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The World Population Conference.

THE head of a social research department, such as exist on the other side of the Atlantic, who was on the outlook for a subject for a student's thesis, might do worse than suggest the modern phenomenon of conference holding as suitable for investigation. Attendance at conferences and congresses threatens to consume an increasing proportion of the lifetime of scientific workers. If the laborious method of investigation which finds favour in certain places was followed in the department, we may suppose that the student would classify the motives for organising conferences and the methods of procedure followed, and would finally attempt to correlate different procedures with the 'results' attained. Such a student might find it difficult to fit the recent World Population Conference at Geneva into any well-defined category. On one hand, the programme was limited to the strictly scientific discussion of certain aspects of the population problem. On the other hand, it is probably correct to say that in the minds of most of those who attended was the conviction that the regulation of the quantity, quality, and distribution of population is a world problem which the organised communities of the world have to face at no distant date. It was a conference of biologists, statisticians, and economists, who did not trespass into the province of the politicians, but for the most part realised keenly the need for an agreed international policy if ordered progress is to be secured.

The problem of migration was discussed at the conference, and it is in connexion with the difficulties arising from migration that the politician is first called upon to deal with practical population problems. It is only within the last few years, owing to the admirable work of the International Labour Office, that trustworthy and comprehensive statistics of migration have become available. These deserve careful analysis and discussion, which should be of practical use. But it may prove to be true that, once the forces leading to a desire for migration have been generated, it is beyond the skill of statesmen, however well informed and well intentioned they may be, to arrange a peaceful solution of the problem. It is necessary, therefore, to inquire into the nature of these forces in the hope that civilised nations may attempt to control them. Since migration is a most complex phenomenon, we are led to study the more fundamental aspects of the whole question, all of which bear upon migration. These

are such as the biological problems of fertility, the economic problems of optimum density, and the social problems of family limitation. The hope is that civilised nations will learn in time to found their internal policies upon such knowledge as may be accumulated upon these matters. In this way maladjustments may be avoided before their results coalesce and manifest themselves in the form of pressure to migrate. This they will only do if they realise that in the end national well-being coincides with international well-being.

This programme sounds sufficiently chimerical, even though we have limited it to civilised States. There can be little doubt, however, that a common action by civilised States is urgent. United upon a population policy, they may be able to maintain world order in face of developments in Asia which seem inevitable. We now know, thanks to the recently published researches of economic historians, the true story of the great outpouring of population in the western world during the last century. It was due not to an increase in the birth-rate, but to a decrease in the death-rate. In all likelihood events in the East will follow the same course. Indeed, in India events are now taking this turn. Since we cannot anticipate that any effective efforts will be made to guide events in the East so as to avoid the otherwise inevitable pressure towards migration, the only hope lies in a western world united in a common policy based upon a common basis of scientific investigation, and thus strong enough to control the situation. If, on the other hand, the so-called civilised States embark upon competitions in numbers, they may well come to grief, quite apart from the fact that the eastern races will inevitably beat them at the game.

It is a commonplace remark that the value of scientific conferences lies in the opportunities of personal contact, and not in the formal communications or discussions. It is only the readers of the popular press who imagine that great discoveries are announced at congresses. This is not quite as true of the social sciences as of the natural sciences. The mechanism for distributing the results of research work in the natural sciences seems to be in advance of that in the field of the social sciences. It was interesting to observe that when biological matters were under discussion, the results of recent research were more generally familiar than when social phenomena took the first place on the programme. Apart from the value of contact and of disseminating information on certain matters, the conference has achieved a distinct success in that it has decided to set up the nucleus of a permanent organisation for the study of population problems. It cannot yet be said what form this will take. But if out of it grows an organisation of a truly international character, with the prestige of the full support of the representatives of the relevant sciences behind it, the conference will stand out as a notable event. The habit of international consultation on the scientific aspect will grow, and this cannot fail in time to influence international policy.

The function of a permanent international organisation might thus be twofold. The greater the prestige it gains, the more unlikely will it be that international policy will be directed regardless of the findings of biologists and economists. It would not be a propaganda organisation except in the sense that it would assist to disseminate facts. Again, a most useful piece of work lies in the correlation of investigations in different fields. The practical problems of population are complex problems. The biologist, the statistician, and the economist all have, for example, something to contribute towards the solution of the problem of migration. A deliberate effort is, however, required in order to give due weight to the various contributions in such a fashion that practical policies have regard to all the more important factors involved. It was evident enough at the conference that workers in different fields who have become interested in practical problems look at these problems only too often from a very narrow angle. An international organisation might do good work in opening the eyes of specialists to the necessity of taking the results of workers in other fields into account before they deliver their opinions as experts upon problems which they have not fully envisaged.

So far as it affects Great Britain, one aspect of the present situation, which is not without its importance, deserves a word of comment. It is not to be supposed that population problems when discussed at conferences or elsewhere will be referred to in the popular press unless they can be dressed up to justify a good headline or to form a sensational paragraph. But it is disappointing to notice that the more responsible organs in Great Britain appear to be committed more or less to a boycott of these matters. The reference is not to this conference in particular so much as to events here during the last few years. We have still a long way to travel towards a rational policy when editors of responsible papers regard population problems as too indelicate or too dangerous for discussion in their pages. A. M. C.-S.

The Homologues of Carbon.

A Comprehensive Treatise on Inorganic and Theoretical Chemistry. By Dr. J. W. Mellor. Vol. 7: Ti, Zr, Hf, Th, Ge, Sn, Pb, Inert Gases. Pp. x+977. (London: Longmans, Green and Co., Ltd., 1927.) 63*s.* net.

THE writer of a 'comprehensive treatise' is in grave danger of being drowned by the torrent of information which flows in upon him as soon as he accepts the responsibility of taking cognisance of all the details of his chosen subject. It is almost a commonplace that the amount of readable matter in such a treatise (like the pressure of a gas) is inversely proportional to its volume. On this basis of calculation, it might be expected that a treatise on chemistry which has only reached Group IV. of the Periodic Classification in a seventh volume of 1000 pages would be intolerable in its dullness. It is therefore a welcome relief to find that the opening sentence of Dr. Mellor's new volume has the arresting character which one might expect to find at the beginning of a detective story. "In 1791, W. Gregor studied the black sands of Menacan, near Falmouth, Cornwall, and found some greyish-black granules which were attracted by a magnet." The sleuth then sets to work to solve his riddle with the help of hydrochloric and sulphuric acids, ammonia and potash-lye, and finally brings in tincture of galls as a means of checking a possible alibi, and ends by confiding —to *Crell's Chemical Journal* instead of to his friend Watson—his conclusion in the following terms:

"The extraordinary properties of the sand have led me to believe that it contains a new metallic substance. In order to distinguish this substance from others, I have ventured to suggest a name derived from the neighbourhood—Menacan, Cornwall—where it was found, and therefore I propose to call the metal *menacanite*."

If the narrative lacks the element of horror, which is such an asset to the writer of detective stories, it has at least the merit of taking us to the romantic west, to speculate whether the hero of the story saw the fig-tree growing out of the side of the church tower when he visited Menacan at the time of the French Revolution, whether he had a magnet in his pocket whilst he was reading in the church the message of Charles I. to his loyal Cornish subjects, and, finally, in what precise locality he discovered the magnetic granules. After reading in the succeeding sentences how the new element was robbed of its Cornish name and called 'titanium,' one is impelled to breathe a lament, such as Urbain must have uttered when 'celtium' was re-baptized as 'hafnium.'

Since the volume deals with all the elements of Group IV., except carbon and silicon, the reader will turn with interest to Chap. xliii. to see what the author has to say about the celtium-hafnium controversy, on which readers of NATURE should be already well-informed (see vol. 111, pp. 79, 182, 252, and 462). The verdict of our modern Berzelius is unequivocal:—

"In 1911, G. Urbain announced the discovery of a new element in some residues remaining after the separation of the lutecium-ytterbium fractions of the rare earths. He called it celtium. Subsequent observations showed that all the evidence in favour of this element was worthless. In May, 1922, A. Dauvillier found that the X-ray spectrum of these residues was in agreement with the presence of an element, atomic number 72, and G. Urbain applied the old term to the new element. The neo-celtium was not obtained in sufficient quantity, or sufficiently purified, to enable any other unequivocal statement to be made of its properties. Meanwhile, January 1923, D. Coster and G. von Hevesy reported a new element. . . . The new element was called hafnium, Hf—from Hafnia, an ancient name for Copenhagen."

After reading these remarks it is not surprising to find that the chapter is labelled 'hafnium' and not 'celtium.'

The remaining elements of the first sub-group are zirconium and thorium, the latter being of interest both on account of its radioactivity and of its technical use in the 'incandescent gas-mantle.' These two topics form the subject of two sections in which the relevant researches are adequately reviewed.

Passing on to the other sub-group, we find a section on "The Physical Properties of Tin" which is effectively illustrated by photographs of slip-bands in strained tin and of the surface of a sample of tin affected by the 'tin-pest.'

Under the heading "Physiological Action of Lead" an amazing story is told of a custom, which appears to have prevailed for many centuries, of "rendering harsh wine milder" by boiling it in lead vessels, or by the action of litharge. The litharge or white-lead was singularly efficacious in renovating spoilt wine, but its physiological effect was disastrous, producing, "according to the constitution of the consumer, a speedy or a lingering death, violent colics, obstructions, and other maladies." It was, however, so successful, from the point of view of the vendor, that its use could barely be stopped by the severest of punishments, torture and death. After this, it is difficult to

admit that the use of preservatives in food is a purely modern vice, since it no longer seems necessary to suggest the infliction of penalties such as these merely in order to prevent the addition of boric acid (not exceeding 0·4 per cent.) to cream, or of benzoic acid to that form of coffee which is sold in a bottle instead of a tin.

The final chapter of the volume deals with the "Inert Gases." This chapter relapses, perhaps inevitably, into the form of a catalogue of numerical data, alternating with long lists of authorities on a subject which has interested many workers both in physics and in chemistry. The reviewer has, however, formed the opinion that Dr. Mellor writes with more freedom and in a more interesting style as he 'warms up' to his colossal task; and the numerous illustrations, although generally reproduced on a very small scale, are of great value in setting out the precise conditions of equilibrium in scores of different systems. The photographs, which are not reduced so drastically, provide another welcome relief to the solidity of the text; and tiny diagrams, representing the results of X-ray analysis of substances such as stannic iodide and the chlorostannates, show how closely the author has kept up with modern developments. He may therefore be congratulated without reserve on having arrived at his half-way house without showing any signs of weariness or flagging, since he appears to be even more fresh and vigorous now than when he first started out on his long journey.

T. M. LOWRY.

Zonæ Torridæ Tutamen.[1]

The Life and Work of Sir Patrick Manson. By Dr. Philip H. Manson-Bahr and Lieut.-Col. A. Alcock. Pp. ix + 273 + 12 plates. (London, Toronto, Melbourne and Sydney: Cassell and Co., Ltd., 1927.) 16*s.* net.

IN the ordinary progress of knowledge, men come and men go, each contributing according to the talents given to him, but from time to time there appears an individual whose work signals the beginning of a new era. Such a man does not merely add his own quota to the growing stream of knowledge, but seems, by some hidden power, to unlock the waters of the well of truth so that the stream becomes a flood. Such a man was Lister, whose centenary is celebrated this year, and such, too, was Manson, who stands in the same relation to modern tropical medicine as Lister does to modern surgery. It can but add to Lister's fame that the recently published "Life and Work of Sir Patrick Manson" makes known the part that Lister played in support of Manson and Ross in their pioneer work.

Manson's contributions to scientific knowledge are as well known as they were varied. A list of his published papers occupies twelve pages. He has been called 'Mosquito Manson.' It is true that his demonstration of the rôle of mosquitoes in relation to parasitic disease in man is the brightest single gem in his crown of achievement, but attention has been focussed too much on this one discovery. Much more than that underlay Blanchard's naming him "the father of the modern science of tropical medicine." It is fitting that the full measure of Manson's worth should be laid before the world by two men so intimately connected with him both in work and private life as Dr. Manson-Bahr and Col. Alcock. What impresses, in this record, is the bigness of the man. Here was no dry-as-dust scientist content with making additions to abstract knowledge. In professional life he was a surgeon of skill and repute—and the two do not always go together—a physician of insight and mature judgment, an obstetrician whose ability and tact made him acceptable to a foreign and highly conservative race, a teacher who could attract and hold his pupils, a laboratory worker whose dexterity overcame the difficulties of place and circumstance; and his work in every sphere was illuminated by an inquiring genius which set him ever speculating, probing, searching, until basic facts and processes were laid bare. In the world of affairs he was shrewd and penetrating, with organising power and driving force which made him the effective adviser of a great department of State, and to which there remain as monuments the medical school of Hong Kong and the London School of Tropical Medicine. Of his private life too little is known, and even his biographers are compelled to sketch with uncertain pen the twenty years and more of Manson's life which were spent abroad. He was good company, kindly and courteous; tolerant of another's contrary opinion so long as it was sincerely held; a great reader, passionately fond of poetry; no mean geologist; a good man with a gun, and an angler after the heart of Isaac Walton.

Born in Aberdeenshire in 1844, Manson was at first destined to be an engineer. His youthful desire to learn 'how the wheels go round' is seen when we find him, as a schoolboy, dissecting a cat. Perhaps this early anatomical study, as much as

[1] The motto of the Royal Society of Tropical Medicine and Hygiene, of which Manson was first president.

some physical frailty, turned his attention from the crude mechanisms of man's construction to the most delicate machine of all, man himself. It may be, too, that the accident of the cat's containing a tapeworm determined his lifelong interest in the helminth parasites of man. Graduating in medicine at Aberdeen, he soon went abroad, settling first at Amoy and later in Hong Kong. Some idea of the difficulties to be overcome may be gathered from his having had to run for his life when attempting to perform an autopsy, and from the fact that the *Customs Gazette* was for long his only medium of publication. His independence of character is seen in his repayment to his father, with the first-fruits of his labour, of the expenses of his medical education. Manson was liked and respected by the Chinese, and himself grew fond of them, a point brought out by Dr. H. M. Hanschell in an admirable pen portrait quoted by the authors. In Manson's experiences on his first return to England is found the key to his determined and successful efforts to establish definite teaching on the diseases peculiar to hot climates. Impressed as he had been with his own ignorance of such subjects, he set about to acquire the fullest knowledge to be obtained in London. He found nothing save what he extracted for himself by searching the library of the British Museum.

Many pages of the "Life" are taken up by an extremely interesting series of letters from Manson to Ross, written while the latter was working to establish the mosquito-malaria theory. This part of the book makes a vivid picture—as vivid as and truer than that painted in highly-coloured language by a recent writer in the New World: Ross in India labouring under difficulties, now making a little progress, now becoming sidetracked, now disheartened, now hopeful again as some success crowned his efforts; and Manson in London anxiously awaiting every mail, writing frequently with helpful suggestions, supporting in high places by all the influence he could wield or induce others to wield, encouraging to solve the problem before other investigators should succeed, and reiterating, with a constancy which Ross might be pardoned for finding tiresome, his advice to "follow the flagellum." The outcome is known to all. Failing with the other mosquitoes, Ross succeeded with the dappled anopheles and was able to go a stage further than did Manson's hypothesis, and to show how the man-mosquito-man cycle is completed by the mosquito in the act of biting.

The account of Manson's work for the Chinese in Amoy and Hong Kong should be read by the many in China and the few in Great Britain who represent at present that the British in China have played no part save that of self-interest. Britain's history teems with the names of her sons who have gone to strange lands and have there enhanced the prestige of their race, and none more nobly than did Manson. Though much of his life was spent outside the Empire and much in a colony territorially insignificant, yet he may with truth be called an Empire builder. Directly through his instrumentality, more than three thousand doctors have received expert training in those special arts and sciences without the exercise of which many of the British Empire's resources could never be tapped. His fame, like the influence of his life and work, is world-wide and abiding.

J. F. C. HASLAM.

An Impeachment of Science.

Science: Leading and Misleading. By Arthur Lynch. Pp. 376. (London: John Murray, 1927.) 7*s.* 6*d.* net.

MR. LYNCH covers a wide ground in his book on science dealing successively with mathematics, physics, chemistry, biology, physiology, medicine, psychology, and ethics. The modern sciences are so highly developed and specialised that it is unusual for a single writer to be able to discuss competently the technical details of more than a few sciences. Mr. Lynch considers that this tendency to specialisation requires correction, and with a laudable courage he attempts to put his principles into practice, mastering at the same time the technicalities of each science and explaining them in language which is intelligible to all. While, however, his book contains a great deal of scientific matter, its central theme does not appear to be so much the particular discoveries or the development of science as a criticism of current views as to the basic principles and methods of science. It is this philosophical theme which gives unity to what is otherwise a series of discursive essays.

Mr. Lynch contends that the ordinary view or assumption as to the absolute certainty of scientific knowledge is mistaken, and he professes to establish his claim by recounting the constant mistakes committed by the great men of science of the past. The soundness of such an argument may be open to question, but the historical account given of science is often lively and interesting, although

perhaps too much is made of the small mistakes and foibles of great men. When Mr. Lynch comes to philosophers such as Kant, he paints a picture which is clearly too one-sided to carry much conviction. He does not set out in this book to explain at any length his own theory as to the character of scientific certainty, but he is content to indicate a view somewhat similar to that of Mach and to refer the reader to his work on psychology for a more complete exposition.

In his first essay Mr. Lynch reviews briefly the early period when the philosophers were also the leading scientific workers. Actuated by a praiseworthy desire to make the speculations of these early thinkers live, he tends to modernise overmuch their doctrines; thus he says that in Heraclitus we find the early apprehension of the principle of evolution and also the theory of ether; moreover, he scarcely does justice to the metaphysics either of Plato or of Aristotle. According to Mr. Lynch, the subject which Plato pursued with the greatest tenacity was mathematics, but the medieval schoolmen seized upon the more obscure of Plato's doctrines and "left their malign influence to obfuscate the brains of many of our most famous and authoritative thinkers of to-day"; and while Aristotle's "Ethics" is "a work of marvellous creation," Aristotle was nevertheless not strong in the "field of psychological analysis."

If Mr. Lynch takes a 'rationalist' view of medieval Platonism and is also hostile to modern absolute idealism, he is equally sceptical both of the scientific and of the philosophical theories of relativism. If his chapters on relativity have been understood aright, he thinks that Einstein has added very little to the body of scientific knowledge, and that his theory is rather a convenient formula liable to be overturned to-morrow, than a statement of an abiding truth. Philosophical relativists, such as Lord Haldane, Mr. Lynch states have taken Polonius as their model and cannot be regarded seriously. Apparently the cure for all these fallacies and the basis for a true system of science and philosophy is to be found in a new constructive psychology.

In the latter part of his book Mr. Lynch reviews modern schools of thought, and he does not conceal his contempt for most of the leading thinkers. Bradley, Bergson, Bosanquet, the Earl of Balfour, Dean Inge, Dr. Schiller, Prof. Wildon Carr, Prof. Dawes Hicks, and others, are dismissed with none too complimentary remarks, and for universities and scientific associations generally Mr. Lynch has scarcely a good word to say. He appeals over the heads of the professors to the great public, but he should bear in mind that while the public always likes and admires outspoken criticism, witty or caustic as the case may be, it immediately turns a deaf ear if it suspects a personal grudge or ill temper.

The Increase of Epidemic Diseases of the Nervous System.

Epidemic Diseases of the Central Nervous System. By Dr. Arthur Salusbury MacNalty. Pp. xiii + 194. (London: Faber and Gwyer, Ltd. (The Scientific Press), 1927.) 12*s.* 6*d.* net.

LIFE and its incidents are always changing, new fashions and phenomena come and go, and among these our diseases alter not only in name but also in nature. With the more rapid means of communication the rate of living, though not longevity, has increased, and, like most generations, the present complacently condoles with itself on the increased strain of modern life. Neurology has made enormous advances in recent years, and, as a result, many new diseases have become recognised, but apart from the influence of this addition to knowledge there appears to be an increasing susceptibility of the central nervous system to attacks of epidemic disease, such as acute poliomyelitis during this century, during the special conditions of the War cerebrospinal fever, and since the later years of the War a practically new disease, epidemic or lethargic encephalitis, known in the lay press as 'sleepy sickness,' which should be distinguished from the sleeping sickness of more tropical climates, due to infection with trypanosomes.

The endowed lectures at medical institutions offer an opportunity for the publication of original investigations and for surveys of current knowledge. The appearance in an expanded form, with more recent additions, of the scholarly Milroy Lectures on "Epidemic Diseases of the Central Nervous System," given in 1925 before the Royal College of Physicians of London by Dr. A. Salusbury MacNalty, of the Ministry of Health, and dedicated to his former teacher, the president of the College, Sir John Rose Bradford, provides convincing proof of the value of such endowments. Dr. MacNalty had much to do with the early investigation of encephalitis lethargica, first described early in 1917 by Economo and von Wiesner in Vienna, and attracting attention a year later in England, where it was first suggested to be botulism, a very rare disease in Great Britain, of which the only definite

outbreak occurred in 1922 at Loch Maree from eating infected potted duck paste.

Well equipped in epidemiology, Dr. MacNalty is therefore able to give an admirable account of the epidemic nature and history of the three diseases—acute poliomyelitis and polioencephalitis, cerebrospinal fever, and encephalitis lethargica—not only in man but also of what is known about their occurrence in animals. Since the end of the War the incidence of cerebrospinal fever has greatly diminished, but unfortunately the reverse applies to the other two, both of which are due to infection with an ultra-microscopic virus spread by healthy 'carriers.' The after-effects of encephalitis lethargica on the brain, which may follow acute attacks so slight as to pass almost or quite unnoticed, are calamitous; when the incidence of abortive attacks and of its form, or the closely allied condition, known as epidemic hiccup, which do not appear in the notification returns, are taken into account, the increase becomes positively alarming. A thorough knowledge of the causation and epidemiology of these diseases is most important in providing efficient means for their prevention, a subject on which Dr. MacNalty also touches, and hence this well-written and detailed account of their epidemiology is most appropriate. H. R.

Our Bookshelf.

Lehrbuch der Geophysik. Herausgegeben von Dr. B. Gutenberg. Lieferung 3. Pp. 401-608. (Berlin: Gebrüder Borntraeger, 1926.) 12 gold marks.

THE third instalment of the work edited by Prof. Gutenberg maintains the standard of the first two. It begins with a clear and up-to-date account of terrestrial magnetism by Dr. J. Bartels. One learns in it that the whole energy of the earth's permanent magnetic field is equivalent to that of the radiation received from the sun in three seconds!—or, it may be remarked, to the gravitational energy released by a radial contraction of the order of 10^{-6} cm. Prof. Gutenberg then devotes sixty-six pages to the physical constitution, figure, density, and thermal state of the earth. In a useful, if brief, account of the figure of the earth, the Radau approximation is given, but neither Darwin nor Callandreau is mentioned.

Present knowledge of the distribution of density is well summarized. The three physical states of matter are clearly defined on p. 455. The distinguishing mark of a gas is its high compressibility, while a solid is distinguished from a liquid by the possession of a measurable rigidity, or elasticity of form, which liquids have not. Glasses are therefore regarded as solids, and not as liquids. But Gutenberg seems to contemplate seriously the possibility that all solids have a finite viscosity; the proposition is perhaps worth consideration, though neither experiment nor theory lends it much support. The work of Bridgman, Tammann, and others on the properties of matter at high temperatures and pressures is described. Methods of measuring gravity and its variations with position are treated fully by Prof. Ansel, with special reference to the detection of masses of abnormal density near the surface. An account of electric currents in the crust is then given by Bartels.

The last chapter, by Gutenberg, deals with the application of seismological methods to the investigation of the uppermost layers of the crust. Until recently seismology, so far as it has dealt with the sedimentary layer at all, has usually regarded it mainly as a nuisance. But the problems it involves are now being attacked, and this chapter is, I believe, the first connected account of the results. Artificial shocks, such as explosions or even the fall of a heavy body, are recorded on instruments with magnifications of the order of a million, so that movements of almost molecular extent can be detected. The sound wave in the air is a prominent feature of the records. The velocities of compressional waves in the sedimentary rocks are notably less than in igneous ones, of the order of 2 km./sec. as against 5·4 km. to 8 km./sec. Distortional waves have hitherto been found more difficult to observe.

H. J.

Mind and its Disorders: a Textbook for Students and Practitioners of Medicine. By Dr. W. H. B. Stoddart. (Lewis's Practical Series.) Fifth edition. Pp. xx + 593 + 12 plates. (London: H. K. Lewis and Co., Ltd., 1926.) 21*s*. net.

IN the fifth edition of his well-known text-book, Dr. Stoddart has made several changes to conform with the latest ideas on the ever-growing subject of psychiatry. It is perhaps in general paralysis that there has been during the last few years the most prominent advance in therapeutics of mental disease. The section on the treatment of this disorder contains details of the modern treatment by induced malaria, and also refers to the use of tryparsamide. The main new feature of clinical psychiatry is the recognition of mental changes following epidemic encephalitis, and a chapter is devoted to this disease and its sequelæ. Dr. Stoddart's experience is that certification is rarely required, and then only for the confused type of post-encephalitic state, but cases certainly occur in which that step is necessitated by changes in the moral sphere.

The author continues to deal with psychopathology on dogmatic Freudian lines. The root of the manic-depressive psychosis is regarded as a repressed sado-masochism; the former intra-neuronic intoxication theory is quite abandoned. Paranoia is said to have an invariable foundation of repressed homosexuality. Exophthalmic goitre is considered to be a variety of anxiety hysteria. It is left undecided whether dementia præcox is primarily organic or psychogenic. While these views may not find general acceptance, they form excellent illustrations of the psycho-analytical

method, which, however far it may be removed from his own ideas, must receive the consideration of every psychiatrist.

Principles of Human Geography. By P. Vidal de la Blache. Edited by Emmanuel de Martonne. Authorised translation from the French by Dr. Millicent Todd Bingham. Pp. xv + 511 + 6 plates. (London: Constable and Co., Ltd., 1926.) 18*s.* net.

HUMAN geography is a new subject, but its facts are old. It is the outcome of the growth of ideas rather than the result of discovery. Man is not an abstraction in the world in which he lives, but his evolution is related to the environment in which he occurs. The study of environment is not static but one that involves continual change in values as man evolves. Prof. Vidal de la Blache shows that there is more in geography than merely a study of the stage on which man has played his part, for man himself is a geographical factor changing and moulding his environment, and the study of progress entails a study of his struggles with physical and other obstacles. His distribution over the globe and his varying degrees of progress are the expression of the geographical conditions he has met.

The book is incomplete except for the early chapters on the distribution of population, and it has been put together from the author's notes after his death. Some of the more interesting sections on the factors of civilisation and the growth and influence of transport are fragmentary, but long enough to show the author's trend of thought. Fortunately, some important maps were complete and are included. In spite of its imperfections, the book is an important contribution to a side of geography which is specially associated with French workers.

Körper und Keimzellen. Von Prof. Jürgen W. Harms. (Monographien aus dem Gesamtgebiet der Physiologie der Pflanzen und der Tiere, Band 9.) Teil 1. Pp. x + 516. 33 gold marks. Teil 2. Pp. iii + 517-1023. 33 gold marks. (Berlin: Julius Springer, 1926.)

THE author, holding that a proper understanding of the relation of germplasm to soma is a prerequisite in the investigation of all problems of biology, has set himself the task of giving in broad review an account of the established facts concerning this relationship as it exists in the animal kingdom (including man). The result of his endeavour is this excellent and most useful book. The objective method of presentation, the historical review followed by a fair statement of modern opinion, the judicial comparison of opposing doctrines, the avoidance of any exhibition of preference save only in those matters upon which the author is a recognised authority, make the reading of this book both pleasant and profitable.

The subject of the endocrine activity of the gonads is treated in a most thorough manner, and any one who seeks trustworthy guidance in the Steinach-Stieve controversy will find it here. Castration, gonad implantation, substitution therapy, and rejuvenation are discussed fully, and the rôle of the nervous system in the maintenance of the sexual characters is examined by reference to the author's well-known work concerning the thumb-pad of the frog. The bibliography does not include all the names and papers to which reference is made in the text.

This work, into which Harms's earlier book is worked in ("Die innere Sekretion der Keimdrüsen," Jena, 1914), can be warmly recommended. Not the least of its good qualities is that the author indicates everywhere lines of profitable research.

Indicators: their Use in Quantitative Analysis and in the Colorimetric Determination of Hydrogen-Ion Concentration. By Dr. I. M. Kolthoff. An authorised translation based upon the second German edition, revised and enlarged, by Dr. N. Howell Furman. Pp. xii + 269. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1926.) 17*s.* 6*d.* net.

UNTIL the development of the conception of hydrogen-ion concentration, the use of indicators was confined within more or less empirical boundaries. It is therefore only during comparatively recent years that any appreciable insight has been obtained of the principles underlying the reactions of these bodies.

The volume under notice fully realises the avowed intention of its author to present a treatise the practical nature of which should be developed from theoretical considerations, without being overwhelmed by them. In the early chapters dealing with neutralisations generally, with amphoteric compounds and with the colour change of indicators, experimental examples are described, wherever possible, to illustrate the various points as they arise. The uses of indicators in quantitative neutralisations and in the colorimetric determination of hydrogen-ion concentration, with practical applications, are then discussed. Short chapters deal with indicator papers and with the theories of the colour changes of indicators, as distinct from the causes which bring about such changes.

Apart from an occasional loose phrase, the translation is well done; misprints are but few. Some useful tables and indexes conclude a volume which merits careful study by those who desire to obtain fullest benefit from the intelligent use of indicators.

B. A. E.

Atoms and Molecules: being Part 1 and Chapter xii. of "The Foundations of Chemical Theory." By Prof. R. M. Caven. Pp. viii + 141. (London and Glasgow: Blackie and Son, Ltd., 1927.) 7*s.* net.

THE chapters which have been retained in this abbreviation deal with atomic and molecular theories, atomic and molecular weights, valency and chemical constitution, classification of the elements, the modern view of the atom and the molecule, and finally the colloidal state. The chapters omitted have reference chiefly to the states of matter, the properties of solutions and the various types of chemical change.

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 Origin of the Nebulium Spectrum.

IN the spectra of the gaseous nebulæ several very strong lines are found which have not been duplicated in any terrestrial source. Many lines of evidence point to the fact that the lines are emitted by an element of low atomic weight. Since the spectra of the light elements, as excited in terrestrial sources, are well known, this leads to the conclusion that there must be some condition, presumably low density, which exists in the nebulæ, that causes additional lines to be emitted.

A type of line, which one would expect to be affected by density in this manner, is that caused by a jump from a metastable state to a lower level. Such a metastable state is usually considered to be one from which jumps are very improbable, that is, one of which the average life is very long. Consequently, under terrestrial conditions, where the time between impacts is a very small fraction of a second, the metastable atom, in general, will be dropped down to a lower state by collisions of the second kind or by impact with the walls long before the return would take place spontaneously with the emission of radiation. Under conditions in the nebulæ, however, the time between impacts is very long, and many of these atoms will have a chance to return to lower states with the emission of radiation corresponding to the difference in energy between these metastable states.

Since the nebulæ are known to emit the well-known spectra of highly ionised nitrogen and oxygen, these ions at once suggest themselves as possible sources of the unknown lines as well.

In a four-electron system such as N_{II} and O_{III} the lowest energy levels are due to the configuration of 2 ($2s$) and 2 ($2p$) electrons. According to the Hund theory, this configuration gives rise to ^3P, ^1D, and ^1S terms. All but the lowest of these are metastable, since any jump between them involves a zero change in the azimuthal quantum number. In a five-electron system such as O_{II}, the normal configuration of 2 ($2s$) and 3 ($2p$) electrons forms ^4S, ^2D, and ^2P terms. These are likewise metastable.

The frequency of lines due to jumps between these terms can be calculated accurately in only two cases, namely, ^1D-^1S of O_{III} and ^2D-^2P of O_{II}. The calculated frequencies, if unresolved, are 22916 and 13646, which correspond to wave-lengths of 4362·54 Å.U. and 7326·2 Å.U. respectively. Two of the strongest nebulium lines are found at 4363·21 Å.U. and 7325 Å.U. These deviations are well within the rather large experimental errors arising from the fact that the values are calculated from the difference in frequency of lines in the 500 Å.U. region.

Another group of which the position can be predicted roughly is ^4S-^2D of O_{II}. Both terms have been calculated from series relationships, but as no intercombinations between quartets and doublets have been found, the predicted frequency is only approximate. The predicted frequencies of the two components are 27157 and 27175, which correspond to wave-lengths of 3681·25 Å.U. and 3678·81 Å.U. respectively. The strongest two nebulium lines in the ultra-violet are at 3728·91 Å.U. and 3726·16 Å.U. The doublet separation checks well and uncertainties in the adjustment of series limits for either the quartets or the doublets can account for the deviation in wave-lengths.

The strongest lines in the whole nebulium spectrum are the pair at 5006·84 Å.U. and 4958·91 Å.U. These have a separation of 193 frequency units, which is in almost exact agreement with the separation of 192 units observed for $^3P_1$-$^3P_2$ in O_{III}. This at once suggests that these two lines are $^3P_2$-$^1D_2$ and $^3P_1$-$^1D_2$ respectively. The relative intensity of these two lines is just what would be expected.

Another strong pair occurs at 6583·6 Å.U. and 6548·1 Å.U., showing a separation of 82·3 frequency units. This agrees very well with the known separation of 82·7 for $^3P_1$-$^3P_2$ in N_{II}. If these lines are identified as $^3P_2$-$^1D_2$ and $^3P_1$-$^1D_2$ of N_{II}, one can calculate at once the term value of $^1D_2$, since those of ^3P are already known. This ^1D term should combine strongly with the ^1P term of the $s^2p{\cdot}s$ configuration and the ^1D term of the $s^2p{\cdot}d$ configuration. The term values of these singlet terms have already been determined accurately by Fowler. The calculated positions of the lines arising from these combinations, obtained with the use of the above nebulium lines, are 746·98 Å.U. and 582·15 Å.U. Strong lines are observed in the nitrogen spectrum at 746·97 Å.U. and 582·16 Å.U. This furnishes almost certain proof of the identification of this pair of nebulium lines.

The other lines to be expected, on the above hypothesis, from N_{II}, N_{III}, O_{II}, and O_{III}, fall outside the range of wave-lengths easily observable in nebulæ. The above identifications account for all but two or three of the strong nebulium lines. It should be noted that in every case where it has been possible to make an exact prediction, a strong nebulium line has been observed at the calculated place. Furthermore, the above identifications are entirely in accord with the behaviour of these lines in the nebulæ as observed by Wright.

The nebulium lines thus far identified are collected in Table I.

TABLE I.

λ.	Source.	Series Designation.
7325·0	O_{II}	^2D -^2P
6583·6	N_{II}	$^3P_2$-^1D
6548·1	N_{II}	$^3P_1$-^1D
5006·84	O_{III}	$^3P_2$-^1D
4958·91	O_{III}	$^3P_1$-^1D
4363·21	O_{III}	^1D -^1S
3728·91	O_{II}	^4S -$^2D_3$
3726·16	O_{II}	^4S -$^2D_2$

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Sept. 7.

The Function of Water Vapour in the Photo-synthesis of Hydrogen Chloride.

EVIDENCE was presented (B. Lewis and E. K. Rideal, *J. Chem. Soc.*, **129**, 583 and 596; 1926) for the view that the photo-expansion of bromine and other halogens in the presence of water vapour (Budde effect) is due to heat liberated by the recombination of halogen atoms set free by the absorption of light quanta. Although absorption of radiation occurs in the dry gas, no Budde effect is observable (J. W. Mellor, *J. Chem. Soc.*, **81**, 1280; 1902; Lewis and Rideal, *loc. cit.*) even when the gas is subjected to an intense source of ultra-violet radiation (E. B. Ludlam, *Proc. Roy. Soc. Edinburgh*, **44**, 197; 1924). This is interpreted to mean that the halogen does not dissociate in the dry state; that the radiation absorbed

activates the halogen molecule for a short period of time and is then emitted (presumably as longer wavelengths).

It has been shown by several workers that the photo-chemical union of hydrogen and chlorine does not proceed in visible radiation in the absence of water vapour. Of the numerous mechanisms proposed for this reaction, the Nernst atomic chain still remains on the whole the most plausible. The formation of hydrogen bromide from the elements is known to proceed by way of bromine atoms, the endothermicity of one of the atomic steps preventing long chains (for literature see Lewis and Rideal, *J. Amer. Chem. Soc.*, **48**, 2553; 1926). Lewis and Rideal (*J. Amer. Chem. Soc., loc. cit.*) have shown that the absence of water vapour retards this reaction. Lack of space prevents adequate reply to Bodenstein and Jost (*J. Amer. Chem. Soc.*, **49**, 1416; 1927), but it should be mentioned that Table III., p. 2558 of Lewis and Rideal's paper, presents a series of experiments on the formation of hydrogen bromide in as dry a system as was possible at the high temperatures without the use of phosphorus pentoxide, in which considerable retardation was observed, and in one case, nearly stopped completely. Two or three typographical errors prevail; the values for experiments 8 and 11 should read 45·8 per cent. and 56 per cent., and in the last column 52·2 per cent. belongs to experiment 10.

It is generally agreed that the high quantum yield in the photo-synthesis of hydrogen chloride is due to some chain mechanism involving chloride atoms. Since the mechanism of the Budde effect is probably the primary step in this reaction (Bernard Lewis, *Trans. Far. Soc.*, **21**, 585; 1926), and if the atoms which initiate the chains are absent, then it follows that the latter cannot be initiated in the absence of water vapour. There seems to be no evidence that water vapour functions in the chain itself as was proposed by Coehn and Jung (*Ber.* **56**, 696; 1923) and Coehn and Heymer (*Die Naturwissenschaften*, **14**, 299; 1926) from the observation that the dry gases did not combine in the visible but did so in the ultra-violet. For the purpose of brief discussion these two mechanisms will be reproduced here.

A. Moist hydrogen and chlorine: in visible light.

(1) $Cl_2 + h\nu$ (small) $= Cl'_2$
(2) $Cl'_2 + Cl_2 = Cl_2 + 2\,Cl$
(3) $Cl + H_2O = HCl + OH$
(4) $OH + H_2 = H_2O + H$
(5) $H + Cl_2 = HCl + Cl$

B. Dry hydrogen and chlorine: in ultra-violet.

(1) $Cl_2 + h\nu$ (large) $= Cl''_2$
(2) $Cl''_2 + Cl_2 = Cl_2 + 2\,Cl$
(3) $Cl''_2 + H_2 = Cl_2 + 2\,H$
twice (4) $H + Cl_2 = HCl + Cl$
(5) $Cl + Cl = Cl_2$

Reaction (2) in both mechanisms is unnecessary, since we know that non-polar (Franck, *Trans. Far. Soc.*, **21**, 536; 1926) and polar (Kondratjew, *Z. f. Physik*, **39**, 191; 1926; Bernard Lewis, NATURE, **119**, 493; 1927) molecules undergo optical dissociation in a single act without collision. It has been pointed out that the time between absorption and dissociation for these simple molecules must be shorter than 10^{-10} sec. (Bernard Lewis, *Proc. Nat. Acad. Sci.*, in press). If atoms can be formed in the dry gas, then since (1) and (2) in *B* are confined to one step without collision, the dissociation of the halogen would have occurred before (3) could take place. At lower hydrogen pressures the quantum yield would be less than one. If we agree that (2) does take place in the dry gas, then in a 1 : 1 mixture of hydrogen and chlorine (2) may occur more often than (3), due to the smaller heat of dissociation, and the quantum yield would again be less than one. Altering the relative concentrations would also affect the yield. It is difficult to see why chlorine atoms resulting from (2) and (4) in *B* cannot propagate chains as in

$$Cl + H_2 = HCl + H,$$

for this reaction still remains thermodynamically possible from latest thermochemical data. In this case chains, and therefore high quantum yields, would be expected. Mechanism *B*, for the dry gases, cannot explain satisfactorily the theoretically predicted quantum yield of two which was in general realised by Coehn and Heymer.

The chain mechanism in *A* for the moist gases is extremely doubtful. Considerable doubt has been cast on (3) by Norrish (*Trans. Far. Soc.*, **21**, 575; 1926). Thon (*Fortschritt d. chem. Phys.*, **18**, 60-67; 1926), after certain considerations, concludes with Lewis and Rideal (*J. Am. Chem. Soc., loc. cit.*) that the action of water is physical and therefore does not enter into the chain mechanism.

It can be shown approximately that reaction (4) in *A* is endothermic to such an extent that the small efficiency of fruitful collisions between OH and H_2 would cut the chains very short. Thus an essential step in the chain is not always effective, if indeed it is at all, and the mechanism therefore is inadmissible.

Until evidence to the contrary is available, the mechanism of the moist reaction must be considered as a primary dissociation of the halogen under the influence of water vapour followed by an atomic chain, either that of Nernst or one suggested by Thon (*Z. phys. Chem.*, **124**, 327; 1926). The dry reaction is most simply explained by activation of a chlorine molecule and its interaction with hydrogen molecules to form two molecules of hydrogen chloride. However, Thon (*loc. cit.*, p. 69) suggests that a trace of oxygen in Coehn and Heymer's experiments would bring about the photo-synthesis of water in ultra-violet light and the main reaction could proceed. This could be tested by exposing a dry mixture to visible light after the reaction had just commenced by exposure to ultra-violet. If this reasoning is correct, the mixture should now react in the visible.

There is a possible method of testing directly whether water vapour functions in the chain mechanism. Porter, Bardwell, and Lind (*J. Am. Chem. Soc.*, **48**, 2603; 1926), in some important experiments on the synthesis of hydrogen chloride, have shown that the chains are of the same length whether the reaction is carried out photochemically or by means of alpha radiation. Since the variation of sensitivity of the mixture produces the same change in rate of both reactions, they conclude that "this must mean that the reaction chains in both cases are of equal length, and hence the mechanisms of the secondary reactions are identical whatever they may be." Ionisation by alpha radiation always takes place, and thus the initiators of the chains are present regardless of water vapour. If water plays a rôle in the chain mechanism, no chains should be propagated when a dry mixture of hydrogen and chlorine is exposed to alpha radiation. On the other hand, if chains, and therefore high quantum yields, persist in the absence of water vapour, this would indicate that the latter does not function in the reaction chains. It is intended to carry out these experiments.

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Transmutation of Elements.

SINCE the publication of my letter on the transmutation of lead in NATURE of May 1, 1926, I have continued the experiments in collaboration with Dr. A. Karssen and W. A. Frederikse. In the letter mentioned above I stated that our repeated experiments showed that the phenomena observed with the quartz-lead lamp and pointing to a transmutation of lead into mercury, were very difficult to reproduce. The lamp with which we obtained the photograms published was the tenth made after changing the construction from time to time to secure the most distinct results. In the hope of arriving at a still better method, and intending to distil off the mercury continually during the sparking process, the construction of the lamp was again changed. The result, however, was that, even without distillation, the lead spectrum now remained absolutely free from mercury lines.

After this very unexpected result, a lamp was constructed as nearly identical as possible with the lamp before the last modification was made. The behaviour of this new lamp was not quite the same as that of the old one; the discharges were different, the last contact was not made by a very thin jet of lead, and by oscillation all the gas was pumped out of the sparking space, which did not take place with the old lamp. Notwithstanding this, the appearance of mercury lines was again observed, but not so strong, and after much longer periods than before. From this we obtained the impression that the kind of discharge, being influenced by the construction of the lamp, was important here. To find another easily reproducible method, we tried now another construction which allowed sparking at high voltages, 160,000 volts and 10 milliamperes in a nitrogen atmosphere at different pressures between two solid lead electrodes, but the lead spectrum remained absolutely free from mercury lines.

Experiments of the same kind were carried out with a lamp in which the lead electrodes were heated above the melting point, but the results of all these experiments with long sparks and consequently with discharges of relatively small potential fall, gave only negative results.

In the meantime, as mentioned in another paper, we applied a different sparking method, using carbon disulphide as liquid dielectric. From the extra pure lead supplied by Kahlbaum, and treated by us in the way already described to remove every trace of mercury, two electrodes, 15 mm. thick and 2 cm. long, were made. These were mounted in two holders of steel, connected to two rods of steel, and all the steel parts were heated beforehand for twenty-four hours in an electric furnace at about 800° in an atmosphere of pure nitrogen. The steel-holders and rods treated in this way, and also the lead electrodes, were examined by the slightly altered method of Stock (*Z. f. anorg. Chem.*, **39**, 465 and 791; 1926) and appeared to be completely free from mercury.

Since it was possible that, for purification, the carbon disulphide had been shaken with mercury, sulphur was added and the solution was boiled for two hours in a flask with a reflux-condenser. The solution was then distilled, and 200 c.c. of the distillate was examined. No trace of mercury was found, whilst a quantity of 0·001 mgm. mercury would have been detected easily. Now we started our definite sparking experiments at 160,000 volts and 10-20 milliamperes. Since we wished to work at this voltage, and the dispersed lead soon diminishes, the electrical resistance of the dielectric, causing a decrease of the tension, every time, as the voltage began to decrease, the experiment was stopped until the dispersed lead had precipitated. After having sparked in this way discontinuously for one or two hours, the dispersed lead was gathered and examined. In 30 gm. of the mixture of dispersed lead and carbon, 0·1-0·2 mgm. mercury was found. The same result was obtained six separate times. Then our transformer went wrong, and it was some time before we could continue our experiments.

In the meantime I resolved to carry out an experiment, the results of which would be very convincing. It would be very important if it could be proved in repeating the experiment, after replacing only the lead electrodes by electrodes of another pure metal, of which no transmutation into mercury could be suspected, that the dispersed metal in this case is always free from mercury. I chose platinum; two platinum rods, 3 mm. thick and 4 cm. long, were mounted in the same steel-holders and the sparking experiments were repeated. The result was that the conglomerate of dispersed platinum and carbon was found to be free from mercury.

On repeating this experiment, the result was the same; and the conclusion consequently was, that the mercury found in our sparking experiment with lead electrodes must have been formed from lead. I intended to send now a preparation of our mercury to Dr. Aston, whom I had asked to examine it in his mass spectrograph, but I preferred not to do so before we had repeated the platinum experiments several times. The third sparking experiment with platinum electrodes and with a new quantity of purified carbon disulphide gave, however, not a negative but a positive result, *but not so strong as we found in our experiments with lead electrodes.*

Taking for the fourth experiment the carbon disulphide previously used in our third experiment, the result was again negative. From this it follows that the *new* quantity of carbon disulphide must have contained a trace of a mercury compound, probably a volatile organic one, which was not removed by the purification method applied, and it had escaped detection. Since the positive result, after sparking with platinum electrodes, had disappeared, it seemed that this mercury compound could be dissociated and removed by strong electrical discharges, and therefore we resolved to purify the carbon disulphide in future by the sparking method with platinum electrodes. The result of this method was excellent. After having sparked 750 c.c. of carbon disulphide for 1½ hours, the conglomerate of dispersed platinum and carbon was separated from the liquid, and the liquid was distilled. The distillate proved to be free from mercury. This was found not only by direct chemical analytical examination, but also by submitting the carbon disulphide to a repeated sparking process between platinum electrodes, and by examination of the conglomerate of platinum and carbon formed—about 7 grams. The conglomerate was now completely free from mercury. This carbon disulphide purified by electrical discharges was used in our next experiments with lead electrodes, 1 cm. thick and 3 cm. long. These experiments, repeated several times, have so far given only negative results. At the moment I am, therefore, inclined to conclude that the mercury found in our earlier sparking experiments came, certainly partly and perhaps entirely, from the carbon disulphide. This seems possible, since in these experiments a used quantity of carbon disulphide was supplemented by a new quantity of carbon disulphide purified in the ordinary way. But there is still this difficulty, that after sparking between the lead electrodes in carbon disulphide, purified in the usual way, the reaction was *stronger* positive than

after sparking in this dielectric between platinum electrodes, in the same circumstances as regards voltage, current strength, and time. Consequently, there is still an uncertainty, which probably will be solved by our continued investigations.

Though the experiments, which have been mentioned here very shortly, have taken a full year, they are only the beginning of detailed investigations in different directions. Still, I feel obliged to make this communication, since I know that other investigators are repeating our sparking experiments with carbon disulphide.

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Thyroid Gland and Plumage in Chickens.

IN a series of experiments now being carried out with Brown Leghorn chicks concerning the relation of thyroid gland to plumage characterisation, some interesting results are already apparent in the thyroidectomised females. The operation was carried out when the birds were 6 weeks old, and 3 weeks after

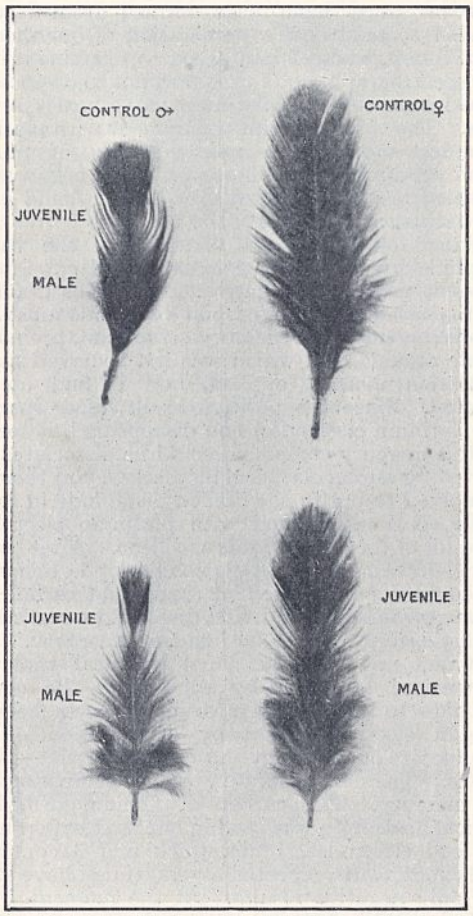

FIG. 1.—Wing contour feathers from Brown Leghorn chicks 10 weeks old. Upper figures, controls; lower figures, thyroidectomised female operated on at 6 weeks old.

the operation the effect on the plumage became visible. Changes in coloration first appear in the contour feathers of the wing, shoulder and cape, the whole forming a continuous arc of brightly coloured feathers from one wing edge to the other when the bird is examined with the wings outstretched. Examination of control male chicks at the same time showed a similar continuous band of brightly coloured feathers replacing the juvenile plumage in these areas, while no such band was present in the control females. In the region of the saddle, brightly coloured feathers were also observed in the thyroidectomised females and in control males, while being absent in control females.

When the feathers were sufficiently grown to determine their shape, it was seen that the majority of these brightly coloured feathers have the blunt tip characteristic of the juvenile feather. At a short distance from the tip, however, the shape changes abruptly, and in the proximal portion the feather is very similar to the typical male feather from the same regions, *i.e.* it is heavily fringed and tapers almost to a point at the junction with the distal juvenile portion. This condition is also found in feathers from control males of approximately the same age (Fig. 1). The coloration of the male-like feathers in the thyroidectomised females, while markedly differing from female colouring, is not quite so deep as that of the feathers from control males.

It would appear thus that the removal of the thyroid gland from Brown Leghorn female chicks leads in the first place to the assumption of plumage of a type approaching in colour and form that of the male. These results are of special interest in view of the recent work on the effect of thyroid feeding on the plumage of the fowl.

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Ultrasonic Stationary Waves.

THE observations described in the striking experiment of Hubbard and Loomis (NATURE, Aug. 6, 1927, p. 189) are another example of the important conclusions which may be derived from a study of the interesting phenomenon of ultrasonic stationary waves. Velocities of sound in various liquids were determined here by the ultrasonic stationary wave method some years ago; some of these results have already been published (*Trans. Roy. Soc. Can.*, **3**, 141; 1923; 159, 191, 197; 1925; 79; 1927); others were reported to the Canadian Research Council (Report, Boyle and Morgan, 1924). The 'detector' of the standing waves in these experiments was 'nodal dust figures,' something like the figures in a Kundt's tube, but less precision was claimed for the results than is claimed by the authors above.

Pierce also carried out very precise experiments on the velocity of sound in gases (*Proc. Amer. Acad.*, **60**, 6, 271; 1925) by the ultrasonic method, the detector of the standing waves in his experiments being a milli- or micro-ammeter in the associated grid-circuit of the electric generating tube. In fact, Hubbard and Loomis's experiment does for liquids what Pierce's did for gases, with the exception that their standing wave indicator is a neon tube instead of a milli-ammeter.

The purpose of this note is to point out that the presence of these ultrasonic stationary waves in a liquid can easily be demonstrated and visualised by making use of another phenomenon, namely, that of ultrasonic cavitation, or the production of bubbles in the liquid by the waves themselves. In our work in this laboratory nodal layers of bubbles, a half wave-length apart, have been produced in a tank of liquid between an ultrasonic generator and a reflector; and some months ago Messrs. Taylor and Sproule arranged an apparatus for ultrasonic waves in which a bell-jar

was sealed to the face of an ultrasonic generator. Liquid was poured in the bell-jar and the pressure in the air-space above it could be reduced by a connected pump. On working the generator, stationary waves were produced in the vertical column of liquid above it, the air-liquid surface serving as reflector. The pressure in the bell jar and the voltage applied to the generator could be adjusted to result in the production of either large or small bubbles in the liquid. When large bubbles were produced they rose rapidly through the liquid, but the small bubbles, especially at very high frequencies, could be made to stay suspended in the liquid in layers parallel to the reflecting surface. The layers were half a wave-length apart, and measurements of wave-lengths and velocities could readily be effected. Our purpose, however, was not to measure wave-lengths but to study cavitation, on which subject papers are in course of publication.

The experiment is a very striking one, and in our work the nodal layers of bubbles were particularly regular and distinct at frequencies around 170,000 cycles per second. In addition, and as pointed out by Hubbard and Loomis, the column of liquid can be thrown into resonance, the condition of exact resonance in our experiment being indicated by a slight humping of the liquid at the free surface. The height of the hump depends on the intensity of the radiation, and if the liquid be slowly drained from the bell-jar the humping recurs every time the free surface passes through the nodal levels. In this way incidental measurements were taken of half-wave lengths and velocities.

In all the determinations of velocity of sound by the ultrasonic method made in this laboratory in the last few years, we have found no detectable change of velocity with frequency, in solids or in liquids, within a range of frequency extending from 30,000 to 600,000 cycles per second.

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Aug. 23.

The Intrinsic Field of a Magnet.

REASONS have been given recently by J. Dorfman (NATURE, Mar. 5, 1927, p. 353) and by W. Peddie (NATURE, July 16, 1927, p. 80) against the view that there is in a magnet an intrinsic magnetic field of immense magnitude. It is true that an enormous intrinsic magnetic field explains simply, by analogy with the behaviour of fluids, how ferro-magnetic properties come into existence when a ferro-magnetic substance passes through the critical point from a high to a low temperature. By equating magnetic and thermal energies a formula can be obtained for the magnitude of this intrinsic field which at its maximum is, according to Weiss, $3R\theta/\sigma_o$, σ_o being the maximum specific magnetisation, θ the critical temperature and R the gas constant referred to two degrees of freedom of kinetic energy.

The calculation is made on the supposition that it is allowable to treat magnetic energy as the simple equivalent of the thermal energy and this leads to a value for the intrinsic field at its maximum of the order of 10^7 gausses, a magnitude so large that serious difficulties arise both in accounting for its origin and also in dealing with some of the facts of induced magnetism where, indeed, a small intrinsic magnetic field would be more appropriate. Undoubtedly forces of great magnitude exist within a magnet, but there are experimental grounds for concluding they are not such as give rise directly to ferro-magnetism. It seems necessary then to suppose that there are two fields within a magnet of different origin and magnitude, one arising from magnetic forces—a true intrinsic magnetic field—and the other, and much the larger one, arising from forces which may provisionally be classed as molecular, and that there is some mechanism whereby one field can act upon the other. It is conceivable that this action is due to the magnetic ties existing between the magnetic molecules of a ferro-magnetic substance, the effect of which is that translational movements of the molecules, controlled by the molecular forces and set up by the thermal agencies, give rise to rotational motion of the molecules, such motion being controlled only by magnetic forces. In this connexion Ewing's latest model of the ferro-magnetic atom is helpful in showing that there may be a fixed and a movable part in the atom.

At a high temperature, when translational and consequently rotational movements are violent, orientation by an external magnetic field is so vigorously opposed that only paramagnetic qualities are in evidence. When, however, the metal cools, and elastic properties appear, the molecular forces which come into action restrict translatory motion, and consequently rotational motion subsides; as there is nothing to oppose orientation of the molecules except a small intrinsic magnetic field, ferro-magnetic properties come into existence. Thus it may be the molecular field of force and not an immense magnetic intrinsic field which brings into evidence ferro-magnetism.

This view explains how any rotational movement of the molecules, if set up by thermal agencies, must involve the energy of agitation of the whole mass, which will be very large, but if set up by magnetic agencies the expenditure of energy will be very small, which is what is observed experimentally. It is also consistent with the facts of the discontinuity of the specific heat at the critical temperature and of recalescence.

Thus it is possible to reconcile the hypothesis of a very large intrinsic field which may have magnetic effects with the hypothesis that the field itself is not a magnetic field immediately controlling ferro-magnetism.

J. R. ASHWORTH.
Rochdale, Aug. 30.

Photoelectric Emissivity and Sparking Potentials.

IN a recent paper in the *Proc. Roy. Soc.* (A, **144**, 73; 1927) I have described a photoelectric theory of the sparking potentials of discharge tubes. According to this theory the sparking potential v_c is a function of the photoelectric emissivity γ, of the cathode, for the radiation accompanying the neutralisation of the positive ions at the cathodic surface.

It has been found possible to complete experiments upon the concomitant measurement of v_c and γ, for the case of a parallel disc electrode tube, with helium as the filling gas.

A measure of proportionality of γ, P, was obtained by radiating the cathode with radiation proceeding from a hot wire discharge box of special form, and measuring the photoelectric effect; v_c was measured in the usual way.

The variation of v_c with progressive purification of the helium by charcoal cooled in liquid air, was unexpected and remarkable. There occurred initially the well-known rapid decrease of the values of the sparking potential until a minimum value was attained. After this, a slow rise in sparking potential took place, until a value of anything from about 10 volts to 600 volts (according to gas pressure, etc.) higher than the minimum was attained.

Introduction of additional helium showed that the effects did not proceed from pressure changes.

Concomitant measurements of P showed a fall

from a maximum at the minimum sparking potential to a minimum at the final sparking potential.

After considering a number of explanations of the phenomena, the following was adopted :

(1) The helium rapidly becomes pure, so that only slight traces of foreign gases remain, a fall of v_e occurs to a minimum, and the properties of the gas then remain almost constant.

(2) The gas layer on the surface of the cathode undergoes slow change, probably by evaporation of the surface gas molecules into the helium and final disappearance in the charcoal. This slow change of the cathode surface diminishes progressively its photo-electric emissivity, and increase of v_e occurs until the modification of the cathode has attained equilibrium under the existing conditions.

It was determined, for various pressures, that throughout this region the graphs showing the relation between the corresponding values of v_e and P were smooth curves, and the relation between $\log 1/P$ and v_e was either linear or of slightly curved form. The quantitative agreement with the equations given in the above mentioned paper was good. We may conclude, therefore, that the results give strong evidence in favour of the photoelectric theory of sparking potentials.

JAMES TAYLOR.

Physical Institute of the
University of Utrecht,
Sept. 14.

Sub-Grain Boundaries in Nickel.

REFERRING to the communication of Messrs. C. J. Smithells and H. P. Rooksby in NATURE of Aug. 13, p. 226, concerning their own and Mr. F. S. Tritton's observations on sub-grain boundaries in tungsten and iron, it may be of interest to record that we have observed a similar structure in nickel, as illustrated in the accompanying photomicrograph (Fig. 1). This particular specimen was melted in an atmosphere of hydrogen, cooled rather slowly until below the solidification point and then somewhat more rapidly to room temperature.

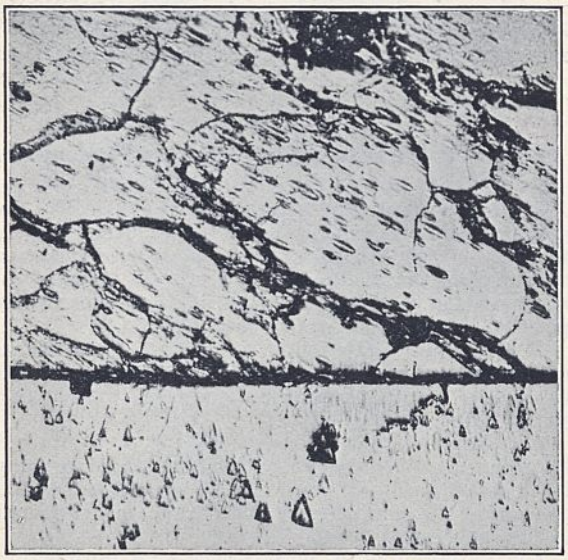

FIG. 1.—Photomicrograph of nickel, deeply etched in concentrated nitric acid. ×200.

The micrograph shows portions of two large grains, with a main grain boundary running parallel to one edge of the photograph. Sub-boundaries may be seen in the upper grain. Deep etching has resulted in a number of etching pits which are seen to be uniformly oriented within the main grains, thus confirming the observations mentioned above. It will also be noted that the sub-grains have a slight elongation (suggestive of cold-working) parallel to the direction of the etching pits.

E. S. DAVENPORT.

Westinghouse Lamp Co.,
Bloomfield, N.J.,
Aug. 25.

Poor Common Salt!

"SOME books are lies frae end to end," says Burns. Scientific (save the mark) speculation would seem to be on the way to this state! Thus on p. 405 of NATURE, of Sept. 17, in a letter on Prof. Lewis's light corpuscles, the statement is made by the writer, that a 'speculation,' by Prof. Lewis, about the quantum, "is repugnant to common sense." Again, on p. 414, Prof. W. L. Bragg asserts that "In sodium chloride there appear to be no molecules represented by NaCl. The equality in number of sodium and chlorine atoms is arrived at by a chess-board pattern of these atoms; it is a result of geometry and not of a pairing-off of the atoms."

This statement is more than "repugnant to common sense." It is absurd to the n . . .th degree, not chemical cricket. Chemistry is neither chess nor geometry, whatever X-ray physics may be. Such unjustified aspersion of the molecular character of our most necessary condiment must not be allowed any longer to pass unchallenged. A little study of the Apostle Paul may be recommended to Prof. Bragg, as a necessary preliminary even to X-ray work, especially as the doctrine has been insistently advocated at the recent Flat Races at Leeds, that science is the pursuit of truth. It were time that chemists took charge of chemistry once more and protected neophytes against the worship of false gods: at least taught them to ask for something more than chess-board evidence.

HENRY E. ARMSTRONG.

Solution of the Equation $\sin\theta/\theta = c$.

AN approximate solution of the equation $\frac{\sin\theta}{\theta} = c$, where $c \longrightarrow 1$, may be got in the following manner. By putting $\sin\theta = y$, transform the equation to $\frac{\sin^{-1}y}{y} = \frac{1}{c} = K$ say. The approximate solution of this equation is given by $y_a = 8\frac{\sqrt{(3K-3)(3K+5)}}{(3K+1)^2}$ which can be evaluated by logarithms. Using $\sin\theta_a = y_a$, we can find θ_a, an approximate solution of $\frac{\sin\theta}{\theta} = c$. If θ_a be in the neighbourhood of 5° we subtract 1″ to get the answer to the nearest second. If θ_a be less than about 3°, the value of θ_a will give us the answer to the nearest second.

In any case, the significant figure of the error (E) may be got by using $E \doteqdot \frac{3\epsilon}{A}\left(-\frac{1}{2} + \frac{1}{Ay_a^2}\right)$ where

$$\epsilon = \frac{(\sin^{-1}y_a)^5}{4\,|\,5}, \quad A = \frac{3K+1}{4}.$$

The true value (y) can then be got by using $y_a - y = E$.

V. NAYLOR.

H.M. Dockyard School,
Devonport.

The Safety in Mines Research Station near Buxton.

By Prof. H. B. DIXON, F.R.S.

IN moving the Mines Experimental Station from Eskmeals, on the Cumberland coast, to Harpur Hill, near Buxton, the Safety in Mines Research Board has sought and has found an equally secluded site in a more accessible district. The choice of such a site in the England of to-day is no easy problem. It must be near a railway so that a siding can be run into it; it must be near a water supply; it must not be near houses or a main road, or indeed near any public path; and, if possible, it must not interfere with the amenities of the neighbourhood. Among the sandhills of Eskmeals there was seclusion enough, and the gun-range of Messrs. Vickers on the adjoining site afforded both access by rail and immunity from complaint of 'explosion-shock.' But Eskmeals had two drawbacks; it suffered from sandstorms often, and from inaccessibility at all times.

Though hidden by the folding hills, the station at Harpur Hill can be reached in about ten minutes from Buxton, whence lighting-gas and water are obtained. The site comprises more than 400 acres and gives a wide 'danger area' on either side of the steel explosion galleries. Indeed, the site of the galleries was used for testing guns and various bombs during the War; the nearest works, adjoining the site, are limestone quarries where blasting is constantly in operation.

While the scientific instruments at Eskmeals on the seashore suffered from sand and salt-spray, the high level of Harpur Hill (1200 feet above the sea) may expose the workers to greater extremes of weather. Great care, however, has been taken to afford protection to the instruments installed, and the observation-huts and experimental chambers are substantially built in concrete.

The two largest buildings on the site may be described as the Administrative Block and the Machinery or Works Block. The first contains a row of offices for the staff, flanked at one end by a conference and lecture hall, and at the opposite end by a large laboratory and dark rooms for research work.

Facing these offices the large works building is erected. It is rectangular in form with a central corridor—through which the light railway runs. On one side are the store-rooms, the machine shop, and the blacksmith's shop; on the other side are the battery-house, the power-house, the joiner's and the electrician's shop. There is also a canteen and a cook-house, and ample lavatory and bath-room accommodation for the workmen, as well as arrangements for drying clothes. From the power-house electric current is supplied to the various centres by two circuits—at 110 volts and 220 volts.

For the transport of heavy material a siding has been run from the High Peak line (L. M. & S. railway), and material can be unloaded here on to a concrete platform or into the waggons of a 3-feet-gauge railway by a cross-travelling gantry crane spanning the siding and the unloading platform. The 3-feet railway runs to the works block and to the various research buildings on the site; it also runs along the full length of the steel explosion galleries.

THE EXPLOSION GALLERIES.

The longer gallery, 1008 feet in length, is made up of 40 sections of mild steel tubing 4 feet in diameter and $\frac{5}{8}$-inch thick. These sections are bolted together gas-tight by means of broad flanges compressing asbestos and wire-rope packing.

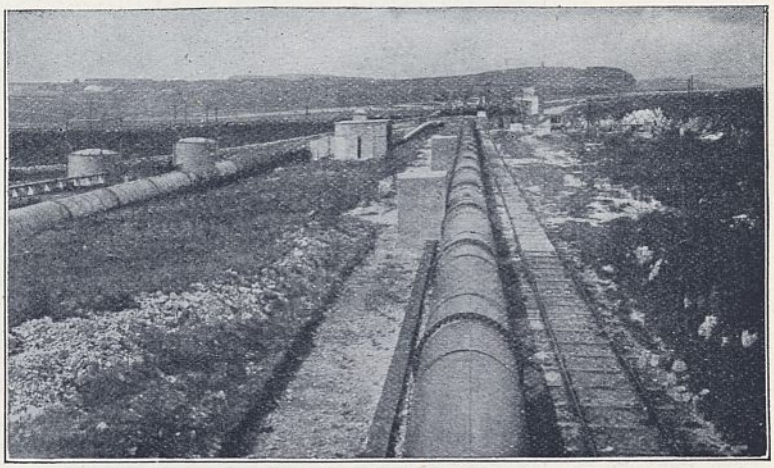

FIG. 1.—View from a bridge across the middle of the 4-ft. gallery.
Reproduced from Paper No. 34 of the Safety in Mines Research Board by permission of the Controller of H.M. Stationery Office.

These packing rings simplify the removal of any section, and permit the insertion of a restriction plate at any of the junctions. To prevent distortion of the tube by jumping or 'whipping' during an explosion, each section is bound down on to its concrete cradle by two steel bands anchored into the solid rock below. While the southern end of the gallery is open the northern end is closed, but connects at right angles through a moveable valve to the drift leading to the fan-house. The ventilating fan can create an air current in either direction through the gallery of 1200 feet per minute. A view of the 4-foot gallery is shown in Fig. 1, with the fan-house in the distance and the larger $7\frac{1}{2}$-foot gallery on the left.

The object of the long gallery being the study of the nature of a coal-dust explosion as it is developed and progresses through its various phases, much care has been expended on obtaining exact records of the passage of the flame and the degree of pressure exerted at fixed points along the gallery. To secure these records instrument-cabins have been erected every 100 feet. They are built of steel plates on concrete foundations; they are close to, but are not fastened to the gallery.

In each cabin a horizontal strip one foot wide has been removed, so that the instruments may be placed on shelves directly attached to the gallery; therefore as the gallery moves longitudinally with changes of temperature the shelves and their instruments travel with it without any strain. To read the pressures developed in the gallery the U.S. Bureau of Mines manometer has been adopted. In this instrument (shown on its shelf in Fig. 2) the pressure acts through a short tube on a cast-steel diaphragm, the movement of which is communicated to a small concave mirror of stainless steel focussing a point of light on to a rotating drum carrying sensitised paper. The arrangement is such that the movement of the diaphragm is magnified 150 times in the displacement of the light image on the drum, the speed of which is registered electrically on a chronograph at the firing-station. In addition to acting as a manometer, the instrument also serves to register the passage of flame past a small thick glass window fixed in the side of the gallery. The light, when the flame illuminates the window, is focussed on one side of the sensitised paper, which shows the duration and intensity of the flame, and also indicates if periodic vibrations of flame have been set up. Each manometer is separately calibrated by subjecting it to known pressures after each series of tests. The manometer records are finally read on a special drum through a low-power microscope fitted with cross-wires.

For measuring the speed of flame along the gallery, bronze plugs are arranged to screw into the roof at intervals of 100 feet. They carry insulated steel rods 3 inches long, between which are stretched fine-gauge tin wire—to be fused by the flame, but not broken by a pressure wave. In each cabin are arranged the electrical switches to connect the flame circuit-breaker to the chronograph in the firing-station (Fig. 2).

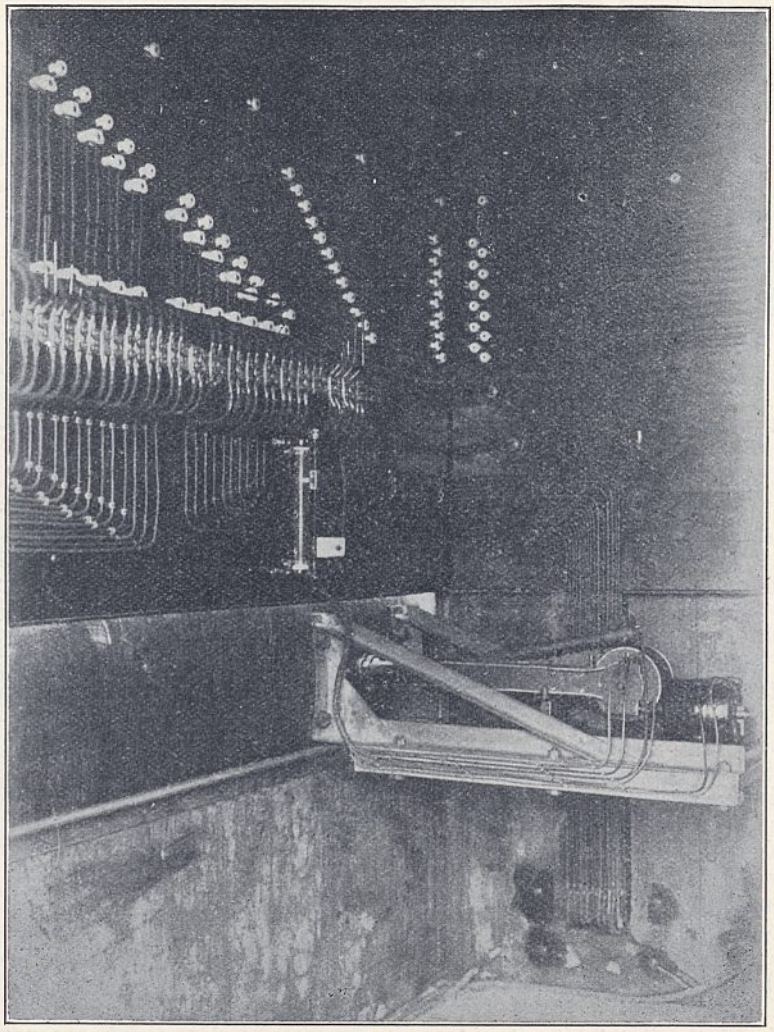

FIG. 2.—4-ft. explosion gallery. Interior of No. 5 instrument cabin, showing distribution of electric circuits and method of mounting manometer.
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THE LARGE AND SMALL GALLERIES.

The 7½-feet gallery, a portion of that used at Eskmeals, has been erected for a length of 400 feet, and will be employed for demonstrations of the explodibility of pure coal-dust when it is raised

in a cloud in air and ignited. This gallery will also be used for other large-scale experiments—for example, to determine the distance to which the flame of an explosion of fire-damp is projected along a gallery. For this latter investigation 50 feet of the gallery is separated from the rest by a sliding shutter, which can be opened when the methane and air in the 50-feet chamber are thoroughly mixed. The distance travelled by the projected flame is measured by the burning of thin sticks of cordite attached to the roof every 10 feet in the open gallery beyond.

Parallel with the large gallery the 1-foot tube, 300 feet long, is formed of sections bolted together by means of flanges—the joints being made air-tight by asbestos rings. Between any two sections a steel 'restriction-ring' can be inserted in order to diminish the diameter of the tube and produce reflexions and turbulence.

The gas and air can be circulated and thoroughly mixed by means of a fan and a by-pass tube running the whole length of the gallery. This tube will be used to study the development of fire-damp explosions as the flame travels forward, both when the bore is smooth and uniform and also when the flame meets with surfaces which reflect pressure waves or cause turbulence by forcing the flame-front through smaller openings. Such restrictions, when tried on a small scale, have been shown to have remarkable effects on the travel of an explosion flame; the 1-foot tube will give the means of studying gas explosions with a larger volume of gas and a greater 'run' of flame than is possible in a laboratory experiment.

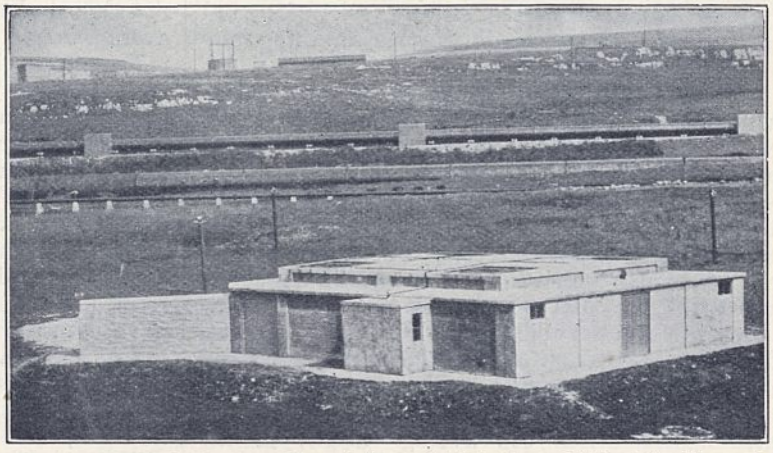

FIG. 3.—The chamber for research on gob-fires. In the background is the 1-ft. gallery and beyond is a portion of the long 4-ft. gallery.
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HIGH-EXPLOSIVES RESEARCH.

One of the most interesting of the new buildings is that devoted to research on the nature of the shock and flame produced by high explosives.

Plant has been installed to photograph by the *Schlieren* method the progress of the shock-wave through air, and also to record the movement of the flame and of the products of combustion when a high explosive is detonated in a cannon. A large concave mirror of stainless steel focusses the light from an arc lamp on to a moving film across the path of the shock-wave which refracts the beam. The movement of the pressure-wave is thus recorded in the wave-speed camera, which also serves to photograph the motion of the flame itself and of the products of combustion. The speed of the shock-wave in front of the flame, and its gradual dying down as it spreads in free air, are recorded and timed. The conditions for blanketing the flame by the burnt gases of the explosion—a sure protection against fire-damp ignition—can thus be investigated.

For the testing of explosives to be used in coal-mining a steel gallery 60 feet long and 6 feet in diameter has been erected. One half of this is the gas chamber, separated from the other half by an oiled-paper diaphragm, and with a central opening at the other end 12 inches in diameter. When the gun is charged it is run up on rails so as to cover this opening—making a tight joint by means of a rubber-washer fixed round the rim of the opening. The methane (or other gas) is filled into the chamber through a meter, and the gas and air are thoroughly mixed by a circulating fan and a by-pass tube. The flame can be watched through two thick glass windows in the side of the gas-chamber from an observing station 60 feet away.

GOB-FIRE RESEARCH CHAMBER.

Another novelty is the structure (of reinforced concrete) to be devoted to the study of gob-fires. The building consists of a central chamber 30 feet square and 8 feet high, simulating a mine goaf, with a passage 6 feet wide running round it. Between the central chamber and the passage are three openings with steel sliding doors operated from outside the building. A fan is arranged to deliver a current of air into the passage, and this can be distributed as desired through the goaf-chamber, into which fire-damp can also be introduced by pipes in the floor leading from a gas-holder. Two control cabins are built against the outer wall, and in these the temperature of any part of the inner chamber can be read off from thermo-couples fixed in metal sheaths, and samples of air and gas can be collected from positions either in the coal heap or outside it by means of $\frac{1}{4}$-inch metal pipes protected from fouling by filter-caps fitted to the inner ends. The design of the building (which is illustrated in Fig. 3) is to determine the limiting conditions necessary for the production and ignition of an explosive gas mixture behind a stopping, and to study the methods of sealing off a fire so as to avoid the danger of such conditions arising.

The slow-smouldering of coal-refuse in the goaf has often led to fires, difficult to extinguish, and dangerous because of the inflammable gas distilled from the heated coal. But the conditions under which such gas becomes dangerous are at present little known, and they demand skilled investigation.

The Englishman of the Future.[1]

By Prof. F. G. PARSONS.

IT has been borne in upon me, little by little, that some of the characteristics of the Englishman of to-day do not seem to be hereditary at all, and that in some things we, in our development, are not following any Mendelian laws; nor are we harking back to Long Barrow, Bronze Age, Celtic, or Saxon types, but that gradually we are building up a new kind of man, differing in certain ways from all of these.

Feeling sure that a change is coming over our younger generation, let us try to see where it is leading, and whether heredity or environment is taking the greater share in guiding it; though we shall surely be wrong if we allow either of these great influences to leave our minds for a moment. I must be careful not to undertake more than I can carry through in my time; and therefore I will only ask you to let me say a little about the three physical characteristics of stature, coloration, and head shape, in order to see whether anything may be learnt from these.

I suppose that no one would dare to say what the average height of the modern Englishman is, because we have no State-controlled and State-aided means of sampling the physical conditions of our population in any way. I can state at first hand that the men of our labouring and agricultural classes in the Chilterns average 5 ft. 6 in., and that the mixed classes in a North Kent doctor's practice are 5 ft. 7 in.; but what we do not know is how much the stunted millions in the Midland manufacturing towns, and the mass of unemployed and unemployable humanity in the east of London, will pull this down. I suppose that, taking these into consideration, the average height of the Englishman to-day is not more than 5 ft. 5 in.; though when we speak of the well-nourished classes there is a different tale to tell. I know, for example, that for the last twenty years my students at St. Thomas's Hospital have averaged 5 ft. 9 in. and in no single year have they ever risen so high as 5 ft. 10 in. or dropped below 5 ft. 9 in.; but, steady though their average at this height has been for twenty years, I am quite sure that they are taller than were my own contemporaries forty years ago, just as those contemporaries, in their turn, were probably taller than the originals of Bob Sawyer's and Ben Allen's fellow-students, who walked the Borough hospitals nearly a century ago.

I think, therefore, that hygiene and better nutrition have done their work so far as stature is concerned. It may be that the more intensive health crusade of the last two or three years may cause a new rise in stature which has not yet had time to show itself, but I can see no signs of it as yet. It may be, too, that, though environment may have played its last card, heredity may not have done so, and that if for any reason the individuals with a higher percentage of Nordic traits in their patchwork composition are put in a more favourable position to marry and beget offspring than those with a large number of Alpine and Mediterranean traits, the stature may rise still further.

I feel sure, however, that there is a certain average height beyond which the purest Nordic stock will not rise, and my belief is that this has been reached, or nearly reached, already—so far as the higher classes are concerned.

We have learnt how to raise our male stature to a point beyond which it will not go, and beyond which it is not well that it should go. But what of the woman? About twenty years ago I measured the height of some 150 students of the School of Medicine for Women, and found their average to be 5 ft. 3 in., but after ten years their successors had added a fraction over an inch to their stature; while this year I have measured 150 nurses and massage students at St. Thomas's Hospital, whose average height was 5 ft. 4·9 in.

Now these girls belong to the very same class of the community as the male medical students; indeed there are brothers and sisters in the two groups, and the difference with which they have reacted to altered conditions is interesting; for, whereas the boys had reached their full average of 5 ft. 9 in. when first I measured them twenty years ago—and their successors, year by year, have never added anything to, or lost anything from, their height, up to the present—their sisters have gained very nearly 2 inches in the twenty years, and practically have reached the height of the average Englishman, whom we dare not estimate as measuring more than 5 ft. 5 in. There are no signs, moreover, that these healthily nourished girls have reached their maximum, as have the boys.

One often hears that the English people are becoming darker. To me the simplest index seems to be gained by adding half the number of the intermediate eyes to the light and half to the dark, and by then taking the new percentage of dark eyes as the index of eye coloration. In most cases it is unwise to use the hair or eyes alone, but to combine the two into a general index of nigrescence by adding the indices of the hair and eyes together and then dividing the sum by two.

I must be content, at this stage, simply to give some massed results in trying to solve the question whether Londoners, who practically are southern English people, have grown darker or fairer during the last sixty years.

The following table gives the material which I have:

	Hair Index.	Eye Index.	Nigrescence Index.
Adult Males.			
1860	39·7 (2400)	35·7 (2400)	37·7 (2400)
1927	27·4 (1485)	33·2 (1485)	30·3 (1485)
Adult Females.			
1860	42·7 (2813)	40·7 (2813)	41·7 (2813)
1927	23·9 (1487)	35·3 (411)	29·6 (949)

[1] From the presidential address to Section H (Anthropology) of the British Association, delivered at Leeds on Sept. 2.

	BOYS (8 TO 16 YEARS OLD).		
1927	8·7 (2565)	33·1 (2565)	20·9 (2565)
	GIRLS (8 TO 16 YEARS OLD).		
1927	11·0 (1922)	34·3 (1922)	22·6 (1922)

On looking at this table one cannot fail to be struck by the increase in fairness, particularly in the hair; but I do not wish to press it too far, because there are so many possible sources of error. Not only is there the possibility that Beddoe and I had a different border-line between brown and dark brown hair, but other things, such as the modern habit of wearing the hair short, the habit of more frequently washing the head, and the disuse to a considerable extent of pomatum and grease, all give an appearance of fairness which was wanting sixty years ago. In the eye records I place more faith, for both Beddoe and I used an intermediate group between the light and dark eyes, a group which I have divided in both sets of records equally between the light and the dark. The drop in the darkness here is not serious, but I think that it is large enough to be significant.

The children's records at first seem irrelevant, since I have nothing of sixty years ago with which to compare them. Their use is to supplement the present-day eye colours of the adults, especially those of the women, which are very scanty. It will be noticed that in children of eight to sixteen the eye colours have become permanent, though the hair has not, and thus their evidence is valuable.

These records, which run into several thousands, do not give us any reason to think that the Londoner is becoming darker, but do give us reason, though it may need discounting, to believe that he is growing fairer under changing conditions.

The last point to which I wish to direct attention is head shape. The anthropologist usually thinks of skulls in terms of their length and breadth, and certainly he has gained a great deal of useful information in the past from this cranial index; lately, however, he has felt that something more is needed, and specialists in craniology have piled up a mass of arcs, indices, coefficients, and angles. The reason why the cranial or the cephalic index is not enough is that it treats the head as if it were a structure of two, instead of three, dimensions. To use a homely simile, it is like giving the length and breadth of a box and then expecting the hearer to grasp what that box is like. We have hundreds of thousands of records of the length and breadth of heads, but very few of their height. I submit that, if we use all three dimensions—length, breadth, and height—together, a standard will be gained which roughly will represent the size of the skull, and with this each dimension may be compared, and a proportional index for each established. The most accurate method, no doubt, is to take the product of the three dimensions and then to extract the cube root and multiply it by three. The result of this is a standard by which the length, breadth, and height of the skull may be divided, and in this way proportional indices obtained which will bear a definite relation to the size of the skull. Unfortunately the process, though soon learned, is tiresome and needs a logarithm table, which is not always to hand.

A much simpler, and for all practical purposes an equally valuable method of gaining proportional indices, is to add together the length, breadth, and height of the skull, and then to divide each dimension by the sum thus obtained. This gives a series of indices which are, on an average, 0·006 lower than those which the cube-root system supplies; but in no case does this alter the relative position of any of my series of British skulls.

We are fortunate enough to have two independent sets of measurements of the three main stocks which went to the making of the Englishman—the Mediterranean, represented by the Long Barrow or Neolithic Race; the Alpine, represented by the Beaker Folk; and the Nordic, represented by the Anglo-Saxons. One of each of these three sets has been measured by myself, and the other has been measured or collected by Mr. Morant, who published them in *Biometrika*. If we add the proportional indices of the three stocks together and divide them by three, the result is as follows:

	Length.	Breadth.	Height.	
Morant . .	0·4185	0·3200	0·2615	= 1·0000
Parsons . .	0·4205	0·3210	0·2585	= 1·0000
Mean . .	0·4195	0·3205	0·2600	= 1·0000

This result, surely, is as close as two people working upon different samples and different numbers of skulls of the same races could be expected to reach; and there is every reason to believe that the mean between the two sets of results is more likely to be nearer the truth than either of them taken separately, and ought roughly to represent what we should be likely to find, in the descendants, if equal numbers of Long Barrow folk, Beaker folk, and Anglo-Saxons were mixed and allowed to interbreed.

Let us compare this with the records of the Northamptonshire people who lived at Rothwell in the fourteenth and fifteenth centuries:

	Length.	Breadth.	Height.	
Mean of Long Barrow, Beaker, and Saxons .	0·4195	0·3205	0·2600	= 1·0000
Rothwell . .	0·4180	0·3230	0·2590	= 1·0000
Hythe . .	0·4090	0·3300	0·2610	= 1·0000

This shows that if we evolve the kind of skull which a mixture of the three main stocks which we know went to the making of the medieval Englishman would produce, we get a form which, in its proportional length, breadth, and height is almost identical with that found in the Midlander of the Middle Ages

When, however, the Hythe crania are compared with these, we see at once that they must have had a different parentage; and what that parentage

is becomes plain when they are placed in company with the Beaker folk.

	Length.	Breadth.	Height.	
Hythe . .	0·4090	0·3300	0·2610	= 1·0000
Mean of Morant and Parsons' Beaker Folk .	0·4035	0·3325	0·2640	= 1·0000

It seems to me clear that these Hythe people, in the fourteenth and fifteenth centuries, were the result of an incursion and settlement of people from the Continent, of the Alpine Race, who had been slightly, but only slightly, modified by mixture with the Kentish folk.

In the eighteenth century the Londoners who lived in the neighbourhood of Clare Market had skulls the proportional dimensions of which differed very little from those at Rothwell :

	Length.	Breadth.	Height.	
Rothwell . .	0·418	0·323	0·259	= 1·000
Clare Market .	0·421	0·322	0·257	= 1·000

Apparently, however, there was a little more of the Nordic and a little less of the Alpine element about them.

In the seventeenth century three series of plague skulls are available and were described by Macdonell and Hooke. They are remarkable for their low vaults and receding foreheads, and it has been suggested that they show that the modern Londoner has reverted to the Early Iron Age type, though formerly Pearson regarded them as Long Barrow in their characteristics. Unfortunately we know very little of the craniology of the Early Iron Age. We must therefore let this suggestion stand over until more work has been done upon the head shape of the Iron Age. There is one point, however, which I think should be borne in mind, especially since the Londoners seem to have gone back to a more normal head height in the eighteenth century ; it is that during the plague the better class of citizens fled from the city, leaving the dregs of the population behind, and it is in these dregs that receding foreheads and low cranial vaults are most likely to be found. I cannot think that it is wise to use plague skulls as types of seventeenth-century Londoners as a whole.

Now we come to a new and striking development. Until the eighteenth century, the only skulls which show a proportional auricular height of more than 0·260 are those belonging to the Alpine Race, that is to say the Beaker Folk and the Hythe people. Bearing this in mind, it is interesting to notice that in the early nineteenth century the proportion of the head height of English soldiers was 0·262, while in the men of the Royal Engineers, measured by Benington in the early part of the twentieth century, it had risen to 0·267, and in the patients at St. Thomas's Hospital in the present day it is 0·271.

These last three examples are of the less well-educated classes, and even in these it is remarkable how the proportional height of the head has risen well above anything which any of our ancestors can show, even were we to claim the Beaker Folk as our main ancestors, which all the evidence tells us would be unjustifiable.

When we come to measure the educated classes of the community, which have enjoyed a greater share of the modern, improved conditions of environment, the result is still more striking, for we see the members of the British Association with a proportional head height of 0·271, the St. Thomas's Hospital students with 0·272, the Oxford undergraduates with 0·272, a number of British anatomists who met in Dublin in 1898 with 0·275, and the University College staff with 0·278.

I can see no signs of heredity or harking back to any known ancestry in the change which is coming over the English head, but only signs of reaction to environment. Is it not reasonable to think that, as the improved conditions of life are gradually shared by all classes, this change in the head shape will gradually become more general until the Englishman of the future is a man with a very differently proportioned head from that of any of his ancestors ? I do not wish to decry the old cranial index ; it has helped us much in the past, it will help us much in the future. All that I would say is that unless we take the proportional height into account we shall miss a great deal that we ought to know.

To sum up, I am left with the belief that the Englishman of the future is, if present conditions persist, making for an average height of 5 ft. 9 in., and the women for one of 5 ft. 6 in. or 5 ft. 7 in. That our people have reached, and are stationary at, a stage in which some 66 per cent. have light eyes and some 34 per cent. dark. That there are no signs whatever that the hair colour has darkened during the last sixty years, though there are signs, which perhaps need discounting, that the hair is lighter than it was sixty years ago. That the head shape is showing unmistakable signs of an increase of its proportional height, with a decrease of its proportional length, and that this increase of proportional height is greater than has been found in any of the stocks from which the modern Englishman is derived. It therefore cannot be looked upon as a harking back to any ancestral form, but must be regarded as an evolutionary process, in harmony with the greatly changed conditions of life which have come about during the last century.

After all this suggestion, which a study of the head height presses upon us, is one which many have held for a long time. If we accept it I fear that many of the sentimental attractions of British anthropology will be lessened, since there will be greater difficulty in determining whether the modern Englishman has more Saxon, Neolithic, Alpine, or Iron Age blood in his veins ; and we must realise that he is becoming an individual who could not be formed by any possible combination of these stocks without the aid of external influences. Heredity alone, therefore, will not account for the Englishman of the future.

Cave Painting from Griqualand East.[1]

By Dr. SIDNEY H. HAUGHTON.

THE large slab covered with paintings, a portion of which is reproduced herewith (Fig. 1), has a height of 3 feet and a length of 7 feet 10 inches. It is obviously incomplete, and forms but part of what must have been a larger mural painting.

The slab, which is in the collection of the South African Museum, was obtained for the Museum in the year 1912 by Mr. G. S. T. Mandy. He discovered it in a cave on the farm Zaamenkomst, which lies about 12 miles from the town of Maclear in Griqualand East. The slab was lying, in two parts, face downwards, in ash which covered the floor of the cave, and must have fallen either forwards from the wall of the cave or downwards from the roof. There is no evidence available to settle this point. From the ash and debris on the floor of the cave no artefacts or other evidence of occupation have been recovered. No traces of paintings were found on other large slabs which lay in the ash; but on the walls were remains of other scenes showing an entirely different technique.

The painting is probably one of the finest of its kind hitherto found in the Cape Province, and is remarkable not only for the coloration but also for the attention paid to details. The nature of the polychrome colouring can be compared with that of the wall-paintings of Altamira.

The scene depicted is that of a herd of elands surrounded by hunters armed with bows and arrows and also with battle-axes. The hunters are running rapidly, this impression being conveyed by a conventional drawing of the outstretched legs. The animals are depicted as foaming at the mouth, and, in one instance, approaching death is indicated by the presence of bloody foam. The details of the animal figures are far more realistic than those of the men; but the presence of head-plumes and battle-axes as part of the equipment of the hunters lends peculiar interest to the scene, for these would seem to indicate that the men were not Bushmen but Bantu. The late Dr. Péringuey considered that the bows and arrows depicted are of the type used by the Barotse and other Zambezi tribes.

FIG. 1.—Part of polychrome painting on the Zaamenkomst slab. Scale about one-sixth natural size.

[1] Reprinted from a paper entitled "Note on the Zaamenkomst Slab" in *Trans. Roy. Soc. South Africa*, vol. 14, part 3, 1927.

Obituary.

SIR ARTHUR EVERETT SHIPLEY, G.B.E., F.R.S.

IT is impossible for me to write without a profound sense of personal loss on the death of the first of the new scientific friends whose acquaintance I made as a freshman at Cambridge in the Michaelmas term of 1880, and with whom I was closely associated during the next twenty-eight years. Shipley obtained a first class in the Natural Sciences Tripos of 1882 (Part 1) and 1884 (Part 2), and his scientific contemporaries included Adami, Bateson, Chree, Fitzpatrick, J. R. Green, Harker, Head, Sherrington, Threlfall, and D'Arcy Thompson. In the interval between the two parts of his Tripos he had spent several months at the Zoological Station at Naples, the results of his studies being contained in his first scientific paper, on Brachiopoda (Argiope). He did not specially follow up this line of investigation in later years, but his continued interest in the subject is shown by the fact that he wrote articles on Brachiopoda for "The Cambridge Natural History" (1895) and the "Encyclopædia Britannica" (1902).

The atmosphere of Cambridge in Shipley's undergraduate days was eminently calculated to encourage and stimulate the imagination of pupils who were ready to take an interest in science. Liveing, Humphry, and Michael Foster had been mainly instrumental in establishing the claims of natural science to an honoured place in the University. Lord Rayleigh was Cavendish professor, and zoology was represented by Alfred Newton as professor, supported by J. W. Clark in charge of the Museum, and by F. M. Balfour and Sedgwick at the laboratory. Vines, a member of Shipley's college, was engaged in teaching botany on modern lines. Balfour had given a great impetus to the study of embryology; and his personal qualities, no less than the scientific eminence he had achieved, endeared him to his pupils in a way few teachers are beloved. The news of the Alpine accident in 1882, which cut short his brilliant career in early life, was, I think, first broken to me by Shipley, and it produced on us a supreme consciousness of personal grief. Balfour's example had had its influence, and Shipley took up the study of vertebrate embryology, producing, in 1887, a memoir on the development of the lamprey. Soon afterwards he turned his attention to the Gephyrean worms, an interest which he maintained for many years, his first substantial paper on this subject having appeared in the *Quarterly Journal of Microscopical Science* (1890). He afterwards contributed a series of papers on this group to this and other journals, and he described the Gephyrea collected by various expeditions, including those of Prof. Stanley Gardiner to Rotuma and Funafuti and the Maldive and Laccadive Islands, and of Dr. Arthur Willey to the Loyalty Islands and New Britain.

Shipley's interest shifted, in later years, to aspects of zoology which are not merely academic. So early as 1889 he had contributed to the *Kew Bulletin* a note on beetles destructive to rice-crops in Burma, and he continued to take a special interest in economic entomology, a subject which is predominantly represented in his charming "Minor Horrors of War" (1915) and "More Minor Horrors" (1916). He was largely instrumental in the inception, by the Colonial Office, of the Imperial Bureau of Entomology, which was established in 1909, at first under another name, with Lord Cromer as its first chairman.

A substantial part of Shipley's scientific work was concerned with parasitic worms, with one or two papers on the Pentastomida, curious worm-like parasites which appear to be degenerate Arachnida. Here, too, the practical side of the subject made a special appeal to him, as for example in his work for the Departmental Committee on Grouse Disease, and for the report to the Ceylon Government on the pearl oyster fisheries. His sense of humour was stirred by the reflection that a lady wearing a pearl necklace is usually not aware of the fact that the production of a pearl may have been due to the effort of the mollusc to protect itself against a young intrusive tapeworm.

In 1893, Shipley produced his "Zoology of the Invertebrata," a text-book which has been largely used by students; and he collaborated with his friend Prof. MacBride in the preparation of another text-book ("Zoology"), which appeared in 1901 and has had an equally successful career. He had previously been associated with Dr. Schönland and Prof. Poulton in issuing as an English translation Weismann's "Essays upon Heredity," a work which greatly assisted in familiarising English readers with Weismann's work. He was joint editor of "The Cambridge Natural History," which appeared in ten volumes from 1895 to 1909, and editor of the Pitt Press Natural Science Manuals (Biological Series) and of the Fauna of British India Series. He was perhaps at his best as a popular exponent of zoology. His writings in this capacity, in the columns of the *Times* and elsewhere, abound in humorous touches which give them a specially readable and attractive quality, and they include many acute observations made by himself during his numerous journeys to the United States and other parts of the world.

Shipley was born at Datchet on Mar. 10, 1861, and was educated at University College School and for a short time at St. Bartholomew's Hospital. He entered Christ's College, Cambridge, in 1880, and became successively Fellow and Master of his College and Vice-Chancellor of the University. He took a substantial part in lecturing, and for many years he was secretary to the Museums and Lecture Rooms Syndicate, a position involving the practical management of many of the affairs of the numerous buildings under his charge. His capacity for work was unlimited, and he did very notable service to his College and University, and to the country generally, particularly during the years of the War. As early as 1887 he was sent by the Colonial Office to the Bermudas to investi-

gate a plant disease, and late in life he was specially concerned in the establishment of the Imperial College of Agriculture in Trinidad, which he visited on more than one occasion and of which he was chairman. He was also chairman of the Council of the Marine Biological Association, a member of Royal Commissions on the Civil Service, Trinity College, Dublin, and the importation of store cattle and of the departmental inquiry into grouse disease; and he was a trustee of the Hunterian, Tancred, and Beit Foundations. His scientific distinction was recognised by honorary degrees conferred on him by Princeton, Michigan, and Philadelphia, and by being made foreign member of the American Association of Economic Entomologists and of the Helminthological Society of Washington, and honorary member of the Société Zoologique et Malacologique de Belgique. His period of office as Vice-Chancellor of the University of Cambridge, in 1917–1919, was described by the *Times* of Sept. 23, in an interesting account of the invaluable services which he performed for the country, fitly recognised by the award to him of the G.B.E. in 1920. He died at the Master's Lodge of Christ's on Sept. 22.

Few men have had a wider circle of friends than Shipley, whose gifts of sympathy made him *persona grata* to all sorts and conditions of men, from cabinet ministers to undergraduates fresh from school. He died full of honours and universally respected as a man who consistently maintained the highest standard of public and private duty, and in the midst of responsibilities which might well have absorbed all his attention, was always ready to give his time to the performance of innumerable acts of kindness.

SIDNEY F. HARMER.

WE regret to announce the following deaths:

M. Emile Haug, *membre titulaire* of the Section of Mineralogy of the Paris Academy of Sciences, professor of geology at the Sorbonne and a past president of the Geological Society of France, on Aug. 28, aged sixty-six years.

Prof. L. R. Lenox, for thirty-five years a member of the faculty of chemistry at Stanford University, on July 25, aged sixty-two years.

Dr. Thomas W. Salmon, medical director of the U.S. National Committee for Mental Hygiene and professor of psychiatry in Columbia University, New York, on Aug. 13, aged fifty-one years.

Prof. Adrian Stokes, Sir William Dunn professor of pathology in the University of London, while with the Rockefeller expedition investigating West African yellow fever, at Lagos on Sept. 19, aged forty years.

News and Views.

MANUFACTURERS in Great Britain have been the targets of much deserved criticism on account of their long neglect of the assistance which systematic chemical and physical research is able to offer them, but in recent years their attitude has implied a growing faith. Doubtless their policy in the past has been conditioned more by the fact that research organisations adequate to the study of many of their problems cost a great deal of money than by any hostility to the idea of progress, although this is probably not universally true; 'small profits and quick returns,' however excellent a maxim, does not stimulate the long view when business is brisk, and cannot afford it during a slump. The realisation, however, that industrial competition does not necessarily exclude scientific co-operation has led to the establishment and profitable operation, with State assistance, of a number of research associations. The youngest member of the family is the Research Association of British Paint, Colour, and Varnish Manufacturers, which was incorporated in September 1926, and the laboratories of which were opened at the first annual general meeting at Teddington on Sept. 21 last.

THE new Association, of which the president is Mr. S. K. Thornley and the director is Dr. L. A. Jordan, comes into existence at an interesting, if difficult, stage in the history of paint and varnish making. The ingredients of the good old varnish, often made by a secret process, find themselves challenged by new materials having unchallengeable protective and decorative qualities; the new materials require careful study in a variety of conditions, and the relation of the character of the protective film to those of the liquid applied are by no means fully understood. It is now realised that the paint or varnish, as manufactured, is, after all, only an intermediate product; its properties are of interest chiefly so far as—subject to the interference of external conditions such as climate and weather—they govern those of the film. Decoration, as well as protection, also moves with the times. The statement that the United States of America is using wood four times as rapidly as it is growing, or that that country wastes thirty million dollars annually on rust and decay, is adequate enough to support the 'more and better paint' movement, but a generally enhanced appreciation of the decorative value of paint coatings, with its demand for new shades of colour, new surfaces, and new properties, cannot be ignored.

CLEARLY, the wide problems of the paint and varnish industries are beyond the resources of single manufacturers. Co-operation, however, has already made possible the equipment for the new research association of three chemical and physical laboratories, with offices and library, and work is now proceeding on the equipment of a workshop and technical laboratory, so that processes can be tested on a semi-manufacturing scale. Already several specialised pieces of plant and apparatus have been presented or lent to the Association by firms or individuals interested in its work. Whilst the technical side of the work is in its preliminary stages, laboratory research on several important problems is already in active progress. Economies and profits will doubtless accrue to the promoters from many of the investigations

undertaken, but it must be remembered that a single important property such as the durability of paint may eventually be thereby improved in such a way as to confer benefits on the community and on the individual far greater than can be measured by the financial return to the paint and varnish industry itself. Governments seldom fail to receive their due share of abuse, and politicians are but infrequently immune from accusation of their failure to see, much less appreciate, the scientific point of view, yet much may be forgiven a Department of State which has had the wisdom to encourage, with practical assistance, the policy of co-operative scientific and industrial research, and those various groups of business men who, though times have been bad, have had the foresight to translate the policy into effective action.

THE biennial conference of the International Society of Leather Trades' Chemists took place from Sept. 12 to 14 at the Leathersellers' Hall, London, and was attended by the president of the Society, Prof. D. McCandlish, the Worshipful Master of the Leathersellers' Company, representatives from British scientific societies and trade organisations, and members of the Society from Great Britain, France, Belgium, Italy, Czecho-Slovakia, Spain, and India. The Conference paid a warm and respectful tribute to the memory of the late Prof. H. R. Procter, the great pioneer of the scientific study of leather manufacture and one of the founders of the Society, and decided in his honour to establish a fund for the endowment of a post-graduate fellowship for research in leather chemistry to be held at the Procter International Research Laboratory at the University of Leeds. The progress of scientific research in the leather industry has constantly been hampered by the difficulty of analysing such complex materials as leather, tanning extracts, and hide, and research in analytical methods inevitably occupies much of the attention of the Society. The methods hitherto recommended by the Society are not trustworthy in their results, and the conference decided to confirm the adoption of the new method for the analysis of tanning materials which was recommended in May last at an international congress of the three societies of leather trades, namely, the International Society, the American Leather Chemists' Association, and the Internationale Vereine der Leder-Industrie Chemiker. This new method has now been adopted by the International and the American societies, and it is believed that the German society is also taking the necessary steps to ensure its adoption by their members.

THE basis of the new method which has been recommended by the International Society of Leather Trades' Chemists for the analysis of tanning materials is the use of a hide powder washed free from mineral salts by means of a very weakly acid solution brought to a *p*H of 5 to 5·4, *i.e.* to the iso-electric point of collagen. Such powders contain only a trace of mineral matter and give much more uniform results in the analysis of tanning materials than earlier powders, which contained a variable residuum of calcium salts. The methods of analysis of vegetable and chrome tanned leather and various materials used in the manufacture of leather were also considered at the recent meeting. It was urgently recommended by the Society that the great amount of damage caused by the warble fly should be brought to the notice of the governments of each country represented. There are several good specifics against the pest, dichlorbenzoyl in vaseline and a suspension of tobacco powder both having proved effective. In Denmark the use of prophylactics had been made compulsory, with the result that the percentage of damaged hides among the indigenous cattle had fallen from 25 to 8. The British Warble Fly Commission, under Prof. Carpenter, abolished warble fly in two years from a small island off the north coast of Ireland. Re-infection of clean areas by imported stock is controlled in Switzerland by the compulsory slaughtering of all imported live cattle within twenty-four hours. In England there are no compulsory measures against warble fly, and live cattle for store purposes enter freely at the ports. It is perhaps not surprising that the percentage of 'warbled' hides among English and Irish cattle is very high.

To the July number of *Electrical Communication*, Mr. Rollo Appleyard contributes a very interesting article on Charles Wheatstone. Wheatstone is best remembered by electricians in connexion with Wheatstone's bridge, which is used in measuring electrical resistance. Yet curiously enough, Wheatstone himself scrupulously assigns this bridge to its first inventor, S. H. Christie. If it is true that a man is known by his friends, then it is sufficient to mention that Wheatstone was the friend of Faraday, Huxley, Brewster, and Tyndall, all of whom did invaluable work in the cause of science and consequently for the benefit of humanity. With the exception of Brewster, none of these had received what can be called systematic education, but all were enthusiastic research workers. Wheatstone, probably more than any other man, developed the practical side of electric telegraphy. No account of a practical electric telegraph was published prior to Cooke's and Wheatstone's patent taken out in 1837. His sine wave model, his kaleidophone, his gas-jet organ, his concertinas, and his polar clock are only a few of his many inventions. His rotating mirror verified Kelvin's prediction that in many cases a Leyden jar spark discharge is oscillatory. His endless patience as an experimenter was proved by the many experiments he made to determine the velocity of an electric discharge through a wire. But as J. B. Dumas said, his memory will live not only by his achievements but also by the recollection of "his rare qualities of heart, the uprightness of his character, and the agreeable charm of his personal demeanour."

ONE of Wheatstone's earliest inventions was an instrument he called "the enchanted lyre." It was suspended from the ceiling by a cord and the music appeared to proceed from a combined "harp, pianoforte, and dulcimer." Wheatstone himself described

it as an application of a general principle for conducting sound. A writer in the *Repository of Arts* for September 1821, when describing this instrument, foreshadows modern broadcasting in a remarkable way. "Who knows but by this means the music of an opera performed at the King's Theatre may ere long be simultaneously enjoyed at Hanover Square Rooms, the City of London Tavern, and even at the Horns Tavern at Kennington, the sound travelling . . . from the main laboratory of harmony in the Haymarket to distant parts of the metropolis . . . perhaps words of speech may be susceptible of the same means of propagation." In this connexion it is interesting to recall that the ancient Greeks believed that Pythagoras could lecture simultaneously in several towns many miles apart.

IN the course of the Congress of the Institut International d'Anthropologie, which was held at Amsterdam on Sept. 20–27, it was announced that the Prix Hollandais of the Institut has been awarded to Miss Dorothy A. E. Garrod in recognition of her work in prehistoric archæology, and especially for her excavation of the cave at the Devil's Tower, Gibraltar, in the course of which she found the second of the two Mousterian Gibraltar skulls, the first having been discovered in 1843. It will be remembered that the site on which Miss Garrod worked was noted by the Abbé Breuil during the War, but excavation necessarily had to be postponed. A preliminary account of the fragments of the skull discovered by Miss Garrod earlier in the summer, which had been reconstructed by Mr. Dudley Buxton, was given at the Oxford meeting of the British Association last year. Miss Garrod returned to the site later in the autumn and cleared the cave to bed-rock, discovering further fragments of the skull. The whole, as now reconstructed, apparently that of a child from eight to ten years old, will be exhibited and described shortly at a meeting of the Royal Anthropological Institute. Miss Garrod is also the author of a valuable survey of the evidence relating to early man from the caves in Britain entitled "The Upper Palæolithic Age in Britain." We offer our sincere congratulations to Miss Garrod on her well-deserved honour.

MR. C. F. TALMAN, librarian of the United States Weather Bureau, is writing articles on weather topics every day for Science Service of Washington. These are appearing in the *Boston Transcript* and ten other North American newspapers. The uniquely favourable position of Mr. Talman for work of this kind is evident after a perusal of one of these articles, which gives an account of the library under his charge at Washington. This library contains about 46,000 volumes, and is said to be the largest of its kind in existence; it includes a vast number of books about the weather and climate of all parts of the globe, in addition to all treatises on meteorology that have appeared anywhere in the world, so far as the U. S. Weather Bureau has been able to secure them. With this mine of information immediately to hand, Mr. Talman no doubt has little difficulty in finding some item of interest for each day of the year; he has, moreover, the gift of being both lucid and entertaining.

THE range of subjects dealt with by Mr. Talman in a sample batch of articles received recently, covering the period May 2 to Aug. 18, 1927, occasionally extends into the borderland of meteorology, *e.g.*, "Experiments with Icebergs"—an account of attempts to destroy icebergs with the aid of ignited charges of thermit—"The Dust we Breathe," "Mysterious Sounds that Haunt the Air," "Will o' the Wisp," and so on. Care has been taken to choose, so far as possible, subjects likely to be topical at the time of their publication, which is of necessity a week or so later than the time when they are completed; thus for May 11 an article on "The Traditional Cold Spell in May" was chosen, while several articles on very hot weather, and the best means of avoiding its attendant discomforts, were timed to appear in that portion of July that has the highest mean temperature. It is satisfactory to find no evidence anywhere in the series under review of a sacrifice of accuracy to interest. The articles must stimulate thought and should tend to dispel many absurd illusions about the weather that are still current.

THE Registrar-General's Statistical Review, 1926, Tables, Part 2, has recently been issued by H.M. Stationery Office (price 5*s*.). Among the wealth of material it contains, the following points are of wide interest. The total population in thousands of Great Britain and Ireland was:

	1926.	1925.	Increase + or Decrease − per cent.
England and Wales .	39,067	38,890	+ 0·46
Scotland . . .	4,897	4,893	+ 0·08
Northern Ireland .	1,256	1,257	− 0·08
Irish Free State. .	2,970	2,985	− 0·50
Total . .	48,190	48,025	+ 0·34

In England and Wales the male population increased by 0·52 per cent. and the female population by 0·40 per cent. The births registered during the year 1926 numbered 694,563, which is equal to a rate of 17·8 per 1000 population. This rate was 0·5 per 1000 below that recorded in the previous year and, with the exception of the War year 1918, is the lowest rate recorded since the establishment of civil registration. Not only has the birth rate declined but also the actual number of births is the lowest recorded since 1860, when the population of England and Wales was only 19,902,000, or about one-half of the estimate for 1926. The number of illegitimate births was 29,591, or 43 per 1000 total births, and was 695 in excess of the total recorded in the previous year. The proportion of male to 1000 female births was 1041. This proportion showed a great increase during the War years and reached a maximum of 1060 in 1919, since when the decline has been almost continuous, and the rate is now approximating to that which prevailed in the period immediately prior to the War.

LATE on the night of Sept. 24, the R.R.S. *Discovery* anchored in Falmouth Harbour, having completed a two years' cruise to Cape Town, South Georgia, and

the Falkland Islands; she is expected to arrive in the Thames on Oct. 1. It will be remembered that the primary object in fitting out the *Discovery* expedition was the investigation of the southern whaling fisheries, and a report of the work carried out up to August 1926 was contributed by the Director of Research, Dr. Stanley Kemp, and members of the scientific staff, to our issue of Oct. 30, 1926, p. 628. The first annual report of the expedition, bringing the account up to the end of 1926, has been recently published (see NATURE, Aug. 27, p. 308). It is expected that the scientific staff will spend some months ashore working up the results of the expedition, and it is confidently expected that these will prove of great value to science and to the whaling industry.

A NEW speed record was set up near Venice by Flight-Lieutenant S. N. Webster when he won the race for the Schneider Cup for Great Britain on Sept. 26 at an average speed of 281 miles 1246 yards an hour. The race was over a course about 31 miles in length and triangular in shape, and seven laps had to be covered; this meant making two sharp turns in each lap. Three Italian and three British machines started, but the Italian pilots and one of the British pilots had to come down. Lieut. Webster was flying a Supermarine-Napier S5 with geared engine. This engine, a development of the Napier Lion unit, weighs 920 lb. and develops 890 h.p. The Supermarine seaplane was designed by Mr. R. J. Mitchell, who seems to have been most successful in devising means for reducing head resistance; for example, petrol was stored in one of the floats, while the radiator for the water-cooling system was fitted in an improved way beneath one of the wings. The only other machine which completed the course, piloted by Flight-Lieut. O. E. Worsley, was also a Supermarine Napier, but with an ungeared engine. Lieut. Worsley's average speed was 273·6 miles an hour. In last year's race for the Schneider Cup, the winner, Major de Bernardi (Italy), on a Macchi monoplane with 800 h.p. Fiat engine, averaged 246·5 miles an hour. This year, for the first time, the British entry was organised entirely by the Air Ministry and service pilots were trained for the race.

To ascertain the value of aerial photography in the revision of 1/2500 Ordnance Survey plans, an area of some fifty square miles near Eastbourne was photographed from the air at the same time that the usual revision was taking place during the summer of 1925. The results of this experiment are given in a small pamphlet issued by the Ordnance Survey and entitled "Report on the Experimental Revision of the 1/2500 Ordnance Survey Plans with the aid of Photographs taken from the Air" (London: H.M. Stationery Office. 4*d*. net). It was found that this method was 50 per cent. quicker than field work, 1670 square miles being photographed by one machine in less than one hundred days. With the exception of some types of wire fences, all details were easily identified in the photographs, and changes in features could be plotted with accuracy. Invasion of lands and premises is reduced by the new method, and the interval between revision and publication should be shorter than it was of old. The high costs of aerial revision could no doubt be substantially reduced, but the speed of the work makes it impossible to offer a continuous programme of flying to the aviators. As a result of the experiment, the Ordnance Survey proposes to revise solely by aerial photography an area of about 100 square miles each year for several years. It will then be possible to decide if the method will be economical to adopt for all large-scale revisions.

WITH the object of collecting, correlating, and placing at the disposal of British industry, all information of a technical and practical character with regard to the use of nickel and its alloys, the Bureau of Information on Nickel, Limited, has been established with offices at 2 Metal Exchange Buildings, Leadenhall Avenue, London, E.C.3. The services of the Bureau will be rendered without charge or condition.

SIR ARTHUR KEITH'S recent presidential address to the British Association is to be published in Messrs. Watts and Co.'s Forum Series. It will contain a foreword and a supplementary paper entitled "Further Evidence and Some Unsolved Problems"; and there will also be included three essays on "Darwin's Home," "Why I am a Darwinist," and "Capital as a Factor in Evolution," as well as a page diagram elucidating man's origin. The price of the publication will be 7*d*.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A lecturer in engineering subjects at the Technical College, East London, South Africa—The Secretary, Office of the High Commissioner for the Union of South Africa, South Africa House, Trafalgar Square, W.C.2 (Oct. 7). A woman professor of physiology at the Lady Hardinge Medical College, Delhi—The Honorary Secretary, U.K. Branch Dufferin Fund, care of Major-General J. B. Smith, India Office, Whitehall, S.W.1 (Oct. 8). An agricultural economist and an agricultural engineer under the agricultural department of the Tasmanian Government—The Agent-General for Tasmania, Australia House, Strand, W.C.2 (Oct. 14). A county education officer for the Administrative County of Southampton—The Clerk of the County Council, The Castle, Winchester (Oct. 17). An entomologist in the veterinary department of Tanganyika Territory with special knowledge of the blood-sucking diptera and the Ixodidæ—The Private Secretary (Appointments), Colonial Office, 38 Old Queen Street, S.W.1 (Nov. 15). A senior lecturer in geography and geology at the Natal University College, Pietermaritzburg—The Registrar, Natal University College, Pietermaritzburg, Natal (Nov. 30). A woman graduate as chief assistant in the Domestic Science Department of the Battersea Polytechnic—The Principal, Battersea Polytechnic, S.W.11. An assistant bacteriologist at the Wellcome Research Laboratories, Khartoum—The Controller, Sudan Government, London Office, Wellington House, Buckingham Gate, S.W.1. A test assistant at the Aeroplane and Armament Experimental Establish-

ment of the Air Ministry, Martlesham Heath—The Officer Commanding, Aeroplane and Armament Experimental Establishment, Martlesham Heath, Woodbridge, Suffolk. An evening lecturer in structural mechanics at the West Ham Municipal College—The Principal, Municipal College, Romford Road, Stratford, E.15.

THE Royal Commission appointed by the Commonwealth Government to inquire into the control and development of radio severely criticises Amalgamated Wireless (Australasia), Limited. This Company claims to have many patents, embracing all branches of radio communication. According to a report in the *Times* of Sept. 15, the Commission says that the Company's demand for royalties is based on the principle "that it is entitled to obtain from the public whatever it can get." The Commission urges that the Company should make reductions in the charges for the use of patents. If the Company fails to make the suggested reductions, the Commission urges that the Commonwealth Government, after ascertaining that the patents are valid, should purchase all the privately held shares in the company and so acquire complete control. Without a full knowledge of the facts, it is very difficult to criticise the motives and actions of the Commission and of Amalgamated Wireless (Australasia), Limited. The Government of Australia holds the majority of the shares, and we should have expected them to control the actions of the Amalgamated Company. Private companies which have expended considerable sums in research for many years hope to reap a harvest later on. It is in the public interest that they should receive royalties on their patents at least for a period of years. It is in this way that great industries have been built up. We believe that there are between two and three thousand companies in Great Britain which utilise broadcasting patents. There seems to be no attempt to create a monopoly for a few favoured firms. The question seems one that could be quickly settled by arbitration.

Our Astronomical Column.

ROTATION OF THE GALAXY.—The fact that the spectroscope reveals rotation in several spiral nebulæ renders it not improbable that a similar motion may be present in the galaxy, which has many points of resemblance to the spirals; it is not very easy, however, to detect a small systematic effect of this kind from star observations. Mr. J. H. Oort makes the attempt in *Bull. Astr. Inst. Neth.*, No. 132. He makes the assumption that there is unlikely to be any systematic motion at right angles to the galaxy; he therefore deduces the precession from proper motions resolved in that direction and finds a correction to Newcomb's precession of $1''{\cdot}37$ per century and a rotational effect of about $\frac{1}{2}''$ per century.

Mr. Oort notes that if all the mass of the galaxy were concentrated at the centre, the law of force would be the inverse square of the distance; while if the mass were distributed uniformly through a sphere, the law within the sphere would be the direct distance; the actual law would be between the two. He deduces tentatively that the force according to the inverse square law is 6/10 of the whole, from which he finds that the central mass is about sixty thousand million times that of the sun.

The linear speed of rotation in the sun's neighbourhood is found to be 286 km./sec. towards galactic longitude 55°. The author suggests that the radial velocities found for the Magellanic Clouds is accounted for by this rotational motion, so that they may be outlying portions of the galaxy.

THE NEW STAR IN AQUILA.—*Astr. Nach.*, No. 5519, contains details of the spectrum of this star as photographed at Königstuhl by Prof. Max Wolf on Aug. 17. These agree well with the usual nova type. The hydrogen lines $H\beta$ to $H\eta$ were seen both as emission and absorption lines; the absorption lines indicated a radial motion of -1600 km./sec., while the emission ones indicated $+100$ to $+150$ km./sec.

THE TOTAL SOLAR ECLIPSE OF JUNE 29.—*Astr. Nach.*, No. 5519, contains observations of the total solar eclipse made at Ringebu, Norway, by G. Armellini and G. Conti of the Campidoglio Observatory, Rome. Shadow bands were well seen both before and after totality, the latter being the stronger. They were curved like the letter S and had an undulatory movement. The illumination during totality was much greater than that of the full moon. Signor Armellini could read type 0·5 mm. high, while 2 mm. was the minimum in full moonlight. Most of the light during totality was diffused skylight, not that of the corona, as was shown by the fact that a stick 4 cm. in diameter threw no perceptible shadow on a white sheet. The observed times of beginning and end of totality were $5^h\ 34^m\ 50{\cdot}3^s$, and $5^h\ 35^m\ 24{\cdot}6^s$, U.T., each about $\frac{1}{2}$ sec. earlier than calculation.

A sketch by Signor Conti shows the corona as a uniform ring some 7′ high, with seven long rays at fairly equal intervals. The longest are 40′ long. The temperature fell from 11°·1 C. to 7°·9 C., afterwards rising to 12°·4 C. The colour of the prominences is described as reddish-violet and as yellowish-red by the two observers respectively.

NORMAN LOCKYER OBSERVATORY.—The annual report of the director of the Norman Lockyer Observatory, which has recently appeared, shows a continuance of the programme which has been so usefully followed during the last few years. The chief features are the photography of stellar spectra for classification and parallax work, and the detailed study of changes in the spectra of bright line stars of early type. Four papers dealing with this work have been published during the year, and three others are in preparation. In addition, the $5\frac{1}{4}$-inch doublet has been mounted for the photography of meteors, and has been oriented to the pole star on clear nights when there has been no bright moonlight. Arrangements were made for obtaining large-scale photographs of the chromosphere, prominences, and corona, and small-scale photographs of the corona and its spectrum, at Richmond (Yorks.) during the total solar eclipse of June 29 last; while at the observatory at Sidmouth, preparations were made for securing large-scale spectra of the chromosphere with the Hilger Littrow spectrograph. Neither programme, however, could be carried out, owing to unfavourable weather. The accounts for the year show a loss of £227, and the hope is expressed that further endowments will be forthcoming.

Research Items.

CHINESE GONGS.—Major E. C. Kenny, in *Man* for September, describes the two types of rare 'Chinese gongs' which are found in Burma, and usually called by the English residents there 'Karen War Drums.' They are now only found in the little frontier State of Karenni. The gongs are of two types, and of these the taller and more modern were made up to a time so recent as 1894 by the Shan for their overlords the Karen. The flatter ancient type is beyond doubt of Chinese origin, and is very rare. The Karen assert that these latter were not made by human agency at all, but by spirits, who are said to assume the forms of beautiful maidens and to sing sweetly in the jungle on the outskirts of villages, attracting youths whom they destroy. One gong of this type in the British Museum is dated "Made by Chang Fu in the 7 month of the 4 year of the reign of Chien Hsing," *i.e.* A.D. 226. The gongs are designated 'male' and 'female' according to whether they are decorated or not, the latter being the male, and are frequently found in pairs. The drums are used for crop and other festivals, and periodically for summoning the outlying villages; but apparently never for war.

THE STONE BATTLE-AXE.—The spread of the stone or copper battle-axe is discussed by Prof. H. J. Fleure and Mr. Harold Peake in a communication in *Man* for September. They take the view that the axe-hammer with a shaft-hole was probably first made in metal and that the oldest example published is that from Cemetery A at Kish, dated at 3100–3000 B.C., although older examples have recently come from Ur. Although it may seem a far cry from Mesopotamia to a European centre, the connexion between early Kuban and the Cyclades has been demonstrated, while the former has too many elements of kinship with Mesopotamia to leave any doubt of their common origin. It is suggested that it was through the Cycladic contact with Kuban that the battle-axe entered Cycladic Minoan culture in Early Minoan II. The early metal axe of copper had the butt end bent round to form the shaft-hole, and the earliest cast specimens had the hole nearer one end. When copied in stone the axe would have one cutting-edge with the shaft toward the butt end, though not so near as in the metal type, to avoid splitting. It has been argued that of the British perforated axes, those with the hole nearer one end are earlier than those in which it is situated centrally. It is agreed that in the Baltic area the stone battle-axe underwent great development, but even here a copper axe from Norway would serve as a metal prototype. The authors' view is that in the Baltic area the only culture was that of the shell mounds until the Megalithic culture impinged on it from the south-west and the culture of the battle-axe and fine flint work came from the south-east.

INTERNATIONAL HERRING INVESTIGATIONS.—*Rapports et Procès-verbaux des Réunions*, vol. 41, of the Conseil Perm. Internat. pour l'Expl. de la Mer, contains a good deal of information concerning the present state of our knowledge of the herrings in the North Sea, and sets out the programmes of investigations which are being undertaken by the countries interested. The immense value of continuous observation over an extended period is admirably demonstrated by the striking results achieved by the Norwegian investigators through an unbroken series of years from 1907 to the present time. Mr. Einer Lea's preliminary report on these results, and his discussion on the most satisfactory method of summarising the observations for one season so as to give the best possible representation of the age-composition of the stock, will be read with interest. The report on Scottish investigations regarding the larval and post-larval stages of herring in the northern North Sea not only indicates the immediate difficulties experienced, but also demonstrates the general fact that great caution must be exercised when estimating age from scales of adult fishes. Evidence is advanced that some of the Scottish post-larvæ acquire scales during the calendar year in which they are born, so that their first winter of life is recorded on the scale as a winter-ring. Others, however, remain in the unscaled condition until the year following birth, the first winter-ring not being formed on the scale until the *second* winter of life. This fact very materially adds to the difficulty of estimating the age and origin of the adult fishes which visit Scottish waters.

FISH EGGS AND LARVÆ FROM THE JAVA SEA.—In vol. 8 and vol. 9 (1926) of *De Treubia*, Dr. H. C. Delsman gives a detailed account of his studies of fish eggs and larvæ from the Java Sea. His observations of the time of the day at which spawning appears to occur, and of the length of the incubation period of some of the eggs, are particularly interesting. Thus, the eggs of three species of the genus Caranx are all set free at a definite time towards midnight. At 9 A.M. on the following morning, that is, less than 12 hours after, those of *C. macrosoma* hatch out. Between 11 A.M. and 1 P.M. those of *C. kurra* hatch, while at 6 P.M. the young of *C. crumenophthalmus* emerge. In the course of egg-sampling with tow-nets, therefore, the eggs of *C. macrosoma* are to be found only in early morning hauls; those of *C. kurra* disappear from the tow-nets at about 1 P.M., so that in the afternoon only those of *C. crumenophthalmus* remain. These results are in accordance with a general rule that larger, more yolk-laden eggs take a longer time for their development than smaller ones with less yolk. Equally striking is the author's account of the growth of the embryo assigned to *Clupea fimbriata*. Eggs taken at 7 A.M. showed only a small germinal disc and had evidently been laid shortly before capture. At 8.45 A.M. the germinal disc had grown half round the circumference of the egg, and the first indication of the embryo had appeared. At 10.45 A.M. the blastopore closed and the rudiment of the embryo had grown more distinct. During the afternoon the tail grew out, the embryo began to 'sprawl' within the spacious egg-membrane, and at 6 P.M. it hatched. Some idea of the speeding-up of the incubation period can be gathered from the comparison between the hatching of *Scomber kanagurta* in less than 24 hours, and that of the mackerel (*Scomber scomber*) in 6 days in British waters, or with the 5 days for the American mackerel.

JAPANESE FRESHWATER BRANCHIOPODA.—M. Ueno (*Mem. Coll. Sci. Kyoto Imp. Univ.*, B, vol. 2, No. 5, art. 12, 1926) gives a list and some details of the genera, species, and varieties of freshwater branchiopoda hitherto found in Japan, together with a few records from eastern China. Of the thirty-one species of Cladocera, twenty-five are found also in Europe, but the Japanese Phyllopoda belong to species not represented in Europe. The author is inclined to believe that Japanese examples of the Cladocera are generally smaller in size than corresponding specimens from Europe or America, but he adds that further study is required before this can be decided.

GROWTH OF PARAMŒCIUM.—F. Mizuno has made careful observations (*Science Reports, Tôhuku Imp. Univ.*, 4th series, vol. 2, No. 4, 1927) on the normal growth of *Paramœcium caudatum*. He found that at a temperature of 24°-26° C., division occurs at the end of eight or nine hours and that there was no difference in the rate of division between examples in light and others in the dark. More than 600 specimens were killed at definite intervals after fission had occurred and they were drawn, their length and breadth measured, and their area determined by a planimeter. Immediately after fission, the daughter Paramœcia increase markedly in length but decrease in breadth; that is, there is a change in their form. Size cannot therefore be estimated by measuring only the length, and as the volume could not be accurately ascertained, the most satisfactory method appeared to be the careful determination of the area. When the areas of specimens killed at known times after fission are plotted, they show that the growth of Paramœcium is represented by a linear curve.

LENS DESIGN.—In *Scientific Paper of the Bureau of Standards*, No. 550, Mr. I. C. Gardner deals with the application of the third order algebraic aberration equations for a thin lens to the design of lenses to fulfil given conditions. Up to the present, there has been no book giving the third order aberrations in a form quite satisfactory for this purpose, and it has been difficult for a designer to get any information between that given in elementary text-books and that to be found in works on instrument design and other specialised problems. The notation adopted is substantially that of von Rohr, but by the introduction of a modification in that of Taylor, it has been possible to give the results in each of the two notations. The sign of the distance of a point from the lens is positive if in moving with the incident light one passes through the lens before reaching the point. Designs of thin lenses and of systems containing thin lenses and prisms are worked out in detail by the author, and the paper of 130 pages should be of great help to the optical designer.

MOLECULAR VOLUMES AT ABSOLUTE ZERO.—In two interesting papers in the August number of the *Journal of the Chemical Society*, S. Sugden has shown that the simple equation $D - d = D_o(1 - T_r)^{3}/^{10}$ applies with great accuracy to Young's results for the liquid and vapour densities of thirty substances. D, d are the densities of liquid and saturated vapour, D_o is the density at the absolute zero, T_r is the reduced temperature. The equation contains two constants, D_o and the critical temperature, only. It is therefore possible to calculate M/D_o, the molecular volume at the absolute zero. This magnitude, V_o, is shown empirically to be a nearly constant fraction, the values ranging from 0·264 to 0·280, for a number of substances. The value for hydrogen in 0·373. The equation proposed by Sugden is a special case of a general one proposed by Verschaffelt, but the constants chosen give better results. The results apply also to associated liquids. It is further shown that values of V_o can be predicted by adding together certain characteristic constants for the atoms and structures present in the molecule for a very large number of compounds.

RETURN CIRCUITS IN ELECTRIC TRAMWAYS.—In electric tramway systems, for the sake of economy, it is customary to use the rails as part of the circuit connecting the dynamos at the tramway power station with the motors on the car. These rails are connected through the tram wheels with the negative poles of the dynamos, and as they have to carry a large current, an appreciable difference of potential exists between various points on their lengths. As they are not insulated, only part of the return current flows by the rails, the rest flowing through the earth, the pipes of water and gas companies, and the coverings of telephone cables. The possibilities of serious electrolytic corrosion in large telephone cables by these leakage or 'vagabond' currents has made traction engineers consider whether the present precautions are sufficient. In *World Power* for September, G. W. Stubbings gives a helpful contribution to the subject. The Ministry of Transport has imposed the regulation that the difference of potential between any two points on the rails must not exceed 7 volts. This regulation has been in use for many years and so far has been found quite satisfactory. The replacement of overhead telephone wires by underground cables is a new fact that has to be considered. When the current flows from the cable sheath to the rails there are risks of serious erosion occurring. A further restriction has been imposed, that the maximum potential difference between the rails and a buried pipe in its vicinity shall not exceed 1·5 volts when the rail is negative to the pipe and 4·5 volts when the rail is positive to the pipe. This restriction seems desirable, but to apply it equitably in practice is difficult. In Great Britain, traction engineers as a rule rely on maintaining the potentials of the rails low by means of special dynamos taking current from definite points of the rails through insulated circuits. Mr. Stubbings considers the relative merits of this method and that of using special copper conductors. Many interesting mathematical problems arise.

ELECTRIC MOMENTS OF ORGANIC MOLECULES IN BENZENE SOLUTION.—Measurements of the dielectric constants of binary systems in which the first component (*e.g.* benzene) is known to have no electric moment allow of the calculation of the electric moment of the molecule of the second component. The equation used is a combination of the familiar Clausius-Mosotti law with a result deduced by Debye, in which the molar polarisation is shown to be a linear function of the reciprocal of the absolute temperature. In the July number of the *Journal of the American Chemical Society*, J. W. Williams and I. J. Krchma apply this formula to the results found with a number of solutions in benzene. The values for the electric moments of the solute molecules vary from zero for carbon tetrachloride to $1{\cdot}70 \times 10^{-18}$ for phenol; ethyl ether has the value $1{\cdot}22 \times 10^{-18}$, chloroform $1{\cdot}10 \times 10^{-18}$, and chlorobenzene $1{\cdot}55 \times 10^{-18}$. These are in good agreement with previous results with the pure substances. These results are clearly of importance in certain fields of speculation in organic chemistry. An interesting result is that the moment of symmetrical xylene is very small, whilst it is appreciable in the case of unsymmetrical xylene.

THE SUPPOSED PHOSPHORUS SUBOXIDE, P_2O.—From time to time various lower oxides of phosphorus have been described, but most of these have been shown to be impure amorphous phosphorus. One of them, Besson's oxide, P_2O, has been investigated by Chalk and Partington, whose results are described in the August number of the *Journal of the Chemical Society*. It is shown that the supposed oxide is again an impure form of amorphous phosphorous, contaminated with the materials used in the preparation described by Besson. The existence of an oxide of phosphorus below P_4O_6 should therefore still be regarded as extremely doubtful.

The International Union of Geodesy and Geophysics.

THE third conference of the International Union of Geodesy and Geophysics was held at Prague on Sept. 3-10, at the invitation of the Czechoslovakian Government, though most of the sections found it necessary to hold some of their meetings in the preceding week in order to get through their programmes of work. Previous meetings held at Rome in 1922, and at Madrid in 1924, had proved to be of great value in providing an opportunity for workers in a group of sciences where international co-operation is essential to discuss methods and to arrange schemes for future work.

On the present occasion, 29 out of the 32 countries belonging to the Union were represented by delegates, who numbered more than 160. The Union, with its sections for geodesy, seismology, meteorology, terrestrial magnetism and electricity, oceanography, volcanology, and hydrology, covers a very wide field, and these triennial meetings afford an occasion when questions involving two or more of these fields of work can be discussed by those who are actually occupied with them.

In the Section of Geodesy the determinations of gravity at sea, made by Dr. Vening Meinesz of Holland on board a submarine during a voyage to Port Said, and also during one to Java by way of the Panama Canal, were described by him, and aroused much interest. The great ocean areas were shown to be generally in a state of approximate isostatic equilibrium, except in places where crustal movement is in progress, such as the Straits of Sunda, where considerable anomalies were shown to exist. The conference expressed the hope that other nations having submarines of a suitable type will co-operate in this work of gravity determination over ocean areas now that a satisfactory method of doing so has been developed, and proved to be efficient. Dr. Vening Meinesz also described certain improvements in his pendulum apparatus which he had introduced as the result of his experiences on submarine cruises. Detailed accounts of this work will be published by the Dutch Geodetic Commission.

The geodetic work which has been carried out recently on a co-operative plan by the countries on the shores of the Baltic furnished an example of an excellent piece of work, well designed and carefully carried out. It was suggested that such work might be done usefully in other restricted areas by similar co-operation. Summaries of geodetic work carried out since the last conference were communicated by many countries, and were thus made available to other geodesists much sooner than would otherwise have been the case.

In seismology much useful work was done in the discussion of the analysis of seismograms, the improvement of telegraphic codes, the preparation of tables for use in the reduction of seismological data, etc. The conference urged that the countries concerned should improve the network of existing stations by establishing additional ones in North Spain, in the Balearic Islands, and in New Caledonia or Tahiti. A proposal of the National Committee for the United States that countries should co-operate in the study of ocean deeps was strongly supported.

The Section of Meteorology was occupied with a large number of scientific questions, among which the preparation of daily synoptic charts of the South Pacific Ocean, the extended study of solar radiation, and upper air observations in tropical regions and in the southern hemisphere, may be mentioned. The conference adopted a recommendation of the Section expressing the hope that this investigation of the upper air in low and southern latitudes might be actively prosecuted. Now that the International Meteorological Committee finds itself very fully occupied with matters relating to the working of the meteorological services of the various countries, this Section of the Geodetic and Geophysical Union finds full employment in the discussion of many scientific matters which would probably not be dealt with by the Committee; thus, each of the two organisations work without duplicating the work of the other, but on the contrary supplementing it.

The Section of Terrestrial Magnetism had a full programme of work which included the discussion of recent work, the comparison of instruments, the design of improved apparatus, and the reduction of observations. Atmospheric ionisation and the observation of auroræ also came under consideration, as well as the need for additional earth-current installations.

The Section of Oceanography did much of its work by sub-committees appointed to consider the investigation of the different great sea areas, and of tidal phenomena.

In volcanology full accounts were communicated of the recent outburst of Vesuvius, and also of the somewhat earlier volcanic activity at the island of Santorin. Certain problems connected with the transmission of waves in the earth's crust were discussed in a joint meeting with the Section of Seismology, and the thermal gradient in the crust came up for detailed consideration. The conference adopted a resolution by the Section that countries in which active volcanoes occur should be invited to undertake the measurement of the thermal gradient in various localities.

In hydrology much work was done on problems relating to the flow of water, and the transport of silt in suspension also came under discussion. By an arrangement with the International Committee on Glaciers, which was established in 1894, its work will now be transferred to and carried on by a committee of the Section of Hydrology, of which committee M. Hamberg will be the chairman and M. Mercanton the secretary.

M. Lallemand was re-elected president of the Union up to the end of 1931, when the statutes may be revised and re-approved by the countries of the Union. He will thus have been president throughout the whole of the first period of the Union's activity, twelve years. Some changes were made in the officers of the sections, Dr. L. A. Bauer replacing Dr. C. Chree as president of the Section of Terrestrial Magnetism, and being in turn replaced as secretary by M. Ch. Maurain. M. Wehrlé becomes secretary of the Section of Meteorology.

The various communications which were made to the sections at their meetings will be published by them in the immediate future, in continuation of the publication series which each section has already initiated.

The most generous hospitality was shown to the delegates both by the Czechoslovakian Government and by the municipality of the city of Prague. In addition, the members of the organising committee made excellent arrangements, by which the delegates were shown all the scientific institutions of importance as well as the numerous museums, galleries, and houses of historical and artistic interest in and near the city.

The President of the Republic was to have received the delegates on one evening, but unfortunately his health did not allow him to return to Prague to do

so ; the Minister of Foreign Affairs held the reception on his behalf.

On the conclusion of the conference delegates had the choice of visiting the Tatra Mountains in south-eastern Czechoslovakia, or the principal health resorts, including Joachimstal, Keilberg, Karlsbad, and Marienbad.

For the next meeting the conference received invitations to meet at Stockholm and at Lisbon ; both were accepted in principle, but it was left to the executive committee to decide later which of the two should be definitely accepted, since the wish had been expressed by the United States Research Council that the Union's meeting should take place near in time and place to that of the International Astronomical Union, whenever this should be practicable.

International Congress of Genetics.

THE fifth International Congress of Genetics, held in Berlin on Sept. 11-18, was a very important and successful meeting. The opening addresses of welcome were given in the auditorium of the Berlin Medical Society in Luisenstrasse, while all the other sessions were held at the University (Unter den Linden). Members of the Congress were welcomed by Prof. E. Baur, chairman of the committee of arrangements, as well as by the German Minister of the Interior, the Prussian Minister of Agriculture, the head of the Berlin Medical Service, and Prof. Kniep, representing the University of Berlin. At this meeting an address was given by Prof. R. von Wettstein on the problem of evolution. Prof. S. Navashin, the distinguished cytologist of Moscow, was elected president of the Congress, a fact which is significant of the fundamental part which cytology has played in the modern development of genetics. The membership of the Congress numbered more than 1000. Mornings were devoted to general addresses, while in the afternoon the Congress met in six sections and about 135 papers were read.

The sections devoted to general genetics, cytology, and cultivated plants were particularly strong. The largest number of papers were devoted to wheat, maize, Drosophila and Œnothera, as many as ten investigators of Œnothera being present. A number of papers were concerned with the subject of mutation ; several were concerned with the statistics of inheritance, and several with crossing-over. A double attack on the theory of crossing-over led to an extensive and lively discussion in which the great strength of the theory was brought out. In this connexion an important paper by Prof. F. Bernstein pointed out new mathematical relationships which follow from the mechanical theory of crossing-over.

The address of Prof. H. J. Muller, of Texas, on the production of mutations in Drosophila by treatment with X-rays, was generally regarded as the most important contribution to the Congress. Mutations were produced in large numbers by subjecting males or females to X-rays for different periods. Four periods were used, and with the longest period of treatment the rate of mutation was 150 times that in the controls. Genes were affected equally throughout the chromatin and an increase in the X-ray dosage was found to increase the rate of 'point' mutations. Sperm used in fertilisation 6 days or 12 days after treatment showed no difference in the rate of mutation-production. The presence of large numbers of mutations was also found to have little or no effect on sperm viability.

In the X-chromosome of Drosophila, mutations normally appear at the rate of not more than 1 in 1000. In these experiments many more mutations appeared in the X-chromosome than have occurred in it naturally in all previous experiments. Such well-known mutations as rudimentary wing, broad wing, cross-veinless, white eye, and vermilion eye appeared repeatedly, but there was an enormous increase in the number of lethal factors. It was also found that the effect of X-rays on the ovaries persisted after treatment, a fact which has an important bearing on some of the present methods of X-ray therapy. X-rays also increased the number of c-factors, which reduce the frequency of crossing-over. Rearrangements of loci were also found to occur in the chromosomes. From various experiments the conclusion is reached that the gene is probably compound in the chromosome, composed of 2 or 4 parts, in preparation for later cell divisions. The great majority of the mutations produced are lethal or otherwise invisible, their presence being proved by later breeding experiments.

In the genetic work on Œnothera, the greatest interest centred around the linkages between chromosomes, which were demonstrated by Cleland and Gates. Each species and mutation is found to have a fixed arrangement of its chromosomes during diakinesis and on the heterotypic spindle. In some wild species all the chromosomes are linked into a ring of 14, while in others there are 7 free pairs. Still other species, such as *Œ. lamarckiana* and *Œ. ammophila*, have 1 free pair and a ring of 12. In the mutations from *Œ. lamarckiana* the arrangement is also a definite one, *Œ. rubrinervis* and *Œ. rubricalyx*, for example, having 4 free pairs with a ring of 6 chromosomes, while *Œ. deserens* has 7 free pairs.

This constitutes essentially a new type of nuclear differentiation. It appears that it will also be of fundamental importance as furnishing the basis for the unique phenomena of linkage of characters into complexes in Œnothera, which has not hitherto received an explanation. It is already indicated that where a large amount of chromosome linkage occurs there will be only two (twin) or three hybrid types, while in crosses between forms with many free pairs of chromosomes much segregation will occur. Shull described a new gene mutation from *Œ. lamarckiana*, a simple Mendelian recessive showing linkage of the ordinary type.

Among the studies of cereals, Dr. C. L. Huskins showed the existence of speltoid and dwarf wheats having respectively 41, 42, 43, and 44 chromosomes, parallel to the fatuoid series which he has recently discovered in oats. He also described a fatuoid chimæra in oats, and this appears to complete the parallelism in the behaviour of fatuoid oats and speltoid wheat.

Dr. M. Navashin made an important demonstration of the nuclear differences in species and hybrids of Crepis. Some of the species differ in the presence of a satellite or a terminal 'head' to the chromosome, and in the hybrids it is shown that the former may be transformed into the latter. This is the first time that a definite change in the structure of a chromosome as the result of hybridisation has been shown. The study of this type of chromosome differentiation is in its infancy and will lead to large results.

Among general addresses to the Congress may be mentioned that of Prof. O. Rosenberg, of Stockholm, on species-formation with multiplication of chromosomes, and Prof. H. Federley, of Helsingfors, on the

chromosome relationships in hybrids. Owing to illness, Prof. C. Correns was unable to give his address on non-Mendelian inheritance, but addresses were given by Dr. Vavilov on the geographical gene-centres of cultivated plants, and by Dr. Blakeslee on the genetics of Datura. Dr. Crew, of Edinburgh, discussed the organisation and function of an animal-breeding research station.

Miss Pellew and Miss de Winton discussed recent work with the garden pea and with *Primula sinensis*. Many other subjects of special interest came before the Congress. Practically every phase of genetical fact and theory was represented, from the study of variegation, clones, and inbreeding to species-crosses, the geographical distribution of genes, and such evolutionary topics as convergence, the unpacking theory of Bateson, and a statistical study of fossil Ammonites.

In the section on human genetics there were several papers on twins and on the blood groups. Prof. van Bemmelen described the inheritance of curly hair as an apparently simple dominant through several generations. Other papers considered the inheritance of shortsightedness, musical ability, general ability, sex, and psychological peculiarities as well as inter-racial inheritance in man. In the smaller section of eugenics a number of less strictly genetical questions were discussed.

The excursions formed an important part of the meeting. A ladies committee arranged numerous excursions to places of interest, and a visit to Wannsee and Potsdam was largely attended. But most valuable was the visit to Prof. Baur's Institut für Vererbungswissenschaft, where his extensive experiments with Antirrhinum were demonstrated, and to the laboratories of Profs. Correns, Goldschmidt, Hartmann, Nachtsheim, and others at the Kaiser Wilhelm Institute in Dahlem. There were also excursions to Petkus and Ruhlsdorf to study pig-breeding.

A reception and dinner was given in the Rathaus by the Municipal Government of Berlin, and the Congress closed with a dinner in the Zoologischer Garten on Sept. 17. This was followed, however, by short visits to horticultural institutions and a four-day excursion to Quedlinburg, Halle, Weimar, and other places, where various plant and animal-breeding establishments were inspected.

The *Proceedings* of the Congress are to be published promptly and will constitute a valuable survey of the present problems in genetics. The next Congress is to be held in America in 1932—under the presidency of Prof. T. H. Morgan. The present Congress, which was the first since the 1911 meeting in Paris, has served to show the fundamental part which cytology has played in the development of genetics during the last fifteen years. It is safe to say that no complicated genetic problem can now be solved without the aid of cytological research, and nearly all the most important recent developments of the subject have had a cytological basis. This mutual support of cytology and genetics is one of the most promising features for the future of genetics.

R. RUGGLES GATES.

Conference on Adult Education.

A CENTURY ago the Mechanics' Institutes were developing among artisans a new enthusiasm for study of the sciences instrumental in bringing about the industrial revolution. One of the marked defects in adult education nowadays is the neglect of science, though here and there a class in biology or some related subject may be found. It is the more cheering, therefore, to learn that the British Institute of Adult Education not only devoted its recent Conference, held at Balliol College, Oxford, on Sept. 23–26, to discussion of this situation, but also can report a singularly interesting and useful series of meetings. The Institute had previously sent to each of those present a copy of the latest report produced by the Adult Education Committee of the Board of Education—"Natural Science in Adult Education" (H.M. Stationery Office. 6*d*. net). The main points which emerged from the speeches and discussions were that the study of science should be an integral part of adult education: that students will be forthcoming if the subject is taught in a humanistic spirit; that fuller co-operation between universities, technical colleges, local education authorities, and voluntary organisations is essential; and above all, that the supply of teachers capable of treating science in a broad as well as a thorough fashion must be greatly increased.

Commenting on the Board of Education report, Sir Benjamin Gott maintained that a real interest in natural science exists among ordinary people and can easily be developed if the prospective student is made aware that he will be studying something about his home, his health, his work—and if teachers will simplify their language. But boys and girls must be caught when they leave school, and not allowed to drift till they reach the twenties. Moreover, it must be recognised that over-specialisation in teaching is an evil: teachers are needed who can show the interrelation of sciences. Mr. Norman Walker stressed the importance of the experimental method—of which he gave a fascinating example—and its power to win the lasting devotion of very humble and unlearned people, though perhaps he exaggerated his advocacy when he remarked that "those who have no capacity for teaching should leave the profession—or lecture!"

In a brilliant address, Prof. Desch showed how even technological studies could be treated humanistically, by presenting them in a historical and biographical setting and explaining their sociological significance. He suggested that the bridge between science and other liberal studies might be found in sociology, and declared that our need is not met by the addition of scientific and humanistic studies one to the other, but only by a synthesis of the two groups. Dr. Varley said that, for purposes of administration, education is cut up into too many divisions, and pointed to the importance of the fact that technical colleges are now recognised as centres of higher education without limitation of the curriculum. Classes in literary subjects are provided there and attended by many students for purely cultural purposes. The trouble is that young folk who finish their technical courses at the age of nineteen or twenty have been absorbed for some years in vocational preparation, have not developed an interest in humanistic studies, and see nothing further for them in our educational system. He therefore advocated the bringing of adult classes into the technical college and the provision there of a Common Room so that a social atmosphere might be created. Prof. Nunn, in the closing session of the Conference, urged that the science to be taught to adults must be the real thing, not merely the history of science (valuable as that aspect is), and that the natural result would be to make people scientifically minded. He observed a rhythmic process in which from wonder students pass to a sense of the practical value of science and then to a desire for systematised

thought. In his view the study of science would lead to a deeper and more widespread interest in philosophy. Sir John Sankey, in his presidential address, spoke of the way in which science, having made increased productivity possible, should also show the way to a proper distribution of our material resources and to the enrichment of our social and spiritual life. Above all, it should teach us a respect for fact and a humility in judgment which would transform our personal and social relationships.

University and Educational Intelligence.

BIRMINGHAM.—The new biology block of the University, which is to be formally opened by the Prime Minister on Oct. 20, is a very important addition to the building on the Edgbaston site. The new block forms part of the 'curtain' fronting on University Road, and extends from the chemistry block to the Harding Library, a distance of nearly 100 yards. It provides accommodation for the Departments of Botany, Zoology, and Biochemistry and Brewing.

The ground floor is allotted to zoology, and comprises large and well-lighted elementary, advanced, honours and research laboratories, museum, insect room, departmental library, rooms for the professor and staff, lecture room, dark room, stores and animal room. A large part of the first floor is occupied by the Biochemistry and Brewing Department, and contains a large general laboratory, analytical and research laboratories, professor's and lecturers' rooms and laboratories, an admirable microscope room, balance room, incubator room, lecture room, and a departmental library. The remainder of this floor is assigned to botany, and includes a large and well-lighted herbarium, staff rooms, and special rooms for mycology. The second floor constitutes the main part of the Botanical Department, with large elementary and advanced laboratories, a laboratory for vegetable physiology, museum, lecture room, and departmental library, professor's and lecturers' rooms and laboratories, balance room, dark room, and store-rooms.

Rising above the general roof level of the 'curtain' is a large theatre which will be shared by all these departments. The building is heated throughout with hot water circulated by electric pump from a steam heated calorifier. General ventilation is furnished by fans in addition to the usual window openings. The windows on the south side look on to the great court, and those on the north look across the University Road to the land (at present arable and pasture) which has been recently acquired as an extension of the University site.

Important additions have also been made to the Chancellor's Hall (the hall of residence for men students). This will now accommodate about 100 men, and the new wings are to be opened by Mr. Baldwin.

LONDON.—The following courses of free public lectures are announced: Six on "Vision," by R. J. Lythgoe, at University College, at 5 o'clock, on Oct. 10, 12, 17, 19, 24, and 26; three on "Hydrogen Ion Concentration," by Mrs. P. M. T. Kerridge, at University College, at 5 o'clock, on Oct. 14, 21, and 28; and four on "Heat Transfer in Reciprocating Engines, including Internal Combustion Engines," by Prof. A. Nägel of Dresden (in English), at the Institution of Civil Engineers, at 5.30 o'clock, on Oct. 11, 14, 18, and 21. The "Stevenson" free public lecture on "Eugenics in the Future" will be given by Major Leonard Darwin at Bedford College for Women on Oct. 25 at 5.15.

NEWCASTLE-ON-TYNE.—Mr. J. O. Cooper has been appointed lecturer in zoology at Armstrong College in succession to Dr. A. D. Peacock, who is going to University College, Dundee, as professor of zoology.

THE Huxley lecture in connexion with the Charing Cross Hospital Medical School will be delivered at the school on Thursday, Nov. 24, by Sir Archibald Garrod, who will take as his subject "Diathesis."

SIR ARTHUR KEITH is giving museum demonstrations at the Royal College of Surgeons, Lincoln's Inn Fields, on Oct. 14, 21, and 28, at 5 P.M., on recent researches into the reproduction and growth of bone, rheumatic and other changes in joints (Strangeways Collection), and congenital dislocation of the hip and other joints. The lectures are open to advanced students and medical practitioners.

"PROFESSIONAL Schools, Post-Graduation Courses, Specialist Studies in the Universities and University Colleges of Great Britain and Ireland, Session 1927–28." That is the title of a pamphlet recently issued by the Universities Bureau of the British Empire. "Of their [the universities] special fields of study," says the prefatory note, "the greater part is common ground, yet each of them has its special plots which it cultivates, in some cases with a view to the needs of the province which it serves, in others because it has been agreed, or arranged, that it shall undertake work for which there is but little demand." The purpose of the pamphlet is therefore to indicate the respects in which the institutions undertake work which is not common to them all. Particularly useful is the section describing the distribution of subjects of study. They are arranged in alphabetical order under the usual headings of arts, science, law, medicine, and technology, and ought to save considerable research in the individual university calendars. Thus, in the case of protozoology, London (Lister Institute), Edinburgh, and Glasgow are indicated; in the case of railway economics, the reader is referred to London and Manchester. In technological subjects such as photography, rubber, sugar, textiles, etc., the special provision made by certain technical institutions is described.

THE East London College Calendar for 1927–28 announces the opening of a new hall of residence for men students, the requisite funds for which were provided by the Drapers' Company (£6000) and H.M. Government (£5000). The College Council has instituted a fund for the encouragement of original investigations by the staff and students and offers three research studentships of £50 annually. It is one of the few university institutions in Great Britain which offer courses in aero-engineering. The Northampton Polytechnic Institute also has an aeronautical laboratory, and its Engineering Day College announcements for 1927–28 give particulars of third and fourth year courses in aeronautics, aero-engines, and aeronautical drawing and design. Another speciality of this Institute is its department of applied optics, in which work is conducted as part of a complete scheme of optical education in London, including advanced classes for graduates at the Imperial College of Science and Technology. The Battersea Polytechnic, which offers full day and evening classes in preparation for University of London degrees in science, engineering, and music, includes among the subjects of its specialist courses architecture, flour-milling, domestic science teaching, and health visiting. A special feature of its organisation for social life is its day students' representative council, which tends to the maintenance of some continuity in the activities of the various students' clubs and societies.

Calendar of Discovery and Invention.

October 2, 1901.—The first British submarine, launched at Barrow on Oct. 2, 1901, was 63 ft. long and 11 ft. 9 in. wide. From the sixteenth century onwards, numerous attempts were made to produce a boat to travel under water, but the early models failed because they relied on man-power for propulsion. The greatest impetus to submarine building came with the 'Holland' vessel, constructed about 1897 by J. P. Holland in America. It was propelled by a gasolene engine on the surface, and used electricity for under-water work. It also had planes, which could be inclined to assist in diving and rising.

October 3, 1846.—Gun-cotton was the invention of Prof. Schönbein, of Basel, and was made known in 1846. On Oct. 3 of that year, the Diet of Frankfurt voted a recompense of 100,000 florins to Schönbein and Dr. Boettger, as inventors of the explosive, provided the authorities of Mayence, after seeing it tried, pronounced it superior to gunpowder as an explosive. Improvements were made by Baron von Lenk, an Austrian officer, about 1852, and in 1862 details of the manufacture were communicated to the British Government.

October 4, 1877.—The Ingram web rotary machine, invented by Mr. (later Sir) W. J. Ingram, M.P., for printing illustrated newspapers, was first used to print the *Illustrated London News*, Oct. 4, 1877.

October 5, 1896.—At the Paris Academy of Sciences on this date, MM. Berthelot and Vieille read a paper describing researches which had been made with the view of seeing what precautions, if any, are necessary in the preparation, compression, and storage of acetylene for commercial purposes. Acetylene was discovered by Edmund Davy in 1836, and first systematically examined by Berthelot. Wöhler, in 1862, prepared it by the action of water on calcium carbide, but its use as an illuminant only became practicable in 1892 when Moissan and Willson showed that it was possible to make calcium carbide on the commercial scale in the electric furnace. Storage of the gas by dissolving it in liquids such as acetone was first suggested by Claude and Hess in 1896. Later Janet and Fouche found that acetylene dissolved in acetone absorbed by a suitable porous material could not be made to explode.

October 6, 1807.—Potassium was isolated by Davy by electrolysis of the fused hydroxide on Oct. 6, 1807. By a similar method Davy isolated metallic sodium. The method of manufacture on the commercial scale was given its first impulse by Deville in 1854, and in consequence of the improved processes it became possible to sell sodium at 10*s*. a pound in 1868. The modern Castner electrolytic process was introduced in 1890.

October 7, 1847.—Sir Isaac Holden and Samuel Cunliffe Lister were responsible for great developments in the machinery for wool-combing. On Oct. 7, 1847, a patent was taken out in their joint names for a new method of carding and combing and preparing genappe yarns, and when the machinery had been brought as near perfection as possible, factories were built which in time became the largest wool-combing concerns in the world. The business was concentrated chiefly at Bradford, to which city it brought prosperity.

October 8, 1884.—On this date, *Rodney*, an ironclad battleship of the *Benbow* class, was launched at Chatham. The modern ship of the same name was laid down on Dec. 28, 1922, with her sister ship *Nelson*. Her length is 702 ft., beam 106 ft., mean draught 30 ft., and normal displacement 35,000 tons.

W. C.

Societies and Academies.

PARIS.

Academy of Sciences, Sept. 5.—Paul **Marchal**: The natural strains of Trichogamma.—**Riquier**: The investigation of the numerical solutions of any system of integral algebraical equations with any number of unknowns.—Léon **Pomey**: The existence of non-linear, partial differential equations which are quasi-normal.—J. A. **Lappo-Danilevski**: The algorithmic solution of the problem of Riemann.—Jean **Chazy**: The advances and retardations of the times of passage of Mercury on the sun's disc.—Raoul **Ferrier**: The theory of the molecular field.—F. **Gonseth** and G. **Juvet**: The equations of electromagnetism and Schrodinger's equation in a five dimensional universe.—Lucien **Vallery**: The stability of the catalytic properties of palladiumised asbestos. Details of experiments bearing on the determination of hydrogen in the atmosphere by the action of asbestos coated with palladium. Traces of hydrogen arsenide and antimonide do not appear to poison the catalyst, neither does the catalytic power of the metal appear to be affected by repeated use.—Pierre **Thomas** and Mlle. Marie **Sibi**: Contribution to the study of the structure of jellies. Researches on the crystallisation of *l*-arabinosazone. By the addition of a suitable foreign substance it is possible to modify the crystallisation of arabinosazone in such a manner that a pseudo-gel is produced. It is probable that the presence of impurities is a necessary condition for the production of gels of this nature, containing long hair-like crystals.—A. **Demolon** and G. **Barbier**: The application of viscosimetry to the study of colloidal clay. Some information can be obtained of the modifications of the state in a suspension of colloidal clay, especially the influence of electrolytes, by measurements of viscosity. It should be noted, however, that these suspensions do not obey Poiseuille's law, and hence the results have only a relative value.—**Pereira de Sousa**: The basalts of Portugal. At Lisbon and in its neighbourhood there have been at least two series of volcanic eruptions showing differences in their chemical composition.—O. **Munerati** and A. **Milan**: The possibility of detecting the presence of forage beet-root and semi-sugar beet-root amongst sugar beet at the commencement of growth.—L. G. **Seurat**: The presence of *Mercierella enigmatica* in a river in Tunis.—G. **Mouriquand**, A. **Leulier**, and P. **Sédallian**: The *p*H and the alkaline reserve in C-avitaminosis.—Edouard **Chatton**: The meiotic gametogenesis of *Paradinium Poucheti*.

CAPE TOWN.

Royal Society of South Africa, July 20.—A. **Ogg**: The symmetry and crystalline structure of the crystals potassium, ammonium, rubidium, and cæsium sulphate. The crystals were shown to belong to the space group Q_h^{16} in Hilton's notation (V_h 16 Schönflies notation). The elements of symmetry are:

Reflection planes $(100)\frac{1}{4}$, $(100)\frac{3}{4}$.
Glide planes $(010)\frac{1}{4}$, $(010)\frac{3}{4}$. Translation $c/2$,
$(001)\frac{1}{4}$, $(001)\frac{3}{4}$. Translation $\frac{a+b}{2}$.

with the corresponding dyad screw axes and centres of symmetry. The unit contains 4 molecules and the molecule has a molecular plane of symmetry. The proposed structure shows the SO_4 group in tetrahedral form, the distance between S and O centres being 1·5 Å.U. The nearest approach of a K centre to an O centre is 2·7 Å.U., and slightly increased distances for other members of the series. The structure gives an explanation of the twinning of these crystals and the

formation of almost true hexagonal prisms.—P. R. v. d. R. **Copeman**: Studies in the growth of grapes (Part 3). The effect of environment upon the growth constants. The same type of equation is applicable to grapes grown in various localities, but the values of the constants in the different equations are directly affected by changes in environment. It seems that plants are affected by environment to a greater extent than animals. Changes due to environmental conditions are greater than those due to seasonal conditions. —J. F. V. **Phillips**: The behaviour of *Acacia Melanoxylon* R. Br. (Tasmanian blackwood) in the Knysna forests: an ecological study. 'Blackwood' acts detrimentally upon the regeneration of the more important forest species, and is a plant which might become commoner if forests containing its dormant seeds were to be distributed. Despite its value as a timber tree and its efficiency as a killer of weeds on open sites, it is not considered wise to plant the species in gaps in the main forests.

WASHINGTON.

National Academy of Sciences (*Proc.*, Vol. 13, No. 7, July).—George A. **Baitsell**: Additional evidence as to the intercellular formation of connective tissue. Inoculation of living tubercle bacilli into the testis of the guinea-pig causes degeneration of the seminiferous tubules. In the intertubular spaces an abundant exudate appears which is quickly transformed directly into fibrous tissue.—W. M. **Copenhaver**: Results of heteroplastic transplantations of the heart rudiment in Amblystoma embryos. The whole and also part of the heart rudiment was transplanted from a large species of salamander into a smaller species and vice versa. The development of the whole heart rudiment and also the pulse rate seemed to depend mainly on its origin. The nerve supply comes from the host species but the heart muscle retains its own specific rhythm.—A. E. **Hopkins**: Vision and retinal structure in mice. By means of an electrical punishment plate, mice in a box were trained to choose one of two outlets with coloured papers or illuminated with coloured lights. The animals seem generally to be colour-blind; their retinæ contain no structurally differentiated cones.—J. B. **Green** and R. A. **Loring**: Zeeman effect and structure in the spark spectra of tin (preliminary report).—Francis A. **Jenkins**: The structure of certain bands in the visible spectrum of boron monoxide.—Carl **Barus**: Pressure phenomena of the mucronate anode. Measurements with the interferometer U-gauge indicate that sharp surfaces of maximum and minimum potential surround an anode and cathode respectively at a distance of about half a millimetre from the electrodes.—J. W. **Beams** and Ernest O. **Lawrence**: On the lag of the Kerr effect. Light from a spark gap passes through a Nicol prism, two Kerr cells and another Nicol. The plates of the Kerr cells are connected with the spark gap by variable leads; if the leads are equal and there is no lag or equal lags in both Kerr cells, no light passes out of the system. With different liquids in the Kerr cells, or with the cells at different temperatures, the difference of the lengths of the leads divided by the velocity of light gives the relative time lag of the Kerr effect. The lag increases with viscosity and decreases with rising temperature, is constant for a given liquid for all wave-lengths, and is greater for polar molecules. The results accord with the theory that the Kerr effect is due to orientation of molecules with lag due to molecular, frictional, and inertial forces.—L. B. **Loeb** and L. **Du Sault**: Mobilities of ions in acetylene hydrogen mixtures. The mobilities of positive and negative ions in acetylene are probably the same; a higher mobility observed for the negative ion is due to the presence of electrons. In mixtures with hydrogen, there is no certain indication of clustering effects.—Francis B. **Silsbee**: Current distribution in supraconductors. The 'critical current' is that at which the magnetic field due to the current itself is equal to the critical magnetic field.—F. **Zwicky**: On the reflexion of electrons from crystal lattices. The whole effect is produced by a few lattice planes near the surface. A theoretical explanation is developed. —R. C. **Gibbs** and H. E. **White**: Displacement of certain multiplets and multiple levels for elements in the first long period. Using the irregular doublet law and the regular displacement law of multiplets, certain characteristic multiplets of Cr III and Mn III have been located.—R. A. **Millikan** and I. S. **Bowen**: Energy relationships and ionisation potentials of atoms of the first row of the periodic table in all stages of ionisation. The most useful graphical exposition is to plot atomic number against the square root of the frequencies of the energy levels.—F. E. **Wright**: Polarisation of light reflected from rough surfaces with special reference to light reflected by the moon. Measurements have been made with a polarisation photometer filled to the 12-in. refractor of the U.S. Naval Observatory of the amount of polarisation of light reflected by the moon. At new moon and full moon, practically none of the reflected light is polarised; the maximum amount occurs at the ends of the first and third quarters and does not exceed 15-25 per cent. Comparison with the effects given by terrestrial substances indicates that the surface of the moon turned towards us consists largely of pumiceous substances high in silica, powders of transparent substances, quartz porphyries and possibly trachytes and granites. There seem to be no dark rocks low in silica such as basalts, no masses of iron, no large ice masses or glassy obsidians, and no powders of basic rocks.—Willard J. **Fisher**, Esther L. **Wurl**, and Marjorie S. **Desmond**: The trails of two periodically flickering meteors. — Bernard **Lewis**: The unimolecular decomposition of azo-methane; the adequacy of activation by collision.—G. L. **Clark**, R. H. **Aborn**, E. W. **Brugmann**, and R. L. **Davidson**: On X-ray diffraction patterns from liquids and colloidal gels (see NATURE, July 23, p. 119).—Florence R. **Sabine** and Charles A. **Doan**: The effect of tubercle bacilli and the chemical fractions obtained from analysis on the cells of the connective tissues in rabbits. The action in rabbits of the proteid and phosphatid fractions from human tubercle bacilli was followed by neutral red. The proteid is toxic, is associated with damage to endothelium and has a pressor effect on clasmatocytes; the phosphatid causes local production of tubercular tissue.—D. H. **Campbell**: The embryology of *Equisetum debile* Roxb. The buds producing secondary shoots are endogenous, thus resembling the primitive fern, Ophioglossum. —F. E. **Denny**: The effect of small amounts of chemicals in increasing the life activities of plants. Citrus fruits which are commercially ripe are often partly green. If they are stored in a chamber containing a small concentration of ethylene (1 in 5000), they ripen off quickly. The metabolism of the fruit is hastened. Similar enhanced activity has been found in dormant buds and other plant tissues stimulated by various apparently unrelated chemicals. The effect may be of the nature of an incipient wound response.—Neil M. **Judd**: The architectural evolution of Pueblo Bonito. Pueblo Bonito sheltered two distinct peoples; the founders, who used a single type of masonry, and a second group, who evolved three types of masonry and created for Pueblo Bonito its prestige. The site was abandoned about a thousand years ago. Neither people had beasts of burden or metal tools.

Official Publications Received.

BRITISH.

Board of Education. Prospectus of the Royal College of Art, S. Kensington, London, Session 1927–1928. Pp. iv+28. (London: H.M. Stationery Office.) 3*d*. net.

The Royal Aeronautical Society. List of Members, September 1927. Pp. 40. (London.)

Palestine and the Empire Marketing Board. By Sir John Russell, and Dr. J. B. Orr, On Agriculture in Palestine. Pp. 24. (London: The Zionist Organisation.)

Memoirs of the Geological Survey of India. Palæontologia Indica. New Series, Vol. 14: A Sivapithecus Palate and other Primate Fossils from India. By Dr. Guy E. Pilgrim. Pp. iv+26+1 plate. (Calcutta: Government of India Central Publication Branch.) 1.8 rupees; 2*s*. 6*d*.

The Royal Technical College, Glasgow. Calendar for the One Hundred and Thirty-second Session, 1927–1928. Pp. 419+xxvii. (Glasgow.)

Lawes Agricultural Trust: Rothamsted Experimental Station, Harpenden. Report 1925–26 with the Supplement to the "Guide to the Experimental Plots" containing the Yields per Acre, etc. Pp. 156. (Harpenden.) 2*s*. 6*d*.

The Journal of the Institution of Electrical Engineers. Edited by P. F. Rowell. Vol. 65, No. 369, September. Pp. 829-912+xxxii. (London: E. and F. N. Spon, Ltd.) 10*s*. 6*d*.

Northampton Polytechnic Institute, St. John Street, London, E.C.1. Excerpts from Announcements for the Session 1927–1928. Evening Classes in Telegraphy and Telephony. Pp. 19. Evening Classes in Civil and Mechanical Engineering. Pp. 39. Evening Classes in Electrical Engineering. Pp. 40. Evening Classes in Applied Chemistry. Pp. 24. Evening Classes in Domestic and Allied Subjects. Pp. 13. Evening Classes in Furriery. Pp. 7. Day and Evening Classes in Horology. Pp. 11. Classes in Applied Optics. Pp. 32. The Engineering Day College. Pp. 38. The Membership and Social Activities. Pp. 7. (London.)

The British Institute of Philosophical Studies. Syllabus, Session 1927-28. Pp. 10. (London.)

Proceedings of the Royal Irish Academy. Vol. 37, Section A, Nos. 8, 9: Mathematical Investigation of the Thrust experienced by a Cylinder in a Current, the Motion being Periodic, by Prof. J. L. Synge; Time Measurement in an Isotropic Space Frame, by Prof. J. L. Synge. Pp. 95-115. 1*s*. Vol. 37, Section B, No. 22: A List of the Hymenoptera Aculeata (Sensu Lato) of Ireland. By Arthur Wilson Stelfox. Pp. 201-355. 5*s*. Vol. 37, Section B, No. 23: Marcelin Berthelot, 1827–1907; a Biographical Note. By Dr. W. R. Fearon. Pp. 356-360. 6*d*. Vol. 37, Section B, Nos. 24, 25: The Hydrolysis of n-Butyl Nitrate, by Dr. Hugh Ryan and Vincent J. R. Coyle: On 3-Nitrodiphenylene Oxide, by Dr. Hugh Ryan, Dr. John Keane and John C. M'Gahon. Pp. 361-372. 6*d*. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.)

Transactions of the Royal Geological Society of Cornwall. Vol. 15, Part 8: The One Hundred and Thirteenth Annual Report of the Council, with the Reports of the Treasurer and Curator, and Papers read to the Society. Pp. viii+539-598. (Penzance.) 4*s*.

Aeronautical Research Committee: Reports and Memoranda. No. 1089 (Ae. 268): Full Scale Test of Slot and Aileron Control on a Woodcock. By H. L. Stevens. (A.2.b. Stability-Full Scale Experiments, 49.—T. 2421.) Pp. 2+3 plates. 4*d*. net. No. 1093 (Ae. 272): A Non-Dimensional Form of the Stability Equations of an Aeroplane. By H. Glauert. (A.2.a. Stability Calculations and Model Experiments, 125.—T. 2431.) Pp. 10. 6*d*. net. (London: H.M. Stationery Office.)

Eighth Annual Report of the Ministry of Health, 1926–1927. (Cmd. 2938.) Pp. xxxii+284. (London: H.M. Stationery Office.) 5*s*. net.

Transactions of the Leicester Literary and Philosophical Society, together with the Council's Report and the Reports of the Sections, 1926–27. Vol. 28. Pp. 104. (Leicester.)

University of London, University College: Faculty of Medical Sciences. University Centre for Preliminary and Intermediate Medical Studies: Courses for Dental Students, Session 1927–1928. Pp. vi+227-262+10. (London.)

FOREIGN.

Proceedings of the United States National Museum. Vol. 71, Art. 20: Pycnodesma, a new Molluscan Genus from the Silurian of Alaska. By Edwin Kirk. (No. 2692.) Pp. 9+2 plates. (Washington, D.C.: Government Printing Office.)

League of Nations: Health Organisation. Principles and Methods of Antimalarial Measures in Europe: Second General Report of the Malaria Commission. (C.H./Malaria/73.) (Publications of the League of Nations. III. Health. 1927. III. 5.) Pp. 95. (Geneva: League of Nations; London: Constable and Co., Ltd.)

The Rockefeller Foundation: International Health Board. Thirteenth Annual Report, January 1, 1926–December 31, 1926. Pp. xiv+219. (New York City.)

Bulletin of the National Research Council. No. 61: Transactions of the American Geophysical Union, Eighth Annual Meeting, April 28 and 29, 1927, Washington, D.C. Pp. 297. (Washington, D.C.: National Academy of Science.) 3 dollars.

Memoirs of the University of California. Vol. 8: The Antisterility Vitamine—Fat Soluble E. By Herbert McLean Evans and George O. Burr; with the assistance of Theodore L. Althausen. Pp. v+176+12 plates. (Berkeley, Calif.: University of California Press; London: Cambridge University Press.) 5 dollars.

Publikationer fra det Danske Meteorologiske Institut. Communications magnétiques, No. 3: On the Heating of the Uppermost Atmosphere caused by Cathodic Rays from the Sun, by Helge-Petersen: No. 4: Valeurs instantanées des éléments magnétiques obseervés à l'Observatoire de Rude Skov à l'occasion de l'éclipse de soleil du 29 juin 1927; Rapport officiel; No. 5: Valeurs instantanées et synchroniques des éléments magnétiques enregistrées à l'Observatoire de Rude Skov pendant la tempête magnétique des 21 et 22 juillet 1927; Rapport officiel. Pp. 9+6+6. (København: G. E. C. Gad.)

R. Osservatorio Astrofisico di Catania. Annuario 1927. Pp. iii+39. (Catania.)

Annalen van de Sterrewacht te Leiden. Deel 15, Eerste Stuk: A Catalogue of the Positions and Proper Motions of 1533 Red Stars. By Dr. C. H. Hins. Pp. 119. (Leiden.)

Bergens Museums Aarbok, 1926. 2 Hefte, Naturvidenskabelig Række. Pp. 53+18+71+22. (Bergen: A/S John Griegs Boktrykkeri.)

Diary of Societies.

SATURDAY, OCTOBER 1.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS (South-Western District Meeting) (at Municipal Buildings, Plymouth), at 11 A.M.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS (North-Eastern District Meeting) (at Shildon, Durham), at 2.

MONDAY, OCTOBER 3.

SOCIETY OF ENGINEERS (at Geological Society), at 6.—R. C. Hall: The Lead Electric Accumulator in Practice.

SOCIETY OF CHEMICAL INDUSTRY (London Section) (at Royal Society of Arts), at 8.—W. J. A. Butterfield: The Gas Industry, Past, Present, and Future (Chairman's Address).

TUESDAY, OCTOBER 4.

INSTITUTE OF METALS (North-East Coast Local Section) (at Armstrong College, Newcastle-on-Tyne), at 7.30.—H. Dunford Smith: Chairman's Address.

SHEFFIELD METALLURGICAL ASSOCIATION (at 198 West Street, Sheffield), at 7.30.—A. J. Dale: Refractories in the Iron and Steel Industry.

INSTITUTION OF AUTOMOBILE ENGINEERS (at Royal Automobile Club), at 8.—Major E. G. Beaumont: The Influence of the Automobile User upon the Automobile Engineer (Presidential Address).

LIVERPOOL PSYCHOLOGICAL SOCIETY (at Liverpool University).—Dr. S. Barton Hall: Dreams and Dreaming (Inaugural Address).

WEDNESDAY, OCTOBER 5.

ENTOMOLOGICAL SOCIETY OF LONDON, at 8.

SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS (at Chemical Society), at 8.—A. Chaston Chapman: The Oil of *Centrophorus granulosus*.—Dr. W. R. Schoeller and E. C. Deering: Investigations into the Analytical Chemistry of Tantalum, Niobium, and their Mineral Associates. IX. The Separation of Titanium from Tantalum and Niobium.—C. L. Hinton and T. Macara: The Determination of Aldose Sugars by Means of Chloramine-T, with Special Reference to the Analysis of Milk Products.

INSTITUTION OF SANITARY ENGINEERS.

FRIDAY, OCTOBER 7.

JUNIOR INSTITUTION OF ENGINEERS (at 39 Victoria Street), at 7.30.—E. Edser: Lubrication (Lecture).

SOCIETY OF CHEMICAL INDUSTRY (Manchester Section).—C. J. T. Cronshaw: Chairman's Address.

DIESEL ENGINE USERS' ASSOCIATION (at Caxton Hall, Westminster).—E. L. Bass: Some Fuel Experiments in a Mechanical Injection Oil Engine.

SATURDAY, OCTOBER 8.

BIOCHEMICAL SOCIETY (at Cambridge).

PUBLIC LECTURES.

WEDNESDAY, OCTOBER 5.

KING'S COLLEGE, at 5.30.—Prof. D. MacCallum Blair: The Brothers Hunter—a Landmark in Anatomy.

LONDON SCHOOL OF ECONOMICS, at 6.—W. Sansom: Office Machinery: The Moon-Hopkins Machine.

THURSDAY, OCTOBER 6.

UNIVERSITY COLLEGE, at 2.30.—Sir Flinders Petrie: Egyptian Architecture.—At 5.15.—Dr. T. G. Pinches: Recent Discoveries in Babylonia.

KING'S COLLEGE, at 5.30.—S. Smith: Babylonian Architecture.

FRIDAY, OCTOBER 7.

KING'S COLLEGE, at 5.30.—Prof. S. Ahmad Khan: The Growth of Primary Education in India from 1920 to the Present Day.

UNIVERSITY COLLEGE, at 5.30.—Prof. J. M. Carré: Michelet et l'Angleterre (in French).

SATURDAY, OCTOBER 8.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Prof. J. R. Ainsworth Davis: The Romance of the Spice Islands.

CONGRESSES.

OCTOBER 3 TO 7.

IMPERIAL SOCIAL HYGIENE CONGRESS (at Caxton Hall, Westminster).

OCTOBER 4 TO 7.

CONGRESS OF ALIMENTARY AND METABOLIC DISEASES (at Vienna).

OCTOBER 8 TO 11.

INTERNATIONAL CONGRESS OF HYDROLOGY, CLIMATOLOGY, AND GEOLOGY (at Lyons).

OCTOBER 11 TO 15.

FRENCH CONGRESS OF MEDICINE (at Paris).