crystals has been followed up by experiments on rock-salt.—**H. Raudnitz**: Communication from the Institute for Radium Research, No. 207. Contributions to the electrolysis of radio-active B- and C-products and of polonium.—**A. Skrabal** and **A. Zahorka**: The kinetics of saponification of vinyl acetate.—**F. Heritsch**: The coal of the Karnatic Alps and of the Karawanken.

Official Publications Received.

BRITISH.

Journal of the Royal Statistical Society. Vol. 90, Part 4, 1927. Pp. x+637-842+vii. (London.) 7*s.* 6*d.*

Agricultural Economics in the Empire. Report of a Committee appointed by the Empire Marketing Board. Pp. 24. (London: Empire Marketing Board.)

Transactions and Proceedings of the New Zealand Institute. Vol. 58, Parts 1, 2, March, June. Pp. iv+188+20 plates. (Wellington, N.Z.)

New Zealand: Dominion Museum. Bulletin No. 6: The Pa Maori; an Account of the Fortified Villages of the Maori in Pre-European and Modern Times, illustrating Methods of Defence by means of Ramparts, Fosses, Scarps and Stockades. By Elsdon Best. Pp. viii+339. (Wellington, N.Z.)

Scottish Marine Biological Association. Annual Report 1926–27. Pp. 24. (Glasgow.)

Commemoration of Armistice Day: an Order for Service. (Prepared for Use in Schools.) Pp. 8. (Cardiff: National Council of Music; Welsh League of Nations Union; London: Oxford University Press.) 1*d.*

The Journal of the Institution of Electrical Engineers. Edited by P. F. Rowell. Vol. 65, No. 370, October. Pp. 913-976+xxxii. (London: E. and F. N. Spon, Ltd.) 10*s.* 6*d.*

University College of Wales, Aberystwyth: Welsh Plant Breeding Station. Red Clover Investigations. By R. D. Williams. (Series H, No. 7, Seasons 1919–1926.) Pp. 136+11 plates. (Aberystwyth.) 5*s.*

FOREIGN.

Department of Commerce: Bureau of Standards. Scientific Papers of the Bureau of Standards, No. 556: Current Distribution in Supraconductors. By F. B. Silsbee. Pp. 293-314. 10 cents. Scientific Papers of the Bureau of Standards, No. 557: A suggested new Base Point on the Thermometric Scale and the $\alpha \rightleftharpoons \beta$ Inversion of Quartz. By Frederick Bates and Francis P. Phelps. Pp. 315-327. 5 cents. (Washington, D.C.: Government Printing Office.)

Wisconsin Geological and Natural History Survey. Bulletin No. 68, Soil Series No. 49: Soils of Wisconsin. By Prof. A. R. Whitson. Pp. xii+270+32 plates. (Madison, Wis.)

Proceedings of the United States National Museum. Vol. 71, Art. 17: The Maskell Species of Scale Insects of the Subfamily Asterolecaniinae. By Harold Morrison and Emily Morrison. (No. 2689.) Pp. 67+29 plates. (Washington, D.C.: Government Printing Office.)

Journal of the Faculty of Agriculture, Hokkaido Imperial University, Sapporo, Japan. Vol. 21, Part 1: Studies on the Melampsoraceae of Japan. By Naohide Hiratsuka. Pp. 41. (Tokyo: Maruzen Co., Ltd.)

Proceedings of the Imperial Academy. Vol. 3, No. 7, July. Pp. xvii-xviii+387-475. (Ueno Park, Tokyo.)

Proceedings of the United States National Museum. Vol. 71, Art. 15: On Fossil Turtles from the Pleistocene of Florida. By Charles W. Gilmore. (No. 2687.) Pp. 10+5 plates. (Washington, D.C.: Government Printing Office.)

CATALOGUES.

Elektro-physikalische Lehrmittel. Pp. ii+24. (Mühlhausen i. Thür.: Hecht und Dehl G.m.b.H.)

Classified List of Second-Hand Scientific Instruments. (No. 91.) Pp. 58. (London: C. Baker.)

Catalogue of Books relating to the Near East and Egypt: including Arabia, the Balkan States, Cyprus, Mesopotamia, Palestine, the Sudan, etc. (No. 502.) Pp. 40. (London: Francis Edwards, Ltd.)

Sectional Catalogue No. 5c: Illustrated Catalogue of Modern Mathematical Drawing Instruments. Pp. 62. Sectional Catalogue No. 8b: Illustrated Catalogue of Drawing Scales, Parallel Rules, Pantographs, Eidographs, Drawing Boards, T-Squares, Set Squares, etc. Pp. 61-104. (London: W. H. Harling.)

Catalogue of Telescopes, etc. Pp. 62. (London: W. Ottway and Co., Ltd., Ealing.)

A Complete Catalogue of Books. Pp. 44. (Cambridge: W. Heffer and Sons, Ltd.; London: Simpkin, Marshall and Co., Ltd.)

Diary of Societies.

SATURDAY, NOVEMBER 5.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS (North Wales District Meeting) (at Town Hall, Llandudno), at 10 A.M.—Paper by W. T. Ward.—At 2.30.—Mr. Hodgson: Ferro-Concrete.

ROYAL SOCIETY OF MEDICINE (Otology Section), at 10.30 A.M.—Dr. J. S. Fraser: A National Investigation of Otosclerosis (Presidential Address).

INSTITUTE OF BRITISH FOUNDRYMEN (Lancashire Branch) (jointly with West Riding and Lancashire Branches) (at Huddersfield), at 2.30.—F. W. Rowe: Metallurgy in Gear Manufacture.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—E. Cammaerts: The Main Features of Modern English Literature (1).

GEOLOGISTS' ASSOCIATION (at University College), at 3.—Annual Conversazione.

MONDAY, NOVEMBER 7.

ROYAL SOCIETY OF EDINBURGH, at 4.30.—W. J. M. Menzies and P. R. C. Macfarlane: Some Further Notes on the Salmon (*Salmo salar*) of the River Moisie, Eastern Canada.—L. H. Easson and R. W. Armour: The Action of 'Active' Nitrogen on Iodine Vapour.—J. W. Gregor: Experiments on the Pollination of *Lolium perenne* and *Lolium italicum*.—Dorothy J. Jackson: Wing Dimorphism in the Genus Sitona and its Inheritance in *Sitona hispidula*, F. (Coleoptera, Fam. Curculionidæ).—B. Kaçzkowski: Contribution to the Study of the European Sheep.—*To be read by title*:—E. T. Copson: On Fourier Constants.

BIOCHEMICAL SOCIETY (in National Institute for Medical Research, Hampstead), at 5.—M. Stephenson: On a Cell-free Dehydrogenase Obtained from Bacteria.—G. A. Harrison: The Cause of Andrewes' Diazo Test for Uræmia.—Prof. A. Harden and F. R. Henley: The Equation of Alcoholic Fermentation.—W. V. Thorpe: Presence of Histamine in Tissue Extracts.—Dr. O. Rosenheim: Note on the Fluorescence of Ergosterol and its Cause.—M. G. Eggleton and P. Eggleton: A Few Observations Concerning Phosphagen.—Demonstrations:—A Simple Shaker for Light Objects, Prof. J. T. Irving.—A New Colorimeter Based on Lovibond's Colour System, Dr. O. Rosenheim and E. Schuster.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.—General Meeting.

SOCIETY OF ENGINEERS (at Geological Society), at 6.—H. W. Towse and others: Discussion on Economic Transport.

INSTITUTION OF ELECTRICAL ENGINEERS (Informal Meeting), at 7.—C. H. Holbeach and others: Discussion on Recent Developments in Electro-Medical Appliances.

INSTITUTION OF ELECTRICAL ENGINEERS (Mersey and North Wales (Liverpool) Centre) (at Liverpool University), at 7.—W. McClelland: The Applications of Electricity in Warships.

SOCIETY OF CHEMICAL INDUSTRY (London Section) (at Chemical Society), at 8.—Recent Advances in the Hydrogenation of Oils:—E. R. Bolton: General Introduction.—Part 1—K. A. Williams: (*a*) Selective Hydrogenation; (*b*) Melting Point of Hydrogenated Oils.—Part 2—R. G. Pelly: Hydrogenation of Fatty Acids and Neutral Oils.—Part 3—E. J. Lush: The Activity of a Nickel Catalyst.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.30.—President's Inaugural Address.

CAMBRIDGE PHILOSOPHICAL SOCIETY (in Botany School), at 8.45.—Dr. Hugh Scott: Narrative of a Journey in Central Abyssinia.

HUNTERIAN SOCIETY (at Cutlers' Hall), at 9.—Earl Russell, Dr. J. Neal, R. Goddard, Sir Herbert Waterhouse, and others: Discussion on The Legal Perils of the Doctor.

TUESDAY, NOVEMBER 8.

ROYAL SOCIETY OF MEDICINE (Therapeutics Section), at 5.—Dr. R. D. Lawrence: Studies of Unusual Diabetics: (*a*) An Insulin Resistant Case; (*b*) Recovery from (?) Pituitary Diabetes after Pregnancy.—Dr. F. Parkes Weber: A Note on Artificial Cerebral Congestion against Sea-sickness.

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 5.—Dr. H. R. Spencer: The History of British Midwifery (1650–1800) (FitzPatrick Lectures) (1).

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Sir John Herbert Parsons: Light and Sight (Tyndall Lectures) (II.).

INSTITUTION OF PETROLEUM TECHNOLOGISTS (at Royal Society of Arts), at 5.30.

ROYAL SANITARY INSTITUTE, at 5.30.—Major H. Barnes: The Royal Commissions on Health and Housing: A Retrospect and Forecast.

INSTITUTE OF MARINE ENGINEERS, at 6.30.—Dr. F. Sass: A New Type of Solid Injection Double-acting Two-stroke Oil Engine.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Scientific and Technical Group), at 7.—A. J. Bull: The Principles of Photo-Engraving.

INSTITUTION OF ELECTRICAL ENGINEERS (Scottish Centre) (at Royal Technical College, Glasgow), at 7.30.—W. McClelland: The Applications of Electricity in Warships.

QUEKETT MICROSCOPICAL CLUB, at 7.30.—E. Ashby: The Laws of Plant Growth.

PHARMACEUTICAL SOCIETY OF GREAT BRITAIN, at 8.—E. S. Peck: The Educative Value of Harrison's Work in Pharmacy (Harrison Memorial Lecture).

ROYAL ANTHROPOLOGICAL INSTITUTE (at Royal Society), at 8.30.—Dr. Ales Hrdlička : The Huxley Lecture.
ROYAL SOCIETY OF MEDICINE (Psychiatry Section), at 8.30.—Dr. R. L. Langdon-Down : Psychiatry and the Report of the Royal Commission (Presidential Address).

WEDNESDAY, NOVEMBER 9.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Lt.-Col. F. E. Fremantle : The Present Situation in regard to Housing.
ROYAL SOCIETY OF MEDICINE (Surgery : Sub-Section of Proctology), at 5.30.—Sir Charles Gordon-Watson and others : Discussion on The Treatment of Cancer of the Rectum by Radium.
NEWCOMEN SOCIETY FOR THE STUDY OF THE HISTORY OF ENGINEERING AND TECHNOLOGY (Annual General Meeting) (in Prince Henry's Room, 17 Fleet Street), at 5.30.—T. Rowatt : Railway Brakes.—H. O. Clark : Horse Gears.
INSTITUTION OF CIVIL ENGINEERS (Informal Meeting), at 6.—S. T. Dutton : The Layout and Manufacture of Railway Points and Crossings.
INSTITUTION OF ELECTRICAL ENGINEERS (South Midland Centre) (at Birmingham University), at 7.—F. Forrest : Economic Aspects of Pulverised Fuel.—Prof. A. W. Nash : Present and Future Possibilities of Extracting Oil from Coal.—Prof. K. N. Moss : Coal Analysis in Relation to Heat Value for Steam Raising.
INSTITUTE OF METALS (Swansea Local Section) (at Thomas' Café, Swansea), at 7.—Dr. P. MacNair : Pyrometers in Works Practice.
NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Graduate Section) (at Newcastle-upon-Tyne), at 7.15.—F. H. Todd : Chairman's Address.
INSTITUTE OF METALS (Sheffield Local Section, jointly with other local Societies) (in Sheffield University), at 7.30.—Sir William H. Bragg : Application of X-rays to the Study of the Crystalline Structure of Materials.
NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Middlesbrough Graduate Branch) (at Cleveland Scientific and Technical Institute, Middlesbrough), at 7.30.—J. Pilgrim : Valves and Valve Gear.
ROYAL SOCIETY OF ARTS, at 8.—Lieut.-Col. Mervyn O'Gorman : Road Traffic Problems of the Pedestrian.
SOCIETY OF CHEMICAL INDUSTRY (Nottingham Section).—S. R. Trotman and Dr. E. R. Trotman : The Action of Chlorine and Hypochlorous Acid on Wool.
INSTITUTION OF MECHANICAL ENGINEERS (Sheffield Branch).—Sir William H. Bragg : Application of X-rays to the Study of the Crystalline Structure of Materials (Thomas Hawsley Lecture).

THURSDAY, NOVEMBER 10.

ROYAL SOCIETY, at 4.30.—C. D. Ellis and W. A. Wooster : The Average Energy of Disintegration of Radium E.—E. T. S. Appleyard and H. W. B. Skinner : On the Excitation of Polarised Light by Electron Impact. II. Mercury.—*To be read by title only* :—J. L. Burchnell and T. W. Chaundy : Commutative Ordinary Differential Operators.—Prof. L. Hill : Measurements of the Biologically Active Ultra-violet Rays of Sunlight.—Prof. E. C. C. Baly, J. B. Davies, M. R. Johnson, and H. Shanassy : The Photosynthesis of Naturally Occurring Compounds. I.—Prof. E. C. C. Baly, W. E. Stephen, and N. R. Hood : The Photosynthesis of Naturally Occurring Compounds. II.—Prof. E. C. C. Baly and J. B. Davies : The Photosynthesis of Naturally Occurring Compounds. III.—Prof. H. Levy and A. G. Forsdyke : The Vibrations of an Infinite System of Vortex Rings.—M. Francis and F. P. Burt : Sorption of Ammonia by Glass.—T. M. Cherry : Periodic Solutions of Hamiltonian Systems of Differential Equations.—R. S. Edwards : On the Effect of Temperature on the Viscosity of Air.—P. Kapitza : Further Developments of the Method of Obtaining Strong Magnetic Fields.—F. H. Rolt and H. Barrell : Contact of Flat Surfaces.—G. I. Finch and J. C. Stimson : The Electrical Condition of Hot Surfaces during the Adsorption of Gases. Part I.—M. H. A. Newman : A Gauge Invariant Tensor Calculus.—Prof. J. C. McLennan, H. Grayson-Smith, and W. T. Collins : Intensities in the Secondary Spectrum of Hydrogen at various Temperatures.—W. Mandell : The Determination of the Elastic Moduli of the Piezo-electric Crystal Rochelle Salt by a Statical Method.—B. Venkatesachar : Density of the Vapour in the Mercury Arc and the Relative Intensities of the Radiated Spectral Lines with Special Reference to the Forbidden Line 2270.—G. I. Finch and L. G. Cowen : Gaseous Combustion in Electric Discharges. Part II.—L. Rosenhead : Resistance to a Barrier in the Shape of an Arc of a Circle.—W. G. Burgers : Investigation of the Molecular Arrangement of Uniaxial Optically Active Crystals.—Dr. D. T. A. Townend : Gaseous Combustion at High Pressures. Part VIII.—H. E. Watson : The Dielectric Constants of Ammonia Phosphine and Arsine.—Prof. C. V. Raman and K. S. Krishnan : A Theory of Electric and Magnetic Birefringence in Liquids.—Prof. O. W. Richardson : On the Intensity Distribution among the Lines of certain Bands in the Spectrum of the Hydrogen Molecule.—D. R. Hughes and R. C. Bevan : A Study of the Catalysis by Nickel of the Union of Hydrogen and Oxygen by a New Method.—P. M. S. Blackett and E. P. Hudson : The Elasticity of the Collisions of Alpha Particles with Hydrogen Nuclei.—W. K. Hutchison and C. N. Hinshelwood : The Relative Stability of Nitrous Oxide and Ammonia in the Electric Discharge.—Prof. J. C. McLennan, R. Ruedy, and E. Conhe : The Magnetic Susceptibility of the Alkali Metals.—J. S. Foster : Application of Quantum Mechanics to the Stark Effect in Helium.—A. Egerton and S. F. Gates : Further Experiments on Explosions in Gaseous Mixtures of Acetylene, of Hydrogen, and of Pentane.—Dr. C. F. Elam : Tensile Tests on Alloy Crystals. IV.—B. Lambert and A. M. Clark : Studies of Gas-Solid Equilibria. Part I.—R. W. Ditchburn : The Continuous Absorption of Light in Potassium Vapour.—D. W. Dye : A Magnetometer for the Measurement of the Earth's Vertical Magnetic Intensity in C.G.S. Measure.—J. W. Ryde : The Spectrum of Carbon Arcs in Air at High Current Densities.—F. B. Pidduck : Adjoint Differential Equations.—Dr. G. W. C. Kaye and W. F. Higgins : The Thermal Conductivities of Certain Liquids.—W. R. C. Coode-Adams : The Refractive Index of Quartz.—Prof. E. T. Whittaker : On Electric Phenomena in Gravitational Fields.

LONDON MATHEMATICAL SOCIETY (Annual General Meeting) (at Astronomical Society), at 5.—Dr. H. Cramèr : On an Asymptotic Expansion Occurring in the Theory of Probability.—Prof. G. H. Hardy : A Theorem Concerning Trigonometrical Series.—T. Kaluza und G. Szegö : Über Reihen mit lauter positiven Gliedern.—A. W. King : Notes on the Geometrical Representation of Functions of One and Two Variables.—E. H. Linfoot : On the Law of Large Numbers.—Prof. W. P. Milne : The 8-tangent Hyperquadrics of Noether's Canonical Curve for $p=5$.—Prof. L. J. Mordell : Minkowski's Theorem on the Product of Two Linear Forms.—S. Pollard : On the Criteria for the Convergence of a Fourier Series.—S. Pollard and R. C. Young : On the Integral $\int_a^b \frac{dF(x)}{x-t}$.—T. G. Room : Some Configurations based on Five General Planes in Space of Ten Dimensions.—E. C. Titchmarsh : On an Inequality Satisfied by the Zeta Function of Riemann.—Prof. H. W. Turnbull : The Maxtrix Square and Cube Roots of Unity.
ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 5.—Dr. H. R. Spencer : The History of British Midwifery (1650–1800) (FitzPatrick Lectures) (II.).
ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Cuthbert Wallace : Enlarged Prostate : a Review (Bradshaw Lecture).
ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—H. Clifford Smith : The Furniture and Equipment of the Mediæval House (II.).
ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Informal Meeting of Colour Group), at 7.—J. Rowatt : The Lignose Colour Process.
INSTITUTION OF ELECTRICAL ENGINEERS (Dundee Sub-Centre) (at University College, Dundee), at 7.30.—A. S. M'Whirter : Electrical Repairs to Motors and Dynamos.
INSTITUTE OF METALS (London Local Section) (at Royal School of Mines), at 7.30.—C. C. Paterson : Some Metallurgical Problems of the Electrical Industry.
OPTICAL SOCIETY (at Imperial College of Science), at 7.30.—J. R. Hamblin and T. H. Winser : On the Resolution of Gratings by the Astigmatic Eye.—O. Aves : The Deviograph and Trial Frame.
INSTITUTION OF MECHANICAL ENGINEERS (Leeds Branch).—Sir William H. Bragg : Application of X-rays to the Study of the Crystalline Structure of Materials (Thomas Hawsley Lecture).
INSTITUTION OF MECHANICAL ENGINEERS (South Wales Branch).—C. J. T. Billingham : Chairman's Address.

FRIDAY, NOVEMBER 11.

ROYAL SOCIETY OF ARTS (Indian Meeting), at 4.30.—M. M. S. Gubbay : Indigenous Indian Banking.
ROYAL ASTRONOMICAL SOCIETY, at 5.
PHYSICAL SOCIETY (at Imperial College of Science), at 5.
INSTITUTION OF MECHANICAL ENGINEERS (Informal Meeting), at 7.—F. Clements and others : What is wrong with Industrial England?
JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—Annual General Meeting.

SATURDAY, NOVEMBER 12.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—E. Cammaerts : The Main Features of Modern English Literature (II.).
PHYSIOLOGICAL SOCIETY (at Institute of Physiology, Cardiff University).

PUBLIC LECTURES.

SATURDAY, NOVEMBER 5.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—H. Harcourt : Indian Pictures and Problems.

MONDAY, NOVEMBER 7.

UNIVERSITY COLLEGE HOSPITAL MEDICAL SCHOOL, at 4.15.—Dr. C. Singer : The History of Medicine : Syphilis, Influenza, and Typhoid Fever. (Succeeding Lectures on Nov. 14 and 21.)
UNIVERSITY COLLEGE, at 5.15.—Dr. E. A. Hauser : The Colloid Chemistry of the Rubber Industry (Gow Lectures). (Succeeding Lectures on Nov. 9, 11, 14, 16, and 18.)
GRESHAM COLLEGE, at 6.—Sir Robert Armstrong-Jones : Physic. (Succeeding Lectures on Nov. 8, 10, and 11.)
EAST ANGLIAN INSTITUTE OF AGRICULTURE (Chelmsford), at 7.—Principal J. C. Wallace : The Cultivation of the Potato.

TUESDAY, NOVEMBER 8.

ROYAL SCHOOL OF MINES, at 5.15.—Dr. G. Shearer : X-rays and Metals (Armourers and Brasiers' Company's Lectures). (Succeeding Lectures on Nov. 15 and 22.)
BRITISH INSTITUTE OF PHILOSOPHICAL STUDIES (at Royal Society of Arts), at 8.15.—Dr. H. Crichton-Miller and K. Richmond : The New Psychology : a Department of Education or Medicine? Chairman, Dr. C. S. Myers.

WEDNESDAY, NOVEMBER 9.

KING'S COLLEGE, at 5.30.—Dr. C. Norwood : Secondary Education (II.) : The Boys' Boarding School.
UNIVERSITY COLLEGE, at 5.30.—I. C. Gröndahl : Regions and Place-Names in Norway. (Succeeding Lectures on Nov. 16, 23.)—P. B. James : The Decoration of Bookbindings.
LONDON SCHOOL OF ECONOMICS, at 6.—Prof. F. R. M. de Paula : Office Machinery : Accounts as an Aid to Management.

THURSDAY, NOVEMBER 10.

UNIVERSITY COLLEGE, at 5.30.—Miss E. Jeffries Davis : More London Place-Names. (Succeeding Lectures on Nov. 17, 24, Dec. 1 and 8.)
IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, at 5.45.—R. H. Fowler : Statistical Mechanics Old and New. (Succeeding Lectures on Nov. 24 and Dec. 8.)
ROYAL SOCIETY OF ARTS, at 8.15.—Major H. Barnes : The History of Housing : Housing before 1885 (Chadwick Lecture).

SATURDAY, NOVEMBER 12.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Mrs. R. Aitken : Dances of the Pueblo Indians.