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The Imperial Conference at Ottawa

THE British nation has built great hopes on the Ottawa Conference. The politicians impress us with its importance, though no one seems to have any very clear idea as to what exactly is going to be achieved there. The British Empire is one in speech, in sentiment, and in ideals, but for a number of reasons, some of which are geographical, those principles so important to trade and industry which are implied in the term 'Imperial preference' have so far found only partial recognition. The grievous problems which afflict the world to-day cannot be solved by the application of the old remedies: they demand totally new methods of approach and the use of scientific fact and thought. When all is approaching chaos it is for Britain to initiate the recovery, a task which alone may well be too much for the nation, but with the aid of our far-flung Empire the possibilities of success will be infinitely greater.

Nationalism, which at one time was esteemed a virtue, has under existing conditions become very nearly a vice. World trade is gradually ceasing to be; the machinery of international credits and payments has all but come to a standstill. At a time when it is most necessary to increase world trade, and the free interchange of raw materials and manufactured articles is essential, each nation is enacting measures to restrict the purchases of its peoples to home-produced articles, being forced to do so by the pressure of increasing unemployment. Increasing taxation—now beyond the bearable maximum—is merely forcing greater personal economies and aggravating the disease. The sequence of oppressive factors can only be broken by the reopening of world trade by a unit which is big enough to reverse the march of events. One such unit—the British Empire—comprises a quarter of the population of the world, and a like proportion of its area. In the main the Dominions and the Colonies are still producers of raw materials; they still contain vast areas awaiting colonisation and development. The mother land is a manufacturing country importing the necessary raw materials. If we deal only, or mainly, within the Empire, trade may be set going again, British ships will cross the seas, and the railways at home and in the Empire will carry goods from the ports to the manufacturing and consuming centres. It is true that trade will be diverted from the foreigner and to his detriment, but the disadvantage will only be temporary if the wheels of commerce can be set to revolve again in so large a unit as the Empire, for

their momentum will soon begin to draw in other nations who are prepared to trade on a sterling basis.

Such is the idea, simple enough in plan but difficult enough in practice, owing to all that has gone before. The question must be approached at Ottawa with full consciousness of its seriousness. The old habit of bargaining must be suppressed and for it substituted the principle of what each can contribute. What is required is not a political or a trade conference, but something much more akin to a scientific meeting at which the ascertained facts are laid on the table and the delegates proceed to make the best possible use out of them. Those who go to Ottawa with executive powers must be instructed to achieve success and not to be content with upholding vested interests, wherein success is defined as the agreeing of measures beneficial to the British Empire and not to any section of it. Sacrifices there will be, but it should be possible to make them of a kind which in the shortest time will prove to be beneficial. The confusing theories of economics, the fetish of gold, must be banned from the discussion: there is opportunity and great need withal for new men, new methods, to lead the Empire back to prosperity. The omens are good: the facts have been collected, industry by industry, well ahead and transmitted by the British Government to the Dominions for study, and it should be possible after broad principles have been willingly and quickly agreed, to get down to details in each industry separately. The Government delegation is a political one, but it includes three special trade advisers, namely, Lord Weir representing the Federation of British Industries, Sir Gilbert Vyle for the Chambers of Commerce and Sir Alan Anderson for the Chambers of Shipping, together with two representatives of agriculture and two labour delegates, making seven industrial advisers in all.

It is open for any industry or trade to send its own representatives to Ottawa; in fact, the Federation of British Industries is advising industries to do so, and it is known that most of the industrial associations are sending expert delegates so that there will be someone at hand to reply without delay to technical questions. It should thus be possible to set up some simple and permanent machinery, both to lay the foundations and erect the superstructure of Empire trade.

The industrial delegates have been organised as a committee by the Federation of British Industries under the chairmanship of Mr. W. J. U. Woolcock, for the purpose of co-operating with the three official representatives of business at the Congress. It is realised by industry that it must do something more than merely wait for the outcome of the political conversations, and there is a widespread movement on foot for each industry to get together with its opposite number in each of the Dominions so as to establish such measure of agreement and effective co-operation as is possible. So far as Canada itself is concerned, wheat and timber are probably the most important items for discussion; on the other hand, British industries are able to supply most of what is now drawn from the United States.

If the whole matter be regarded from a more detached and scientific point of view than is customary for either industrialist or politician, it would seem that there is at least an opportunity for much wider questions to come under review during the discussions. Every thoughtful business man who is engaged in management knows that stabilisation, planning, orderly procedure, prudence, and the adjustment of production to demand, are necessary to keep the economic machine of his own business running steadily and efficiently. Such considerations seem to be forgotten when the unit becomes part of an industry or of the State itself. Here the individualistic creed has asserted itself, and the Darwinian principle of the survival of the fittest prevails. If we believe that there can be too much individualism in the present social organisation, that this creed is principally responsible for the distress in which western civilisation finds itself, then we have to discover how much planning is necessary, by whom it can be done, and what limitations must be imposed. If, however, we take the contrary view and advocate more individualism, smaller units, and abolition of Government interference in any form — in short, a return to the conditions of fifty years ago—then the responsibility of finding work for the nation under the entirely altered world conditions is a heavy one. At Ottawa the first doctrine will be in the ascendant, one of co-operation, of planning so as to ensure the resources of the Empire in men, machinery, and materials being used to the best purpose. The fact that the Conference is under Government auspices, and that definite legislative action to help trade is expected to be its outcome, involves also some measure of control over the planning and its consequences.

Everything depends on the good will of the participants to find a successful solution of the urgent problems, and on their courage to act constructively: without this, indeed, the hopes of the nation will prove to have been built on a foundation of shifting sands.

Higher Chemistry for Schools

(1) *Physical Chemistry.* By Arthur Sutcliffe. Pp. vii + 373. (London: John Murray, 1931.) 6*s.* net.

(2) *Inorganic and Theoretical Chemistry.* By Dr. F. Sherwood Taylor. Pp. xii + 818 + 19 plates. (London: William Heinemann, Ltd., 1931.) 12*s* 6*d.*

(3) *Inorganic Chemistry: a Textbook for Colleges and Schools.* By Dr. E. J. Holmyard. Pp. xii + 576 + 10 plates. (London: Edward Arnold and Co., 1931.) 6*s.* 6*d.*

(1) MR. SUTCLIFFE, formerly of the County School at Cambridge, and now headmaster of the City School at Lincoln, has written an attractive book on physical chemistry for sixth form students. The book appears to have been written in response to a real demand for a description, in the simplest possible terms, of the elements of this branch of chemistry; but it is not certain that a separate volume is the best way to meet this demand, in view of the wide extent of the overlap with 'general' inorganic chemistry—an overlap which happily does not occur when the elements of organic chemistry are segregated in a separate volume.

In the present instance, the first six chapters, representing nearly one-third of the text, are given up to a duplication of work that must in any event be included in a course of elementary general chemistry, and very little of it is beyond the scope of a book on inorganic chemistry for sixth form classes. It may be said at once, however, that the compilation of these chapters, and of those which deal with the more familiar branches of physical chemistry, has been very well done, since the author has taken trouble to establish contacts either with first-hand reports on the literature or with the literature itself, as in his citation from Wollaston's paper on "Super-acid and Sub-acid Salts".

The less familiar and more modern sections of physical chemistry are handled in a much less satisfactory way. It is, for example, unfair to a schoolboy to introduce him to a neon atom with eight planetary electrons in a common orbit; and the use of a cubic octet is even more dangerous, since it is in flat contradiction with the tetrahedral configuration of carbon atoms in the diamond, and is here illustrated by a diagram of the electronic structure of sodium chloride, which is definitely misleading. The 'modern form' of the periodic classification of the elements is also incorrect, since it ignores the Rydberg series, assigns only one element instead of two to the first group, and couples zirconium with cerium instead of with hafnium.

Similar difficulties have arisen from the rapid development of the theory of complete ionisation of strong electrolytes, which has upset so many traditional notions. There is no difficulty in describing the properties of electrolytes in simple terms, which are in strict accord with modern views; but this has not been done; and little good can result from including Arrhenius's theory in a course of school chemistry in the form in which it is here presented. Whilst, therefore, the less ambitious sections can be commended without reserve, the more modern sections are less satisfactory and tend to decrease rather than to increase the value of the book.

(2) Dr. F. S. Taylor's "Inorganic and Theoretical Chemistry" is a well-produced book and is published at a very reasonable price. Attention is at once attracted by the maps inside the covers, which illustrate the distribution of raw materials, and by the nineteen full-page plates. These include pictures of the laboratories of Faraday, of Lavoisier, and of an alchemist (from the picture by Pieter Breughel), followed by ten pictures of crystals, luxuriously displayed on separate pages, three micrographs of steel, and a few miscellaneous illustrations.

Two founts of type are used, since the sections in large type are intended to cover the course which the student would follow in the first year or eighteen months after matriculation, whilst the smaller type is intended to provide for scholarship candidates—or for second year students at the university, who are apparently expected to repeat the work done by scholars during a final year at school. This contingency is by no means impossible, in view of the way in which scholarship candidates are kept at school to the last possible moment, in order to secure a maximum of financial reward; but the claim that the book is suitable for a second year at the university is by no means clearly established, since it has obviously been written for schoolboys rather than for undergraduates.

The book opens with a single historical chapter of seventeen pages, which recalls the names of the great pioneers, and will make a pleasant impression on anyone who is already familiar with the history of chemistry; but since Scheele, Priestley, Black, and Cavendish are disposed of in about a dozen lines each, it is obvious that no serious attempt at historical detail is possible, and it is difficult to say what impression the narrative would make on a

reader who had no historical knowledge with which to supplement the bare outlines of the text.

The next seven chapters are devoted to general and theoretical chemistry and are in part of an 'advanced' character. Definitions form a conspicuous feature of these chapters, but are qualified in certain cases by footnotes, which indicate how the older definitions have been modified by later discoveries. The sequence in which information should be given provides at this stage a difficult problem, and one which is, perhaps, incapable of ideal solution. Thus, it must certainly be considered a policy of convenience rather than of logic to insert a section on types of chemical change, including equations, structural formulæ, and even a definition of tautomerism, ten pages in advance of the paragraph in which symbols are assigned to the elements; and, perhaps by a mere oversight, the kilogram-Calorie is used in place of the more familiar calorie before attention is directed on the following page to the significance of the capital C.

In the chapter on "Polar Compounds in Solution" the distinction between the complete ionisation of strong electrolytes and the reversible ionisation of weak electrolytes is mentioned tentatively; but it is not used in practice, since potassium chloride is cited as an example of incomplete ionisation in solution. This chapter is, however, free from the gross contradictions which usually result from incomplete assimilation of the more modern doctrines of electrolytic conduction.

The treatment of the periodic classification is unexpectedly ambitious, since the freshly matriculated student is introduced at once to the whole array of the elements, whilst the 'small-type' student is introduced also to elliptical orbits and to the second (but not to the third and fourth) of the quantum numbers which characterise the planetary electrons. The systematic chapters display a similar lack of compassion, since the immature student is carried remorselessly through the eight columns of Mendeléeff's table, and is expected to learn about the compounds of columbium, the oxides of vanadium, and the chlorides of tantalum before passing on to the discovery of oxygen and the preparation of chlorine. As is well known, this arrangement was tried forty years ago, when Mendeléeff's table still held the field as the best expression of the periodicity of the elements; but even then it was found to be unsuitable for general use, except for works of reference, like Mellor's "Comprehensive Treatise". Its reintroduction at the present day is a retrograde step, in view of the clear-cut classification which has replaced Mendeléeff's pioneer efforts. It is, for example, no longer necessary to discuss whether hydrogen should be placed in 'Group I., *A*' or in 'Group VII., *B*', since the octave or octet on which this classification was founded has not yet begun to operate; and the alternation of *A* and *B* groups is now an anachronism for which no obvious justification can be found.

The author's introduction of the electronic theory of valency at an early stage has made it possible to insert a considerable number of electronic structures in the subsequent chapters. By a curious oversight, the >SO group is generally represented with a non-polar double bond and the $>SO_2$ group with two non-polar double bonds, although a semi-polar structure is assigned to the $\rightarrow$NO group, on evidence that it is substantially the same in both cases. Non-polar bonds are also used invariably in formulating metallic salts, even when the ionic character of the linkage is most clearly established, apparently because the author still thinks in terms of Arrhenius, and not of Debye and Hückel.

In conclusion, it should be said that the reviewer's criticisms are to be accepted as a form of congratulation to the author, who has broken new ground in attempting to fertilise the rather arid soil of post-matriculation school chemistry by liberal applications of electronic doctrine, and has achieved a considerable measure of success in doing so.

(3) Dr. Holmyard also has introduced a table of electronic structures in the second edition of his "Inorganic Chemistry"; but the chapter on the structure of the atom still occupies only twenty pages and is expressed in the simplest possible terms. It therefore adds greatly to the vividness of the story, without making it too difficult to follow.

The other changes made in the new edition are generally very slight, and up to this point the original pagination is retained, although the total bulk of the book has been increased by fourteen pages. A new diagram of a reverberatory furnace has been added, and the old picture of Berzelius has been replaced by a new one, with a balance on the table by his side, but the 'rocker' form of cell for making electrolytic alkali is still retained. A paragraph and a question in reference to hydrogen ion concentration have been added to the chapter on the ionic theory, and a reference to the "Boulevard des Italiens" illuminates the reference to neon lamps.

The elements are discussed systematically in the order of Mendeléeff's table, but this is not a bad

arrangement to use at this relatively elementary stage, since the rare earths and most of the less common transition elements are not cited in the text, although they are mentioned in the titles of the chapters, and most of the others are relegated to the last eighty pages of the book. It is, however, incorrect to limit the term ' transition elements ' to the elements of Group VIII.; and a similar error, which has not been corrected in the new edition, is found in the Periodic Table itself, where the rare earth elements are placed in Group IV., as if they were quadrivalent, instead of being obstinately tervalent in nearly every case. The classification of hydrogen is also discussed on old-fashioned lines, with the help of a table, which implies that the alkali metals are exclusively monatomic, and with the object of deciding whether hydrogen may be classed " with the halogens " or even " as a halogen ", instead of frankly accepting the natural consequences of its unique atomic structure.

The author is, however, to be congratulated on having brought his book up to date with so little change in size or contents ; and he would certainly be ill-advised to make any more drastic changes, in view of the success which he has achieved by his original presentation of the subject.

Physics in the Séance Room

Les pouvoirs inconnus de l'esprit sur la matière. Par Dr. Eugène Osty et Marcel Osty. Pp. 153. (Paris : Félix Alcan, 1932.) 25 francs.

THE Institut Métapsychique in Paris is an organisation founded for the purpose of investigating psychic phenomena ; and in the brochure before us we have a summary of the records of a series of séances held at the Institute. The subject of the inquiry was the young Austrian medium, Mr. Rudi Schneider, concerning whom acute controversy has raged for nearly seven years. As in the case of his brother Willi, the most amazing phenomena are reported to occur in his presence, such as the movement of heavy objects without normal contact, the materialisation of human limbs exhibiting all the attributes of life, and many other similar manifestations. The means taken by the investigators to prevent fraud on the part of both mediums have usually been sufficient to exclude their active participation in the more striking phenomena observed ; and certain of the investigators have found some difficulty in explaining what they have witnessed in terms of the normal. Indeed, after the recent London sittings one well-known psycho-therapeutist published a letter declaring that he had experienced a strong feeling of some mysterious power working from within the cabinet ; a power for which he could imagine no " mechanical or pneumatic contrivance ".

In the present volume will be found further records which claim to demonstrate the mental control by the medium of some invisible substance at a distance from him, but apparently connected with some obscure form of externalised energy.

Before dealing with these claims, it may be significant to remark that Dr. Osty and his collaborator, although they print two pages of anecdotal matter dealing with the biography of the medium, fail to make any reference to certain well-known facts in his history which might throw light on the *modus operandi* of Mr. Schneider's more startling manifestations, and which might possibly help in elucidating the nature of that contrivance which appeared to puzzle certain of the London observers. Had these realised the true nature of the problem underlying the Schneider mediumship, they would scarcely have written as they did ; for the history of the Schneider brothers is one of the most extraordinary in the annals of psychical research.

So early as 1924, Profs. Meyer and Przibram, of Vienna, declared that Mr. Rudi Schneider had surreptitiously freed a hand during a sitting, and the statement led to much heated discussion. In 1925, Dr. E. J. Dingwall put forward the theory that confederacy was quite possibly responsible for many of the more striking phenomena produced by the Schneiders, a suggestion followed up in 1926 by Mr. Warren J. Vinton, who later published a statement that he had felt the confederate crouching behind the medium's chair. Again, in 1927, Mr. Malcolm Bird, at that time an official of the American Society for Psychical Research, asserted that he had noticed that the ' materialised ' hand was furnished with a normal sleeve ; and further, he printed a full account of how, in his opinion, the confederate was smuggled in and out of the séance room. In the same year, Dr. Walter Prince, of Boston, arranged for a series of sittings with Mr. Schneider in Stuttgart, at which the active assistance of a concealed confederate was excluded. Thereupon not one of the more startling phenomena occurred, and both Dr. Prince and his collaborator, Mr. R. Lambert, came to the conclusion that there was no good reason to suppose that any of the manifestations were genuine. In 1929, 1930, and again this year, Mr. Rudi Schneider was in London

under the auspices of the National Laboratory of Psychical Research. In the earlier series, startling phenomena were recorded. Human limbs and 'terminals' were observed; 'entities' touched and even brushed past the investigators, and at the end of one of the most extraordinary sittings a match-box, containing some stale matches and unclaimed by anybody, was found near the cabinet! Moreover, during the sittings this year similar wonders have been recorded, if we can judge from the interviews given to the Press by certain of the investigators.

Such in brief are a few of the facts in the life of Mr. Rudi Schneider which are omitted by the authors of this book, facts which have to be considered in any examination of the claims now put forward on his behalf, namely, that in the trance state he is able to externalise a 'force' or form of matter, which can be controlled at a distance by him, and the presence of which can be demonstrated by suitable physical apparatus.

The evidence adduced in support of this claim is derived from an ingenious use of a simple installation whereby infra-red rays are directed upon a certain area and thence to a sensitive cell. After amplification, the current finally passes to an electromagnet, which is so arranged that, if any diminution of the current occurs due to any interruption in the infra-red field, a photograph is taken by flashlight or a bell rung. In later sittings, registration of the phenomena was obtained on photographic paper, this recording time intervals, direction signals, interruptions in the infra-red, and chart of the hyperpnea of the medium in the trance state. Although certain objects were reported as being moved supernormally, this, unfortunately, did not occur when the apparatus was linked up with the cameras, although plates were exposed several times through apparent interruption in the infra-red which induced the flash. In these cases nothing was recorded on the plates which explained how the flash had been set off, the objects on the table under the infra-rays being in the same position. It seemed as if the field were being invaded by some invisible substance, and it was shown how this interruption was under the control of the medium, whose trance personality indicated to the observers when it was to take place, and permitted them to give the signals in order to demonstrate the purposive nature of the phenomena. Moreover, the respiration of the medium, which, in normal state, was of a frequency of about 12 to 14 per minute, increased in the trance state to rates ranging from about 180 to 400. This hyperpnea, so Dr. Osty surmises, is connected in some way with the externalisation of the 'force' which, he is convinced, is responsible for the results, and which in the photographic charts is seen to be connected with respiratory changes.

For reasons which seem scarcely adequate, Dr. Osty omits to give the names of many of his collaborators, and no independent testimony is brought forward to confirm his findings. Since it is clear that the experiments can scarcely be independently verified without the medium, it was all the more incumbent upon the observers to invite additional assistance from trained physicists of established reputation; for not only is it impossible to repeat the experiments in the absence of the subject, but it is equally impossible to criticise them from published accounts and rough drawings. If Dr. Osty's experiments with Mr. Rudi Schneider prove in truth that the human organism in certain states is capable of affecting matter at a distance, then they are obviously of great importance and deserve the most rigorous scientific scrutiny. The present method of psychical researchers is, however, seemingly to avoid that independent examination which is essential to the verification of their claims. It is so common as to be almost universal; and its significance can scarcely fail to be apprehended.

Methods of Birth-Control

The Practice of Contraception: an International Symposium and Survey. Edited by Margaret Sanger and Dr. Hannah M. Stone. From the Proceedings of the Seventh International Birth Control Conference, Zurich, Switzerland, September 1930. Pp. xviii + 316. (Baltimore, Md.: The Williams and Wilkins Co.; London: Baillière, Tindall and Cox, 1931.) 21*s.* net.

THE urgency of the need for the spread of the knowledge of the means of birth-control is forcing itself more and more on the attention of the public. In these days of sentimental philanthropy, it required courage on the part of Sir Arthur Keith to remind us that war was Nature's pruning knife and the only ultimate means of deciding that the superior race should survive rather than the inferior one. This is only another way of saying that the fundamental cause of war, which cannot be dispelled by argument at Geneva, is population pressure. No nation bursting with a rapidly increasing population will allow the question of whether or not it may expand into new territories to be settled for

it by a group of other nations. All those, therefore, who desire peace must strive for the spread of birth-control.

Increasing population does not necessarily mean an increase in the birth-rate: in European countries it means an increase in the *survival-rate*. How great that has been will be seen when we reflect that, exactly a hundred years ago, out of all the children born in London three-quarters died before they were five years old. The decrease in the death-rate of children has been due chiefly to the efforts of those imbued with humanitarian sentiment: these efforts, intended to add to human happiness, have actually added to human misery, since they have led to the production of large families by the parents least able financially or morally to support them. The only real charity which attacks the evil of poverty at its roots is teaching poor people the methods of birth-control, as Dr. Drysdale is reported as saying in the volume which is the subject of this review.

The book consists of a detailed report of the seventh international conference on birth-control, which was held at Zurich in 1930. The author, Mrs. Sanger, may be justly termed the heroine of the birth-control movement. Born in New York as a member of a large family of restricted means, she learnt early what the struggle to provide daily bread involved. She took up the profession of district nurse in a poor quarter of New York and her early impressions were deepened; she flamed with just indignation against the make-believe of professional religion and professional medicine. A poor woman among her patients was warned after a difficult birth that another pregnancy would be fatal. When she asked the doctor how to avoid it, he became jocular. The pregnancy duly arrived, and the woman died: on the night of her death, Mrs. Sanger tore off her nurse's uniform and decided to devote the rest of her life to the spread of birth-control knowledge. She braved the 'blue' laws of her native country and suffered imprisonment for her propaganda: but she aroused such a wave of popular enthusiasm that she was released, and never again imprisoned. She visited Europe repeatedly, and travelled to India, China, and Japan; and she was largely instrumental in starting birth-control in several countries besides her own. In this volume, however, which she has edited, her personality does not appear; she has produced a marvellous compilation of expert opinions on all methods of preventing unwanted births, from simple vaginal douches to abortion under skilled surgical supervision, as it is practised in Soviet Russia. But Mrs. Sanger herself is opposed to abortion; the chapter dealing with it is only included for the sake of completeness.

It is somewhat disappointing to learn that no single method is to be relied on absolutely; all show a certain percentage of failures; but where the evil is so glaring, a percentage of successes of seventy to eighty per cent—such as is attained by the use of the Dutch cap in Holland—is a great achievement. What is patent is that the ideal method would be the subcutaneous injection of some fluid which would either prevent the dehiscence of the egg or its capacity to unite with the spermatozoon. This method has not yet been discovered, although it appears to hover on the horizon, for we learn from Dr. Baker of Oxford that if we were mice and not men, it would be possible to inject a hormone which would stop the egg from ripening. But this is not possible in the case of the primates and man, owing to the different sequence of events within the ovary. It is clear, therefore, that in solving this question success will be obtained only when we have attained a far more complete knowledge of the sexual cycle in man than we at present possess: and therefore the greatest aid to the cause of birth-control would be afforded by a continuance of properly directed physiological research. E. W. MACBRIDE.

Monkey Behaviour and Associations

The Social Life of Monkeys and Apes. By S. Zuckerman. (International Library of Psychology, Philosophy and Scientific Method.) Pp. xii + 357 + 24 plates. (London: Kegan Paul and Co., Ltd., 1932.) 15*s*. net.

FEW lines of inquiry may be expected to contribute more to forging a link between the biological and social sciences than investigations upon the social behaviour of man's nearest allies. That so little experimental research upon the social behaviour of monkeys has been carried out in the country of Darwin's birth is perhaps surprising and certainly regrettable. In his new book, Dr. Zuckerman, who has conducted a series of comparative researches into the characteristics of the reproductive cycle of primates during the past few years, examines the social life of monkeys and apes with the view of elucidating the relation of their habits of association to the peculiarities of their sexual physiology.

The first half of the book is devoted to the thesis that association in the primates—other than man—is primarily conditioned by two circumstances that coexist in primates alone. One is that the cyclical

activity of the sexual organs is not seasonally interrupted by a period of anœstrous. The other is that the female receives the male at any stage in the ovarian cycle. From this point of view, Dr. Zuckerman classifies mammals in three groups. One includes the majority of orders other than the primates. In these there is a period of anœstrous interrupting a succession of periods of heat for a considerable portion of the year. Such mammals form temporary herds for the mating season, and in a few isolated cases associations determined by the nature of their available food supply. A second group, including *inter alia* the field mouse and the reed buck, breed throughout the year, but mate only at such times as the female is on heat. The species belonging to this group do not form associations. Primate associations are not conditioned by the exigencies of food supply. According to Dr. Zuckerman, individuals are kept together by the absence of any discontinuity in their sexual relations. The development of this view is supplemented by an extremely lucid presentation of comparative studies upon the œstrous cycle in different orders of mammals. The existing literature on this subject is not easy to follow, and a clear exposition of the field covered by the most recent advances is difficult to find elsewhere.

The second half of the book is devoted principally to a detailed study of the way in which the sexual responses of primates influence the interrelationship of different individuals within the herd. In this section, Dr. Zuckerman maintains a conservative attitude to the tendency to emphasise the similarity between the social behaviour of apes and monkeys and the social behaviour of human beings. His point of view may be epitomised in the statement that monkey society rests upon sexuality, whereas human society owes its predominant features to the fact that man is a tool-bearing animal, capitalising the resources of his tool-bearing activities through the machinery of speech. Adopting this attitude, Dr. Zuckerman devotes little space to the consideration of psychological studies of the kind which Kohler and his disciples have undertaken. He rightly criticises the *Gestalt* school for constructing a new philosophy on the basis of observation of animals the history of which has not been rigidly controlled from birth.

Dr. Zuckerman is one of the very few trained physiologists who have made extensive studies of monkeys in the field as well as in the laboratory. In the latter portion of his book considerable space is devoted to an eminently readable account of his field observations on baboons in South Africa and his close association with the history of 'Monkey Hill' at the London Zoological Society's gardens. An important part of his task is to reconcile the thesis of the earlier chapters with the phenomenon of 'dominance'. In the baboon society a number of 'overlords' exercise special sexual privileges at the expense of their weaker brethren, the relationship of which to the females is one of 'clandestine promiscuity'. Grooming the fur and homosexuality play an important rôle in consolidating the family nucleus. The actual care of the young is of secondary importance in maintaining the integrity of the group. Monkeys apparently do not distinguish between dead and living individuals as objects for nursing or grooming. The author's theory of the sexual basis of monkey society is thus opposed to the view that altruistic familial responses underlie the social behaviour of the lower primates.

Short Reviews

The Archæology of Somerset. By D. P. Dobson. (The County Archæologies.) Pp. xv + 272 + 8 plates. (London: Methuen and Co., Ltd., 1931.) 10*s.* 6*d.* net.

The Archæology of Surrey. By D. C. Whimster. (The County Archæologies.) Pp. xiv + 254 + 12 plates. (London: Methuen and Co., Ltd., 1931.) 10*s.* 6*d.* net.

(1) MRS. DOBSON'S volume on Somerset in the "County Archæologies" is the most widely general in interest that has yet been published in the series. Not only are all phases of prehistoric culture, excepting the Eolithic, represented in the finds within the county borders, but it also has, in the caves of the Mendips and the lake villages of Glastonbury and Meare, sites of quite exceptional importance for their respective periods. In Roman times the attraction of the lead mines of the Mendips made known the advantages of the country, which would appear to have been appreciated to the full. The wealth of the district in Roman remains is indicated by the number of coins which have been found, here estimated with moderation at 50,000, and by Roman villas, of which that at Keynsham is the largest yet found in Britain. The relative poverty of the area in Saxon remains is in some degree counterbalanced by the historic interest of the one important site, Glastonbury, the only site in Britain on which Christianity claims an unbroken history since its earliest introduction. Somerset's geographical features and position, of which the influence is pointedly indicated by the distribution maps of finds relating to each period within the scope of the book, give the county a special significance for the student of prehistoric culture, to which Mrs. Dobson has done full justice.

(2) Mr. Whimster's "Surrey" is also a volume of exceptional interest, This is due not so much to the number and character of the finds—indeed, Surrey would come off comparatively poorly in

certain periods if it were not for the fact that the County of London, south of the Thames, has been included in this volume—but owing to the treatment of the subject matter. The geographical and geological conditions of the county are such that their relation to culture periods is capable of being treated with exceptional lucidity. Mr. Whimster has not failed to make the fullest use of the opportunity. His diagram, not entirely original, it is true, is a remarkably ingenious piece of graphic statement, and is invaluable as a bird's-eye view of the prehistory of the county. The citation of material from outside the county boundary for purposes of comparison is fuller than it has been in the case of previous volumes ; but the nature of the material, especially in the later periods, makes this almost inevitable.

The Coloured and Colour Breeding. By T. W. Hogarth. Pp. 54 + 12 plates. (Galashiels : A. Walker and Son, Ltd., 1932.) 6*s.* 6*d.*

IF we look through genetical literature, we find very little data concerning colour inheritance in dogs. The author of this little book has outlined the history of the coloured bull terrier and gathered together nearly a hundred authentic pedigrees of bull terriers carrying white and coloured blood. 'Coloured' in bull terriers may mean brindle, black, fawn, or red, and these colours with white. The pedigrees indicate the following points : (*a*) the white bull terrier is not a true white, but a coloured animal inheriting a factor which inhibits the outward expression of the colour except in the nose and eyes ; (*b*) the brindle pattern seems to be of the synthetic type, and is not a true breeding factor, though one or two individuals may exist carrying the definite brindling factor which seems to be established in certain hounds ; (*c*) brindles bred to brindles may produce brindles, blacks, fawns, reds, or whites ; (*d*) the white animals arising from coloured parents may be expected to breed true for white. This latter finding should go far to dispel the prejudices against breeding from such white dogs. Actually it is a means by which the frequent character of deafness in white bull terriers may become dissipated.

Mr. Hogarth has had the collaboration in two chapters of Messrs. Graham and Ritchie of the Royal (Dick) Veterinary College, and Dr. Fraser Darling of the Imperial Bureau of Animal Genetics. If Mr. Hogarth's example were followed for other breeds of dogs, we should hope to accumulate much valuable data for genetical interpretation.

Les étoiles dans leurs courses. Par Sir James Jeans. Traduit de l'anglais par A. Sallin. Pp. xii + 205 + 47 planches. (Paris : Hermann et Cie, 1932.) 35 francs.

THIS French translation of a well-known English book is well and accurately done. The translator makes no comment on his work beyond a mention of the fact that he has retained British measures of length, temperature, etc., and added their French equivalents ; and he gives at the beginning a key to the determination of one from the other. This is excellent, but readers to whom the statement of a figure conveys some notion of the order of accuracy implied by it will regret to find, for example, on p. 22, that 53,000 miles is equivalent to 85,287 kilometres. The translator, quite excusably, appears to have failed to recognise the source of the title, which he has translated literally. He has, however, taken the trouble to correct some of the lapses from accuracy in the English book—for example, the date of publication of Copernicus's "De Revolutionibus", at the end of Chapter 1. The printing and paper are excellent, and so are some of the numerous illustrations which form one of the most important features of the book, but others are very badly reproduced. Some are too dark—for example, Plates xvii., xx., xxx.—while others, such as Plates xxvii. and xxviii., through the opposite fault, are mere travesties of their English prototypes. No acknowledgments of their origin are made. With the exception of the unsatisfactory illustrations, the book can be recommended as worthy of its original.

Impassioned Clay. By Llewellyn Powys. Pp. v + 120. (London, New York and Toronto : Longmans, Green and Co., Ltd., 1931.) 6*s.* net.

THE unknown author of "Ecclesiastes" wrote to deter others from the vanity of excessive indulgence in Oriental pleasures ; all was vanity except the fear of God. Omar Khayyám, a man of simple life and desires, expounded the doctrine of ephemeral joy : "Eat, drink and be merry, for to-morrow we die". Each, it will be observed, advocated a course of life inconsistent with his individual practice. To-day we meet Mr. Powys, a self-confessed Epicurean, more consistent than the above, but less pleasant and more dangerous. Happiness is the keynote of Mr. Powys' cry—happiness at all costs, be it sensuous or sensual. He is consistent in his plea for poetry, and perhaps the most dangerous quality in this book is its rhythmic flow. All religions are counterfeits, he tells us ; Christianity has ever been opposed to natural happiness. All ethical considerations are man made ; he even goes so far as to mitigate the horror of a drunkard's grave. The book is an open appeal to youth, and it is to be hoped that youth will pass it by. Mr. Powys quotes Hobbes, and a part of the quotation may, as a prayer, end this notice : "Know then that all this is but an empty store of words".

P. L. M.

Grundriss der allgemeinen Zoologie. Von Prof. Dr. Alfred Kühn. Vierte, verbesserte und vermehrte Auflage. Pp. viii + 264. (Leipzig : Georg Thieme, 1931.) 13·20 gold marks.

THE "Grundriss" of Prof. Kühn, now in its fourth edition, has become a standard textbook of zoology for medical students. It is characteristic of the modern trend in morphology that considerable space is devoted to animal parasites and to heredity. This book can be recommended to English students of zoology as a rapid means of acquiring familiarity with the German language, for the copious illustrations are simple and clearly labelled.

The Problem of Dental Caries

THE prevalence of dental caries in civilised communities has always excited discussion as to its cause: the frequent consumption of sticky sweets has been generally implicated, and their avoidance, together with the eating of fibrous fruits and a proper use of the toothbrush, recommended as a means of prevention. The experimental work of Mrs. Mellanby on the relationship between diet and hypoplasia of the teeth led to the conclusion that vitamin D played an important part in tooth development, and further research indicated that there was a relationship between imperfect structure and caries in human beings.[1] The previous emphasis upon the deleterious action of fermenting carbohydrate in the mouth on the enamel of the teeth has therefore tended to shift to an emphasis upon the deleterious action of the food after absorption on the structure of the teeth: in brief, vitamin D is the cure for caries, rather than the toothbrush.

Interest in the problem has recently been aroused afresh by the publication of the report of Surgeon Lieut.-Commander (D) W. E. A. Sampson upon the dental condition of the inhabitants of Tristan da Cunha,[2] as shown by subsequent correspondence in the columns of the *Times*. It may be of value, therefore, to consider what light the dental condition of different peoples throws upon the etiology of caries, to examine how far this evidence agrees with the results obtained in animal and human experiments, and finally to analyse briefly the possible factors involved.

Dental caries does occur in Tristan da Cunha, but the incidence is so low that it would be difficult to find any other community so perfect dentally, and this in spite of the fact that the inhabitants never clean their teeth. Pyorrhœa was only found in two people, who had not been born on the island. The diet consists of fish, potatoes, milk, and eggs; vegetables are occasionally eaten. Until recently, sugar and flour formed no part of the diet, but visiting ships now regularly leave large supplies, which, however, have not, so far, increased the incidence of caries. It may be mentioned also that all the infants are breast-fed.

The dental condition of other communities is also of interest. E. Mellanby quotes the investigation of Dr. William Hall carried out in Leeds in 1902 upon school children and the Carnegie Report on the inhabitants of the island of Lewis in the Hebrides.[3] In the first case, the teeth of Jewish children were much better than those of Gentile children of the same social standing. Hall considered that differences in dieting were responsible for this; the Jewish children ate large amounts of fish, milk, eggs, and fruit and vegetables; oil was freely used for cooking. In the second case, the children lived under bad environmental conditions and were never taken out until they could walk: but they were breast-fed and later lived on fish, especially fish liver, oatmeal, and eggs: rickets was unknown, and the adults had beautiful teeth.

Another example of the effect of diet on a people's teeth has been described in these columns[4] in an account of the dietary conditions of two African tribes. The incidence of dental defects in Kikuyu children, living on cereals, roots, and fruits, is 30-40 per cent; in Masai children, eating chiefly milk, meat, and blood, 7-8 per cent. The latter have a high intake of protein, fat, and calcium; the former a high intake of carbohydrate and a low one of calcium.

There is also evidence that the teeth of certain races remain in good condition only so long as a particular diet is consumed: thus, Eskimos living on walrus, seal, and fish have good teeth, but dental decay appears so soon as this diet is replaced by the one customary among civilised peoples.[5] Again, in Asia, caries is more prevalent near the centres of civilisation, and appears to accompany the increased consumption of refined carbohydrate.[6]

The general conclusion from these observations is that diet is the important factor in the etiology of caries, and that climate, hereditary influences, and oral hygiene can play only a subsidiary part. Confirmation is obtained from experiments carried out under more strictly controlled conditions. Thus, J. D. Boyd, C. L. Drain, and M. V. Nelson,[7] having observed that caries was arrested in diabetic children who were strictly dieted, tested the effect of a similar diet on normal children and obtained the same result. The diet consisted of milk, cream, butter, eggs, meat, cod-liver oil, vegetables, and fruit. Oral hygiene played no part in the arrest of caries, but unless continuous supervision over the diet was exercised it began to spread again. Bunting and his colleagues[8] similarly found the incidence of caries much less in children given a good diet containing milk, green vegetables, and fruit, with a minimum of white flour and sugar, than in those who used a mouth wash but were not submitted to dietary control: in the former, active caries was present in about 6 per cent and 75-80 per cent had none; in the latter, caries was active in 50 per cent and only 18-20 per cent had none.

E. Sprawson has recently published evidence[9] that the provision of a daily allowance of raw milk —that is, milk which has never been heated above body temperature—during the period of development of the teeth, prevents the subsequent onset of caries in these teeth. The children were in institutions, and the diet contained oatmeal porridge and white flour. Many were subnormal on admission; the majority lived so far as possible in the open air.

Mrs. Mellanby has recently summarised her work on the prevention and arrest of caries by the administration of vitamin D, and published a further series of cases.[10] The children were in an institution, and the diet was not only rich in vitamin D and calcium, but also free from cereals. Potatoes and other vegetables, milk, fat, meat, and eggs replaced bread, oatmeal, rice, and tapioca, and vitamin D was given in cod-liver oil or as irradiated ergosterol,

and was also present in the egg yolk, butter, and milk. The experiment lasted 6 months and there were 22 children in the group. The average number of teeth per child showing initiation or spread of caries was 0·37, the average number per child showing hardening of caries 4·7, and the average extent of increase of caries was 0·32. (The figures for the previous investigations, in which the diets contained cereals but were supplemented with irradiated ergosterol or cod-liver oil, were respectively 1·0, 3·9, and 1·1, and 1·4, 3·7, and 1·7.) The teeth were hypoplastic and much active caries was present at the beginning of the investigation. The diet, however, prevented almost completely the development of any new points of caries.

There is general agreement that diet is an important factor in the prevention of caries, but controversy has arisen as to its mode of action. Caries is primarily due to the acid formed in the mouth by the fermentation of stagnant carbohydrate attacking the enamel: this implies the presence of an organism (*B. acidophilus*) and stagnant carbohydrate. Caries could then be prevented by ensuring the absence of the organism and carbohydrate by proper dental hygiene, and the presence of well-formed jaws and well-arranged teeth by proper feeding and adequate masticatory exercise during the developmental period. The arrangement of the cusps of the teeth may be such as to favour or prevent the lodgment of food particles; here a hereditary factor may come into play. Immunity to caries must be distinguished from its prevention or arrest: a dirty mouth may be immune because the acid-forming organism cannot establish itself, probably owing to the bactericidal powers of the saliva.

The fact that caries can be arrested, with hardening of the exposed area, indicates that the calcification of the teeth can be influenced after eruption, by substances circulating in the blood stream, just as their calcification can be affected before eruption. These substances are derived ultimately from the food, which must therefore also influence the teeth after digestion and absorption in the intestine, and the evidence suggests that this is a more important factor than its local effect, especially since it has been shown that the structure of the teeth is closely related to the amount of caries present.

The dietary factor is, however, complex, and it appears advisable to stress the necessity of considering the proper balancing of the different constituents, as well as the necessity of examining the relationship of this factor to those of climate and race, in any discussion of the problem. It is always essential in the investigation of the influence of any one factor to keep all other factors as constant as possible, but this may lead to undue importance being attributed to this one factor, and where other factors cannot be completely controlled, as in so many dietary investigations, to neglect of the possible influence of these other factors.

The factors in diet may be briefly summarised: vitamin D, cereals, salts, especially calcium and phosphorus, the total acidity or basicity of the ash of the diet, and its fibrous or pappy nature: these must be related to the rate of growth, the previous history of both the mother and her infant, including the duration of breast-feeding, the environmental conditions, such as exposure to sunshine and the clothes worn, and finally to the possible influences of race and heredity. A few of these may be considered in more detail. There is no doubt that cereals favour the development of caries, and that vitamin D prevents and arrests it. Some recent investigations indicating that vitamin D is not a main factor are not satisfactory evidence against the controlled experiments of Mrs. Mellanby, but rather show that it is difficult to draw conclusions when many factors are uncontrolled. H. H. Mackay and S. F. Rose compared the teeth of children who had suffered from rickets with those of a control group, of similar age and social class, who had not, and found that hypoplasia of the permanent teeth was almost confined to the rachitic group, but that the amount of caries was only slightly greater in this group than among the controls.[11] It is probable, however, that the rachitic group received a better diet for some time than the non-rachitic, when the rickets was diagnosed, so that afterwards these children were no worse off than the non-rachitic group. Similar results were obtained by A. F. Hess and H. Abramson in an examination of the dental condition of children who had suffered from rickets as compared with that of those who had not.[12] It may also be pointed out that, without strict dietary control, it is not possible to say that a diet which appears the same is actually the same, since it is well known, for example, that the vitamin D content of milk and eggs varies considerably according to the diet and environmental conditions of the cow and fowl.

In considering the balance of the dietary constituents, it is necessary to bear in mind that calcium salts are soluble in acid and that calcium may be withdrawn from the teeth, as from the bones, to neutralise excess of acid in the body, as well as to supply the fœtus and infant, if the intake in the food is insufficient.[13]

To sum up, immunity to caries depends on the teeth being properly calcified and the mouth being immune to the growth of the acid-forming bacillus. Prevention of caries in a susceptible mouth depends on oral hygiene and especially on the regulation of the diet, with the view of increasing the resistance of the teeth. Cereals should be avoided, and a plentiful supply of vitamin D (or vitamins A and D) provided; and the diet should contain an abundance of milk, eggs, potatoes, fish, meat, green vegetables, and fruits.

[1] NATURE, vol. 123, p. 210; 1929.
[2] *B.M.J.*, vol. 1, p. 538; 1932.
[3] *B.M.J.*, vol. 1, Suppl., p. 85; 1931.
[4] NATURE, vol. 128, p. 326; 1931.
[5] M. S. Goldstein and H. B. Collins: *Science Service*, March 17, 1932.
[6] D. H. C. Given: *B.M.J.*, vol. 1, p. 589; 1932.
[7] *Am. J. Dis. Child.*, vol. 38, p. 721; 1929.
[8] R. W. Bunting, F. P. Hadley, P. Jay, and D. G. Hard: *ibid.*, vol. 40, p. 536; 1930.
[9] *Proc. Roy. Soc. Med.*, vol. 25, p. 649; 1932.
[10] M. Mellanby and C. L. Pattison, *B.M.J.*, vol. 1, p. 507; 1932.
[11] *Lancet*, vol. 2, p. 1230; 1931.
[12] *Dental Cosmos*, vol. 73, p. 849; 1931.
[13] F. W. Broderick: *B.M.J.*, vol. 2, p. 725; 1931: vol. 1, p. 588; 1932.

Recent Advances in the Study of Enzymes

PROF. R. WILLSTÄTTER, of Munich, and his former pupil, Prof. Waldschmidt-Leitz, of Prague, were the chief speakers at a discussion on recent advances in the study of enzymes, held by the Royal Society on June 16. Most of the contributions were primarily descriptions of particular pieces of work, so that the discussion had no formal unity. It was therefore all the more striking that the proceedings should compose so readily into a set of variations on a group of related themes, indicating quite clearly what are the main problems in current enzyme research. Lack of time cut short the beginnings of an interesting general discussion.

There was general support for Prof. Willstätter's view that an enzyme consists of an active group of definite chemical constitution, with a colloidal carrier. The question of the nature of the active group is closely bound up with the study of enzyme specificity. Prof. Waldschmidt-Leitz described the specificity shown among the peptidases. These enzymes, which have been separated by processes of preferential adsorption and elution from the complex mixtures of proteolytic enzymes found in Nature, are without action on native proteins, but readily hydrolyse polypeptides. They fall into three main groups. The substrate must always have a peptide linkage, but amino-polypeptidases will hydrolyse only those peptides which have a free amino-group, and carboxy-polypeptidases those with a carboxyl group, while di-peptidases will usually attack only dipeptides. The substrate is attached to the enzyme at two points—at the peptide link and at one other group, which varies with the nature of the polypeptidase. The enzyme therefore possesses two combining groups, with chemical affinities for the two groups by which the substrate is held, and so spaced and oriented that they fit in with the structure of the type of polypeptide hydrolysed. This implies rigid chemical structure at the active group of the enzyme. Little is known of the chemical nature of the substrate-holding groups in the enzyme, but similarity between the *p*H-activity curves of peptidases and the effect of hydrogen ion concentration on the combination of sugars and peptides suggests that one of the groups may be chemically related to the sugars.

Many other enzymes appear to hold their substrates at two different points. Dr. J. H. Quastel described work he has done in collaboration with Mr. Wheatley on the inhibition of enzymes by a wide range of dyes. The chemical nature of the dye greatly affects the extent of the inhibition, but in general dehydrogenases and urease are sensitive to basic dyes only, while fumarase is also poisoned by acidic dyes. Since the enzyme is protected by the substrate and related compounds from the inhibiting effects of the dyestuffs, it is probable that the toxic action is exerted at the substrate-binding groups. The active groups of dehydrogenases and of urease thus seem to be acidic in nature, while fumarase attaches its substrate at both an acidic and a basic group. Other examples, based on kinetic evidence, were given by Prof. J. B. S. Haldane. Animal lipases were found by Murray, and bacterial dehydrogenases by Woolf, to be inhibited by excess of substrate. The data fit in quantitatively with the hypothesis that in low concentrations the substrate bridges two groups in the enzyme, but in high concentrations inactive complexes tend to be formed, in which each of the enzyme combining groups is linked with a separate molecule of substrate.

Prof. Haldane showed, by a series of examples, that there is a marked correlation between specificity in an enzyme and rigidity of structure in its substrates. Specificity is confined to groups in the substrate molecule which are rigid, such as sugar rings. It never appears to extend to groups which are flexible owing to the possibility of rotation, such as saturated chains. Thus absolute specificity is found among the oxidases, but only a wide group specificity among the enzymes hydrolysing peptides or esters. It seems to follow that specificity depends on the fitting together of rigid structures in enzyme and substrate. The rigidity possessed by systems of condensed rings at once suggests this type of structure for the active group of an enzyme. For three enzymes at least, there is good evidence that the activity is associated with iron combined with condensed pyrrol rings to form a hæmatin compound.

This important recent work on the hæmatin nature of some oxidising enzymes was referred to also by Prof. Willstätter. It has been shown by Hellström and Zeile that highly purified catalase preparations always give the same hæmatin-like spectrum, in an intensity which remains proportional to the catalytic activity through different methods of purification and of inhibition of the enzyme. Similar results have been obtained by Kuhn and his co-workers with the enzyme peroxidase. There was no challenge during the discussion to the conclusion that these two enzymes are hæmatin compounds, but doubts were expressed on the validity of the evidence in the case of a third enzyme, the *atmungsferment* of Warburg. The evidence here is also spectroscopic, but rather indirect. The enzyme, according to Warburg, functions properly only when the cell is intact, when it activates oxygen and so controls cell respiration. Oxygen uptake is depressed by carbon monoxide, and the inhibition is greater in the dark than in the light. The power of light to reverse the inhibition varies with its wave-length, and when this power is plotted against wave-length a hæmatin-like spectrum is obtained, which Warburg regards as the spectrum of the *atmungsferment*. This identification was contested by Prof. D. Keilin, who described his well-known work on cytochrome. He recognises three factors in cell respiration: dehydrogenases at which the hydrogen of the meta-

bolites is made available; the oxidase, identical with the indophenol oxidase, at which oxygen is mobilised; and the three hæmatin compounds, cytochrome *a*, *b*, and *c*, which act as intermediaries, becoming reduced at the dehydrogenases and re-oxidised at the oxidase. Prof. Keilin identifies the *atmungsferment* with the indophenol oxidase, and finds that it differs from typical hæmatin compounds in many of its properties. There is evidence, however, that cytochrome forms a complex with the oxidase, and it is the hæmatin in the cytochrome moiety of this complex which is responsible for the spectrum found by Warburg.

Similar doubts were expressed by Dr. Meldrum from rather a different point of view. Dr. Meldrum has been working with Dr. F. J. W. Roughton on carbonic anhydrase, the enzyme in blood which catalyses the formation of gaseous carbon dioxide from carbonic acid in solution. They have separated it from hæmoglobin, and concentrated it to a very great extent. It is inhibited by cyanides, hydrogen sulphide, and carbon monoxide, and the CO inhibition is reversed by light. These properties in the case of the *atmungsferment* are regarded by Warburg as proofs of its hæmatin nature. But carbonic anhydrase has no trace of a hæmatin spectrum, so that the validity of Warburg's argument is rendered very doubtful.

So far, the nature of the active group of the enzyme has been considered. Prof. Willstätter summarised the present knowledge of the colloidal carrier, and described recent work on the relation of the enzyme to the living cell. Enzymes are always obtained as complex colloidal solutions, and the nature of the carrier must be inferred by finding what colloids can be dispensed with. Several American workers claim that enzymes are protein in nature—Sherman with amylase, Sumner with urease, and Northrop with pepsin and trypsin. But amylase has been obtained free from protein, and Sumner's crystalline urease preparation is still active after partial hydrolysis with proteolytic enzymes. Protein-free pepsin was obtained so early as 1861. The carriers seemed to vary with the methods by which the enzyme was extracted from the cell. The properties of an enzyme bound to the cell are often unlike those of the same enzyme in solution. The cell-bound or desmo-enzymes are being actively studied in Prof. Willstätter's laboratory, and it has been found, for example, that the desmo-amylase of leucocytes differs from the lyo-amylase in that it is inhibited by glycerol and is active in absence of phosphates.

The relation of the enzyme to the cell was considered from another point of view. Sir Frederick Gowland Hopkins, in his opening remarks, referred to the work of Stephenson and Stickland on hydrogenlyase. This is an enzyme, found in *B. coli communis* and other bacteria, which catalyses the breakdown of formic acid into carbon dioxide and free hydrogen. The enzyme appears only in cultures which have been grown on broth containing formates. The substrate thus seems to have the power to influence the growing cell so as to induce in it the formation of a new enzyme. Prof. A. Harden described a similar phenomenon found with yeast. Normal yeasts ferment only glucose, fructose, and mannose, but the power to ferment galactose may be acquired by yeast grown in a galactose-containing medium. The course of the fermentation appears to be completely normal, the same co-enzyme being required and the same hexose phosphates being formed as in the fermentation of the other sugars. Robison has shown that a mixture of the mono-phosphates of glucose, fructose, and mannose is formed when any one of these sugars is fermented. This suggests that the fermentation takes place through a common intermediate form. Since fructose is fermented the fastest and is the sugar of hexose-diphosphate, this intermediate is probably akin to fructose. The conversion of a sugar into the fermentable form is probably effected by an enzyme or activator specific for the sugar. Such activators may be identical with the hexo-kinase obtained by Meyerhof from yeast, and found by him to enable muscle extracts to use hexoses as a source of lactic acid. The presence of galactose in the growth medium induces the formation in the yeast of a special kinase for galactose.

A distinction between the mode of action of hydrating and oxidising enzymes was brought out in the discussion on the mechanism of enzyme catalysis. Prof. Haldane pointed out that hydrating enzymes show symmetrical *p*H-activity curves, while dehydrogenases give curves rising from the acid side to a plateau in the alkaline region, as required by Woolf's theory. The discussion on the mechanism of enzymic hydrolysis was disappointing. Prof. Waldschmidt-Leitz regards union between enzyme and substrate at two points as evidence for the two-affinity theory of Euler, according to which the substrate is bound at one group in the enzyme and caused to react by another. But there seemed to be no indication of this difference of function in the two enzyme combining groups, nor was there any discussion on how the water, which is an essential substrate in a hydrolysis, is brought into the reaction. On the other hand, the mechanism of oxidising enzymes gave rise to a lively exchange of opinion. This discussion is being continued in the correspondence columns of NATURE, so it is only necessary to give the barest summary here.

Prof. Willstätter gave an account of the theory he put forward in conjunction with Prof. Haber, that the substrates of oxidising enzymes leave the enzyme in the form of free radicles, which initiate chain reactions throughout the medium. Thus ethyl alcohol would form the radicle $CH_3.\overset{\uparrow}{C}H.OH$, which interacts with oxygen and a molecule of alcohol to form two molecules of aldehyde and the radicle $\overset{\uparrow}{O}H$. This takes up a hydrogen atom from a molecule of alcohol, regenerating the first radicle, and so the whole cycle is repeated an indefinite number of times. Prof. Haldane criticised this view. It fails to account for the proportionality between enzyme concentration and reaction velocity,

the formation of radicles like OH which react with many different substances contradicts the facts of enzyme specificity, and the theory cannot account for coupled reactions. Dr. Richter objected to the idea of free radicles, and supported instead the view of Christiansen that there are chains of molecules with abnormally high energy content. Prof. Willstätter replied that such activated molecules would lose their excess energy by collisions before they could enter into chemical reaction. He admitted the force of some of Prof. Haldane's arguments, and said that the formulation involving radicles like $\overset{\wedge}{\text{OH}}$ is too simple, and the mechanism must be revised in accordance with the specificity of enzyme action. But whether the chain reaction theory is finally accepted or not, it was made clear by Prof. Haldane that it will be of great service in stimulating fundamental experimental work.

B. WOOLF.

Obituary

PROF. J. W. GREGORY, F.R.S.

IN the *Times* of June 14 the brief announcement was made that a wireless message received from Iquitos had been transmitted by Reuters from Lima stating that Prof. J. W. Gregory had been drowned in the Urubamba, near Megantoni Falls in Northern Peru. A subsequent message on the following day confirmed the report and added that Prof. Gregory was drowned by the overturning of his canoe in the rapids of Pongo de Mainique in the River Urubamba. The river at this point is only 24 feet wide, the banks consisting of perpendicular rocks of immense height.

Prof. Gregory left Liverpool six months ago with a small party of which Miss Mackinnon Wood was one, intending to study the geology of Peru with especial reference to earth movements in recent geological times and the connexion between them and earthquakes and volcanic phenomena. Miss Mackinnon Wood was specially interested in the collection of fossils. As no further particulars of the fate of the rest of the party have been received, it may be presumed that they have escaped disaster. The Peruvian Government afforded every facility to the expedition and is stated to have sent two Peruvian geologists to accompany them.

With the death of Prof. Gregory, the most prominent and most widely known British geologist of the present time is removed from the scene. As a writer on geological topics and a lecturer to scientific meetings he had a large public, and his activities as a traveller had made his name well known not in Britain alone but in all parts of the world. He was a ready writer with an easy, fluent style, and was well versed in so many departments of geographical and geological science that his writings cover a vast range of subjects. The mere list of his published volumes is a very impressive one, without taking count of the great series of scientific papers, more than two hundred in number, which came from his pen.

To take a general view of the contributions of a scientific worker so active and so versatile is by no means easy, but we think that Gregory's greatest achievements were in the fields which form a borderland between geology and geography. He will be remembered for his explanation of the rift valleys of Africa, his exposition of the tetrahedral configuration of the earth, his brilliant contribution to the history of the Atlantic and Pacific basins which formed his presidential addresses to the Geological Society of London, his speculations on the history of valleys and fiords, and the startling hypothesis of the deep-seated and probably volcanic origin of the artesian waters of Central Australia. His mind was constantly occupied with the greater problems of earth structure and history, and his vast erudition gave his opinions a weight which made even those who were most critical of his conclusions treat them with the respect due to profound knowledge and a strikingly original and individual outlook.

Gregory was born in Chelmsford, Essex, in 1864. His father was a wool merchant, and his son assisted him until he was twenty-three years of age. In 1887 he was appointed an assistant in the British Museum, where he served until 1900, when he was appointed professor of geology in the University of Melbourne. He returned from Australia in 1905 to become professor of geology in the University of Glasgow, a post from which he retired on pension in 1929.

At the British Museum, Gregory was engaged principally in the study of fossil Bryozoa, on which he published three volumes of catalogues well known to specialists, but at an early age the *Wanderlust* was strong in him. He visited western North America in 1891 and first attracted attention as a traveller and explorer by his journey in British East Africa in 1892–93. This showed clearly the stuff he was made of, as, in spite of discouragement, difficulty, and danger, he executed a notable piece of work, which characteristically formed the foundation of a brightly written book that thoroughly deserved the great popularity with which it was received. Afterwards he visited, on scientific work intent, almost every quarter of the habitable world. In Spitsbergen, 1896 (with Sir Martin Conway), Central Australia and Queensland (1901–4), Cyrenaica (1908), Southern Angola (1912), Rhodesia and India (several times), North America (repeatedly), and Chinese Tibet (along with his son in 1922) he collected geological information and wrote many geographical and geological papers. In 1919 he was awarded the Victoria Medal of the Royal Geographical Society, in 1922 the Gold Medal of the Scottish Geographical Society and the Gallois Medal of the Société Géographique de Paris. These were only a few of the numerous honours which fell to him. He was president of the Geological Society of London (1928–30), and for the second time presided over Section C (Geology) of the British Association at its centenary meeting in London, 1931.

As a professor of geology in Glasgow, Gregory was eminently successful. He had the art of making the subject appear easy and attractive. His classes were the largest in any British university, and he trained a considerable number of students who have afterwards made their mark. Much of this success was due to his remarkable personality. No one could have been more free from assumption or arrogance. His enormous erudition, based on wide reading and a very retentive memory, was free from any kind of ostentation. He was willing to discuss his subject with all comers, however superficial or ignorant; but only those who were experts could appreciate his extraordinary range of vision and realise how much he had seen and learnt. He began his scientific work as a palæontologist and continued through his whole life to work at that subject, but he wrote also on petrology, translated a book on mineralogy, and was recognised as an authority on mineral deposits, such as copper and gold. He was, for example, one of the first to maintain the theory of the origin of the gold mines of the Rand which now receives the support of the majority of the skilled engineers and geologists who are best acquainted with that field. He published a very useful handbook of economic geology.

My experience of a long friendship with Gregory was that it was very unwise to assume that you knew more of any subject than Gregory did: it was dangerous to differ from him in opinion, as in the quietest possible manner he would produce some devastating facts, well attested but not widely known, that would shatter premature hypotheses.

JOHN S. FLETT.

DR. J. G. GARSON

THE death occurred on June 1, at the age of seventy-seven years, of Dr. J. G. Garson of Ewell Court, Surrey. Dr. Garson was born in Orkney and was educated at the University of Edinburgh, taking the degree of M.B. in 1875 and of M.D. in 1878. He was admitted a licentiate of the Royal College of Surgeons, Edinburgh, in 1875. He also studied in Vienna, Berlin, and Leipzig. For many years Dr. Garson was a prominent figure among anthropologists, especially in connexion with the (Royal) Anthropological Institute, of which he was for long a member of council, and the Anthropological Section of the British Association. He assisted in the revision and re-editing of "Notes and Queries on Anthropology" when a new edition of that manual was issued by the British Association in 1892.

As an anthropologist Dr. Garson specialised in craniology, especially in its bearing on race in the prehistory of Western Europe, and he did much to foster in Great Britain a knowledge and appreciation of the work of Broca and other Continental anthropologists. His close association with French anthropologists and his friendship with Bertillon led him to the study of Bertillon's anthropometric methods of criminal identification, and when this method was adopted in police work in England, Dr. Garson became adviser to the Home Office on the methods of identification of criminals and the classification of their records, a position which he continued to hold until the introduction of the fingerprint system. Dr. Garson was also lecturer in comparative anatomy at the Charing Cross Hospital and Swiney lecturer of the British Museum. From 1902 until 1904 he acted as assistant general secretary of the British Association for the Advancement of Science, organising the Belfast, Southport, and Cambridge meetings, and was a member of its council until the time of his death.

Dr. Garson was the author of a large number of papers contributed to medical and scientific journals; and his services to anthropological studies were widely recognised on the Continent. He received the award of the medal of the French Association for the Advancement of Science in 1914, and was an honorary or corresponding member of the anthropological societies of Berlin, Moscow, Rome, and Paris. During the War he held a commission as captain in the R.A.M.C.

WE regret to learn from the *Chemiker-Zeitung* of the death on March 14 of Prof. M. A. Rakusin, of Moscow, at the age of sixty-three years. Rakusin was principally interested in the chemistry and technology of petroleum. At first a believer in the mineral origin of petroleum, his researches upon its optical activity led him to uphold the theory of its organic origin, and in 1906 he found evidence of the existence in petroleum of cholesterin. From his studies upon the opacity to polarised (though not to ordinary) light of dilute solutions of petroleum in benzene, he developed a theory of the existence of ultra-microscopic carbon particles in petroleum, from the amount of which he attempted to calculate the geological age of the deposit. In his later studies he took up the investigation of adsorption phenomena and biochemical problems. He had undertaken to prepare the section on optical activity for the new edition of the handbook "Das Erdöl".

WE regret to announce the following deaths:

Dr. William Briggs, founder of University Correspondence College (1887) and also of University Tutorial College, where practical work in physics, chemistry, and biology was introduced to supplement correspondence courses, on June 19, aged seventy years.

Dr. Cuthbert Christy, who travelled extensively in Central Africa and was a member of several British and Belgian commissions on sleeping sickness, on May 29, aged sixty-eight years.

Dr. C. Dwight Marsh, formerly physiologist to the United States Bureau of Animal Industry, known for his work on plankton life in fresh-water lakes and the effects of poisonous plants on animals, on April 23, aged seventy-seven years.

Mr. Robert E. Montgomery, adviser on animal health to the Colonial Office, on June 11, aged fifty-one years.

Dr. Marcus S. Paterson, lately medical superintendent of Colindale Hospital, Hendon, an authority on tuberculosis, on June 1, aged sixty-two years.

News and Views

Sunset Glows and the Andean Eruptions

THE possibility that the Andean eruptions of April 10 and the following days might be followed by notable sunset glows, at least in the southern hemisphere, was mentioned in our issue of April 23, p. 604, seeing that the eruptions of Krakatoa and Mont Pelée both gave rise to such effects. A letter dated May 18 received from Mr. T. B. Blathwayt, Box 7532, Johannesburg, suggests that these have already begun. Mr. Blathwayt says: "We have had them strongly in evidence the last few weeks both here and in other parts of South Africa, so that they must have begun within two weeks of the outburst in South America. There is a strong, dull red glow extending over the whole sky on most evenings, and I saw it one morning at sunrise." Inquiry at the Meteorological Office (Air Ministry) suggests that this may be the first report of phenomena of this kind to reach England. It may be noted that May is one of the dry months in the neighbourhood of Johannesburg and the weather would not normally be such as to favour the formation of sunset cloud effects; moreover, the low latitude yields short twilight, and only very high clouds would be exposed to the sun's rays for long after sunset or before sunrise. The attention of readers interested in this subject may be directed to an article in the *Meteorological Magazine* of the Meteorological Office for May, in which Dr. C. E. P. Brooks discusses the movements of volcanic dust over the globe following the Krakatoa eruption of Aug. 26–27, 1883. This paper is based largely on the Report of the Krakatoa Committee of the Royal Society, London, 1888.

Meteorite Craters in Arabia

SINCE the general article in NATURE of May 28, p. 781, on meteorite craters was written, a still more remarkable discovery has been made known from the Arabian desert, which was crossed by Mr. H. St. John Philby early this year. On the site of the supposed ancient city of Wabar in the Rub' al Khali, he found two shallow craters, the larger one 100 metres across, together with indications of other craters buried in the sand. Around the craters the ground is thickly strewn with slaggy and cindery material, suggesting a volcano. Near by, a 25-lb. mass of iron together with a few smaller pieces of iron and iron rust were collected. The cindery material proves to be silica-glass and the iron is meteoric nickel-iron. Silica-glass is of rare occurrence in Nature, and this example is the most remarkable yet known, both in the abundance of the material and the variety of its forms. Most of the pieces are complete individuals or 'bombs' with a white cellular interior and a black glossy and pimply surface, and they range in size down to 'black pearls', which were collected in considerable numbers. Such an association of silica-glass with meteoric iron around craters can be explained only as the result of the fall of an enormous meteorite or a shower of meteorites. Their energy of motion was suddenly transformed into intense heat at a very localised spot; and in the sandy desert a rain of molten silica full of bubbles was shot out from the craters through vapours of iron and silica. The large quantity of material collected by Mr. Philby has been presented to the British Museum by H.M. the King of the Hijaz and Najd, and a selection of that from Wabar is now exhibited in a lighted wall-case near the entrance to the Mineral Gallery in the Natural History Museum at South Kensington.

Tenth International Horticultural Congress

THE Tenth International Horticultural Congress was held in Paris on May 30–June 5, on the invitation of the Société Nationale d'Horticulture de France. Great Britain, many European States, Canada, and the United States of America were represented by official delegates. The meetings were held in the rooms of the Société Nationale d'Horticulture in the rue de Grenelle, where the delegates were received by the president of the Society, M. F. David, who was also elected president of the Congress. The papers presented were grouped in sections dealing respectively with fruit-arboriculture, genetics and soil-science, plant-diseases and their treatment, and botanic gardens—their function, organisation, and arrangement. The standing committees appointed at previous congresses met to report progress and to consider further action. The Committee on Nomenclature had for its consideration a list of generic names recommended for use in horticulture to avoid the confusion arising from the use in practice of different names for the same plant. Steps were also taken to arrange for the preparation of lists of species of the more important genera in cultivation. The names adopted would be those valid under the Rules of Botanical Nomenclature as passed by the International Botanical Congress of 1930. Interesting features of the Congress were visits to the Jardin des Plantes, the National School of Horticulture at Versailles, and to a number of horticultural establishments near Paris, including the famous nursery of Vilmorin-Andrieux et Cie, and others at Tours and Orleans. During the Congress, an "Exposition Internationale" arranged by the Horticultural Society was held in the Cours la Reine in Paris.

Printing Mathematical Expressions

THE London Mathematical Society has recently issued a pamphlet ("Notes on the Preparation of Mathematical Papers." Pp. 19. London: C. F. Hodgson and Son, Ltd. 1*s*.) of suggestions to authors and others preparing mathematical script for the press. In the preparation of satisfactory mathematical print there are three points which should not be overlooked. (1) The difficulties of the compositor should not be insuperable. Whereas in the past it has often been necessary to cut special pieces of type, frequently with unsightly results, the printer is now generally able to find everything he requires in his fount. (2) The print should be easy of comprehension by the reader for whom it is intended. (3) The printer should also aim at elegance in the display of formulæ.

As an illustration, it is better to print $\sqrt{(a+b)}$ than $\sqrt{a+b}$ in a line of type, since the latter involves irregular spacing between the lines. On the other hand, the second of these expressions is more readily grasped when it can be displayed in a separate line. With the notation now in general use, almost all the symbols required in mathematical work can be so adapted as to be manageable to the compositor. It is pointed out that symbols which are necessarily awkward in appearance are fortunately rare. The present pamphlet is mainly of interest to the professional mathematician, there being no mention of the special symbols employed in such wide offshoots as actuarial mathematics. It includes a collection of the symbols which (in the eyes of a compositor) are better avoided, also a list of the symbols forming part of the stock of an up-to-date mathematical printer.

Science and Art in the Textile Industries

In a speech at the annual Conference of the Textile Institute at Leamington Spa on May 19, Dr. S. G. Barker discussed the general relation of science to industry. Dr. Barker cited the recent observation in physics that drops of one electrolyte in another when submitted to the action of an electric field exhibit the phenomena of lateral spreading, as an example of the truth that none can say what textile applications will follow even a remote discovery in physical science, or when and how such discoveries will be made. In regard to the concrete benefit of science to the textile industries, Dr. Barker asserted that most of the work has been pioneer in character, and that good foundations once well and truly laid are rarely seen again. Unfortunately, the rapid extension of the bounds of physical science in the last decade created an inferiority complex in the minds of many ordinary individuals. The new knowledge appeared so vast and confusing that the minority of experts and investigators responsible for it were placed on a pedestal and their dicta accepted without thinking. Not only did the majority of people fail to realise the significance of the discoveries thus made, but inevitably the discoverer himself was frequently unable to recognise the social or industrial value of his discovery.

In Dr. Barker's opinion, the scientific worker must endeavour to provide at the moment more practical results if, when prosperity returns, opportunity is to be afforded for the long-range fundamental researches. Only so can we hope to diminish the disparity between our mechanical skill and our social wisdom, between our power over Nature and the mentality which dictates its use. The challenge thus offered to us affords fresh opportunities for the spirit of adventure and romance which already finds expression so frequently in scientific research; and in regard to the textile industries, Dr. Barker stressed the importance of linking science to art and seeking to develop products which possess the supremely important æsthetic appeal. The union of art with science should mean not the degeneration of craftsmanship, but the creation of a progeny which will be economic, utilitarian, artistic, and scientific.

National Parks in America

In an article in *The Christian Science Monitor* of May 13, much interesting information is given of the growth of the National Park Service of the United States, and of the projects now under consideration. The inauguration of the first national park took place some sixty years ago, but the National Park Service of the Department of the Interior was established by law of Congress, approved on Aug. 25, 1916. Its objects are to promote and regulate the use of the federal areas known as national parks, monuments, and reservations, and " to conserve the scenery and the natural and historic objects and the wild life therein, and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations ". Mr. Stephen Mather, the ' father ' of the national parks, was the first director of the service, but in 1929 he was succeeded by Mr. H. M. Albright. At the present time, the service has the administration of 22 national parks and 36 national monuments, but many others are supervised by the Department of Agriculture and the War Department.

In an interview, Mr. Albright referred to the establishment of the Branch of Research and Education of the National Park Service. This has already given much attention to the natural scientific phases of the educational work, which includes the development of the means of informing visitors in the simplest way of the interesting geological and biological features of the parks. Special attention is now being given to the historic aspect. Among the most important projects now being considered are those for national parks in Virginia, Kentucky, Michigan, and Florida. The proposed Shenandoah National Park is in the Blue Ridge Mountains, Virginia, and consists of an irregular strip of virgin forest, 66 miles long and 8-18 miles wide. For the Mammoth Cave National Park the State Legislature of Kentucky has already appropriated 1,500,000 dollars for buying caves and properties in the area. The caves are said to have passages and chambers extending approximately 150 miles on different levels. The Michigan scheme relates to the wilderness area, 45 miles long and 5-9 miles wide, on the shores of Lake Superior and only a little more than twelve miles from the coast of Ontario. The area is called Isle Royale, and it is the home of large herds of moose and caribou. Of a different character is the area of 2000 square miles which it is proposed to preserve in the south and south-west of Florida. This area includes channels, lakes, and swamps bordered by groves and forests filled with tropical vegetation. Another project is to connect the eastern parks by an Eastern National Park-to-Park Highway, giving tourists approximately 2000 miles of road, nearly every mile of which runs through scenic or historic country.

Natural Reserves in the Belgian Congo

It is well known that the King of the Belgians has played an active part in the development of scientific institutions in his country, and that he is a keen supporter of research. Among his other interests is the question of the protection of the flora and fauna,

particularly of the tropical colonies of Belgium. So long ago as 1909, after travelling in South Africa and the Congo, he emphasised the necessity of taking measures without delay for saving a part of the fauna and flora, which intense and often unregulated economic development threatens to destroy. In the Congo in particular, this destruction was going on with great rapidity, often without apparent cause. We owe to the intervention of the King of the Belgians the creation, in 1929, of the Parc National Albert, comprising about 357,000 hectares (nearly 1400 square miles). The administration of this reserve is in the hands of a commission of which the King's son, Prince Leopold, is president, and Prof. V. Van Straelen, director of the Royal Museum of Natural History, Brussels, is vice-president. During last April, King Albert, accompanied by Prof. Van Straelen, visited the Kivu Park in the Belgian Congo, having made the journey specially to see for himself the effectiveness of the measures of protection in force. His gesture for the cause of the protection of the fauna and flora is of high importance and should result in intensification of the efforts being made in this direction, not in the Belgian Congo alone but also in other countries.

Bird Invaders in London

THE nesting of the jay in Ladbroke Square in west London, recently reported in *Cage Birds*, is certainly a marked invasion of the metropolitan area by this woodland species, but it has been present in south-east London for years past, and has regularly nested in the grounds of the Horniman Museum at Forest Hill within a few dozen yards of a main road. The curious thing is that it is this shy bird and not the bolder magpie that has colonised London, and that among the typical crows it is the carrion crow and not the building-haunting jackdaw that is the familiar London bird. The colonisation of London by birds of prey is also not in accordance with expectation; the buildings have failed to attract the barn-owl, but the tawny owl is so generally diffused that it has been heard within five minutes' walk of King's Cross Station; while, though the pigeons and ducks in London might have been expected to attract the peregrine falcon, and the sparrows and starlings the sparrow-hawk, the only hawk commonly to be seen is the kestrel, which must subsist there on birds rather than on the mice and insects which are its more usual food.

The Advance of Medicine

THE Romanes Lecture entitled "The Advance of Medicine" delivered at Oxford on June 1 by Lord Moynihan, president of the Royal College of Surgeons, who received the honorary degree of D.C.L. on that occasion, has been published by the Clarendon Press (2*s*. 6*d*. net). After an historical introduction in which he briefly reviews the work of Hippocrates, Galen, Vesalius, the Italian anatomists, Harvey, Morgagni, and John Hunter, Lord Moynihan passes on to Lister, whom he describes as the greatest material benefactor of mankind the world has ever known. He attributes Lister's genius to the fact that he was master both of the Hippocratic method of induction and the Galenic method of deduction, and combined the qualities of a physiologist and clinician. Lord Moynihan deplores the fact that physiology is now losing the close relationship it formerly had with clinical medicine, and urges that physiologists and surgeons should make a common attack upon "the innumerable mysteries of disease". On the other hand, he maintains that though the aid given by physics, chemistry, and physiology is indispensable, these sciences are merely ancillary to medicine, which is a science as well as an art in itself. In view of the fact that laboratory aid, though sometimes decisive or at least helpful, is not seldom negligible, the clinician must maintain his sovereignty. In conclusion, Lord Moynihan exemplifies the humanism of medicine by the work of Harvey, John Hunter, Hillman, who discovered anæsthesia, and Lister. Three appendices to the lecture deal respectively with the ideal training of the surgeon, experiments on animals, and the relation of physics and chemistry to medicine.

Modern Oil Production Problems

MR. A. BEEBY THOMPSON'S recent survey of engineering progress in petroleum production (Institution of Petroleum Technologists, May 10) showed clearly the remarkable changes which modern industrial, chiefly economic, conditions have brought about in the technique of oil mining. Only a few years ago 10,000 ft. oil wells and the safe and efficient handling of pressures of 5000 lb. were considered impossibilities; unit operation of oilfields, now an accepted principle, was then an unattainable ideal. The modern technique of deep drilling has brought with it a chain of difficult problems confronting oilfield engineers throughout the world. Among these may be mentioned control of flowing wells; freezing of wells as a result of rapid expansion of gas together with formation of ice actually in the well itself; mechanical extraction of oil, that is, pumping and plant to raise oil to the surface from depths of 5000-10,000 ft., involving as it does pump pressures up to several thousand pounds per square inch; crooked holes and their avoidance; air-gas lift efficiency; paraffination of wells where waxy oil is encountered, a difficulty still not satisfactorily solved; the ultimate recovery of oil from at present commercially exhausted pools; disposal of surplus natural gas, particularly in regions far removed from populous areas; and the thorny question of practicability of extending the principle of mining oil measures, as at Pechelbroun. None the less, progress in the last few years has been of such a character that one cannot but anticipate a satisfactory solution to some, if not all, of these problems in the near future, especially when economic conditions in the industry improve.

Street Lighting

THE improvement in modern street lighting is largely due to the appointment of public lighting engineers whose whole time is devoted to the work. They pay attention to details which have been previously overlooked or neglected. In *Electrical Industries* for June 15 there is a paper on modern

street lighting by Haydn T. Harrison which brings this out clearly. The outstanding advances took place several years ago, gas and the arc lamp being two of the earliest. The invention of gas mantles largely stopped the use of luminous gas. They also prevented the adoption of the carbon filament electric lamp. The invention of the gas-filled lamp was the last notable step forward. The rapidly increasing use of electricity for street lighting at the present time is due not so much to the efficiency of these lamps as to the fact that light can be distributed from them in any required direction by simple optical means. Hence the most notable feature of modern street lighting is the large number of electric lamps fitted with reflectors or glassware designed specially for distributing the total light most efficiently. The motor vehicle head-light is an excellent example of the adaptability of the gas-filled electric lamps. These lamps only take 20 or 30 watts—the same as a small house lamp. By suitable reflections they produce a beam of light in front of the car which enables the driver to see objects to be avoided on the road 100 yards in advance. No other commercial source of light could be made to do the same thing. In modern street and road lighting, the tendency whenever there is a change of system is to raise the height of the lamps. This improves both the illumination on the road surface and the visibility, except when the weather is very foggy.

Electrification of the Great India Peninsula Railway

To a joint meeting of the Institute of Transport and the Institution of Electrical Engineers on April 28, Mr. F. Lydall read a paper giving a general account of the suburban and main line electrification of the G.I.P. Railway. He compared the actual with the anticipated traffic and dealt with the design of the plant and apparatus. The electrified portion of this railway is second only in extent, within the British Empire, to that on the Southern Railway in Great Britain. The length of single track fully equipped is 571 miles, the capacity of the substation plant is 100,000 kilowatts, and there are 272 miles of 100,000-volt transmission line. It joins Bombay, a city of about $1\frac{1}{4}$ million inhabitants, situated mainly on an island, with Northern and Central India by the North-Eastern main line and with Southern India by the South-Eastern main line. Both these lines have to negotiate the escarpment which runs roughly parallel to the coast about forty miles inland, known as the Ghats. On both sections the ruling gradient is 1 in 37. The reason given why the traffic is less than was anticipated is the world depression of trade, which affects India in general and Bombay in particular. The most prolific source of trouble in electric operation is the propensity of the crows in and near Bombay to build nests with iron wire on the overhead line structures. It is related that one such nest was built of metal spectacle-frames which had been filched by a crow from an open shop-window. During the nesting period, crows fly about with pieces of wire sometimes about a yard long in their beaks, and this naturally sometimes causes short circuits. Flying foxes also have sufficient spread of 'wing' to hook across the mains on 20,000-volt lines. Methods to overcome these difficulties have been devised.

Centre International de Synthèse

THE "Centre International de Synthèse" of Paris is planning—and has already begun work on—three important vocabularies. The first is a vocabulary of the most important terms used by historians, jurists, sociologists, and economists. The second is a historical dictionary of science, considered in its relation to philosophy; it will deal with the mutual influence of philosophy and science throughout the historic periods. The third is a vocabulary which will analyse the more important scientific concepts of to-day, their origin and development, and may throw some light upon the various meanings frequently assigned to the same scientific term. The Centre International de Synthèse was formed in 1925 with the object of co-ordinating researches in various branches of pure science. It is under the direction of M. Henri Berr, and it has among its members and associates many French and foreign savants, as well as some young and active investigators. It has four sections: (1) Synthèse historique; (2) Histoire des Sciences; (3) Sciences de la Nature; and (4) Synthèse générale. These meet weekly, in rotation, and the results of their discussions and labours are published in two periodicals, *Revue de Synthèse* and *Archeion* (*Archivio di Storia della Scienza*). In addition, the Centre holds yearly international meetings (*semaines*), during which specialists in various branches of science describe recent advances in their respective fields.

Literature of Food Investigation

WITH the very belated appearance of the issue for September 1931 of the index to the literature of food investigation (vol. 3, No. 2, September 1931. London: H.M. Stationery Office, 1932. 2*s*. 6*d*. net), the third volume of this abstract journal is completed. It is published twice a year from the Low Temperature Research Station at Cambridge, two numbers comprising the volume. This number contains 183 pages and a list of the periodicals read. For the benefit of those who do not know this publication, it may be mentioned that it consists of elaborated titles of papers dealing with the problems of food preservation and marketing, arranged in fifteen different sections, namely, meat, pig-flesh, poultry and game, fish, eggs, dairy produce, fats and oils, fruit and vegetables, grain, crops and seeds, theory of canning, theory of freezing and chilling, bacteriology, mycology, engineering, and finally miscellaneous. It was instituted to enable research institutions in the Empire to keep abreast of progress in preservation and transport of food, but should also be of use to all who are interested in the scientific and practical aspects of this subject.

The Seminoles

MISS FRANCES DENSMORE, who has recently returned to Washington from Florida, reports a somewhat unusual attitude of aloofness towards the whites and their civilisation on the part of the Seminole Indians of the Everglades. Apparently they have never become

entirely reconciled since the great Seminole wars at the beginning of the nineteenth century. Miss Densmore visited these Indians on behalf of the Smithsonian Institution, Washington, D.C., with the view of the investigation of their music, and although she had been assured that the Seminoles had no songs, she was successful, in the end, in obtaining two hundred phonograph records. In a preliminary statement issued by the Smithsonian Institution, Miss Densmore says that the Seminoles are ruled by 'old men', who remain in seclusion in the Everglades and are rarely seen. A rule is imposed upon the people that they are not to learn, or at least to speak, English. Intercourse with the whites is conducted by signs, except that sometimes they will name prices for the articles they wish to sell. They pride themselves on being a full-blood tribe, and a recent count gave 17 mixed bloods only in a population of 500.

Breeding Insects

IN a useful note in the *Vasculum* for May (p. 61), Prof. J. W. Heslop Harrison gives simple instructions for the breeding of insects for experimental and other purposes. This information about the materials used, the methods of constructing cages for moths and butterflies, and the rather unorthodox methods of wintering pupæ, should help to solve problems which have baffled willing but inexpert experimenters.

Announcements

PROF. C. G. SELIGMAN, professor of ethnology in the University of London, has been awarded the Nelson Annandale Gold Medal of the Asiatic Society of Bengal for his "contributions to the study of Anthropology in Asia". This medal, which is awarded triennially, was founded in 1927, and the only previous recipient was Dr. Fritz Sarasin, of the Museum für Völkerkunde, Basle.

THE KING, on the recommendation of the Minister of Health, has approved the appointment of Miss Ruth Darwin as a senior commissioner of the Board of Control. Miss Darwin, who is a daughter of the late Sir Horace Darwin, was an honorary commissioner in 1920–30 and has been a commissioner since Jan. 1, 1931. She is a member of the committee recently appointed to consider certain issues arising in connexion with the sterilisation of the mentally unfit.

THE twenty-fifth Conference of the Society for Experimental Biology will be held at the laboratory of the Marine Biological Association, Citadel Hill, Plymouth, on July 9–11. Some thirty papers are to be read, and on July 10 a visit will be paid to the laboratories and farms at Dartington Hall, Totnes.

THE fifty-first annual meeting of the Society of Chemical Industry will be held at Nottingham on July 12–15. The presidential address will be delivered on July 13 by Prof. G. T. Morgan, on "Ourselves and Kindred Societies". On the following day, the Messel Medal will be presented to Sir William Pope, who will give an address on "Forty Years of Stereochemistry". The greater part of the meeting will be devoted to visits to works in the neighbourhood.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned: — An assistant lecturer in philosophy in the University of Manchester—The Registrar, University of Manchester (June 27). A reader in electrical engineering (telegraphy and telephony) at the Imperial College, City and Guilds College—The Academic Registrar, University of London, South Kensington, S.W.7 (July 1). An assistant in the Department of Agricultural Botany of the Edinburgh and East of Scotland College of Agriculture—The Secretary, Edinburgh and East of Scotland College of Agriculture, 13 George Square, Edinburgh (July 1). A full-time master for zoology and botany at the Medway Technical College, Gillingham—Head of the Senior Departments, Medway Technical College, Gillingham, Kent (July 1). An assistant lecturer in pharmaceutics at the Cardiff Technical College—The Director of Education, City Hall, Cardiff (July 2). An assistant lecturer in geology in the University of Manchester—The Registrar, University, Manchester (July 2). A William Morris Research Fellow in Radiology at Mount Vernon Hospital—The Secretary of the British Empire Cancer Campaign, 12 Grosvenor Crescent, S.W.1 (July 2). A part-time lecturer in the Biology Department of the Plymouth and Devonport Technical College—The Secretary for Education, Education Office, Rowe Street, Plymouth (July 5). An Alfred Fripp Memorial Fellow in Child Psychology at Guy's Hospital—The Dean, Guy's Hospital Medical School, S.E.1 (July 8). A professor of electrical engineering at the Manchester Municipal College of Technology—The Registrar, College of Technology, Manchester (July 9). A lecturer in physics and mathematics at the Sir John Cass Technical Institute—The Principal, Sir John Cass Technical Institute, Jewry Street, E.C.3 (July 9). A head of the Chemistry Department of the Sunderland Technical College—The Principal, Technical College, Sunderland (July 11). A lecturer in zoology at the Victoria University College, Wellington, New Zealand—The Secretary, Universities Bureau of the British Empire, 88A Gower Street, W.C.1 (July 12). Chemists in the Department of the Government Chemist—The Government Chemist, Clement's Inn Passage, W.C.2 (July 16). A senior lecturer in economics and politics at the Rhodes University College, Grahamstown—The Secretary, Office of the High Commissioner for the Union of South Africa, 73 Strand, W.C.2 (July 30). Evening instructors in advanced building construction, sanitary engineering, and physics, at the Kingston-upon-Thames Technical College — The Principal, Technical College, Kingston-upon-Thames. An assistant master for mathematics at the Halifax Municipal Technical College—The Principal, Municipal Technical College, Halifax. A lecturer in physiology at the Chelsea Polytechnic—The Principal, Chelsea Polytechnic, Manresa Road, S.W.3. A whole-time lecturer in biology in the Department of Anatomy of the University of Durham College of Medicine—The Registrar, University of Durham College of Medicine, Newcastle-upon-Tyne.

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.*]

Theory of Induced Polarities in Benzene

RECENTLY in this periodical, Lapworth and Robinson [1] gave a criticism of the theory developed by Erich Hückel [2] of the induced polarities in benzene. This criticism referred mainly to three points, which may be shortly reviewed here. (For the details see the note of Lapworth and Robinson.) First, the authors claim that any theory of the influence of groups on the course taken by substitution in benzene must be able to correlate this influence with the influence of the groups on the additive reactions of unsaturated compounds, since these reactions are said to obey the same laws as those that govern aromatic substitution, although in the case of substitution a hydrogen atom * is expelled, which does not occur in the case of addition. Secondly, they correlate the influence of the different groups on the strength of binding of the H-atoms in benzene with the influence of such groups on the relative strengths of acids and bases. From this correlation they derive certain contradictions. Thirdly, they direct attention to the fact that in certain cases of substitution the loss of the hydrogen atom may happen at some other carbon atom than that which is to be the point of attachment of the new substituent.

With respect to this criticism we would like to make the following comments. In the theory of Hückel any more detailed picture for the mechanism (if the expression ' mechanism ' is permissible for a *quantum*-mechanical process) of substitution reactions was intentionally avoided, since we believe that at present such a picture is not possible without quite arbitrary assumptions. We do not see how the assumption of Lapworth and Robinson that substitution in aromatic compounds is to be considered as an addition followed by the expulsion of the hydrogen atom could be proved either by experimental knowledge or by theoretical considerations. On the contrary, the assumption in Hückel's theory is *not* that the mechanism of substitution is to be considered as an expulsion of the hydrogen atom followed by the addition of the new substituent, but only that for a definite reaction the heat of activation is smaller for a hydrogen atom bound more loosely and greater for a hydrogen atom bound more strongly. It cannot be denied that for all simple substitution reactions which have been investigated *quantitatively* up to the present time this assumption—taking the charge density calculated by Hückel—leads to results which are in agreement with observation; and that not only the differences for the heat of activation of *o*-, *m*-, *p*-substitution can be explained, but also the order of these differences for Cl, Br, I as directing substituents can be predicted by the theory.

In connexion with this, point (3) of the criticism of Lapworth and Robinson may be discussed first. It is obviously quite possible—and according to chemical experience even probable—that in certain cases of substitution reactions, such as the perhalogenisation of phenols [3] mentioned by Lapworth and Robinson, the mechanism of reaction is quite different from that which underlies the substitution reactions discussed in Hückel's paper. But evidently one cannot expect that the theory will be applicable to this quite different type of reaction.

As to points (1) and (2) of Lapworth and Robinson, the criticism fails for similar reasons. The dissociation of an acid or base, point (2), is a process quite different from a substitution reaction, for the reason that in the first case a proton (or an OH^--group) is freed from the molecule, whereas in the second case a hydrogen atom is freed; and in the first case the rest of the molecule remains as an ion and not as a neutral molecule as it is in the case of substitution reactions. It is clear that not only the influence of the group on the undissociated molecule is of importance for the dissociation, but also on the remaining ion. The latter has nothing to do with the charge density calculated by Hückel. Furthermore, in the case of dissociation, the H^+ or OH^- is not attached directly to a C-atom in the benzene ring. We cannot see what connexion there is between the dissociation of acids and bases and substitution reactions in benzene. We do not feel it surprising, therefore, that the influence of the different groups on the dissociation is of an entirely different character from the influence on substitution reactions. (As examples may be mentioned α-, β-, γ-chlorobutyric acid and *o*-, *m*-, *p*-chloro- and nitro-benzoic acids. The chloro- and the nitro-group have here an effect in the *same* sense, namely, strengthening, and at the same time not alternating.) Furthermore, the influence referred to, of groups on dissociation, has been observed in the case of *saturated* compounds also, whereas the directing influence for substitution and addition reactions is characteristic for aromatic and unsaturated compounds.

As to the addition reactions, point (1), nothing is known about the connexion of their mechanism with that of substitution reactions in aromatic compounds. Moreover, there are quite different kinds of addition reactions (for example, addition of alkali, halogens, halogen acid). Therefore also in this case one cannot expect that an explanation which has proved useful for simple substitution reactions will be applicable also to addition reactions—and conversely. It may be possible, however, also in the case of certain addition reactions to explain the influence of substituents on the places of addition by the calculation of the distortion of the charge density produced by the substituent; and it may well be possible that in this case (the addition of halogens, for example) the addition takes place more easily at places of higher electronic density—in contradiction to the case of substitution reactions, where, according to Hückel, the substitution happens more easily at places of lower electronic density, since the mechanism of reaction in the two cases may be quite different. But assumptions like this can be proved only by the quantum-theoretical calculation of the distortion of charge density for compounds for which the addition reactions have been investigated quantitatively, as is the case for substitution reactions discussed in Hückel's paper.

Summarising, we suggest that Lapworth and Robinson are trying to apply the theory of Hückel to cases which are in no simple way connected with the cases for which the theory of Hückel has been developed, and for which alone the theory claims to be applicable. What Lapworth and Robinson attempt, namely, to correlate the influence of groups on entirely different kinds of reactions, could be successful only if a complete theory for the mechanism of reaction for all these cases had been worked out. To give such a complete theory was not the intention

* For the case of substitution Lapworth and Robinson repeatedly refer to the strength of binding and the expulsion of a *proton*, although as distinct from the case of dissociation of acids we have to deal here not with the proton but with the hydrogen *atom*. This mistake may perhaps be due to a misprint on page 326 in Hückel's paper, where (last but one line) " H-atom " should be read instead of " H^+ ". From the whole discussion, however, it is clear that " H-atom " is to be read.

of Hückel's paper. Its purpose was rather merely to show that for the influence of different groups on simple substitution reactions in benzene a simple and intuitive interpretation without detailed assumptions about the mechanism of reaction can be given by means of the quantum theoretical calculation of the distortion of the electronic distribution in the benzene ring produced by the substituent.

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[1] NATURE, **129**, 278; 1932.
[2] *Z. Physik*, **72**, 310; 1931.
[3] See, for example, Fries und Schimmelschmidt, *Ann. d. Chem.*, **484**, 245; 1930.

Sulphur Assimilation in Wool Growth

IN a series of important papers dealing with 'Bush sickness' of ruminants in New Zealand, T. Rigg[1] and his co-workers at the Cawthron Institute, following on the work of B. C. Aston,[2] established the incidence of this ailment as due to iron deficiency in well-marked localities recognised as 'unhealthy'. So far as the pasturage on healthy and unhealthy areas is concerned, the average seasonal iron content is practically the same. The soil-iron content, however, is in general far greater in the healthy areas; and in the one comparative case where the *total* iron is actually higher in the unhealthy area, the 5 per cent oxalic acid soluble iron (a rough measure of relative availability) is only one-fourth of that in the healthy area.

From these investigations emerges the startling but apparently unassailable conclusion that ingested soil is an absolutely essential supplement to the pasturage, which in itself, in clean condition, is definitely iron-deficient in all these sheep-rearing areas. The habit of the sheep of ingesting soil has thus provided Rigg with an interesting interpretation of the incidence of the similar 'pining' sickness of Cheviots, which was unknown when the land was overrun with moles, but made its appearance when the moles were exterminated.

These investigations are also highly significant in relation to the associated nutritional problem of the excessive cystine yield in wool growth compared with the cystine available in normal diet.

To quote Rigg's own words, "an interesting and unexpected result was the great improvement both in growth and in lustre and elasticity of the new wool grown after administration of ferric ammonium citrate. It seems possible, therefore, that 'iron' plays some special rôle in wool growth. Is it possible that the wonderful results in increased wool growth obtained through the provision of a 'lick' of blood meal in the Meteor Downs experiment in Queensland may be due partly to the iron content of the blood meal (approximately 0·2 per cent)? It does not seem probable that the great increase in wool growth (averaging 20 oz. per sheep) was wholly due to the small amount of cystine administered in this way."

Accepting Evans's values[3] for the cystine contents of pastures, it is self-evident that conversion of non-cystine sulphur into cystine *must* occur, and one means of such conversion may be dependent upon invigorated action of intestinal bacteria, as recently suggested by Dr. Rimington and Mr. Bekker.[4]

Equally evident is the probability that adventitious sulphur as well as adventitious iron may be an essential supplement to the food-stuff. Soil ingestion in the areas investigated by Rigg, which are of volcanic origin and almost exclusively silicious in character, would not appreciably affect the sulphur intake, yet with the iron supplement not only do the general anæmic symptoms of bush sickness disappear, but, also, the wool, which practically ceases to grow in severe cases, resumes normal growth and lustre, with a well-defined 'break' coincident with the remedial treatment. Pasturage from such soils may well prove to be deficient even in *total* sulphur (though evidence on this point is lacking). In this event, the stock-water supply, particularly from artesian wells, may assume a special significance.

Evident again is the sweeping conclusion that the view hitherto widely accepted, which regarded the cystine supply as the essential limiting factor in wool production, is now definitely exploded, and that the various attempts to influence wool growth *directly* by administering cystine-rich fodder were foredoomed to failure.

The situation has thus radically changed since 1927, when I first pointed out the significance of the variable sulphur content of wool in its histological, nutritional, and technical aspects.[5] The extensive scheme of research developed from this, in conjunction with my present and past colleagues and co-workers, Mr. Barritt,[6] Dr. Rimington,[7] and Mr. Bekker,[8] did in fact include an attempt to influence the sulphur content of rabbit wool by addition of varied doses of cystine and of wool hydrolysate, to a standard ration.[9] It was clear from these experiments that the seasonal factor completely masked any possible cystine effect, a difference of as much as 18 per cent in the sulphur content of wool from the same animal between one three months' clip and the next being found equally in the cystine-fed and control animals.

It was, moreover, further observed by Mr. Barritt and Dr. Rimington[7] that the increased sulphur yield was still wholly in the form of cystine.

While the recent developments do not lessen but rather emphasise the importance of the work on sulphur content in relation to wool quality, initiated in these laboratories, they expose the dubiety of attempts to associate with a supposedly specific diet supplement, divergent effects from those obtained with a basal diet control. In view of the above-mentioned and possibly other as yet unrecognised factors, field-work data especially would appear to need very careful consideration before recommendations are made to pastoralists on nutritional methods of improving wool growth and quality.

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[1] Rigg and others, N.Z. Dept. of Scientific and Industrial Research, *Bulletin*, No. 32; 1932.
[2] Aston, *Trans. N.Z. Inst.*, **58**, 536; 1928, and later papers.
[3] Evans, *J. Agric. Science*, **21**, 806; 1931.
[4] Rimington and Bekker, NATURE, **129**, 687, May 7, 1932.
[5] King, *J. Text. Inst.*, **18**, 364T; 1927. *Text. Merc.*, Oct. 23, 17; 1929.
[6] Barritt and King, *J. Text. Inst.*, **17**, 386T; 1926: **20**, 151T; 1929. *Biochem. J.*, **25**, 1075; 1931.
[7] Barritt and Rimington, *Biochem. J.*, **25**, 1072; 1931.
[8] Bekker and King, *Biochem. J.*, **25**, 1077; 1931.
[9] Barritt, King, and Pickard, *Biochem. J.*, **24**, 1061; 1930.

Constitution of the Keratin Molecule

OF the two comments which Dr. Rimington[1] has to make on our recent note[2] regarding the constitution of the keratin molecule, one is erroneous and the other misleading. In our original communication, we claim to have shown that the amount of free amino

nitrogen in wool is precisely equivalent to the amount of hydrochloric acid absorbed from solution at *p*H 1·0 and to the arginine and lysine content of the fibre as determined by Marston.[3] In Rimington's opinion, the significance of these identities is lost because " the guanidine group of arginine does *not* . . . yield nitrogen with nitrous acid under the usual conditions ". Van Slyke and Birchard [4] are quoted in support of the contention, a more recent paper by Plimmer [5] being overlooked. The latter has shown that the guanidine group of arginine *is* attacked slowly by nitrous acid under the usual conditions, and his data indicate that, in twenty-four hours, reaction with the second amino group is almost complete. The determinations which we made of the free amino nitrogen in wool were all allowed to proceed for twenty-four hours, and there is, in consequence, no necessity to follow Rimington in his speculation " that wool probably contains hydroxylysine or other diamino acid in addition to lysine ". The " other diamino acid " is undoubtedly arginine.

In regard to the disagreement between Marston's [3] and Vickery and Block's [6] determinations of the arginine and lysine content of wool, reference must be made to the preceding paper [7] by Vickery, which contains an illuminating comment on the methods employed. He states that " there is, therefore, every reason to believe that the arginine content of human hair may be well over 8·0 per cent ", the value he obtained. Similarly, the value of 7·8 per cent for the arginine content of wool is probably low, as also Rimington's own value, obtained, presumably, by the same technique. There is therefore every reason for adopting the higher value of 10·2 per cent, obtained by Marston, as being the true arginine content of wool.

Rimington's second difficulty is that no account was taken in our original communication of the amide nitrogen in wool, which amounts to 1·2 per cent by weight. Even if the amounts of arginine and lysine present in wool are assumed to be the maximum values obtained by Marston, an excess of glutamic and aspartic acids remains unaccounted for after the necessary amounts for combination with arginine and lysine have been deducted from the quantities estimated by Abderhalden [8] in wool. This excess would be available for combination with 0·4 per cent of amide nitrogen. But Abderhalden's determinations of the glutamic and aspartic acid content of wool are known to be low, and since only 75 per cent of the wool fibre has so far between accounted for by protein analysis, there can be little doubt that sufficient glutamic and aspartic acids will be found present in wool to account quantitatively for its content of amide nitrogen, as well as for that needed to combine with arginine and lysine. We had proposed to avoid all comment on amide nitrogen until such a relationship had been established, and determinations of the glutamic and aspartic acid content of wool are in progress in this laboratory.

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May 17.

[1] Rimington, NATURE, **129**, 580, April 16, 1932.
[2] Speakman, NATURE, **128**, 1073, Dec. 26, 1931.
[3] Marston, Council of Sci. and Ind. Research, Commonwealth of Australia, *Bull.* 38; 1928.
[4] Van Slyke and Birchard, *J. Biol. Chem.*, **16**, 539; 1913–14.
[5] Plimmer, *Biochem. J.*, **18**, 105; 1924.
[6] Vickery and Block, *J. Biol. Chem.*, **86**, 107; 1930.
[7] Vickery and Leavenworth, *J. Biol. Chem.*, **83**, 523; 1929.
[8] Abderhalden and Voitinovici, *Z. physiol. Chem.*, **52**, 368; 1907.

Adsorption of Weak Electrolytes on Charcoal

WE wish to direct attention to two recent statements about our experiments, which may be misleading if left without comment.

In a paper describing results of wide biological significance, Ockrent [1] has suggested, as an interpretation of our results, that in accordance with his theory of selective adsorption " it is to be expected that in a mixture containing strongly adsorbable undissociated molecules and weakly adsorbable ions (arising either from the presence of salt or by the slight dissociation of acid or base) the more strongly adsorbable component will be preferentially adsorbed ". It would seem, however, that if ionic adsorption were normally suppressed by simultaneous molecular adsorption, some degree of adsorption should be observed in solutions of such hydrogen ion concentration that the amount of adsorbate existing in the molecular form is negligible. Ockrent observes a very slight hydrolytic adsorption of sodium salicylate under his conditions (using activated sugar charcoal). On the other hand, with the vacuum-heated charcoals used in our experiments, there was no measurable hydrolytic adsorption of propionate, succinate, or hexoate. Hence, we do not think Ockrent's interpretation correct.

The same criticism applies to the statements of Roychoudry and Mukerjee.[2] In an interesting communication, the latter have established that strong anions and cations are adsorbed by activated charcoals of high purity (cf. Miller [3]). These authors further suggest that these observations are not consistent with our views on adsorption. This surely is due to a misunderstanding. Throughout our work, attention has been confined to a study of the adsorption of weak electrolytes by purified, vacuum-heated charcoals. Such a carbon being degassed, and having very little mineral impurity, should approximate very nearly to a true neutral surface. The results which we obtained indicate clearly that weak organic electrolytes are adsorbed only in the molecular form.[4, 5, 6]

From the above experiments, taken with the earlier work of Miller, we must conclude that the adsorption of weak electrolytes by highly purified charcoals is essentially a different process from the adsorption of strong electrolytes under the same conditions.

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[1] Ockrent, *J. Chem. Soc.*, 613; 1932.
[2] Roychoudry and Mukherjee, *Kolloid Z.*, **57**, 302; 1931.
[3] Miller, " Colloid Symp. Monograph ", No. 5, p. 55; 1927.
[4] Phelps and Peters, *Proc. Roy. Soc.*, A, **124**, 584; 1929.
[5] Phelps, *J. Chem. Soc.*, 1724; 1929.
[6] Phelps, *Proc. Roy. Soc.*, A, **133**, 155; 1931.

Mechanical Hardness Influenced by Magnetisation

IN a paper on " A Correlation between the Mechanical Hardness and the Magnetostrictive Effects of Ferromagnetic Substances ",[1] attention was directed to the possibility of annealing or softening a steel rod by ' working it ' magnetically.

Recently the work of E. G. Herbert,[2] in which he deals with the hardening of metals by rotating magnetic fields, has been brought to my notice. Herbert says, " The result of the magnetic treatment was an immediate decrease of hardness followed by an increase, stability being attained after 3 hours ". The work in 1923 seems to be confirmed by Herbert's work.

A series of four rods were given different degrees

of mechanical hardness by different drawing temperatures. The changes in total length were then measured as the applied magnetising force was increased from zero up to about 950 gausses. The changes in total length for the four rods are shown in Fig. 1. The rods were all of the same length, namely,

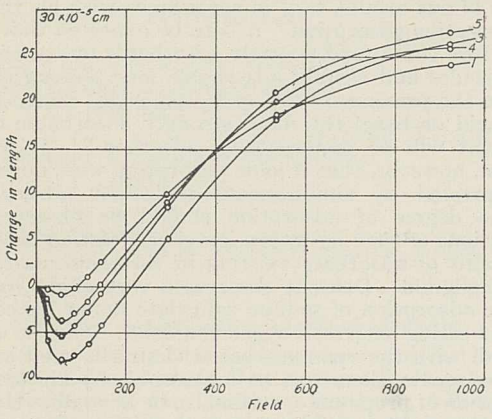

FIG. 1.

58·5 cm. All four rods increased their lengths for small field strengths, but decreased them for strong. The values of the maximum elongations increase with decrease in scleroscope hardness.

Rod No.	Scleroscope Hardness.	Max. Elongation.
1	70·7	1 × 10⁻⁵ cm.
4	51·9	3·7 × 10⁻⁵ cm.
5	42·8	5·3 × 10⁻⁵ cm.
3	34·6	8·1 × 10⁻⁵ cm.

Each one of the curves in Fig. 1 is the average of 4-6 sets of curves. The steel rod was demagnetised by sending a decreasing *A.C.* through the coil surrounding it. Then the rod was magnetised by a *D.C.*, so that the field was directed upwards in a vertical coil and increased continuously from zero up to a value of about 950 gausses. The deflexions of the extensometer were recorded photographically. This took about 60 seconds for each run. Again the rod was demagnetised, but this time the rod was magnetised by a *D.C.* with the field directed downward instead of upward as in the preceding run. This procedure was repeated 4-6 times; each time a reversal of the *D.C.* field occurred.

Rod No. 5 showed a certain instability, and it was only after repeated reversals of the *D.C.* field, with demagnetisation between runs, that it seemed to settle down. A further study of the preliminary runs on this rod showed that each time the rod was demagnetised, and the field was reversed, the maximum elongation was increased, so that a series of curves was obtained for rod No. 5, not unlike the series of curves shown for the four rods in Fig. 1. If, then, increase of the maximum elongation may be interpreted as an increase in the softening of the rod, and Fig. 1 indicates this, then rod No. 5 showed a softening due to magnetic working. Apparently the work in 1923 caught only the softening which occurs at the time of magnetic treatment, and did not disclose, what Herbert has recently shown, that the magnetic treatment is followed after some time by an increased hardness and stabilisation.

The work of Herbert seems to be a most important contribution to the theory of hardness. It is hoped that the magnetostrictive tests may be carried on much more extensively than has been done; for, in my opinion, the magnetostrictive tests offer one of the outstanding approaches to the study of the mechanical properties of ferromagnetic materials.

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[1] *Trans. Amer. Soc. Steel Treating*, 362, April 1924.
[2] *Proc. Roy. Soc.*, **130**, 576; 1930–31. *American Machinist*, **74**, 967, June 25, 1931.

Neanderthal and Modern Man

THE recent communication by Miss Garrod [1] concerning discoveries of human remains in Palestine raises questions of such wide and general interest, and bears so directly on work in which we have been engaged, that we venture to put forward the following views as to a possible line along which a synthesis may be made of the complicated evidence so far obtained relating to the fossil history of the human family.

Miss Garrod reports the discovery by Mr. MacCown in a Mousterian deposit of the skeleton of a young child, the skull of which had certain features which suggested the Neanderthal race, while "others seemed to be incompatible with it". We are not told what these were, but in the *Times* of May 4, Sir Arthur Keith is reported as saying that while "the front of the skull was Neanderthal, the back of the head was of an entirely new type, more resembling that of modern man", so that the specimen might be regarded as a transitional stage between European Neanderthal and modern man. It is clear that this young form differs considerably from the adult more recently discovered, which, whether it represents a new species or a new genus, is of the neanderthaloid type.

Concerning the difference between the young and adult forms of the skull of *Homo neanderthalensis*, however, we are in the fortunate position of being able to make some definite statements, thanks to the number, now considerable, of adult specimens of the species that are known, and to the Devil's Tower skull discovered by Miss Garrod at Gibraltar, which represents a stage of development of an individual of the Neanderthal race corresponding to a modern human infant of between five and a half and six years of age. Although this Devil's Tower skull is quite clearly Neanderthal, in general form it bears a closer resemblance to modern adult *Homo sapiens* than it does to its own adult (*H. neanderthalensis*) or to the young form of modern *H. sapiens*.

The resemblance between adult *H. sapiens* and young *H. neanderthalensis* suggests that the former may have been descended from the latter by a progressive retention into adult life of characters present in the young stages in the ancestor. This view is but an application of that which was most skilfully developed by Bolk [2] in his demonstration of the changes accompanying the descent of man from other mammals: a view favourably commented upon by Sir Arthur Keith [3] and recently shown to be capable of wide application in the realm of organic evolution,[4] and especially concerned in the production of new generalised types, such as the Insecta or Vertebrata, the generalised character of the original representatives of which may be estimated by the large amount of variation and radiation which the members of these groups have since undergone. Evolution by such means may be referred to as 'fœtalisation', or, more generally, 'pædomorphosis'. The differences between adult *H. neanderthalensis* and adult *H. sapiens* skulls in respect of the dentition, chin, the position of the foramen magnum, and the nature of the frontal eminences, to mention only a few points, are precisely

what would be expected if, in its ontogenetic development, *H. sapiens* departed less from its embryonic form than *H. neanderthalensis*. In other words, *H. sapiens* is simpler or more generalised, and this attribute of his evolution accords well with what has been said above with regard to pædomorphosis. At the same time, of course, *H. sapiens* has also evolved along his own progressive lines.

We therefore suggest that the available evidence may be most profitably synthesised by regarding *H. neanderthalensis* as the antecedent in consanguinity of *H. sapiens*, the descent of the latter having been characterised by pædomorphosis, so that it may be said that *H. sapiens* has derived his main characters from *young H. neanderthalensis*, the adult characters of *H. neanderthalensis* having been discarded and lost by this process. It is interesting to us to note that this view is in substantial agreement with the conclusions with regard to the affinities between *H. neanderthalensis* and *H. sapiens* at which Prof. Hrdlička has arrived from other lines of investigation.[5]

L. H. DUDLEY BUXTON.
G. R. DE BEER.

University Museum, Oxford,
June 15.

[1] Garrod, D., *Times*, June 11, 1932.
[2] Bolk, L., *Lancet*, Sept. 10, 1921; *Proc. Konin. Akad. v. Wetensch. te Amsterdam*, **25**, 1922; "Das Problem der Menschwerdung", Jena, 1926.
[3] Keith, A., NATURE, Supplement, Aug. 18, 1923.
[4] de Beer, G. R., "Embryology and Evolution", Oxford, 1930.
[5] Hrdlička, A., *J. Roy. Anthrop. Inst.*, **57**, 1927.

Mother-of-Pearl Clouds over Scandinavia in January and February 1932

THE remarkable stratosphere clouds[1] which the late Prof. Mohn called mother-of-pearl clouds, again appeared over Scandinavia several times during the months of January and February of this year. Elaborate preparations had been made to obtain photographs and visual observations of these remarkable clouds. All my aurora stations in southern Norway were ready to take photographs as soon as the clouds appeared, and Capt. Ween, of the Norwegian Geodetic Survey, in collaboration with me, had made preparations to take photographs with modern photo-theodolites. Further, through the photographic stores of Nerlien in Oslo, I had secured assistance in obtaining photographs and moving pictures of the clouds in natural colours. Through broadcasting and by articles in the Press, I asked people to send me observations of the clouds, and this proved to be a most valuable help, since I received about three hundred most interesting reports from different parts of Scandinavia and Finland.

The clouds were first seen in Oslo on Jan. 14, and during the following week from several parts of northern Norway. On Jan. 27 and 29 they were again seen in Oslo, and about fifty successful photographs for determining the height were secured at my aurora stations in southern Norway. Some photographs were also taken by Capt. Ween. During the following two weeks the clouds were observed on several occasions from southern, central, and northern Norway.

On Feb. 19, clouds of exceptional beauty were seen about sunset in southern Norway; about seventy reports, with sketches, and a series of interesting photographs, were received. In Oslo, I observed the clouds for three hours from sunset and from about midnight until the next morning, the clouds being illuminated by the moon. All my aurora stations were in action, and more than a hundred successful photographs, with base lines 27·3-105 km., were taken, first after sunset and then during the night in moonshine.

A series of successful photographs was also taken by Capt. Ween, and four very interesting photographs and a moving picture, both in natural colours, were secured by Mr. Simonsen and Mr. Gibbson, of the firm of Nerlien, Oslo.

The preparation of the large amount of material will undoubtedly reveal much that is new concerning these remarkable clouds. Preliminary measurements of some of the photographs show the same altitudes as before, that is, somewhere between twenty and thirty kilometres.

During the night of Feb. 19-20, I made an interesting observation which may give some idea as to the nature of these clouds. A rather homogeneous cloud happened to be near the moon, and I then observed part of a large corona. From the moon and outwards there was a region of bluish-yellow colour, and then came part of a red ring with an inner radius of between fourteen and fifteen degrees from the moon. The outer radius was not observed. If we assume the outer radius of the red ring to be equal to or greater than 18°, we have[2] for the cloud particles diameters not exceeding 0·0025 mm.; the height of the clouds was at that time 21-25 km., according to preliminary measurements.

CARL STÖRMER.

Oslo.

[1] "Clouds High in the Stratosphere." By Prof. S. Chapman, NATURE, April 2, p. 497.
[2] Pernter-Exner, "Meteorologische Optik", Zweite Auflage, 2 Kapitel, Wien und Leipzig, 1922.

Freshwater and Land Mollusca from British Somaliland

SINCE my letter on climatic changes in British Somaliland was written,[1] Major Connolly has kindly identified for me some freshwater and land mollusca from that Protectorate, collected in the Dumuk tug near Buramo, a few miles from the Abyssinian frontier.

They were extracted from the bank of the dry channel under about fifteen feet of alluvium, and include *Zebrinops revoili* (?) Bgt. and two species of *Subulina*, known from Gallaland, but not before recorded from British Somaliland, namely, *S. erlangeri* Bttgr. and *lacuum* Bttgr.

Z. revoili is more or less a desert form. Although these three terrestrial species were found at nearly the same horizon as the freshwater forms and may have fallen or been swept by flood waters into the tug, yet their occurrence at least suggests a pause in deposition when the expanse of alluvium through which the present channel is cut became dry land.

The point is worth investigation, as such a break, if confirmed, may simplify the correlation of variations of climates with other areas.

The remaining species are: (1) the widely distributed *Melanoides tuberculata* Mull., and (2) *Planorbis stanleyi* Smith, not previously recorded from British Somaliland, although a living Abyssinian form.

In addition to these five species, *Z. maunoirianus* Bgt. was found on the Sorl Haud between Illad and Heman (lat. 48° N. and long. E. 10°). The distribution of this snail, amongst other details, is given by Connolly in a paper published in 1931.[2]

From the ruins of Gorgab, he identifies *Cerastus somaliensis* Smith, and another species of that genus, unidentifiable by reason of the fragmentary condition of the specimen, also *Sub. erlangeri* Bttgr. and *Limicolaria donaldsoni* Pilsb.

Two small pieces of the shells of freshwater mussels were picked up amongst the ruins of the old town of Eik, forty miles south of Burao and about thirty from the Abyssinian frontier. These are determined to be (i) a species of *Mutela*, and (ii) most probably a

Unio. Below Eik is a shallow depression which was once clearly a small lake and is even now swampy during the rainy season. Fragments of glass bangles from the ruins were kindly determined by Mr. R. L. Hobson of the British Museum to be of Arab manufacture of the fifteenth century or later. The obvious inference is that desiccation has proceeded rapidly during the last 500 years, although at present the doubt must remain whether the shells were brought from elsewhere for domestic purposes. No mussel shells, however, were found in four other similar ruins examined, a point in favour of their former habitat being Eik.

It may be added that no doubt can exist that a survey dealing with the Pleistocene geology of Somaliland, and including the Northern Frontier Province of Kenya, would provide results of no small scientific interest, especially if archæological work were undertaken at the same time.

JOHN PARKINSON.

The Athenæum,
Pall Mall, S.W.1, May 5.

[1] NATURE, **129**, 651, April 30, 1932.
[2] *Ann. Mag. Nat. Hist.*, Ser. 10, 8, p. 322.

Specific Heat of Gases at High Temperatures

EVIDENCE has been accumulating in my laboratory that combustion is in general far from being complete at the moment of maximum pressure in closed vessel gaseous explosions even under the best experimental conditions, and that consequently specific heat values for gases at high temperatures determined by the explosion method are much larger than the true values. Much of this evidence has rested upon certain assumptions, such, for example, as that the specific heats of various diatomic gases constituting the diluents in explosive mixtures are practically the same over any given temperature range.[1] But recently Messrs. J. R. Brown and A. H. El Din have completed a carefully conducted and extended series of experiments which seem to offer conclusive proof that incomplete combustion at the moment of attainment of maximum pressure in closed vessel explosions is generally so large as to make the explosion method as usually employed unreliable for specific heat determinations.

In these experiments, mixtures of identical composition were exploded in two spherical vessels of different sizes—one 6 inches in diameter and the other 18 inches. Both pressures and heat losses during the explosion period were measured in each vessel. It was found that higher pressures were developed in the larger vessel than in the smaller vessel, and that these higher pressures were not to be explained to any very considerable extent in terms of smaller relative heat losses in the large vessel. The conclusion seems irresistible that combustion is more complete in the larger vessel than in the smaller one, due possibly—at any rate, in part—to the fact that as the time of explosion is greater in the larger vessel, combustion is in a more advanced phase.

Taking the data from one typical experiment in which the explosive mixture was an over-rich carbon monoxide air mixture at atmospheric density, it was found by the usual method of calculation that the apparent specific heat of carbon dioxide over the temperature range of the explosion, after allowing for the measured heat loss, was 15·55 for the small vessel (temperature range 20°–1920° C.) and 14·4 for the larger vessel (20°–1990° C.). The values for the specific heats of carbon dioxide over these temperature ranges, as given by Partington and Shilling, are 9·75 and 9·81 respectively, and these are in all probability nearer to the true values than those yielded by the explosions. The inference, then, is that while combustion is more complete in the large vessel than in the smaller one, it is seriously incomplete in both vessels.

Hydrogen explosions in the two vessels yielded apparent specific heats for steam which differ to much the same extent as those for carbon dioxide, but they are nearer to the Partington and Shilling values. An over-rich hydrogen mixture, for example, yielded apparent specific heat values of 10·7 for the smaller vessel (20°–1920° C.) and 9·5 for the larger vessel (20°–1985° C.). The values given by Partington and Shilling for these temperature ranges are 8·4 and 8·54.

W. T. DAVID.

Engineering Department,
The University, Leeds,
May 24.

[1] Thorp, *Phil. Mag.*, Dec. 1929, p. 829.

Relative Excitation of the Three X-ray *L*-Levels with Cathode Rays of Different Velocities

SKINNER, Robinson, and others have studied the relative excitation of the three X-ray levels L_{III}, L_{II}, and L_I, when for this excitation primary radiation of different wave-length is used. Such experiments may be done by studying the relative intensity of the emission lines which combine with each of the three *L*-levels (Skinner) or by an estimation of the relative intensity of the secondary β-rays which emerge from these levels (Robinson). The following remarkable result was obtained: when the exciting radiation is a little harder than that of the hardest *L*-absorption edge (L_I-), then the levels L_{III} and L_{II} give much more intense lines than the level L_I. With increasing frequency, however, this relation is totally changed in favour of L_I. With a frequency about five times as large as that of the *L*-edges, L_I is excited to a much larger extent than L_{II} and L_{III}, so that the generally not very intense lines belonging to L_I become the most intense lines of the corpuscular β-ray spectrum in the experiments such as done by Robinson. This result points to the large influence of the quantum number l (which is 1 for L_{III} and L_{II} and 0 for L_I) on the excitation of the three *L*-sublevels.

It seemed to us worth while to try if a similar effect exists when the excitation is brought about by cathode rays of different velocities. The difficulty with such measurements is that the electrons which penetrate into the anticathode lose their velocity according to the Whiddington law, so that even when the X-ray tube is operated with direct current a whole spectrum of velocities is obtained in the anti-cathode. We have tried to avoid this difficulty in the same manner as has been done for other purposes by Webster. A massive anticathode of beryllium with an extremely thin layer of tungsten was used and the three *L*-levels of tungsten were studied. The thickness of the tungsten was such that not more than 5 per cent of the energy of the cathode rays was absorbed by it. In this case, apart from small corrections, the relative intensities of the X-ray lines coming from the three different *L*-levels give a good idea of the relative cathode ray excitation of these three *L*-levels. The lines β_2 (L_{III}), β_1 (L_{II}) and β_3 (L_I), which lie about in the same region of the spectrum, were used. When the tension varied from 15 to 40 kv., the line β_1 gets about 10 per cent more intense relative to β_2; the line β_3, however, gets about 30 per cent more intense relative to β_2. This result is the more interesting because for tungsten the energy difference L_{II}-L_{III} is about 2·5 times as large as the difference L_I-L_{II}. It seems, therefore, that here, as in the case of the excita-

tion by primary radiation, the influence of the quantum number l is of more importance than the energy differences between the three L-levels.

D. COSTER.
J. VAN ZUYLEN.
Natuurkundig Laboratorium der
Rijks-Universiteit,
Groningen.

Photochemistry of Vitamins A, B, C, D

PROBABLY because our letter in NATURE of May 14, p. 720, on this subject was too compressed, some misunderstanding seems to have arisen as to the method which we have described. After reading the remarks of Prof. Heilbron and Dr. Morton in NATURE of June 11, p. 866, we think it may save further difficulties if we reaffirm the purpose of our original communication. We wished to show the possibility and to describe some applications of selective *monochromatic irradiation* as an instrument of research in biological problems.

Before this, filters have been used in order to separate different spectral regions, chiefly because monochromators have not been constructed to give a sufficiently high intensity in the ultra-violet to bring about photochemical changes in a reasonable time. (In 1929 Marshall and Knudson, however, applied monochromatic radiation to ergosterol.) With our instrument, we are able to secure accurately monochromatic light of very high intensity. The use of broad bands of ultra-violet radiation, even though selected with a knowledge of absorption spectra, may often conceal the essential molecular changes which occur in a photochemical reaction. Thus, unless the parent substance is irradiated with strictly monochromatic light, the possibilities are left open (*a*) that the parent molecule may be destroyed in two or more ways simultaneously, and/or (*b*) that the daughter molecule may be destroyed by absorption of wave-lengths other than that causing its production from the parent. These possibilities cannot be definitely excluded by the use of filters, but only by the use of monochromatic radiation.

The method and its applications (which naturally vary from molecule to molecule) will be described in full in a subsequent publication. Until this complete statement is available, we feel that it will economise in time and space to postpone discussion of the detailed points raised by Heilbron and Morton. We should, however, like to say, in reference to vitamin A, that up to the present we have only recorded the fact that on irradiating carotene we have obtained a band near 3280 A.; at a later date, however, we hope to be able to announce the results of experiments on the nutritive value of samples in which the whole of the carotene has been destroyed. We are also trying to devise physical tests more detailed than those in present use, to apply to our irradiated product and to vitamin A itself.

F. P. BOWDEN.
C. P. SNOW.
Laboratory of Physical Chemistry,
Cambridge, June 10.

Hexuronic Acid as the Antiscorbutic Factor

AT the request of Prof. A. Szent-Györgyi, crystalline hexuronic acid from adrenal glands, kindly supplied by him, was tested by us for antiscorbutic activity. Six guinea-pigs, weighing 260 gm., 275 gm., 300 gm., 280 gm., 295 gm., and 310 gm., were employed in the test. Each animal received 1 mgm. of the preparation daily, the first dose being administered when the animals had been six days on the scorbutic diet.

Fifty-five days after the commencement of the experiment the guinea-pigs were chloroformed, owing to the exhaustion of the supply of hexuronic acid, and were found to be free from macroscopic signs of scurvy at autopsy. The weight of the animals at the time of death was 430 gm., 465 gm., 355 gm., 392 gm., 370 gm., and 442 gm. respectively. All the guinea-pigs showed uninterrupted growth during approximately the first forty days, after which time their weights declined slightly. The post-mortem examination did not, however, suggest that this decline was due to scurvy.

The results are, therefore, very similar to those obtained by Svirbelly and Szent-Györgyi,[1] but, as I pointed out later,[2] although this proves the presence of the antiscorbutic factor in Szent-Györgyi's preparation, it does not, in my opinion, afford sufficient evidence of the identity of hexuronic acid with the antiscorbutic factor.

S. S. ZILVA.
Lister Institute of Preventive Medicine,
London, S.W.1, June 11.

[1] NATURE, April 16, p. 576.
[2] NATURE, May 7, p. 690.

VITAMIN C is the name given to a substance the lack of which causes scurvy. Svirbely and Szent-Györgyi have shown (NATURE, April 16 and May 7) that the hexuronic acid which was discovered by one of them, and is present in orange and lemon juice, is capable of preventing scurvy. Furthermore, they have shown that lemon juice has approximately the same antiscorbutic activity as the hexuronic acid present in it. In my opinion, no clearer demonstration could have been given of the identity of hexuronic acid and the vitamin. No circumstantial evidence can have much value against such a direct demonstration. The only possibility of doubt was with regard to the correctness of the experiment. However carefully an experiment is done, there is always the chance of an error, especially in such a subtle question as a deficiency disease. For this reason I asked Dr. S. S. Zilva to repeat our experiments, and supplied the necessary crystalline hexuronic acid. Dr. Zilva was kind enough to accept and undertake the work. As he reports above, his experiments were entirely confirmatory, so that no doubt is left whatever regarding the antiscorbutic activity and thus the vitamin nature of the hexuronic acid.

It needs very big assumptions to explain these results in any way other than by supposing that hexuronic acid is in fact the vitamin. An adequate explanation will be given in our detailed report in the *Biochemical Journal* of the observations which led Dr. Zilva several years ago to the opinion that the vitamin could not be part of the 'Reducing Factor', and thus could not be identical with hexuronic acid.

A. SZENT-GYÖRGYI.
Institute of Medical Chemistry,
University Szeged, Hungary, June 17.

Central and Peripheral Vision

IT is generally stated that the fact, long known to astronomers, that faint stars are seen most distinctly when viewed eccentrically is a phenomenon of dark adaptation, but this is not the case, as exactly the same condition is found with the light-adapted eye, as a simple experiment will show.

If two discs of white paper, each of a diameter of a sixteenth of an inch, be pasted on black cardboard an inch apart and viewed from a distance of twelve to eighteen inches, it will be found that the one that is directly looked at (with one eye) appears much darker than the other. This is observed in broad daylight.

F. W. EDRIDGE-GREEN.
Board of Trade, S.W.1,
June 4.

Research Items

Ancient Eskimo Art.—Archæological investigations on St. Lawrence Island in Northern Alaska, carried out by Mr. Moreau B. Chambers (Report on Investigations and Field Work of the Smithsonian Institution in 1931, *Pub.* 3134), have brought to light evidence from a small village site which has an important bearing on the source and development of Eskimo glyptic art. The village was abandoned many centuries ago when a rich old arctic culture still existed along the coasts of Siberia and Alaska in the vicinity of Bering Strait. The inhabitants lived in small houses, partly underground, with floors of stone-slab and walls of driftwood. Their implements differed little from those of later times; but their art was unique, giving the old Bering Sea culture its distinctive stamp. Bone and walrus ivory were carved by stone tools in many and ingenious forms. Animal figures and human heads are good examples of carving in the round; but the inhabitants excelled in executing graceful curving and flowing lines incised on ivory surfaces. A little more than a thousand years ago the Bering Sea culture underwent a sudden change. Instead of graceful curvilinear designs they used deeper, straighter, and more evenly incised lines. This style, though graceful, was inferior to that which preceded it. It is known as "Punuk" from the island where it was first isolated in 1928. It would appear that the cause of the cultural change was the introduction of iron from Siberia, some hundreds of years before the arrival of the Russians there in the seventeenth century. Chinese records show that iron was being used in Siberia in the third century A.D.

Buka and Bougainville.—Miss Beatrice Blackwood's preliminary report on her expedition to Buka and Bougainville, Solomon Islands, undertaken in 1929 on the invitation of the Institute of Human Relations, Yale University, has been published (*Oceania*, **2**, No. 2). The inhabitants of Buka were found to be more affected by contact with white civilisation than had been anticipated, but in Bougainville, especially in the central mountainous portion, they are still very hostile. The mountain people live in scattered settlements of one, two, or three huts at short distances from one another; the coastal and island people in villages varying in size from half a dozen huts to twenty or thirty. Some villages are composed of several hamlets. The huts are long and narrow, with low walls of betel-nut planks and an overhanging roof of sago-palm leaves, in shape somewhat like a flattened Gothic arch. They are arranged in straight lines. Each house is occupied by a family group, and every village has one or more boys' houses. In every village also there is one family of recognised high rank. Rank is hereditary in the female line. The successor to a chief is his eldest sister's eldest son. Marriage is normally exogamous; man and wife as a rule belong to different villages. Child betrothal is the rule. When a suitable girl child is found by a boy's father, he gives her father a present as a sign that she is appropriated. This is the beginning of a long series of reciprocal visits, culminating in a marriage ceremony, the essential part of which is that the couple sit down in close contact and are offered food and drink, which they must pretend to taste, the first meal eaten together being taken afterwards. Marriage is not consummated until after puberty.

Swarming of the Palolo Worm in March.—In an account of the Polychæta collected during the voyage of Prince Leopold of Belgium to the Dutch East Indies ("Rés. Sci. Voyage aux Indes Orientales Néerlandaises", vol. 2, Fasc. 7; 1931) Prof. P. Fauvel directs particular attention to a collection of Palolo worms made at Amboina in the Moluccas. This collection includes numerous fragments, up to 30 mm. in length, of both sexes, of *Eunice viridis*, all lacking their anterior ends. This epitokous form, which consists of the posterior part of the body containing the reproductive products, detaches itself from the anterior non-sexual part, which remains ensconced in the fissures of the coral reefs. The posterior parts swarm at the surface of the sea, where they shed their sexual products. This swarming of the Palolo and its relation to the phases of the moon has been described by many writers. In the New Hebrides, at Samoa, Tonga, and Viti, swarming occurs in October-November; it is of considerable interest to find that in the bay of Amboina swarming occurred in March. The collection was made on March 28, 1929, the last day of the swarming, towards sunset, and the moon (then sixteen days old) was bright. Besides *Eunice viridis*, numerous portions of *E. dubia* were taken at the same time.

East-Indian Alcyonarians.—Sir J. Arthur Thomson and Miss Laura M. I. Dean have described a rich collection of alcyonarians from the *Siboga* Expedition to the Dutch East Indies ("The Alcyonacea of the *Siboga* Expedition, with an Addendum to the Gorgonacea." Monographe XIIId. of Uitkomsten op Zoologisch, Botanisch, Oceanographisch en Geologisch Gebied versameld in Nederlandsch Oost-Indië 1899–1900 aan boord H.M. Siboga. Leiden: E. J. Brill, Ltd.). The authors have been assisted by Prof. W. R. Sheriffs (Dendronephthya), Miss Dorothy Chalmers (Siphonogorgia), and Dr. J. J. Simpson (Stereonephthya and some related genera). Amongst the material are two new genera and fifty new species of the Alcyonacea, three new species of the Gorgonacea, and two new species of the Telestacea. Of much interest is the new species *Anthelia simplex*, a primitive form which is represented by a single polyp rising from a thick membranous base, having no calyx and very simple short pinnules, the whole surface of tentacles, body, and base being studded with minute blunt-ended rodlets. For another primitive form, previously described as *Coelogorgia repens* by Thomson and Henderson, the authors establish the new genus *Protodendron*. It is not possible to refer to all the peculiarly interesting new forms and old forms revised which are discussed, described in detail, and beautifully figured in this splendid volume, but the fact that a parasitic copepod has been found, probably for the first time, in an alcyonarian, must be mentioned. This occurred in *Xenia ashworthi*, a dimorphic species in which curious abnormal stunted tentacles were observed. The tip of the abnormal tentacle was bent round to the oral surface where a small swollen pocket was found. These swellings each contained a copepod, usually lying transversely across the pocket, and several carried egg sacs. The pocket cavity, was definitely continuous with the tentacle cavity, and the appearance of the pocket strongly suggested that it is simply an enlargement of the tentacle cavity at the tip into which the copepod has passed from the polyp.

Vitamins in the Mango.—The mango is a fruit of very great importance to the inhabitants of the tropics, and might find a market in colder climates if conditions of transit, storage, and distribution could be adjusted. Its cultivation spread first from India to

tropical and subtropical America: at present, it is gaining favour as a dessert fruit in North America. The vitamin A, C, and D content of certain varieties has recently been investigated by Perry and Zilva (Empire Marketing Board. Preliminary Report on the Vitamin Content of the Mango. London: H.M. Stationery Office. 1*s*. net). The fruit, which was transported at a temperature of 40°-50° F. and then kept frozen at −20° C. during the experiment, was tested for its growth-promoting power (vitamin A activity) on rats, for its antiscorbutic potency on guinea-pigs, and for its antirachitic effect on rats, comparisons being made in each case with cod-liver oil or lemon juice. The pulp of the three varieties examined contained about the same amount of vitamin A as butter. Two contained as much vitamin C as lemon juice, or even more: the pulp or rind of the "Alphonso" variety was found to be a more potent source of vitamin C than lemon juice, containing about twice as much, while the pulp of the "Cawasji Patel" variety contained about as much vitamin as the latter. The "Shendrya" variety, however, contained much less and was about as potent as "Bramley's Seedling" apple. None of the varieties contained any significant amounts of vitamin D. Similar variations in vitamin C content between different varieties of the same fruit have already been noted in the case of apples (NATURE, **127**, 75; 1931).

Browning Root Rot of Cereals.—Farmers in the province of Saskatchewan have been troubled with a root rot of cereals sown after summer fallow. The rot was sufficiently extensive to nullify any of the beneficial effects on yield usually associated with fallowing. Many opinions and theories were prevalent amongst practical men as to the cause of the malady, but two members of the University of Saskatchewan have recently proved that species of *Pythium* are responsible ("Studies on Browning Root Rot of Cereals (II.). Some Parasitic Species of Pythium and their relation to the Disease", by T. C. Vanterpool and J. H. L. Truscott, *Canadian Journal of Research*, vol. 6, No. 1, pp. 68-93, 1932). The account describes numerous field experiments, which show that the cause of the disease was present in the fallowed soil. From the numerous species of *Pythium* isolated from rotted roots, two, *P. arrhenomanes v. Canadensis* and *P. volutum*, were found which upon inoculation reproduced symptoms of the malady. *Pythium volutum* is a new species, and varies greatly in the degree of its parasitism. The present work has shown that the seed treatments previously used against browning root rot are quite unnecessary and, in fact, may aggravate the disease. Hydrogen ion concentration of the soil seems to have no effect upon the distribution of the pathogenic species of *Pythium*, which have actually grown on culture media more acid than any of the prairie soils examined.

Fungi Pathogenic to Man.—The attention of medical men, mycologists, and others who are interested in fungi pathogenic to man is directed to an account by Mr. J. Ramsbottom, Keeper of Botany in the British Museum (Natural History), published by the Medical Research Council in vol. 8 of "A System of Bacteriology in Relation to Medicine" (London, 1931), and also available separately. After giving an outline of the classification of fungi and of some features of their biology (for example, polymorphism, pleomorphism, strains), the author proceeds to record in systematic sequence, beginning with the Phycomycetes, the fungi which have been described as causing disease in man. Many of these organisms are insufficiently described and their systematic position doubtful. The majority of the pathogenic forms are classed as Fungi Imperfecti, as the spore forms known do not include the sexual or perfect stage. The account concludes with a more detailed consideration of the ringworm fungi.

Tectonic Analysis of the Mourne Mountains.—Dr. H. P. T. Rohleder has carried out a tectonic investigation of the Tertiary granite mass of the Mourne Mountains, applying the principles developed by Prof. Cloos of Bonn (*Proc. Roy. Irish Acad.*, **40**, B, 12, 160-174; 1932). The pre-existing trend-lines of the Silurian country rock showed the way to the pre-granitic basalt dykes. These have been cut off abruptly by the granite which domed up the overlying strata to form a 'discordant laccolith'. During the phase of cooling, there came up quartz-porphyry dykes and aplites, followed by basic veins representing post-plutonic pneumatolytic and hydrothermal activity. In the post-granitic phase, a second series of basalt dykes intersected the granite and the neighbouring Silurian rocks. Vertical joints can be traced in all the members of this complex. There are four dominant directions: a system of principal joints at 16° and 94° (measured clockwise from true north), and a system of diagonal joints at 50° and 149°. The quartz-porphyry and aplite dykes follow mainly the 16° joints and to a less extent the diagonal directions. The 94° joints are avoided until all the other potential openings have been filled. Only the younger basalt dykes show an obvious majority in the 94° direction. Corresponding to these observations, the direction of best fissility of the granite coincides with the 16° direction. The latter is accordingly regarded as that of the 'open' cracks, and as the direction in which tectonic pressure was applied to the area during intrusion.

An Irish Bog-flow.—Although bog-flows are comparatively rare events, a good many have been recorded in Ireland, particularly the famous Kerry flow of 1896. Few, however, are described in greater detail than the flow at Glencullin, Co. Mayo, in February 1931, of which Messrs. A. D. Delap, A. Farrington, R. L. Praeger, and L. B. Smith have recently published an account (*Sci. Proc. Roy. Dublin Soc.*, vol. 20, No. 17, 1932). This flow did much damage in destroying scanty arable land in the valley down which it swept for more than two miles. From a low ridge the flow suddenly started in peat about ten to twelve feet in thickness, until about 400,000 cubic yards had slipped down to the valley. At the first rush, the impetus was sufficient to cause the flow to rise on the opposite side some twenty-two feet above the valley floor. Immediately afterwards, the semi-liquid mass began to move down the valley. The harder, drier surface floated in the lower liquid bog as great floes or rafts. The flow was seen to advance like a wall down the valley. It carried stones and boulders with it. The writers of the report, in considering the cause of this flow, note a slight change in gradient where it began a little below a shallow tarn. The fracture was probably across the normal drainage of this tarn, and the lower layers of the bog were evidently in a saturated condition and without coherence. When the accumulation of water reached a certain amount, the 'burst' took place, and spread over the area of semi-liquid bog, ceasing where it reached drier under-peat.

Variation of Hearing with Age.—There is a popular belief that hearing deteriorates with increasing age. In the *Bell Laboratories Record* for May, H. C. Montgomery describes a set of experiments made to determine the magnitude of this effect. The investigation was carried out with an audiometer on 200 employees in the laboratory, ranging in age from twenty to sixty

years. The audiometer produces any one of eight pure tones, varying in octave steps from a frequency of 64 to 8192 cycles. These frequencies cover the useful hearing range and correspond to the *C*'s on the piano—omitting the lowest and adding one above the highest. Measurements were made of the threshold of audibility at the various frequencies and diagrams were drawn. These audiograms were divided according to age into four groups, each group ranging over ten years. It was found that the difference between the thresholds of the youngest and oldest age group is quite small compared to the difference between the normal and those who have a difficulty in hearing. In fact, at frequencies below 2000 cycles, the differences in the four groups are practically negligible. At frequencies above 2000 cycles, the younger people hear the best. In ordinary conversation, where speaker and listener are close together, this is not noticed. In concert halls and theatres the effect is noticeable, some of the 50-60 group finding difficulty in distinguishing consonant sounds. They thus mistake 'thin' for 'sin', 'famish' for 'vanish', etc. The older group appreciate melody and rhythm as well as anyone, but the tones would sound more brilliant to youthful ears. It is concluded that the average difference in hearing ability between twenty-five and fifty-five years of age is relatively small. A further study including more advanced age groups might possibly discover marked differences in hearing ability.

Positive Ions of Mass 220.—L. L. Barnes and R. C. Gibbs announce, in a letter appearing in the *Physical Review* for April 15, that they have observed positive ions of mass 220 with a mass-spectrograph of the Dempster type. The source of ions was a specimen of a mixed alkali sulphate, which was believed from X-ray analysis to contain a quantity of the missing alkali metal with atomic number 87. When heated in a high vacuum at a temperature of about 650° C., this gave rise to small but steady positive ion peaks in the mass-spectrum, a convincing example of which is reproduced. The cæsium ion currents from the same source at the same temperature were about ten thousand times greater, showing that the concentration of the heavier element is almost certainly only

minute. The average value for m/e obtained from six curves was 220, with a maximum variation of not greater than one-half per cent, but a still more accurate determination of this quantity is being undertaken.

Spectra of Lead Isotopes.—The small differences in wave-length which were found more than ten years ago by Aronberg and Merton in the spectra of lead from different sources have been found by H. Kopfermann (*Z. Physik*, April 6) to come from differences in nuclear spin and hyperfine structure. In the earlier work, this was not resolved, although the optical apparatus was of sufficient power, probably because of Doppler broadening of the lines on account of the high temperature of the source. In Kopfermann's experiments, this is overcome by volatilising the metal in a gas discharge from a cathode kept cool by water or liquid air, and the hyperfine structure is readily observed. The lines of uranium lead (206) and thorium lead (208) are all single and well separated, but the 207 isotope gives a more complex structure, the centre of gravity of which is intermediate between the terms of the lighter and heavier isotopes in the spark spectrum (Pb II). Kopfermann remarks that his results do not conflict with Schüler and Jones's discovery of a weak component of hyperfine structure, which they attribute to Pb^{204}, as they used much more intense sources.

Alchemical Manuscripts.—In the current number of *Archeion* (xiv., 1932, pp. 57-61), Principal H. E. Stapleton publishes a preliminary account of the very important collection of Arabic alchemical manuscripts possessed by the Asafiyah Library of H.E.H. the Nizam of Hyderabad. It appears that this collection comprises no fewer than 195 separate volumes, representing approximately 150 different treatises. Twenty-two of the MSS. are ascribed to Jābir ibn Ḥayyān, about a dozen to Aidamir al-Jildakī, six to Muḥammad ibn Umail (or Amyal), and three to Khālid ibn Yazīd, many other of the well-known Muslim alchemists also being represented. Of considerable interest is the large number of works by previously unrecorded alchemical writers, which may be expected to yield valuable information when their study is undertaken. Mr. Stapleton promises a complete *catalogue raisonné* with as little delay as possible.

Astronomical Topics

Astronomical Notes for July.—Mercury is at its greatest elongation, 27° east of the sun, on July 20; but being south of the sun, it will only be seen with difficulty in the evening sky; it passes 2½° to the south of Jupiter on July 23. Jupiter is in conjunction with the sun on Aug. 3, and is therefore too low for convenient observation in July. Venus has become a morning star, but being still a thin crescent, it is not very conspicuous until the end of the month. Saturn is in opposition on July 24, but its south declination of 20° makes delicate observations difficult. There is only one occultation at a convenient hour; on July 10 the star ψ Virginis, of the fifth magnitude, disappears at 10.17 P.M. summer time, as seen from London. No conspicuous comets are visible at the date of writing. Ephemerides of periodic comets are given in the B.A.A. Handbook for 1932. Those who have suitable optical means should join in the search for Tempel's comet of the November meteors. It will, however, be in a better position in a month or two.

Photography of the Full Moon.—Most photographers of the moon choose phases other than full for their exposures, in order to show the shadows, which aid in throwing the surface into relief. Mr. H. G. Tomkins, who has for many years made the moon his special study, has lately taken a series of photographs of the full moon with the large reflector that he has erected at Dedham, Essex. Ilford Astra plates were used with an orange filter; three prints from these plates are reproduced in *Monthly Notices* of the Royal Astronomical Society for April. They were designed to bring out the contrast between the dark and the bright areas as strongly as possible, so that the maria are almost perfectly black and the brightest regions white. But all through the bright regions there is a mottling of dark patches. Mr. Tomkins suggests that this dark eruptive rock forms a base extending over the whole surface of the moon, but overlaid in many places by some whiter material; pumice or volcanic ash are suggested, or possibly an efflorescence of some kind.

The maria have some patches which are still darker than their general surface; it is shown that some of these are connected with the lava flows to which Mr. Tomkins directed attention in an earlier paper; they probably arise from an outpouring of dark lava on a surface that was already dusky.

The paper also contains a study of the relative antiquity of various formations; thus the Mare Humorum is considered to have been the scene of comparatively late eruptions.

Vision

ON Friday, June 3, the Physical and Optical Societies held a joint discussion on vision at the Imperial College of Science, South Kensington. The meeting was divided into four sections, two in the afternoon and two after dinner. A discussion took place at the end of each group of papers forming a section.

The proceedings were opened by Mr. J. Guild, who in a general paper reviewed the scientific basis of vision. He pointed out that the retina is not the only factor concerned, for nerve tracts and endings in the central nervous system must also be considered. He stated that for colour vision there may be either three kinds of receptors with multiple central connexions, multiple sets of receptors with three groups of central connexions, or three sets of receptors with three groups of central connexions. The number three must come in because of the known facts of colour mixing.

Mr. Guild also touched upon the problems of the nerve impulse and its relation to the intensity of a sensation; that is, if the nerve impulse is always of the same magnitude, is the intensity of sensation due to the frequency with which impulses follow each other up the individual nerve fibres? During the discussion it was stated that, from the physiological point of view, the intensity of a sensation depends upon the frequency of the nerve impulses, and that the more intense sensation, due to a larger area of stimulation, is related to the greater number of impulses in consequence of more nerve fibres being active.

Mr. Guild also contributed a general paper dealing with the significance of measurements in visual work and with their mathematical treatment.

As might be expected, the word colour appeared in the titles of many of the papers and the subject of colour perception was discussed in many more papers, but other aspects of vision were also considered.

The more purely mechanical and optical aspects were dealt with in four papers. Prof. A. von Pflugk and Mr. E. F. Fincham were concerned with the mechanism of accommodation. Mr. Fincham believes that the lens is plastic and that its change in shape is due to the elasticity of the lens capsule. Presbyopia is due to increased rigidity of the plastic constituents of the lens. Prof. von Pflugh contended that the zonule of Zinn is not responsible for the shape of the lens, but that the pressure of the vitreous with unslackened zonule produces the change in shape. The last word on this subject has not yet been said.

Prof. C. E. Ferree and Dr. G. Rand presented a paper on the refractive conditions for the peripheral field of vision, in which the results of the examination of the eyes of twenty-one individuals were reported. Prof. F. Roessler described the method of testing for astigmatism by combined red and blue lights.

Visual acuity formed the subject of two papers. Dr. R. S. Creed discussed the relationship of the retinal rods and cones, the nerve paths, and the frequency of impulses to visual acuity. Prof. H. Hartridge described the effects of chromatic aberration on the distribution of colour in the image of a point source of light.

The fundamental process whereby light stimulates the receptors in the retina was considered by Mr. D. Roaf. He showed, on the assumption that an increase in sensation denotes a definite quantity of decomposition of photochemical substance, that the acuity data of Houstoun agree with a bimolecular reaction for the synthesis of photosensitive material, but that the results will not fit the curve for a monomolecular reaction.

Prof. A. Brückner presented a paper showing different rates of adaptation in a number of individuals for whom the curves can be grouped into several classes. The condition of adaptation was mentioned by a number of speakers. Prof. L. C. Martin wished to know whether the dark or light adapted condition were the simpler to work with. Prof. H. E. Roaf agreed with Prof. Martin that the dark adapted condition was simpler, but Dr. R. A. Granit considered that the difficulty of accurate fixation makes the dark adapted condition more uncertain for experimental purposes. The condition of adaptation, that is, whether it is the result of diffuse illumination of neighbouring portions of the retina or whether it is due to the light shining on the same part of the retina as the test light, was not specifically discussed. From some points of view, Mr. W. D. Wright's paper, "The Significance of Colour Fatigue Measurements", Dr. R. A. Houstoun's on "New Observations on the Weber-Fechner Law", and Prof. H. E. Roaf's communication were dealing with aspects of adaptation to light, as they described changes in sensitivity due to previous or simultaneous illumination of the eye. Messrs. W. S. Stiles and B. H. Crawfurd measured the change in sensitivity due to extraneous light sources by finding out the illumination of the background or surrounding fields which produces the same alteration in visual threshold. They use this alteration in threshold as a measure of retinal adaptation.

The colour triangle received attention from two points of view. Prof. J. Drever presented results of estimations of the wave-length of 'pure' colours at varying intensity, showing that at 4710, 5080, and 5680 A. the colours appear pure even with marked differences in intensity. Prof. Drever then pointed out the inadequacy of the colour triangle as a means of representing all colour sensations, including variations in brightness and saturation.

Mr. T. Smith dealt differently with the colour triangle. He folded it up, opened it out as a straight line extending to infinity, and brought it back as a much improved triangle in which variations in wave-length discrimination throughout the spectrum are of no significance.

The presence and number of different kinds of receptors (whether these depend on retinal conditions alone is beside the point) was considered from a number of aspects. Mr. J. Guild gave some sound generalisations as to what is implied and what is not implied by the Young-Helmholtz or trichromatic theory. His view does not entirely agree with that expressed by Prof. W. Peddie. Prof. F. Allen and Prof. S. Hecht each presented long papers. The former pointed out that his well-known observations by the flicker method can all be explained on the trichromatic theory. In the subsequent discussion, it was pointed out that the duration of the dark period cannot be assumed to depend only on the sensitivity of the eye, even when the intensity of the light is kept constant. Prof. Hecht repeated his description of alterations in the sensation curves so that they form three almost identical curves. It did not seem reasonable to some of the participators that such closely similar curves could be a satisfactory basis for colour discrimination. Prof. H. E. Roaf presented evidence in favour of there being three sets of receptors, one for the whole visible spectrum, one for red and green, and one for red alone. Absence or diminished specificity of the last would account for the ordinary defects in colour vision.

Various experimental papers were contributed, all of which will be useful in the final interpretation of the processes involved in colour vision. Prof. L. C. Martin, Mr. F. L. Warburton, and Mr. W. J. Morgan

presented the results of observations on the number of recognisable steps between white and the spectral colours. There are fewer steps between green and white than between either red or blue and white. There are about an equal number of steps between either red or blue and white. This result agrees with the appearance that green has of being a less 'intense' colour than red or blue.

Prof. H. Hartridge described colour perception in an ivory white light formed by removing all the rays less than 5300 A. and some of the red. By such a light, it is possible to recognise pigmentary colours, but yellows are too pale, blues too dark, and purples too red. Ishihara's tests can be passed by a normal individual in such a light. These results indicate that the receptors for blue are probably stimulated by wave-lengths other than those less than 5300 A.

Prof. H. Pieron's paper dealt with the time necessary for the production of colour by stimuli of short duration. For red the time is 95 σ, for green 105 σ, and for blue 120 σ, thus showing the slower response for receptors for blue.

There were five papers which dealt with the problems of interpretation of visual stimuli. Dr. L. F. Richardson has obtained estimates of the relative amount of red in a given sample of colour, and finds that different individuals show an agreement between their estimates of the relative proportions of red and white in the mixture.

Prof. F. C. Bartlett sent in a paper dealing with the visual perception of depth; and Mr. H. Bannister offered an explanation of Pulfrich's pendulum experiment. Prof. Koffka described the phenomena concerned with contrast in the black-white series, and based a general theory of vision on the results.

Dr. R. A. Granit enlarged upon the significance of the synapses in the retina in relation to the path of the impulses proceeding through the retina to reach the optic nerve cells and fibres.

By the system of limiting each speaker to eight minutes, all the papers were disposed of in time to allow of discussion. As the authors did not reply to criticisms, we must await the publication of the whole discussion in order to know the final decision on some points. It might have been better if the papers had been grouped under subjects, though that is almost impossible, because so many of the subjects overlap, and until the papers have been read it is not easy to know under which subject to classify them.

Amongst the points brought out during the discussion are the following. It seems clear that vision is to be explained on a trichromatic basis. The actual wave-lengths that stimulate the different kinds of receptors are not yet determined. There is no certainty as to the relation between total brightness and the brightness due to the individual receptors. Even such a mechanical process as the change in shape of the lens during accommodation is not beyond the sphere of active controversy, so it is not to be expected that the more recondite processes of visual perceptions will be agreed upon with equanimity.

The discussion was undoubtedly successful and a worthy successor to the one held a year ago on audition. With all the papers but one in print, the authors had only to refer to the salient points.

Unfortunately, Sir John Parsons was unable to attend and to open the proceedings. Mr. Guild undertook that duty at the eleventh hour, hence his opening remarks were not in print. From what one can recollect of them, the printed paper will be a valuable contribution to the philosophy of vision and a guide to future makers of hypotheses. All those interested in vision will look forward to the publication of the discussion in full.

Research Defence and Anti-Vivisection

THE Research Defence Society was founded in 1908 by the late Stephen Paget. It was the outcome of the Association for the Advancement of Medicine by Research and Prof. Starling's Committee which collected and presented evidence for medical and scientific research before the Royal Commission on Vivisection which sat in 1906–8. That Commission probed the anti-vivisection question to the depths, but declared in favour of research work under the Act of 1876, which has controlled the use of animals for experimental purposes in England for more than half a century. In spite of this rebuff, anti-vivisectionists have continued to attack research workers and their institutions, even those who are engaged on veterinary research. The Research Defence Society undertook to inform the public of the conditions under which animals are used, the need for the work, and the alleviation of human and animal suffering which has resulted from such work.

The Annual Report of the Society for the past year pays a glowing tribute to the work and devotion of the late Lord Knutsford, who had been chairman since 1908. The Hon. Sir Arthur Stanley, chairman of the British Red Cross Society, succeeds Lord Knutsford as chairman of Committee, and Prof. A. V. Hill has accepted the office of vice-chairman formerly held by Mr. Stephen Paget, while the following have become vice-presidents of the Society: Mary Viscountess Knutsford, Mrs. F. M. Sandwith, Lord Moynihan, Sir Frederick Gowland Hopkins, Sir Walter Fletcher, Sir Alfred Beit, Sir Henry H. Dale.

During the year under review, an event of outstanding importance was the final judgment of the Court of Appeal and the Order of the House of Lords in regard to the will of the late Mrs. Sarah Martha Grove-Grady, who left her residuary estate, amounting to approximately £200,000, to found and endow a new anti-vivisection organisation. If this bequest had been held to be charitable, a slur would have been cast on medical and veterinary progress by research and on institutions registered under the Act of 1876, for the conditions she laid down even precluded the Royal Society for the Prevention of Cruelty to Animals from accepting any of her money, because it could not be said that all members of the governing body of that Society were confirmed anti-vivisectionists. Largely as a result of the endeavours of the Research Defence Society, the Court of Appeal reversed the decision of a lower court which had upheld the will, and an Order of the House of Lords finally settled the case by ruling that £25,000 out of the residuary estate should be devoted to the benefit of animals, provided that none of the money were used for anti-vivisection propaganda. The Research Defence Society urged that this money should be given to the Royal Veterinary College (which had been attacked by anti-vivisectionists), with the gratifying result that the whole of the sum has now been allocated to that institution for the purposes of building and endowing an animals' hospital.

The annual general meeting of the Society took place on June 3, in the lecture hall of the London School of Hygiene and Tropical Medicine. Lord Lamington, the president, took the chair, and Sir Arthur Keith delivered the sixth Stephen Paget Memorial Lecture on "Some Aspects of the Modern Conflict between Sentiment and Reason".

Sir Arthur opened by contrasting physical and

physiological research, pointing out that whereas the physicist has to satisfy only a scientific ideal, the physiologist has to confront an ethical as well as a scientific standard. "The conflict between sentiment and reason, as carried on to-day, finds its sharpest expression in the opposition offered to the beneficial work carried on by experimental physiologists. This society—the Research Defence Society—rightly concentrates its efforts on the vindication of the work carried on in our physiological laboratories. The anti-vivisection crusade is dangerous and has to be repelled, but after all, it is only an acute manifestation of a conflict which permeates modern society—a conflict in which blind sentiment is ranged against clear reason."

In dealing with the conflict between economic needs and sentiment, Sir Arthur pointed out the difference in the conditions when our ancestors hunted for their food and modern times when animals are deliberately bred for the butcher. We have to recognise by force of reason our economic needs, or, if sentiment becomes too strong, we must forswear all forms of animal meat. He continued: "It is not sentiment but reason which must be the final arbiter in the attitude we are to adopt to our four-footed dumb friends".

Discussing the problem of cruelty, Sir Arthur said: "The vice of cruelty has been given to man for the same reason as a sting has been given to the wasp and thorns to the rose—namely, for protection—to make their enemies afraid of them". In its primitive form it is a vice of hot blood; thoughtless cruelty, on the other hand, is a prevalent failing which everyone would wish to see eliminated. The most terrible form of cruelty is that which wilfully seeks to misinterpret motive. While there is need for a society to save animals from unnecessary suffering, there is still more need for a society, such as the Research Defence Society, to save scientific men from the cruelty of misrepresentation and of injustice.

Critics of research on animals have based arguments on so-called common sense, but as Sir Arthur pointed out: "When 'common sense' comes against expert knowledge, retreat is the wiser policy. Darwin's victory was one over the 'common sense' of his age. In the recondite fields of medicine, especially in the basal science of physiology, we must be prepared to be guided not by common sense but by the argument of irrefutable fact. We can hardly expect the man in the street, who has his own preoccupations, to know all that special experience has vouchsafed to us. If research is to prosper, the great public must be kept informed of its aims and accomplishments."

Sir Arthur then paid an eloquent tribute to the work for animals carried out by the Royal Veterinary College, and condemned emphatically the anti-vivisectionists who had attempted to frustrate the appeal of that institution for funds.

University and Educational Intelligence

BIRMINGHAM.—Applications from holders of an honours degree in engineering of a British university are invited for the James Watt Research Fellowship in Mechanical Engineering, the annual value of which is about £250. They should reach the Registrar of the University by, at latest, July 11.

CAMBRIDGE.—The John Humphrey Plummer professorship of inorganic chemistry has been established, and the electors will meet on July 18. The stipend of the professor is £1200 a year or, if he holds a fellowship with dividend, £1000 a year. Candidates are requested to communicate with the Vice-Chancellor on or before July 7.

Applications for the Gwynaeth Pretty Studentship, the holder of which shall devote himself to original research in the etiology, pathology, and treatment of disease, with particular but not exclusive reference to those diseases which cripple or disable in childhood or early life, are invited, and should be sent before July 30 to Prof. H. R. Dean, Department of Pathology. The studentship is of the annual value of £200 and is tenable for three years.

The Lucasian professorship of mathematics will be vacated by Sir Joseph Larmor on Sept. 30. A meeting of the electors will be held on July 25. The stipend of the professor is £1200 a year or, while the professor holds a fellowship of a college with dividend, £1000. Candidates for the professorship are requested to communicate with the Vice-Chancellor on or before July 11.

Dr. W. H. Thorpe, of Jesus College, has been appointed University lecturer in entomology. Mr. B. H. C. Matthews, of King's College, has been appointed assistant director of physiological research.

APPLICATIONS are invited by the Royal College of Physicians of London for two Leverhulme research scholarships, each of the annual value of £500, for the investigation of some clinical problem of disease as it occurs in man. Applications must be sent before July 4 to the Registrar, Royal College of Physicians, Pall Mall East, S.W.1.

THE Science Scholarships Committee of the Royal Commission for the Exhibition of 1851 has made the following appointments to Senior Studentships for 1932, the name of the recommending university being given in brackets: Dr. S. Tolansky (Durham), for research in physics; Mr. R. S. Alcock (Cambridge), for research in biochemistry; Mr. S. H. Bastow (Cambridge), for research in physical chemistry; Mr. H. D. Ursell (Cambridge), for research in mathematics; Dr. E. A. Moelwyn-Hughes (Oxford), for research in physical chemistry; Dr. R. D. Preston (Leeds), for research in botany.

ELEMENTARY education in the United States of America is reviewed in *Bulletin* No. 20, 1931, of the Office of Education, Washington, consisting of advance pages of the official biennial survey for 1928–1930. Widespread appreciation of the conception of learning as an active rather than an absorptive process has led to notable improvements in equipment, courses, and instructional materials providing for constructing, illustrating, dramatising, modelling, and many other forms of creative activity. Elementary school aims have shown progressive enlargement of scope so as to include, in addition to the traditional function of instruction, the promotion of physical, recreational, educational, and social welfare outside the regular school day, as is evidenced by the creation of new posts such as home visitor, social care worker, after-school recreational director, and director of parent educational activities, and also by the linking up of school work with libraries, clubs, juvenile courts, Red Cross works, and community clinics. The instructional possibilities of radio and sound films have been receiving close attention. There has been a movement towards requiring a certain minimum standard of special qualifications when selecting school librarians, teachers of elementary school science, literature, and social studies. Finally, much ingenuity has been devoted to the elaboration of courses of study for pupils of different learning, interests, difficulties, or capacities.

Calendar of Geographical Exploration

June 26, 1843.—The Wady Hadramaut

Adolph von Wrede started his journey inland from Makalla on the Gulf of Aden, and succeeded in crossing the barrier maintained by the sheikhs of the coast towns between long. 46° and 52° for so long against foreigners. Disguised as a Mohammedan, he penetrated to the Wady Doan and ultimately reached the great sands of the Ahkāf, where he found that a sixty-fathom plumb line disappeared completely in the sands. He did not reach the main wady of the Hadramaut proper, but his journey established the general character of the fertile Hadramaut country as a system of branching valleys, deeply sunk in a high plateau and debouching into the great Wady Hadramaut Channel.

June 28, 1819.—Crossing Arabia from Sea to Sea

Capt. G. F. Sadlier started on a mission which resulted in the first crossing of Arabia from sea to sea by a western European. He went to Hofuf in the Hasa Oasis, entered Nejd by the province of Yemama, passed south of Riyadh, and reached Aneiza. He arrived in the suburbs of Medina, but was not allowed to enter the Holy City itself, being banished to Bir Ali. There at last he had audience of Ibrahim, but Sadlier could come to no agreement with the Egyptian pasha. The British envoy and his party reached the Red Sea on Sept. 20. Sadlier took many compass readings, recorded the names of all settlements which he passed or saw, and gave notes of the time occupied on each march. He also recorded many details relating to trade and transport, to the character of the settlements along his route, and to the type of cultivation of the soil. For the first time, medieval information about the peninsula was checked by actual survey.

June 29, 1871.—Route to the Polar Sea

C. F. Hall, in command of the United States North Polar Expedition, left Brooklyn in the *Polaris*. In 1860–61, I. I. Hayes had explored Ellesmere Island, between lat. 77° and 78° N., and had reached Kennedy Channel, which he mistook for the open polar sea. Hall's voyage in the *Polaris*, when he reached 82° 26′ N., was a result of the hopes raised by Hayes, and it finally showed the route to the polar sea, though Hall himself was taken ill and died while exploring Greenland. Hall made his first voyage in 1860, when, though his vessel was wrecked, he made a two and a half years' exploration by sledge and boat off Frobisher 'Bay' and Countess of Warwick Sound, returning with charts and with descriptions of native life. In 1864, Hall again set out to try to obtain news of Franklin's fate. After spending five years in the search, he returned convinced that there was no survivor of Franklin's party, and bringing back with him many relics of the Franklin expedition obtained from the natives.

July 1, 1648.—An Early Discovery of Bering Strait

A Cossack, Dezhnev, started from the Kolyma River on an exploring expedition, undertaken with the approval of the Russian Government, partly to discover islands in the polar sea which had been reported by hunters, and partly to increase the territory paying tribute to Russia. Dezhnev rounded the north-east point of Siberia apparently in open water, though he remarked that this sea was not free from ice in every year. He continued his voyage down the east coast of Kamchatka, and reached the mouth of the Anadyr River in October. The record of his voyage was long forgotten, but papers discovered concerning a quarrel between him and a companion about the right of discovery to a walrus bank on the east coast of Kamchatka brought it to light. The Russians have renamed East Cape as Cape Dezhnev in his honour. These Cossack journeys in the polar seas are the more remarkable because the vessels they used were small rowing boats, only using sail in a fair wind, and were often caulked with moss mixed with clay and held together with willows. The strait between Siberia and America, through which Dezhnev had passed, did not become known until Bering's voyage in 1729.

July 1, 1906.—Grenfell on the Congo

George Grenfell died at Basoko. Grenfell began his geographical work in 1874, when he explored many of the navigable tributaries of the Congo. In 1884 he made a survey of the Congo up to the equator in long. 18° E., and in 1885 ascended the Ubanga to the Zongo Falls. Later he explored the Aruwimi River, reaching Mawambi in November 1902. His work and that of von Wissman first elucidated the drainage of the Congo basin.

Societies and Academies

LONDON

Geological Society, April 27.—**W. F. Whittard**: The stratigraphy of the Valentian rocks of Shropshire: the Longmynd-Shelve and Breidden outcrops. A dual division of the Valentian rocks of Shropshire into a lower group, the Pentamerus beds, and an upper group, the Purple shales, was adopted. Further, two lithological subdivisions of the Pentamerus beds, the Arenaceous phase and the Mudstone phase, were recognised. The Longmynd-Shelve outcrop is divided into several areas by glacial deposits. The rocks of these areas exhibit different lithological and faunal characters, due to the variable conditions under which they were laid down. Two distinct faunas characterise the Valentian rocks of the main outcrop, and these were selected as the standard faunas. Several local modifications of each standard fauna are present in the Longmynd-Shelve and Breidden outcrops. The character of the sea-bed and the control it exerted on the kind of fauna which frequented a particular area were stressed, and attention was directed to the mud- and sand-loving genera and species. The encroachment of the sea over the district in Upper Valentian times resulted in a complicated region of land and sea to which the name of 'Salopia' was given.

DUBLIN

Royal Irish Academy, April 25.—**A. W. Conway**: The radiation of angular momentum. The application of classical electrodynamics to the general problem of the radiation of angular momentum from an oscillating system of n^{th} order with $4n+2$ amplitudes: Components of type $\frac{sh}{2\pi}$ and $\frac{1}{2}\sqrt{n(n+1)-s(s+1)}\cdot\frac{h}{2\pi}$ are obtained and an energy term of type $\{n(n+1)-s^2\}\frac{h^2}{8\pi I}+Dn^2(n+1)^2$.—**A. W. Conway** and **A. J. McConnell**: The determination of Hamilton's principal function. Hamilton's great contribution to dynamics was his discovery of his *principal function* by means of which he was able to bring dynamical theory under one central principle. He showed that the function satisfied two partial differential equations, but he failed to give any account of how it was to be formed other than by direct integration of the equations of motion. Jacobi's contribution consisted in showing that the paths of the dynamical system could be obtained from

a complete integral of the first of Hamilton's differential equations. The present paper completes the theoretical aspect of this question by describing a method of forming the principal function directly from a Jacobi complete integral.

PARIS

Academy of Sciences, May 9.—J. Costantin: The importance of the mosaic disease of the sugar cane from the point of view of degenerescence. Sugar canes raised in the mountains in Java are resistant to the disease and this has been confirmed by experiments in the Dutch West Indies.—**M. de Broglie and L. Leprince-Ringuet:** The dispersion of the neutrons of beryllium and the existence of recoil nuclei caused by excited lithium.—**Charles Nicolle and Charles Anderson:** A new proof of the individual specificity of the spirochætes of recurring Spanish-African fever. A reply to criticism by Delanoë. Further experiments are described proving that the results do not depend on the dose of the virus.—**A. Yersin:** Long survival of *Hevea* trees broken by a typhoon. Some of the plants, broken by the typhoon at heights of 1-2 metres from the soil in November 1926, are still alive. Although without leaves, they still produce latex in practically the same proportion as the uninjured plants. The rubber produced from this latex is normal.—Henri Buisson was elected *correspondant* for the Section of General Physics in succession to the late R. Blondlot.—**Pierre Boos:** The relation which exists between an arc of a curve and the angle under which it is seen from its origin.—**Michel Fekete:** Some generalisations of Jensen's inequality.—**J. Leray:** Certain classes of non-linear integral equations.—**Vladimir Bernstein:** The analogy between the distribution of the straight lines of Julia of holomorph functions and that of the singular points of analytical functions.—**P. Lejay and R. Goudey:** Measurements of gravity made with the No. 2 Holweck-Lejay apparatus. The results of measurements made at 17 stations in France are given and a reduction formula worked out.—**Albert Pérard:** A new line as a light wave standard of length. Instead of the green-yellow krypton line (5649), which is not very bright, the krypton line 5562 is suggested.—**Jean Galibourg:** The elastic limit of extra mild steel drawn out into wire. A study of the effect of keeping at the ordinary temperature.—**Georges Vaudet:** A vacuum contact breaker for high tension currents.—**Raymond Dubois and Louis Laboureur:** A direct reading electric chronograph allowing the exact measurement of very short time intervals.—**Marcel Cau:** The variation with the thickness of the magneto-optical effects by transmission through thin layers of iron.—**Ny Tsi-Ze and Chien Ling-Chao:** The photographic effect of pressure. If E is the illumination producing a density d when the emulsion is under a pressure p, and E' the illumination which produces the same density when the emulsion is submitted to no pressure, the ratio E/E' depends only on the pressure p. Above a certain pressure, 200 kgm./cm.^{2} for one plate used, E/E' is a linear function of p.—**Jean Thibaud and F. Dupré la Tour:** The penetrating power of the radiation (neutrons) excited in beryllium by the α-rays. The neutrons from beryllium appear to be much more penetrating than would appear from the figures already published. Thus after passing through a screen of 30 cm. of lead, one-tenth of the incident radiation remains. The absorption resembles that of a heterogeneous radiation, of which each constituent follows an exponential law.—**Desmaroux:** The mechanism of the decomposition of the nitrocelluloses. The experiments described lead to the conclusion that the principal phenomenon in the decomposition of the nitrocelluloses by heat, at least in the first stage, is the destruction by a partial combustion of one of the residual glucose rings, followed by a break in the chain.—**Mlle. Choucroun:** Selective permeability and polarisation of membranes.—**Félix Trombe:** The preparation of metallic lanthanum free from iron and silica. The electrolyte was a mixture of lanthanum chloride, potassium chloride, and calcium fluoride. The cathode was molybdenum, and the deposited metal was collected in a crucible of fluorspar or silica. The metal was spectroscopically free from calcium and aluminium, and when collected in fluorspar contained less than 0·05 per cent silicon.—**E. M. Bellet:** The mechanism of the reaction of esters in the presence of alcohol in weakly alkaline medium.—**L. Capatos:** Some combinations of arsonium bases.—**Ch. Courtot, M. Chaix, and L. Nicolas:** The preparation of diphenylene sulphide. Study of Schönberg's method, the interaction of diphenylsulphinone and sodium amide, leading to a higher yield and to the isolation of some secondary products.—**Mme. Bruzau:** The action of parabromanisylmagnesium on dimethylphenylacetamide.—**Charles Dufraisse and Maurice Loury:** Researches on the dissociable organic oxides. Three isomeric dimethylrubrenes, $C_{44}H_{32}$. Their dissociable oxides.—**L. Domange:** The action of heat on fluorspar. The luminescence produced by heating fluorspar crystals is not in any direct relation with a loss of material. It occurs when the crystals are broken.—**Maurice Blumenthal:** The structural elements of the Bokoya (Eastern Spanish Rif).—**Marcel Thoral:** A new contribution to the stratigraphy of the Cambrian and Silurian in the eastern part of the Monts de Lacaune.—**G. Debebant:** The kinematics of the isobaric centres.—**Chadefaud:** The physodes of the Pheophyceæ.—**Marc Simonet:** The cytological study of the Pogoregelia hybrid, *Iris olbiensis* × *Iris Korolkowii*.—**H. Colin and E. Bougy:** The structure and richness in sugar of the hybrids of the beetroot.—**Jan Hirschler:** Certain membranous and granular plasmatic components in the male sexual cells of the Lepidoptera.—**L. Lutz:** The soluble ferments secreted by the Hymenomycetes fungi. The ketones, the anthraquinonic bodies, and the anti-oxygen function.—**G. Stodel and A. Bourdin:** The relation between the toxic power and the antigen power of the diphtheric toxins.—**A. and R. Sartory, J. Weill, and J. Meyer:** A case of blastomycosis of long standing transmissible to the guinea-pig due to a pathogenic Saccharomyces (*S. Jadini*).—**Joseph Lignières:** The determination of the types of aphthous virus.—**Marcandier and Robert Pirot:** The transmission from man to the guinea-pig (after passage through the rat) of the Toulon typhus virus (mild endemic typhus of warships).—**E. Roubaud:** The trophic strains of *Anopheles maculipennis* detected by comparative experimental cultivation.

ROME

Royal National Academy of the Lincei, Jan. 3.—G. Fano: Birational transformations on algebraic varieties of three dimensions.—**E. Paternò:** (1) Action of sodium carbonate on cellulose. After immersion for three hours in water at the ordinary temperature, celluloses of various origins lose 0·5 per cent of their weight, this loss being doubled at 50°. The extents to which water and sodium carbonate solution are absorbed at 10°-12° may be taken as identical and as characteristic of the particular cellulose. For various sulphite wood-celluloses and for cellulose prepared by means of chlorine from straw, esparto, and hemp, such absorption varies from 98 to 152 per cent; the absorption seems to consist of simple imbibition due to the porosity. Cellulose containing relatively large proportions of γ-cellulose and pentosans (esparto

cellulose) is not suitable for the preparation of viscose, but preliminary treatment with sodium carbonate may be of use in such a case.—(2) Exhausted cellulose. Cellulose which has been treated with sodium hydroxide solution—so-called exhausted cellulose—is a form of pure cellulose. Certain of the products known collectively as hemi-cellulose, whether pre-existent or not in wood, are formed also by the action of the air, the action being enhanced by the presence of water or salts, and to a greater extent by that of alkali.—(3) Oxycellulose and its identity with β-cellulose and cellodextrin.—**L. Cambi and G. Devoto**: The action of certain organic substances in the electrolytic deposition of zinc.—**Vladimiro Bernstein**: The growth of holomorph functions of exponential type.—**G. Lampariello**: An equation of the partial derivatives of the fourth order.—**N. Obrechkoff**: A generalisation of Borel's summation of divergent series.—**P. E. Brunelli**: Certain singular values of the critical velocities of shafts.—**A. de Mira Fernandes**: Zermelo's brachistochrone problem.—**Ioan I. Placinteanu**: The equations of the movement of three bodies of variable mass.—**G. Viola**: Certain peculiarities of the annual variation of relative humidity. In Italy, as throughout Europe generally, the relative humidity follows a law of variation opposed to that of the temperature, the minimum temperature corresponding with the maximum of humidity and vice versa. The results obtained at certain observatories do not, however, accord with this law, and are influenced, not only by the temperature, movement of the air, rainfall, etc., but also by the topographical position and by the frequency of wind. This is particularly the case at Gaeta and Chiavari, and the same would doubtless be found at other coastal stations.—**B. Rossi**: Calculation of the action of the terrestrial magnetic field on a corpuscular radiation generated in the atmosphere. The negative results of experiments made with the object of showing an action of the earth's magnetic field on the intensity distribution of penetrating radiation are usually regarded as a proof that the primary penetrating radiation is an ultra-γ radiation, which generates in the atmosphere the corpuscular radiation revealed by the apparatus used. Consideration of this question leads to the conclusion that the corpuscular radiation observed cannot be the secondary radiation of a γ-radiation. Experiments on the subject are in progress.—**R. Bruscaglioni**: The form of the interference fringes obtained from waves affected by pure astigmatism with gratings at any orientation.—**Paolo Straneo**: The unitary theory of gravitation and electricity (4). Discussion and improvement of the earlier theory.—**G. Piccardi and A. Sberna**: Molecular spectra and spectroscopic analysis (2). Investigation of lanthanum. From the qualitative point of view, the molecular spectrum method shows a sensitiveness equal to that of the spark spectrum method in the case of lanthanum. For low concentrations and in presence of elements of complicated spectra, it permits of more certain identification. For the concentration of lanthanum in solution, this method gives results of an accuracy corresponding with that shown by optical methods.—**L. Mascarelli and D. Gatti**: Diphenyl and its derivatives (11). New derivatives of 2-methyldiphenyl and the influence of the methyl group on the reactions of an amino group in the 2′-position. The results of experiments on 2-methyl-2′-aminodiphenyl show that the hypothetical closure—by means of NH, O, or I—of a third nucleus at the 2-2′ or 2-6′ position never occurs, this indicating that the union between carbon atoms is stronger than that between other elements. Not only is the 2-methyl group not displaced, but it does not disturb any of the reactions of the 2′-amino group.—**G. Natta and R. Pirani**: Solid solutions by precipitation and isomorphism between complexes of quadrivalent tellurium and platinum (1). Structure of cæsium and rubidium chloroplatinates. These compounds form cubic crystals of the space-group Oh^5. The unit cell contains four molecules and has the side $10{\cdot}15 \pm 0{\cdot}01$ A. for the cæsium and $9{\cdot}83 \pm 0{\cdot}01$ A. for the rubidium compound; the respective densities are 4·25 and 4·04. Calculation of the structure factor shows that the parameter u which defines the position of the chlorine ion has the value of about 0·23-0·24 for the cæsium compound.—**C. Sandonnini**: Transpositions in the benzene nucleus (1).

Forthcoming Events

SATURDAY, JUNE 25

BRITISH PSYCHOLOGICAL SOCIETY (General Meeting) (at National Institute of Industrial Psychology, Aldwych House, Aldwych, W.C.2), at 3.—Dr. J. W. Cox: An Experimental Enquiry into the Effects of 'Practice', and of 'Training', in Manual Operations.—B. Babbington Smith: A Critical Examination of Recent Work on Perseveration.

ROYAL SOCIETY OF MEDICINE (Disease in Children Section) (Annual Provincial Meeting) (at Alton).

JOURNÉES MÉDICALES DE BRUXELLES (at Brussels) (*continued on June* 26 *to* 28).

TUESDAY, JUNE 28

NATIONAL PHYSICAL LABORATORY, TEDDINGTON, at 3.—Meeting of the General Board of the Laboratory.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—Capt. T. A. Joyce: The 'Eccentric Flints' of Central America (Presidential Address).

FRIDAY, JULY 1

GEOLOGISTS' ASSOCIATION (in Architectural Theatre, University College), at 7.30.—Dr. T. Neville George: The Superficial Deposits of the South Coast of Gower.—Dr. A. W. Groves: The Geology of Uganda, B.E.A., with special reference to the Tectonics (Lecture).

Official Publications Received

BRITISH

The Imperial Council of Agricultural Research. Scientific Monograph No. 1: The Fungi of India. By Dr. E. J. Butler and Prof. G. R. Bisby. Pp. xviii+237. (Calcutta: Government of India Central Publication Branch.) 6.12 rupees; 11*s*.

Journal of the Royal Statistical Society. New Series, Vol. 95, Part 2. Pp. viii+185-394. (London: Royal Statistical Society.) 7*s*. 6*d*.

Transactions of the Institute of Marine Engineers, Incorporated. Session 1932. Vol. 44, No. 4, May. Pp. 167-218+xxxvi. (London.)

Transactions of the Royal Society of Edinburgh. Vol. 57, Part 1, No. 8: The Development of the Sorus in some Species of Nephrolepsis, together with some Observations on points of Anatomical Interest. By Dr. Isobel M. Case. Pp. 259-276. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.) 2*s*. 3*d*.

FOREIGN

Smithsonian Institution: Bureau of American Ethnology. Bulletin 105: Notes on the Fox Wâpanōwiweni. By Truman Michelson. Pp. v+195. 35 cents. Bulletin 107: Karuk Indian Myths. By John P. Harrington. Pp. v+34. 5 cents. (Washington, D.C.: Government Printing Office.)

University of California Publications in American Archaeology and Ethnology. Vol. 31, No. 2: The Northfork Mono. By E. W. Gifford. Pp. iv+15-65+16 plates. (Berkeley, Calif.: University of California Press.) 1.25 dollars.

The Academy of Natural Sciences of Philadelphia. 1931 Year Book. Pp. 62. (Philadelphia.)

CATALOGUES

Liver Extract B.D.H. Pp. 14. (London: The British Drug Ho[illegible] Ltd.)

Società di Esportazione Polenghi Lombardo Industrie del Latte. Pp. 256. (Lodi.)

Catalogue of New Books of all Publishers on Physics and Mathematics. Pp. 26. (London: H. K. Lewis and Co., Ltd.)

Ornithology. (New Series, No. 28.) Pp. 56. (London: Wheldon and Wesley, Ltd.)

Sotheran's Bibliotheca Chemico-Mathematica: Catalogue of Works in many Tongues on Exact and Applied Science. First Supplement. Pp. xii+490. (London: Henry Sotheran, Ltd.) 10*s*. 6*d*. net.