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Labour and the Universities.

THE subject of "Labour and the Universities" was included in the agenda of the annual conference of the Universities of Great Britain and Ireland held in London on May 13. Mr. Arthur Greenwood, M.P., who opened the discussion, said that the Trade Union, Co-operative, and other working-class movements needed in an increasing measure trained men with the broad outlook and the other qualities which a university education could give; but he did not believe they were getting a fair share of the existing resources. This defines one part of the problem of Labour in relation to the universities in the simplest and clearest language. Admittedly the problem is not yet solved: but, as Prof. Elton of the University of Liverpool said, there is a disposition on the part of the universities to do all that can be done to find the solution. He invited Mr. Greenwood and his friends to tell the universities plainly what they wanted, coupling the invitation with a hint that the Labour Party must not expect the teaching of such subjects as economics and history to be adapted to the political tenets of their party. "Some sections of Labour," Prof. Elton said, "suspected that university economics might be capitalistic economics, and that history might be some form of Imperial history"—a suspicion which he believed to be unfounded.

One other warning might have been added. The educated man is not created *per saltum*: he is the product of years of toil, sacrifice, dedication. It may be true, as Mr. Greenwood said, that knowledge and an enthusiasm for knowledge would give the working classes something which no trade depression could take away. But how much study would this require? With the rapid advance of knowledge in all subjects, the problem of education becomes more and more complex for everybody, but especially for those who, under our present social system, are obliged to devote most of their time to forms of labour which are remunerative only in a physical sense. Prof. Burnet, in his recent Romanes lecture, warned us that specialism, pushed to its logical conclusion, would land us in a society where no one knew anything that any one else knew. There is real danger that working men may look with indifference on the Mount Everest of science. It is fair to say, however, that the higher education of the working classes, as directed and inspired by the Workers' Educational Association, has shown a disposition to encourage the thorough and humane study of a relatively small field in a spirit which gives to the student not only

knowledge of facts but wisdom to understand and interpret:

"Knowledge is proud that he has learned so much;
Wisdom is humble that he knows no more."

If, as we hope, there is no confusion of ideals in regard to the higher education of the working classes, questions of method and machinery should not present insuperable difficulties. The needs of the adolescent are, in many respects, distinct from those of the adult. Representatives of the Labour Party have often contended that there is at present in the youth of the working classes a great "stream of talent" which is allowed to run to waste. This contention has never been fully proved; but if it is true, the blame must rest with the Board of Education and the local education authorities for neglecting their statutory duties. As to the adult, the tutorial class and summer course are methods which have stood the test and yielded good results. The Master of Balliol, in a paper read at the conference, said that the summer school required to be better organised and more developed. Sixteen years' experience had shown what potentialities were in that direction. Another possibility was the organisation of one-year courses of intensive study in universities for selected extra-mural students so that adult education might breed its own teachers. Finally, he suggested, there was a need to develop the system of resident tutors in districts—"decentralised university work."

So much on the question of what the universities can do for Labour. There remains the converse question—what the Labour Party can do for the universities?—a question which has assumed greater importance since the Labour Party became His Majesty's Opposition. It is gratifying that the Labour Party, alone of the great political parties, has made the question of university education the subject of formal investigation and study. Their memorandum of evidence submitted to the Royal Commission on Oxford and Cambridge Universities, and recently published in the Appendices to the Report, gives proof of an earnest desire to make our ancient universities more efficient in a national sense. The memorandum is unsigned, and it is therefore difficult to determine its final authority. It speaks throughout, somewhat oracularly at times, in the name of the Party. Occasionally, however, the views expressed appear to have a personal character. For example, can it be supposed that the average member of the Labour Party, whether a horny-handed son of toil or one of the so-called "intellectuals," feels with any intensity of conviction that "the old Pass course both at Oxford and Cambridge should be abolished"?

There is much to be said for the view that specialisation has been carried too far in university education and that, for teachers particularly, a broader course of study than is at present offered by the Honours schools is to be preferred. In the United States, the first degree is granted on a general course of training, specialisation being postponed to a later age. Proposals to introduce "honours" degrees on the English pattern have been vigorously resisted in America on the ground that it is undemocratic to label some citizens as intellectually superior to others. Should not these questions of curricula be settled by educational experts rather than by work-a-day politicians?

The control of the universities which receive financial aid from the State is on a different footing. The memorandum states that "the Labour Party does not wish to deprive the universities of their independence; on the contrary, it would encourage their initiative within the national educational system"; but it goes on to assert that "something of the nature of continuous administrative control by the State must be undertaken." Thus are our universities to be placed on the slippery slope which leads to intellectual regimentation. Questions of new developments in literary and scientific research in universities will have to be submitted to Government officials as are, under present arrangements, questions of supplies for elementary schools.

No doubt co-operation and co-ordination could be carried further in university education, and the Government might stimulate the self-activity of the universities in these matters. But the doctrine of continuous administrative control is fraught with danger. Mr. Wood, the president of the Board of Education, speaking at the conference, admitted this. "In my judgment," he said, "if the universities are to fulfil their functions and duties, it is vital that they should retain the fullest measure of liberty possible. There is at present no disposition to challenge that principle. So long as the universities can justify the work that they are doing, so long, I think, Parliament will be prepared to trust the universities to do it."

Psycho-analysis.

(1) *Conditions of Nervous Anxiety and their Treatment.* By W. Stekel. Authorised translation by Rosalie Gabler. Pp. xii+435. (London: Kegan Paul and Co., Ltd.; New York: Dodd, Mead and Co., 1923.) 25*s*. net.

(2) *Some Applications of Psycho-Analysis.* By Dr. Oskar Pfister. Authorised English version. Pp. 352. (London: G. Allen and Unwin, Ltd., 1923.) 16*s*. net.

(3) *Psychological Types: or the Psychology of Individuation.* By Dr. C. G. Jung. Translated by H. Godwin Baynes. (International Library of Psychology, Philosophy, and Scientific Method.) Pp. xxii+654. (London: Kegan Paul and Co., Ltd.; New York: Harcourt, Brace and Co. Inc., 1923.) 25*s.* net.

(4) *Psychology and Politics, and other Essays.* By Dr. W. H. R. Rivers. (International Library of Psychology, Philosophy, and Scientific Method.) Pp. vii+181. (London: Kegan Paul and Co., Ltd.; New York: Harcourt, Brace and Co. Inc., 1923.) 12*s.* 6*d.* net.

(5) *Conflict and Dream.* By Dr. W. H. R. Rivers. (International Library of Psychology, Philosophy, and Scientific Method.) Pp. xi+195. (London: Kegan Paul and Co., Ltd.; New York: Harcourt, Brace and Co. Inc., 1923.) 12*s.* 6*d.* net.

(6) *Problems in Dynamic Psychology: a Critique of Psycho-analysis and Suggested Formulations.* By Dr. John T. MacCurdy. Pp. xv+383. (Cambridge: At the University Press; New York: The Macmillan Co., 1923.) 12*s.* 6*d.* net.

(1) THE physician who makes acquaintance with psycho-analysis in this, the first of Dr. Stekel's clinical works to be translated, will assuredly experience some kind of emotional reaction. The author takes for granted that therapeutic aims should not be hindered by reticence or taboo, but although medical men have accepted that principle in regard to the anatomy and physiology of sex, yet its application to the psychological factors is, in the form presented by Dr. Stekel, so thoroughgoing as to arouse certain opposition. The reader may capitulate in face of the mass of clinical evidence, or find in the frequent and facile dogmatism of the author a reason for rejecting whatever appears strange or new. The statement, for example, that "the sex impulse may be directly identified with the instinct of self-preservation" (page 3) is presented with no evidence or explanation, and we are left to guess whether it is a tenet of psycho-analytical orthodoxy or one of Dr. Stekel's own bright thoughts.

The many blemishes of this nature are unfortunate, for the book fills a gap in medical literature by its detailed accounts of the bodily symptoms of the anxiety states, symptoms which are commonly treated from the physical point of view with a total neglect of the underlying mental condition. Heart and stomach neuroses, asthmatic attacks, even the anxiety attack itself, rarely meet correct recognition, and Dr. Stekel gives clinical examples of all these with the mental factors fully analysed; a host of other disorders—phobias, professional neuroses, stammering, and the like—are adequately illustrated. The psychical treatment of epilepsy is approached with commendable caution, but the enthusiasm and confidence with which the author handles the therapeutics of melancholia are not shared by his analytical colleagues.

The book is a blend of useful information with rash dogma. The translation shows many literal errors and should have been revised by some one acquainted with medical terminology.

(2) Dr. Pfister combines the functions of pastor, pedagogue, and psycho-analyst, and his writings are regarded by psycho-analysts as serious contributions to their subject. In his opening essay he tilts at orthodox psychology, which certainly has failed to render to medicine or education the service that psycho-analysis offers, but in Great Britain at least the "psychology of the schools" no longer refuses to admit, however grudgingly, the importance of Freudian fundamentals. Pfister quotes from Stern the advice to differentiate between the actually perceived external fact and the interpretation attached to it. Psycho-analysts sometimes offend against this self-evident maxim in one direction, and their critics, on the other hand, often insist upon treating observations as if they were interpretative artefacts; it is notable that Pfister makes clear in his analyses what are the patient's associations—the perceived facts—and what are the interpretations.

Pfister's analysis of an artist and his art serves the double purpose of illustrating technique and studying the psychological processes of artistic inspiration, which is the manifestation of repressed desires and comes into line with neurotic symptoms and dreams, except that an ingenious whole is created. The latent significance of a picture is for the artist, the manifest is for others, but may not the success of an artistic production depend upon an unconscious appreciation, on the part of beholders, of the latent significance? In the chapter on "Psycho-analysis and Philosophy" Pfister acclaims Freud as the first great positivist among psychologists, but makes a plea for metaphysics as a stage towards the highest plane of knowledge. Of more immediate interest is the relation of analysis to ethics, for, as the author points out, the most powerful argument of Freud's opponents is that his procedure is immoral. Ethics, he says, is an empirical science standing in need of purely objective and sober criticism (p. 299), and "all ethics which ascribe to experience an influence upon its standards (and another kind of ethics is scarcely conceivable nowadays) may derive the most important doctrines from these discoveries" (p. 195).

Educationally, psycho-analysis aids more in the removal of inhibitions than in the prescription of methods, and the chapter on "Child Life" is the most

useful in the book; it gives accounts of actual cases which show that the analytic method of approach is the most hopeful one for the understanding and treatment of the "neurotic" child.

There is a want of correlation between the different essays, and it is doubtful whether a reader new to the subject would find it made sufficiently clear: yet the book is useful to place in the hands of people who see only evil in psycho-analysis.

(3) It is not realised that Freud and Jung, starting with a general agreement upon observed material, have so far diverged that Dr. MacCurdy expresses the usual Freudian view when he writes "No attempt has been made to consider the theories of Jung because, quite frankly, I cannot understand them" (p. xiii of "Problems in Dynamic Psychology"). Yet, although Jung admits that his earlier book ("Psychology of the Unconscious") so aggravated the difficulty that "many otherwise able minds became utterly confounded" (p. 626), this book concerns practical psychology in a sphere where Freud offers little help. Psychological types have always been recognised: William James defined the tough-minded and the tender-minded, or the rationalist and the empiricist, and found the history of philosophy to be mainly that of a clash of temperament. Furneaux Jordan (whose work with Herbert Page on "Railway Spine" is a neglected but important chapter in psychological medicine) is credited by Jung as being the first to give a relatively appropriate characterisation of emotional types. Jung himself has already developed the ideas of introversion and extraversion as character types, and in actual life the want of *rapport* between these types is a matter of daily observation. He notes "the normal bias of the extraverted attitude against the nature of the introvert" (p. 472). A recent novel attained success with its picture of the dis-harmony between the introverted Mark Sabre and his extraverted wife, and whoever ventured to criticise the hero inevitably revealed, by the nature of his criticism, the nature of his own type.

Jung now carries his analyses of types to a finer degree of differentiation, according as they are marked by excess of feeling, thinking, sensation, or intuition. His description is often practical and understandable; the extraverted intuitive type, for example, to which commonly belong merchants, contractors, speculators, agents, politicians, etc., is to be recognised in actual life, and, though he makes no mention of the application, a knowledge of the different types in children should be a useful part of the pedagogic art. But his discussion of the type problem contains a good deal of what will appear to many readers as mysticism. His conclusion is that each type views psychic processes in a manner peculiar to that type; that every theory of the psychic processes is in its turn a psychic process; hence every individual supposes that there is only one interpretation of the psychic process, namely that which agrees with his type. "The scientific theorist is confronted with the disagreeable dilemma of either allowing mutually contradictory theories of the same process to exist side by side, or of making an attempt that is doomed from the onset to found a sect which claims for itself the only correct method and the only true theory" (p. 627). Whether one rests content with this conclusion is a matter of one's own psychological type.

(4) Dr. Rivers's mode of thought was so remote from the rationalisations of politics that it was not easy to imagine him in the political world; his candidature was only possible in the comparative calm of a university constituency, and these essays, as Prof. Elliot Smith says in his prefatory note, were a most remarkable form of appeal to parliamentary electors. It seems likely that as electoral propaganda they would have met with only moderate success; a serious study of "red-tape" as "an attitude which must be understood if we are to correct the evils now associated with government control," for example, lacks the emotional appeal of vituperation, and even in an educated constituency the belief in the intellectual power of political ideas is so strong that few voters would be attracted by the view that "no great movement is likely to succeed except under the leadership of one who is able to inspire a degree of confidence comparable with that which actuates the instinctive attitude of the animal herd towards its leader." In fact, Dr. Rivers's demonstration of the strength of the instinctive and unwitting motives in political and social life indicates the tactical weakness of his own unemotional and logical presentations. Nevertheless, those who turn away from the catch-words and pseudo-intellectualism of politics will find pleasure in these essays while regretting that the voice was that of one crying in the wilderness. Dr. C. S. Myers writes an appreciation of the work of the late Dr. Rivers, which expresses the feelings of all who knew him.

(5) In the opening lines of his preface Prof. Elliot Smith tells us that "The aim of this book is to give a sane interpretation of the significance of dreams . . ." and the implied criticism of other interpretations does not prepare us for the absence of emotion or prejudice that marks this posthumous work of Dr. Rivers. Accepting the truth of the main lines of the Freudian position, Dr. Rivers examined his own dreams by encouraging a half-sleeping state in which the thoughts came which furnished the explanation of the dream. Working also with the dreams of patients, he tentatively propounded certain views as alternatives to

those of Freud. Instead of a wish-fulfilment he regarded the aim of the dream as an attempt at the solution of a problem, generally associated with a current difficulty, while he ascribes the form of the dream to a regression to modes of activity characteristic of early life instead of to the influence of early desires. These differences are not of vital import; in fact, on page 98 reference is made to dreams and their analyses recorded by Freud himself, in which Dr. Rivers found a striking similarity with respect to the recency of the conflicts they reveal, and he suggested that the dreams of a patient under analysis may be influenced by the attention of the dreamer being led back to the experience of early life.

Dr. Rivers doubted the scientific value of free association as a means of leading back to the source of the dream, though there may be clinical value in the material thus obtained. Pfister, in the book reviewed above, admits this doubt when he writes (p. 38): "We do not by any means believe that *every* association . . . shows the paths by which the image under investigation was produced." Freud's conception of the "censor" is rejected in favour of the supposition that as sleep becomes deeper the dream takes on a more infantile mode of mental activity and hence is more disguised and more readily forgotten. In regard to the universality of symbolism Dr. Rivers was in more serious discord with psycho-analysts. By "universality" he did not mean the invariability of the symbolic meanings, for the existence of such invariability is not claimed; it *is* claimed, however, that certain symbolisms are innate and universal to all mankind, and this claim Dr. Rivers denied on ethnological grounds.

This book, with that of Dr. MacCurdy, should be welcomed by psycho-analysts. The vigour of the heresy hunt is now abating, but, more than from the intimidatory effect of the hunt, psycho-analysis has suffered from the absence of scientific criticism. The death of Dr. Rivers has meant the loss of one of its few understanding critics.

(6) Dr. MacCurdy assumes that his readers know and accept the observations of psycho-analysts, which he confirms from his studies of the psychoses, but when he examines Freud's theoretical principles he finds them, to his surprise, not internally consistent. He meets difficulty in Freud's conception of the ego and its relation to the libido and finds untenable the idea of the object libido being transformed into ego libido, while he rejects as arbitrary and unconfirmed Freud's pathology of dementia precox as a withdrawal of the libido from the outer world with a transformation into ego libido. He is content to regard the disease as marked by a central theme, often of a crude Œdipus order, and the problem is how such a theme can gain this ascendancy. English psychiatrists will perhaps be surprised at the entire neglect of the pathological findings in this disorder, but the physiological and psychological points of view seem to be mutually exclusive.

It is characteristic of Dr. MacCurdy's position that he criticises Freud's theories from a point of view that demands attention from Freudian orthodoxy, which has been compelled to ignore the criticism of those who without investigation dismiss the findings of analysis as absurd and void of psychic reality. In the case of the war neuroses, to quote a simple example, the use of an easy technique demonstrated the existence of buried memories that expressed themselves in the bizarre symptoms of shell-shock, but discussion was impossible with objectors who refused to acquire the technique necessary to confirm or confute the observations. Similarly the significance of the birth-phantasy—a common-place finding of analysis—has not hitherto been subjected to useful criticism. But Dr. MacCurdy rejects as a wild speculation the idea that unpleasant feelings at birth have become the prototype of anxiety and are repeated in states of anxiety (it is curious that the same hypothesis was propounded by Erasmus Darwin in "Zoonomia"); he agrees that mythology, delusions, and dreams are replete with examples of birth experience, but points out that the unconscious ideas of painful birth may originate in later life and have psychic reality without being memories at all. He agrees, too, that each analyst finds what he is looking for, but declares this a matter not of suggestion but of selection, and believes that even with this partial selection cure results as soon as sufficient unconscious energy is deflected from symptoms to constructive activities. A chapter is given to an appreciative but critical examination of the theories of Dr. Rivers.

This important book is constructive as well as critical, and ends with a consideration of the co-operation and conflict of instincts and the statements—in which psycho-analysis takes the offensive—that "Ego and sex instincts, when in the ascendant, lead to the destruction or ineffectiveness of the individual," but "The world of men suffers and has suffered more from . . . insensate devotion to the herd than from all crime, insanity, or nervousness." MILLAIS CULPIN.

Chinese Potters and Porcelain.

The Wares of the Ming Dynasty. By R. L. Hobson. Pp. xvi+240+59 plates. (London: Benn Bros., Ltd., 1923.) 84*s.* net.

THIS admirable account of the arts and crafts of the Chinese potters and porcelain-makers during those spacious days of its history when the Celestial

Emperors held sway over the larger part of eastern and central Asia is worthy of its great subject; and one could not award it higher praise. The position of Chinese porcelain is so commanding in the history of man's art and craftsmanship, and its example and influence have proved so dominant in Europe, as well as in the Far East, that so comprehensive and reasoned a survey of its development will prove of signal interest to all lovers of fine and noble porcelains; whether their predominant interest is centred in the wares of Asia or in those, of later date, that have been made in Europe. Only an untiring student and scholar, who has charge of a famous collection such as that in the British Museum, and who has worked, there and elsewhere, at the subject in all its aspects, could have produced a volume of such sterling worth. All available sources of information have been utilised—the accounts of early European travellers are drawn upon equally with the latest records of exploration and research—so that we are here presented with as trustworthy an exposition of the subject as we are likely to obtain, and one which might well serve as a model for later workers in similar fields.

It is refreshing and gratifying to find such an authority as Mr. Hobson dealing so outspokenly with some of the common misconceptions cherished by many dealers and collectors. "Misconceptions about Ming are so many, and the word has been so frequently abused, that it will be well to devote a little destructive criticism to the things which are not Ming, but too often masquerade as such. . . . Ming is not a home for stray pots, in which every mongrel piece, which has no fixed attribution, can find a refuge. . . . Not long ago all glazed pottery figures were called Ming as a matter of course. No self-respecting merchant would have thought of stocking anything later in that line of goods, . . . etc." These are but two examples of many that might be cited where Mr. Hobson, as befits his position, has performed a real service to students and collectors alike; but many such illuminating *dicta* occur throughout the work, and it is encouraging to find valuable advice and information conveyed in such an authoritative and unhesitating a fashion.

Two special chapters are devoted to a consideration of Ming technical methods, and they have been compiled in such a way as to provide a sound and trustworthy foundation on which the collector may base his own knowledge. In addition to a clear and succinct account of the raw materials used in the body and glazes and the regions whence they were obtained, there is a description of how the more important varieties of porcelain were fashioned, finished, painted, and fired. The subdivision of labour "which effectually obliterated the individuality of the decorators" is explained, as well as the fact that the painted designs were mostly based on well-known paintings and on such standard patterns as those used in silk-brocades. These had been filtered through the hands of the Palace artists, whose designs were sent to Ching-tê Chên to be copied on the ware by the porcelain decorators.

As an example of concise statement it would be difficult to surpass Mr. Hobson's account of the method by which gold was applied to the Ming porcelains. "Gilding was used from the earliest reigns of the Ming. It was the last operation in the manufacture and always required a separate firing at a low temperature. Thus one of the red bowls described will be fired first in the full heat to take the body and glaze and develop the underglaze blue inside the bowl, then it would have the outside covered with red enamel which had to be fixed in the muffle stove; and finally the gilt floral pattern would be painted over this red and fixed by another visit to the muffle. In several cases the gilding on these red bowls is applied in the form of gold leaf, while in others it was evidently painted on with a brush."

Space will not permit me to dwell further on the merits of the work, but attention must be directed to the excellence of the numerous illustrations and the selective skill with which objects have been chosen to cover, adequately, such an extensive field. The coloured plates are of remarkable excellence; the subtlety of the Chia Ching bowl decorated with enamel colours (plate 7) being as perfectly suggested as is the precision of the design of an earlier type, in a more conventional style, which appears as the frontispiece. The half-tone plates are equally successful, and as the objects chosen are often of extreme beauty, they undoubtedly add to the value and distinction of the book.

WILLIAM BURTON.

Maps and Survey.

Maps and Survey. By Arthur R. Hinks. Second edition. Pp. xvi+258+26 plates. (Cambridge: At the University Press, 1923.) 12*s*. 6*d*. net.

THIS new and enlarged edition of Mr. Hinks's book is heartily to be welcomed, for it forms an admirable introduction to the whole subject of map-making, both in the field and in the office. Indeed, in some respects, it is more than an introduction, for such chapters as "Maps and Survey in War" and "New Methods of Survey" can be read with advantage even by those experienced in the construction of maps. An excellent feature of the book is its wide outlook; thus examples are given of methods of work and of instruments used, in the United States, in France, in India, and in the British Protectorates and Colonies,

as well as those employed by the Ordnance Survey and in British military practice at home.

In his preface to the second edition the author states that it should be considered as transitional from the pre-War subject which he taught in the geography school at Cambridge "to the considerably developed and altered maps and survey" which have come within his experience at the Royal Geographical Society. It is a fact that not only has the subject altered considerably in recent years under normal conditions, but also the War has brought forcibly to the attention of surveyors the great value, in suitable circumstances, of air-photo-surveying and of photographic methods generally; while in peace-time exploration the use of wireless time signals for the determination of longitude has removed the traveller's greatest technical difficulty.

An interesting addition is entitled "A further Chapter on Maps"; it deals with some of the many problems which are now before the cartographer, such as flying maps, the international air map, the spelling of place names, and styles of lettering. As an example of the difficulty of meeting the airman's requirements it is pointed out that, on the international air map, the sign for Brest must indicate aerodrome, sea-plane station, wireless, radio-goniometer, wireless telephone, meteorological station, aerial light and aerial ground-sign: a striking example of the difficulty of selecting conventional signs. While dealing with the subject of conventional signs it may be mentioned that the Ministry of Transport and the Ordnance Survey are now publishing a new set of half-inch maps of Great Britain, giving the new road classification and the road numbers approved by that Ministry. The issue of this series of maps has taken place since the book under review was published. The chapter ends with an analysis of more than thirty new types of maps, mostly published since the first edition of this book was printed.

The account of maps and survey in war is excellent, and is chiefly based on the experience of the British Army on the Western Front. Some of our cartographic difficulties were caused by using a grid marked in squares of a thousand yards' side printed over maps, with dimensions derived from the Belgian Survey, which were a definite number of kilometres in length and depth. Then as regards the projection, both French and Belgian peace-time maps were plotted on Bonne's projection, which gives equivalence of areas but is not well suited for military use. Both English and French survey staffs came to the conclusion that it was desirable to adopt a form of orthomorphic projection, and the French in 1917 introduced a close approximation to Lambert's conical orthomorphic projection. Arrangements had been made for the British to follow suit, when the War came to an end. Of course the quality of orthomorphism only strictly holds locally, but for some miles it is sensibly exact. These questions of the grid and projection have their importance, but it would be wrong to overestimate it. Generally speaking, the British maps on the Western Front were excellent, and compared most favourably with those of the enemy; and it was undoubtedly right to start with the Belgian projection and size of sheet—in no other way could the maps have been produced in time to be of use in the early days of trench warfare.

The book ends with an account of photo-stereoscopic survey, including a description of the stereo-autograph of von Orel—of the Military Geographical Institute of Vienna—another instance of the debt which the arts of surveying and cartography owe to the armies. This stereoscopic method has a future before it, but at present the price of a von Orel machine is high, and it is to be hoped that some less costly and less elaborate piece of apparatus may be devised which will be equally efficient. As the author remarks, however, the method is not easily applied to flat country without commanding points of view, and is not suitable for very small scales.

It will be seen that Mr. Hinks's book is in effect an excellent account of the present state of surveying and cartography, and all interested in these subjects will find the book well worth perusal and study.

C. F. C.

The Drapers' Company and Statistical Research.

Department of Applied Statistics, University of London, University College. Drapers' Company Research Memoirs. Studies in National Deterioration. IV.: On the Relationship of Health to the Psychical and Physical Characters in School Children. By Prof. Karl Pearson. Pp. 77. (London: Cambridge University Press, 1923.) 15*s*.

IN this most recent of the Drapers' Company Research Memoirs Prof. Karl Pearson discusses the relationship of health to the psychical and physical characters of school children, on the basis of information supplied by selected schoolmasters and schoolmistresses, some years ago, in respect of more than 2000 boys and 2000 girls in schools for the professional classes. The information represents, as it were, the collective considered and recorded judgment of the masters and mistresses who contributed, and previous examinations of the data have afforded evidence of trustworthiness. Prof. Pearson finds that the statistics show little relationship between health and the characters considered: the healthy

child is rather more intelligent, vivacious, and self-assertive and considerably more athletic than the less healthy, but the physical characters (head measurements, hair, eye colour, etc.) show no relation on which stress could be laid. In the course of the work the author sums up in general terms what the statistics show to be the athletic and the popular child. The latter is intelligent, conscientious, athletic, healthy and good-natured or quick-tempered rather than sullen: self-assertive children are a little less popular than the shy. Red-haired boys and wavy-haired girls enjoy a large share of popularity but in other respects appearance seems unimportant. The athletic child may be summed up as a "healthy, reasonably intelligent, and fairly conscientious, if somewhat self-assertive and undoubtedly noisy child who is quick-tempered, but not sullen . . . in several respects better, in none worse, than the average child."

No one will, in all probability, cavil at these results, but Prof. Pearson before reaching them had to examine the effect of age on the various characters, and in this part of his work he comes to conclusions which, he seems to think, will find less ready acceptance. These conclusions are that general intelligence and a variety of psychical characters seem to be unchanged throughout school life, that general health changes exceedingly little during the same period and the statistics do not support the "widely-spread opinion that Health is a governing factor of temperament." Our surprise is not so much at the results as at the expectation of disagreement. As general intelligence is described as a measure of capacity and not of acquired knowledge, the teacher's work is, in a sense, eliminated from the calculation, and surely any masters or mistresses may feel satisfied if school influence teaches control of temper although it cannot make the quick-tempered child into an even-tempered one. The author's analogy is to the point: you will need to harden, temper, and grind your chisel if it is to become efficient for its task, but no amount of treatment will permanently convert bad steel into good steel. With regard to the conclusion that general health changes little with age, this might have been anticipated, because rates of mortality and sickness increase but little with the age during the years of school life, and the "widely-spread opinion" to which reference is made by Prof. Pearson is perhaps the outcome of a kindly wish to make excuses for the temperamental shortcomings of an unhealthy person. But, after all, the only practical way of reaching conclusions on such matters is by collecting evidence from samples of the population as Prof. Pearson has done, and the conclusions so reached are preferable to those general impressions on which people form their opinions regardless of the fact that few of us take account of all the cases that pass before us, but are tempted to rely on the relatively small part of the experience, which by its rarity rather than its frequency creates an impression.

The Memoir was prepared as a lecture, and while giving a careful discussion of the statistical problems, etc., it contains remarks intended to make it attractive to a listener: these lighter touches make it easier, but no less pleasant reading than some of the more severely mathematical work that has been published in the same series.

This brings us to another aspect of the Memoir to which we may direct attention. It is the latest of a very large number of productions that bear the name of the Drapers' Company. For twenty years or so, papers have been written and issued from University College with the help of this Company. The Memoirs include much original work on the theory of statistics; the three volumes on albinism with which Nettleship and Usher were largely concerned—a storehouse of information—monographs on anthropometric subjects, many technical papers, studies in fertility and disease, and, in some respects as important as any of these, the tracts for computers and the volume of tables for statisticians. It would have been a great output for the period for any department—even if its other activities were ignored—but it would have been an impossibility if there had been no financial help available. The Drapers' Company has helped science in other ways, and it must be gratifying to such generous givers to see the help used to so good a purpose, and to know, as surely the Company must, that its gift is appreciated, for the help it affords to scientific research, by many people besides those connected with the Department or the College to which the grant is actually made.

Our Bookshelf.

Hutchinson's Splendour of the Heavens: a Popular Authoritative Astronomy. Edited by T. E. R. Phillips. (In about 24 Fortnightly Parts.) Part 1. Pp. 48. Part 2. Pp. 49-88. Part 3. Pp. 89-128. (London: Hutchinson and Co., 1923.) 1*s.* 3*d.* net each part.

THE name of the editor of this serial, the secretary of the Royal Astronomical Society, is a sufficient guarantee of the excellence of the work. As collaborators he has gathered together a band of observing members of the Society, each an expert in one or other of the subjects which will constitute the work. The salient feature of the parts which have appeared is the beauty of the plates and of the illustrations which are scattered so lavishly over their pages. Sources both ancient and modern have contributed a veritable picture gallery of the science. This will appeal to both young and old, to the student, and not less to the adept.

The descriptive matter too is not unworthy of the pictures. The writing is popular in the best sense of the term, simple, but yet exact in the exposition of the fundamental laws and the progress of observation of the physical facts of the science. The explanations are rendered more intelligible by apposite and original diagrams. After a general and historical introduction by the editor, Dr. Steavenson treats of the "Story of Light and Man's Control of It," with illustrations of telescopes from that of Galileo to the giant 100-inch reflector at Mount Wilson. Spectroscopy is adequately explained, and the chapter concludes with an account of the astronomical applications of the interferometer. Of Chapter II. "The Solar System," it is enough to say that it is in the very capable hands of Dr. Crommelin. It is a model of popular scientific style. "The Sun and Sun-spots" constitute Chapter III., written too in a fascinating manner by Mrs. Maunder, and copiously illustrated by very fine photographs, mainly from Greenwich Observatory. Mr. C. P. Butler writes on the "Prominences," and the stars and nebulæ, meteors and comets, gravitation and tides are among the subjects yet to be discussed.

The title "The Splendour of the Heavens" is well chosen, for it is this aspect of the firmament which excites wonder and appeals most directly to the mind of man. It inevitably leads to the recognition of the Majesty, the Wisdom, the Beauty of the Creator, and is thus an antidote to the naturalism, and to the stark materialism which is the bane of much of modern science. With unstinted praise we can recommend this excellent serial, which promises to be a standard work of popular astronomy. A. L. C.

Guide to the Mollusca exhibited in the Zoological Department, British Museum (Natural History). Pp. 55. (London: British Museum (Natural History), 1923.) 1s.

A NEW edition of the Guide to the Mollusca in the British Museum (Natural History) has been certainly long overdue, none having been issued since 1908, when other Invertebrata were associated with the Mollusca in the descriptive account of the "Shell and Starfish Galleries."

This new Guide occupies practically the same number of pages as did the section of 1908, although much of it has been rewritten, and in its "get up" is fully equal to others of its kind for which the Natural History Museum is famous. It cannot be exactly described as a "popular guide"; the subject does not lend itself to that, as the mammals and birds do, but it appeals rather to more advanced students of the particular subject. The casual visitor desirous of more simple explanation can fortunately rely on obtaining the information he may require from the demonstrations of the Official Guide, who alone probably can satisfactorily deal with such. No one who has not attempted a similar production knows how difficult it is to produce a really satisfactory work of the kind, or of the pitfalls that beset the compiler, to whose own lapses may be added those introduced by the "familiar" of the printing press.

Beyond pointing out that the scientific name of the British freshwater pearl mussel has somehow been applied to the marine pearl oyster of commerce (Pinctada), we do not propose to dwell on those errors we have observed, preferring to leave that task to "kind friends." It is a pity, however, that further currency has been given to a text-book statement that a "*Helix* has been known to survive a temperature of −120° C." and even to have strengthened the startling statement by substituting "tolerate" for "survive." We suggest a lost decimal point as explanation.

Physikalische Chemie der Zelle und der Gewebe. Von Prof. Dr. Höber. Fünfte, neubearbeitete Auflage. 1 Hälfte. Pp. xv+544. (Leipzig: W. Engelmann, 1922.) 575 marks.

THE late Prof. Benjamin Moore reviewed this important book at length in NATURE (November 30, 1911, vol. 88, p. 140) upon the appearance of the third edition. The general character of the book is unaltered in this the fifth edition, and it still remains one of the outstanding texts for the use of students of physiology.

The present edition has evidently been completely revised, the most striking modification being the division of the book into two main sections; the first dealing with the underlying physico-chemical phenomena apart from their manifestation in the living organism, the second part considering the operation of these phenomena in living cells and tissues. The book also now appears in two volumes; this first volume includes the six chapters comprising the first section of the book, while Chapter VII., the first chapter of the second section, discusses the osmotic properties of cells and tissues. The material of this seventh chapter in the third edition appeared scattered throughout three chapters dealing respectively with osmotic pressure, osmotic properties of cells and tissues, and a criticism of the lipoid theory. Judging by the present volume, the rearrangement of the subject-matter has provided a more natural and logical presentation of the subject. It is also certainly natural to find that a discussion of permeability no longer centres around the lipoid theory of the plasma membrane. Throughout the book modifications have been made in accordance with the trend of modern physiological investigation; to cite one example, Chapter III., upon the quantitative estimation of hydrogen ions, has been altered to cover the modern use of a wide series of indicators in conjunction with standard buffer solutions; it also includes a fuller discussion of the regulatory mechanism controlling the reaction of the blood.

English Coastal Evolution. By E. M. Ward. Pp. xii+262+14 plates. (London: Methuen and Co., Ltd., 1922.) 8s. 6d. net.

MR. WARD has chosen a very interesting subject, and has treated it systematically and well. In his general introduction, he points out that the present features of our coasts are built up or carved out on a land that has been recently submerged. The features of this land are largely due to subaerial erosion, but in places they are becoming modified by the deposits caught on sea-worn flats. In other places features are becoming again revealed by the removal of beach-detritus belonging to an earlier epoch. The glacial deposits that extended the land-area as the ice melted away form here and there protective

barriers, but have little stability against the battery of the waves. The pictures of coastal "planes of marine denudation" (Ramsay wrote "plains" for his larger features) are pleasing examples of the many excellent photographic illustrations.

The English and Welsh coasts are dealt with by districts, which is a far better method than any attempt to distinguish coasts of accumulation from those where erosion is now active. The descriptions thus appeal to readers who know the landscapes, and they add much in the way of local geography for dwellers near our shores. The descriptions of the Chesil Beach and the coves of the Dorset coast may be cited as examples of this treatment. Note has been taken of the probable derivation of the big stones of the Chesil Beach from flint-gravels formed on lost but adjacent land. The re-opening of Pagham Harbour in the Selsea area by a heavy gale in 1910 provides a parallel on a small scale with the flooding of the lands west of Dordrecht in 1421. The loss and gain of land in East Anglia is illustrated by many details and references that show the wide reading of the author.

This readable book forms a sound basis from which a historian might proceed to a study of our maritime industries, our relations with the continent, and our great adventures overseas. G. A. J. C.

The Statesman's Year Book: Statistical and Historical Annual of the States of the World for the Year 1923. Edited by Sir John Scott Keltie and Dr. M. Epstein. Sixtieth Annual Publication: Revised after Official Returns. Pp. xxxii+1583. (London: Macmillan and Co., Ltd., 1923.) 20*s.* net.

THE sixtieth issue of this well-known work of reference shows the same high degree of accuracy for which previous issues have been distinguished. The information for every country for which statistics are available has been carefully revised, and the same applies to the full lists of works of reference dealing with every part of the world. For the first time Turkey appears shorn of its old-time possessions, which now figure either as independent states or as mandated territories of other states. The new conditions in Ireland have resulted in two new sections devoted respectively to Northern Ireland and the Irish Free State. In default of separate figures, certain statistical information for Ireland has still to be included under Great Britain and Northern Ireland. The term United Kingdom would seem to have disappeared. The two coloured maps in this issue show respectively Ireland, and Palestine with Trans-Jordan. There are the usual statistical tables and a section on the League of Nations. A voluminous index enhances the value of this well-arranged volume.

Lands of the Thunderbolt: Sikhim, Chumbi, and Bhutan. By the Earl of Ronaldshay. Pp. xvii+267+32 plates. (London, Bombay and Sydney: Constable and Co., Ltd., 1923.) 16*s.* net.

THE barest record of the journeys made by Lord Ronaldshay from Darjeeling into Sikhim, Chumbi, and Bhutan, could scarcely fail to be of interest. Sikhim is probably the most mountainous country in the world, while both Chumbi and Bhutan are little known to Europeans. Lord Ronaldshay's record, however, has the added attraction that he is intensely interested in the curious lines of thought of the peoples he met. These are the result of that combination of Buddhism and the animistic beliefs of primitive Tibet which we know as Lamaism. In Lamaism, the rationalistic philosophy of Buddhism, of which the author gives a succinct account, coexists side by side with a belief in "devils," and the efficacy of the praying wheel, a reverence for repetition and an unquestioning faith in number, most strikingly manifested in the endless reiteration of religious formulæ as an effective exercise of piety. The result of the incongruous combination is strikingly manifested in a weird ceremonial in which such observances as the devil dances of the Black Hat and the bizarre pantomimic dances of Bhutan play a prominent part. Lord Ronaldshay's record of his observations is illustrated by a large collection of photographs, many of great beauty, taken by himself.

Food, Health, and Growth: a Discussion of the Nutrition of Children. By Dr. L. Emmett Holt. Pp. xi+273. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1922.) 7*s.* 6*d.* net.

THIS book embodies a series of five lectures on certain important and interesting topics relating to child nutrition. The objects are to demonstrate the relation of nutrition to health and growth, to state the requirements of children during the period of growth, and to discuss how these requirements may best be met. Considerable attention is paid to the accessory food factors.

The most important chapter is the last, which deals with practical measures. Dr. Holt believes that the only way of dealing with health problems, including that of errors of nutrition, is by education of children in matters of personal hygiene, and he suggests that much can be done in schools to make the teaching of health interesting and its practice attractive.

The book contains much that is useful and interesting to the general reader, and its understanding requires no previous scientific knowledge of nutritional principles.

The Chemists' Year Book, 1923. Edited by Dr. F. W. Atack, assisted by L. Whinyates. Vol. I. Pp. iv+422. Vol. 2. Pp. vii+423-1107+xv. (Manchester: Sherratt and Hughes, 1923.) 2 vols., 21*s.* net.

"THE Chemists' Year Book," which is the English equivalent of the "Chemiker Kalender," is now approaching the latter in completeness. In the present issue there has been some revision, and a new section, on "Leather Analysis," has been added. It is worth considering whether the space taken up by such descriptions of analytical methods, which would usually be sought in special manuals, could not be better used in giving further numerical data. Thus, the section on thermochemical data, or sections rather, since the material is dispersed, cannot compare with the information in the "Chemiker Kalender." The price is also very high for a book which is to be replaced every year.

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.*]

Effect of Infinitesimal Traces of Chemical Substances on Photosynthesis.

THE possibility of ultra-measurable traces of certain chemical substances affecting assimilation is a matter of much importance in physiology. The carbon-assimilation of water-plants affords an extremely sensitive process for the investigation of the subject. The usual method of counting the number of bubbles of oxygen given out by the plant under light is, however, most untrustworthy for quantitative determinations, since the size and frequency of the bubbles undergo spontaneous variation. This difficulty has been completely removed by a new device which I have been able to perfect, by which the evolution of *equal volumes* of oxygen is automatically recorded on a revolving drum by an electromagnetic writer; records thus obtained enable us to determine the normal rate of photosynthesis and its induced variations. I have also found that there is a definite relation between the evolution of oxygen and the formation of carbohydrate in the leaf. The automatic apparatus referred to can be so adjusted that the successive dots in the record represent the photosynthetic production of amounts of carbohydrate as small as a millionth of a gram. It is impossible in this short communication to give a detailed account of the apparatus, which will be found fully described in my forthcoming work, "The Physiology of Photosynthesis," to be published by Messrs. Longmans.

My attention was directed to the possible effect of traces of chemical substances on carbon-assimilation by the extraordinary increase in the photosynthetic activity after the thunderstorm and rain which lasted from February 10 to February 13 of this year. The coefficient of photosynthetic activity of the aquatic plant, *Hydrilla verticillata*, growing in the pond of the Institute, had been carefully determined for January and for the first week of February, and found to be practically the same in different specimens. The coefficient for light, *i.e.* the ratio of increment of activity to the increment of light, was found to be 13·2 per 100 lux immediately before the thunderstorm (February 9); whereas after the thunderstorm it was found to be 26·9, the activity having been thus increased 100 per cent; later the value decreased by stages to 22·9, as if the beneficial effect of the thunderstorm were subsiding to a certain extent. There was no variation of temperature, which remained constant at 22° C.

The rain could not have produced any variation of turgor in the plant, which was submerged in water. A plausible explanation of the enhanced activity is that the electrical discharges during the thunderstorm produced oxides of nitrogen which, washed down by the rain, added traces of nitric acid to the water of the pond in which the plants were growing. The quantity thus added would, however, be inconceivably minute. The correctness of the above hypothesis may for the present be left an open question. There can, however, be no doubt that minute traces of nitric acid exert a potent influence on photosynthetic activity, as is shown by the results of the following experiments carried out under constant light and temperature. At first I applied a dilution of one part in ten thousand which caused a depression of activity. I therefore went to the other extreme and prepared different dilutions of 1, 10, and 100 parts in 100,000,000,000. It is difficult to form any clear conception of ultra-measurable quantities from a row of zeros, and I will therefore, following the French system of measurement, designate a thousand millions as a billion. Application of a solution of one part of nitric acid in 100 billions induced no change in photosynthesis, but one part in 10 billions produced a marked increase in activity of about 100 per cent; 1 part in 2 billions caused a further increase of nearly 200 per cent. This was the climax. The enhanced activity underwent a slight decline at dilutions of one to ten parts in a billion, the activity being still greater than the normal by 100 per cent. There was an abrupt depression of activity at lower dilutions than 1000 parts in a billion (Fig. 1). The above figures may be taken to be typical of the effect of traces of nitric acid; for a dozen different specimens taken at random gave very similar results. In subtonic specimens, with

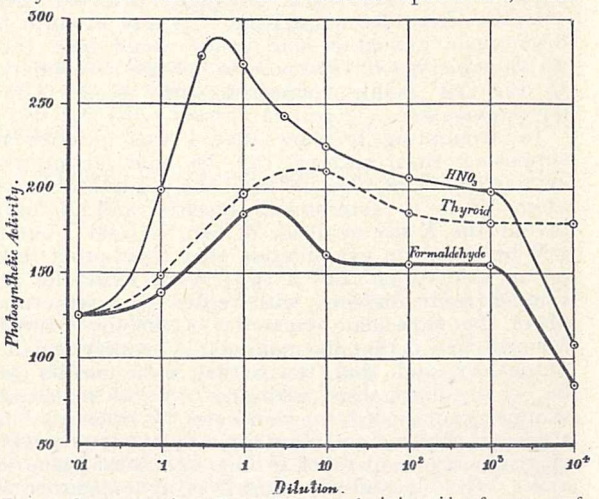

FIG. 1.—Curves showing effects of traces of nitric acid, of extracts of thyroid gland, and of formaldehyde, on the activity of carbon assimilation by the aquatic plant *Hydrilla verticillata*. The ordinals represent induced change in photosynthetic activity, the normal being taken as 100; the abscissæ represent dilution from 0·01 to 10^4 parts in a billion.

photosynthetic activity at standstill, an addition of two parts nitric acid in ten billions caused vigorous photosynthetic evolution of oxygen, the renewed activity persisting for a very considerable length of time.

I obtained similar increase in carbon-assimilation with traces of certain other substances of which I will give only two examples. The dotted curve in the middle of the figure exhibits the effect of extract of thyroid gland. Here the maximum activity was produced at a dilution of ten parts in a billion. The noticeable fact is that there was no reversal for a considerable range: the increased activity of about 80 per cent persisted up to the lower dilution of one part in a million.

The effect of traces of formaldehyde, which is a highly poisonous agent, is of much theoretical interest. A dilution of one part in a billion caused an increase of photosynthetic activity by 85 per cent. At higher concentrations, formaldehyde produced its normal poisonous effect. The action of traces of formaldehyde has special significance in regard to the "first product" of assimilation. According to Baeyer's theory, formaldehyde is one of the first products from which carbohydrates are formed by polymerisation. This theory labours under the difficulty that formaldehyde is extremely poisonous to plants.

The experiments just described, however, show that minute traces of formaldehyde are by no means poisonous, but actually enhance photosynthetic activity in a remarkable degree. The intermediate stages of transformation from formaldehyde to carbohydrate are likely to be rapid; there would therefore be no accumulation of formaldehyde to a poisonous degree.

At first sight it is inconceivable that infinitesimal traces of certain chemical substances could have such a potent influence on life-activity. There is, however, no doubt of the reality of the phenomenon.

J. C. BOSE.

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Molecular and Crystal Symmetry.

I GATHER from Messrs. Shearer and Astbury's reply (NATURE, June 2, p. 740) to my former letter to NATURE (May 12, p. 632) that my mention of a paper by Fedorov has unhappily diverted their attention from the main issue. As any attempt to disentangle numerous side issues would only take up valuable space, I propose to confine my remarks to the few points connected with recent X-ray developments.

In attempting to show that I was in error in supposing that nothing can be said about the symmetry of the molecule until the position of every atom in it is determined, Shearer and Astbury invoke the X-ray evidence of benzoic acid; but it will be found on examination that their proof rests on an assumption that if two crystal molecules are symmetrically disposed with regard to a structural plane the molecular symmetry is thereby limited. My own view is that the molecular symmetry remains untouched, and that the actual X-ray results can be equally harmonised with any type of molecular symmetry, provided the molecules be orientated in a general way, *i.e.* so that no molecular plane or axis of symmetry be parallel to any structural plane or axis. What is, indeed, wanted is an experimental proof that a structural plane beset with molecules, individually symmetrical but facing the plane asymmetrically, is distinguishable from a plane studded with asymmetric molecules; but as such an experiment is unrealisable, I do not see how the symmetry of an individual molecule can be deduced without first determining the positions of every atom in the structure. Further, I fail to see how Messrs. Shearer and Astbury can take a different view, for if the molecular symmetry of a complex organic compound can be deduced from X-ray measurements, what object was there in advancing Shearer's rule? If it were really feasible, it would surely be better to solve the intimate structural details of benzoic acid by the method of experiment than by a process of speculation.

The only other subject I need refer to is that of tartaric acid. It now appears that my previous conjecture, that Astbury's crystal molecule is axially symmetrical, was erroneous, and that this substance is really in formal agreement with Shearer's rule. I may, however, point out that I was formerly particularly adverse to drawing any definite conclusion from such a complicated structure, a position which I see no reason to modify. In this connexion it is pertinent to add that evidence from simple compounds is already coming in. Dickinson's recent investigation of tin tetraiodide reveals 8 chemical molecules, each of a symmetry number 6, to the unit of structure; and as the symmetry number is generally held to be 24 (and not 48) the rule is correspondingly infringed.

In conclusion, it may be useful to add a word of explanation on the part played by Shearer's rule in X-ray investigations of organic compounds. In the typical case of benzoic acid classical methods of crystallography allow of the determination of the symmetry and also of the relative edge-lengths of the unit of structure. Building on this foundation the X-ray method goes further by determining the mass associated with this unit, its absolute dimensions and therefore volume, and, somewhat approximately, the relative positions of the centres of gravity of its constituent molecules. This represents a great advance to the crystallographer, but scarcely so to the chemist unless such molecular centres can be expanded into bodies of definite shape and atomic configuration. Now as volume determines neither external shape nor internal structure the problem is obviously one of great complexity, and X-ray results cannot usefully be applied to its solution on account of the enormous number of variables concerned in crystals of low symmetry and complex chemical composition; consequently, more general but less direct aids have to be relied on.

One method of bridging the gap is to adopt the hypothesis that atomic radii are approximately constant in crystals, whereby a radius determined from an element or simple inorganic compound can be carried over to a complicated organic compound. By such means spheres of appropriate sizes can be packed together in a tentative way so as to fill variously shaped cells of the correct volume, but there is obviously still much scope for varieties of arrangement and some further limiting principle is needed. That actually favoured at the present moment is Shearer's rule that a crystal makes the utmost use of the symmetry of its component molecules, or, alternatively stated, that the molecular symmetry is deducible as being the crystal symmetry divided by the number of molecules involved in the unit of structure. Since such a rule generally leads to low molecular symmetries (*i.e.* those which are practically consistent with any given arrangement), it is somewhat difficult to see how it can serve to limit the number of structural solutions. It can, however, be employed in a more superficial way, since the creation of an upper limit to molecular symmetry serves to rule out any stereochemical formulæ of still higher symmetry. Thus, it has been suggested that the Kekulé and Claus formulæ for benzene must be abandoned in favour of the Dewar formula, at any rate in the crystal.

Such results are obviously worthy of attention in so far as Shearer's rule is true. The present position is that the rule is a postulate and so also are the results that flow from it, ranging from the disposition of electrons in a crystal molecule of alumina to that of the atoms in any complex organic compound.

T. V. BARKER.

University Museum, Oxford,
June 16.

Stirling's Theorem.

MR. H. E. SOPER, in NATURE of May 5, p. 601, gives Stirling's Theorem in the form

$$n! = \sqrt{2\pi}\left(\frac{n+\frac{1}{2}}{e}\right)^{n+\frac{1}{2}} \times \exp.\left\{-\frac{1}{24(n+\frac{1}{2})}+\frac{7}{2880(n+\frac{1}{2})^3}+\ \ldots\right\}.$$

This form suggests that a first approximation of the form $\sqrt{2\pi}\left(\frac{n+\frac{1}{\alpha}}{e}\right)^{\left\{n+\frac{1}{\alpha}\right\}}$ might be made exceedingly accurate by choosing α in a suitable way.

Commencing in a similar way to that of Mr. Soper, we have

$$\log\left(n+\frac{1}{a}\right)!-\log\left(n+\frac{1}{a}-1\right)!=\log\left(n+\frac{1}{a}\right),$$

where $n!$ is generally $\Gamma(n+1)$.

Now

$$\log\left(n+\frac{1}{a}\right)!-\log\left(n+\frac{1}{a}-1\right)!=e^{D/a}(1-e^{-D})\log n!,$$

$$\therefore \log n!=\frac{e^{-D/a}}{1-e^{-D}}\log\left(n+\frac{1}{a}\right),$$

where D is the differential operator.

$$(1-e^{-D})^{-1}=\frac{1}{D}\left\{1+\frac{D}{2}+\frac{D^2}{12}-\frac{D^4}{720}\cdots\right\},$$

$$e^{-D/a}(1-e^{-D})^{-1}=\frac{1}{D}\left\{1+D\left(\frac{1}{2}-\frac{1}{a}\right)+D^2\left(\frac{1}{12}+\frac{1}{2a^2}-\frac{1}{2a}\right)\right.$$
$$+D^3\left(-\frac{1}{3!}\frac{1}{a^3}+\frac{1}{4}\cdot\frac{1}{a^2}-\frac{1}{12a}\right)$$
$$\left.+D^4\left(-\frac{1}{720}+\frac{1}{24a^2}-\frac{1}{12a^3}+\frac{1}{4!}\frac{1}{a^4}\right)\cdots\right\},$$

$$\frac{1}{D}\log\left(n+\frac{1}{a}\right)=\left(n+\frac{1}{a}\right)\left\{\log\left(n+\frac{1}{a}\right)-1\right\},$$

$$D\log\left(n+\frac{1}{a}\right)=\frac{1}{n+(1/a)}.$$

. . . . . .

$$\therefore \log n!=\left(n+\frac{1}{a}\right)\left\{\log\left(n+\frac{1}{a}\right)-1\right\}+\left(\frac{1}{2}-\frac{1}{a}\right)\log\left(n+\frac{1}{a}\right)$$
$$+\frac{1}{2}\left(\frac{1}{6}+\frac{1-a}{a^2}\right)\frac{1}{\left\{n+\frac{1}{a}\right\}}$$
$$+\left(\frac{1}{3!}\frac{1}{a^3}-\frac{1}{4a^2}+\frac{1}{12a}\right)\frac{1}{\left\{n+\frac{1}{a}\right\}^2}$$
$$+\left(-\frac{1}{360}+\frac{1}{12a^2}-\frac{1}{6a^3}+\frac{1}{12a^4}\right)\frac{1}{\left\{n+\frac{1}{a}\right\}^3}$$
$$+\text{a constant},$$

i.e.

$$n!=\sqrt{2\pi}\left(\frac{n+(1/a)}{e}\right)^{n+(1/a)}\times\left(n+\frac{1}{a}\right)^{(a-2)/2a}$$
$$\times\exp.\left[\frac{1/6+(1-a)/a^2}{2\{n+(1/a)\}}+\cdots\right]. \quad (1)$$

It will easily be seen that this reduces to Mr. Soper's form if a is taken to be equal to 2.

As a first approximation to the value of $n!$ we have

$$n!=\sqrt{2\pi}\left(\frac{n+(1/a)}{e}\right)^{n+\frac{1}{a}}\left(n+\frac{1}{a}\right)^{(a-2)/2a}.$$

To make this the best possible first approximation, it is necessary to choose a so that the first term of the exponential series is zero, *i.e.*

$$\frac{1}{6}+\frac{1-a}{a^2}=0$$

is an equation for determining a, *i.e.*

$$a^2-6a+6=0.$$

The roots are $3\pm\sqrt{3}$ or 4·73205081 and 1·26794919. Approximately these roots are 19/4 and 5/4.

To decide which of these two values would be the better, the values of the coefficients of the next two terms of the exponential were determined for each value of a, and it was found that these values were practically of the same order of magnitude. I have chosen to take the lower value, because $\{n+(1/a)\}$ will be greater for that value.

[At first it occurred to me that the desired result would be obtained by making the first term involving a in the exponential a minimum; but although a minimum it might be negatively large, so this criterion had to be ruled out. However, it was noticed that $a=2$, which Mr. Soper uses, is practically the value of a which makes this term a minimum, especially for the larger values of n.

The condition for a minimum is that a should satisfy the equation

$$a^2(6n+1)-12an-6=0,$$

i.e. a would be a function of n.

It is the positive root which concerns us, and it will be seen that as n increases this root tends to the value 2,

$$a=2+\frac{1-\frac{1}{4n}}{(6n+1)},\ \text{approx.}$$

Thus for the range of a values which makes the first term of the exponential negative, $a=2$ is the worst possible choice in finding a good first approximation.]

Taking $a=3-\sqrt{3}$, our series for $n!$ becomes

$$n!=\sqrt{2\pi}\left(\frac{n+b}{e}\right)^{n+b}(n+b)^{-c}$$
$$\times\left\{1-\frac{0\cdot0080,1875}{(n+b)^2}-\frac{0\cdot0004,6296}{(n+b)^3}\cdots\right\}, \quad (2)$$

where $b=0\cdot7886,7513$, $b-c=\frac{1}{2}$, $c=0\cdot2886,7513$.

The value $a=5/4$ was used in some calculations, and although the series then looks simpler, there is really nothing to be gained by taking this value; this is especially so for the computer who has a calculating machine. It will be noticed that our first approximation in (2) will be affected by an error of the order of $1/125n^2$ of its own value.

First approximation:

$$n!=\sqrt{2\pi}\left(\frac{n+b}{e}\right)^{n+b}(n+b)^{-c}. \quad . \quad . \quad (3)$$

This approximation was tested on a comparatively small value of n, $n=10$, $\log 10!=6\cdot5597931$, *i.e.* $10!=362,9051$.

Mr. Soper's first approximation $\sqrt{2\pi}\{(n+\frac{1}{2})/e\}^{n+\frac{1}{2}}$ gives $\log 10!=6\cdot5614855$, *i.e.* $10!=364,3221$.

The correct value is 362,8800; the error in the first case is only 251, while the error in the second is 14,421.

Extending the idea, we come to consider the Second Approximation. In the British Association Report for 1883, p. 407, Prof. A. R. Forsyth deduces a very pretty result for $n!$:

$$n!=\sqrt{2\pi}\left\{\frac{\sqrt{n^2+n+1/6}}{e}\right\}^{n+\frac{1}{2}}. \quad . \quad . \quad (4)$$

This compact result is obtained by a process which is essentially the same as the above, but applied to the second term of the exponential instead of the first. If we attempt to find a so that this term may be zero, it is necessary to solve a quartic in $1/a(=x)$.

$$36x^4-24x^3-24x^2+12x+1=0.$$

[The term we are considering is

$$\left[\frac{1}{2}\left(\frac{1}{3a^3}-\frac{1}{2a^2}+\frac{1}{6a}\right)+\frac{1}{2!}\left\{\frac{1}{2}\left(\frac{1}{6}+\frac{1-a}{a^2}\right)\right\}\right]\frac{1}{\left\{n+\frac{1}{a}\right\}^2}.$$

There are two positive roots, both between 0 and 1. The greater is the more suitable for our series. It is very nearly equal to unity and it was found to be very nearly 32/33.

As a second approximation $n!$ is then equal to

$$\sqrt{2\pi}\left(\frac{n+(1/\alpha)}{e}\right)^{n+(1/\alpha)}\left(n+\frac{1}{\alpha}\right)^{(\alpha-2)/2\alpha}\left[1+\frac{1/6+(1-\alpha)/\alpha^2}{2\{n+(1/\alpha)\}}\right], \quad (5)$$

where $1/\alpha = 32/33$.

From this expression, which is affected by an error of order $-1/360n^3$, 10! was calculated:

$$10! = 362,8806 \text{ (an error of 6).}$$

The approximation (4) gives

$$10! = 362,8787 \text{ (an error of 13).}$$

From the original value of α, the second approximation will be

$$n! = \sqrt{2\pi}\left(\frac{n+b}{e}\right)^{n+b}(n+b)^{-c}\left\{1-\frac{\cdot 0080,1875}{(n+b)^2}\right\}. \quad (6)$$

The error in this case will be less than $1/2000 \times n^3$ of the whole.

(6) gives

$$10! = 362,8801 \text{ (an error of 1).}$$

Forsyth's approximation (4) has an error of order $1/240n^3$. It will be seen that the first approximation (3) is a remarkably good one, and the expression is quite good for calculation purposes. The value of $n!$ may be calculated in a very short time.

Mr. Soper's expansion, taken to the same order as (4), gives

$$10! = 362,8792 \text{ (an error of 8),}$$

with an error of order $1/400n^3$. The second approximation (6) derived in the same way as our first approximation is exceedingly accurate, and is better than that of (4); it is also better than Mr. Soper's, which in turn is better than Prof. Forsyth's (4).

Prof. K. Pearson has given in *Biometrika*, vol. vi., a very close approximation to the value of $n!$ This takes account of terms up to $1/n^4$ and partially of the term in $1/n^5$:

$$\log\frac{\Gamma(n+1)}{n^n e^{-n}} = 0\cdot 3990899 + \tfrac{1}{2}\log n + \cdot 080,929 \sin\frac{25^\circ\cdot 623}{n}. \quad (7)$$

On evaluating 10! by means of this expression, it is found that the exact value is given to the nearest unit.

My chief aim in this note has been to show that a very good first approximation may be obtained without the use of any terms of the exponential and that the resulting expression is useful for computing factorials.

It may be of interest to give the values of 1! 2! and 10! found from these approximations in a single table:

	(3) of Present Note.	(4) Forsyth.	(7) Pearson.	Exact.
1!	1·00248	·99883	·99952	1·00000
2!	2·00266	1·99948	1·99996	2·00000
10!	362,9051	362,8784	362,8800	362,8800

JAMES HENDERSON.

Biometric Laboratory,
University College, London.

Dr. Kammerer's Alytes.

MAY I reply in a few words to Dr. Bateson's brief letter on Kammerer's Alytes, which appeared in NATURE of June 30?

Dr. Bateson states that when the nuptial callosities of genera allied to Alytes are described as appearing on the "inner" sides of the fingers, the word "inner" means the radial side and not the palmar surface.

This is quite true, but the callosity on the radial edge of the finger involves the palmar surface also, as Dr. Bateson may convince himself by inspecting Boulenger's figures, and as, indeed, is demonstrated to every student when he is shown the nuptial callosity of the male Rana.

Further, I learn from a letter from Dr. Kammerer that in the specimen of Alytes shown at the Linnean Society, the callosities extend round the radial edges of the fingers on to the dorsal surface, and that he would have demonstrated this to any one who had raised this point while he was explaining his specimens before the meeting.

Readers of NATURE are thus now in a position to judge what ground there was for Dr. Bateson's objections.

E. W. MACBRIDE.

Imperial College of Science,
South Kensington,
London, S.W.7, July 4.

Molecular Interruption.

IN reply to Mr. R. d'E. Atkinson's criticism (NATURE, March 10, p. 326) of my note on the possibility of selective molecular interruption, I should like to point out that so far from attempting to dispose of the validity of the ordinary treatment and claim the effect in question for "infinite free path," I had already shown (NATURE, July 22, vol. 110, p. 112) the reverse to be the case, and that such an effect is not then possible.

It is manifestly clear that it is illogical to conclude, however, because this is the case with "infinite free path" (*i.e.* in the absence of intermolecular collision in the system), that it must also be true for a system in which intermolecular collisions exist, with long free paths relative to the diameter of the directing vessel employed, the particular and special case alone dealt with in my note.

Mr. Atkinson's misinterpretation appears to have arisen from his overlooking my words "molecules issuing from collision in circle O," since his statement "all points on their long paths may equally be taken" as being in O is otherwise unintelligible.

His statement that I have admitted the length of the free path to be irrelevant is not correct. The excessive downward bias to which he refers is, in my opinion, due entirely to the fact that molecules proceeding from collisions (with equal probability of motion in all directions) are interrupted by the vessel before the end of their normal free path period, *when they are moving in certain specific directions*; and are uninterrupted throughout the whole of their normal flight, *when they are moving in other specific directions*: a selective redirection or elimination of the former class which must continuously be leaving a corresponding preponderance of the latter—a conclusion which more careful calculation confirms.

ARTHUR FAIRBOURNE.

King's College,
University of London,
Strand, W.C.2.

The Transport of Rocks.

MAY I ask Prof. Grenville A. J. Cole, through the medium of your columns, how far the authority for the statement that "the Portuguese stone . . . was brought in carracks round the Cape to build the jutting fort on the coral shore of Moçambique" (NATURE, March 17, p. 353) is to be regarded as trustworthy?

I first saw this fort in 1911, and as recently as September last year I walked all round it. I have never been inside, but I am told by Portuguese residents on the island that the same kind of stone has been used throughout in the construction of the fort. This stone is a sandy coral-rock, with occasional small pebble bands. The country rock of Moçambique island is also a coral rock identical in composition and fossil contents—so far as one can judge by hand specimens and very numerous exposures—with that of which the fort is built. This material occurs in vast quantities on the eastern coast of Africa, and indeed on many tropical coast belts: it is well seen at Mombasa and Zanzibar, which island, like that of Moçambique, consists of little else. The coral-rock is not the best material for constructional purposes, as an examination of the external walls of the fort is sufficient to show. Can it be that this material was shipped all round the Cape? It may be so, but I find it difficult to believe.

E. J. WAYLAND.

Fort Portal, Uganda, May 3.

IN reply to the interesting letter from Mr. Wayland of the Geological Department of Uganda, I beg to say that my authority for the statement that the fort of Moçambique was built of stone brought from Portugal is the uninitialled article in the "Encyclopædia Britannica," 11th ed., vol. 18, p. 949, where we read: "There are three forts, of which the principal, St. Sebastian, at the northern extremity of the island, was built in 1510 entirely of stone brought from Portugal."

I have examined the coral-rock here and at Mombasa, and, as Mr. Wayland states, it is not attractive for building purposes. I cannot speak as to the outer wall of the fort, and it may have been rebuilt or refaced since 1510. It would be interesting now to pursue the matter in some detailed history of Moçambique.

GRENVILLE A. J. COLE.

On Auroral Observations.

IT has been found that the green auroral line is regularly visible in the clear night sky, and Lord Rayleigh has discovered the remarkable fact that it is more intense at Terling than in the north of England. A cognate investigation, which, so far as I know, has not yet been made, may be suggested to auroral observers, namely, to examine how the intensity changes at any one place throughout the night. The observation is doubtless a difficult one, but might be made by exposing a series of plates at different hours on a succession of clear nights. It would be of great interest to know whether or not the intensity remains nearly uniform throughout the night hours.

S. CHAPMAN.

The University, Manchester,
July 4.

Gradient of Potential near Electrodes.

IN NATURE of March 31, p. 431, Messrs. H. Nagaoka and Y. Sugiura describe a method of observing the Stark effect in the iron arc; namely, in the thin layer at the surface of the lower electrode. This fact points to the existence of a considerable gradient of potential in this layer.

In the course of an investigation of the radiation in the spark I have found, by means of direct electric measurements, the existence of a considerable gradient of potential in the thin layer that surrounds the electrodes when the sparking discharge takes place.

The discharge of 952 sparks per sec., yielding an effective current of 24 milliamperes, shows that the change of the difference of potential depends upon the length of sparks, as the accompanying diagram (Fig. 1) shows. If the sparks are so short that the thin layers in the proximity of the electrodes, which yield a metallic spectrum, are not yet divided, then there exists a great gradient of potential (Fig. 1, I). The size of gradient depends first upon the nature of the metal forming the electrodes. This is shown by the two curves on the diagram for electrodes of platinum and aluminium.

At longer sparks, while among the above-mentioned layers only a spectrum of gas appears, the gradient of potential is much less (Fig. 1, II); this does not depend upon the nature of the electrodes.

The intermediate space, marked by interrupted lines, is difficult to examine. Sparks of both kinds generally come into view.

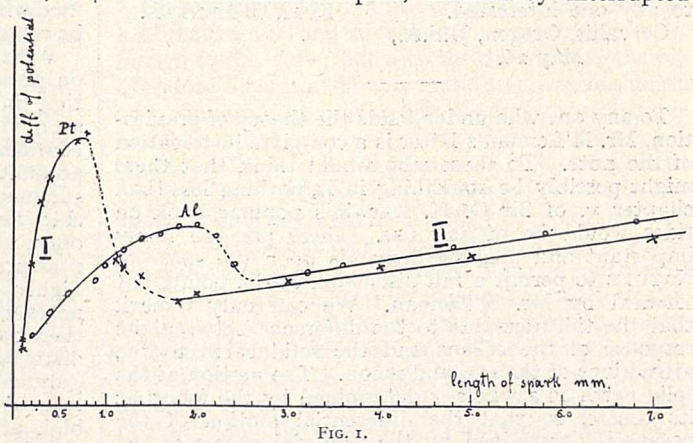

FIG. 1.

If V_1 signifies the difference of potential for short sparks, and V_2 that for long sparks, we get for platinum and aluminium electrodes about:

$$\left(\frac{\text{grad. } V_1}{\text{grad. } V_2}\right)_{\text{Pt}} = 10 \qquad \left(\frac{\text{grad. } V_1}{\text{grad. } V_2}\right)_{\text{Al}} = 5$$

The thickness x of the layer where there is a considerable gradient of potential is small:

Pt.	Cu.	Al.
$x = 0.4$	0.4-0.5	0.7-0.9 mm.

This investigation is being continued.

S. PIEŃKOWSKI.

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Hoza 69.

The Tides.

THE notice in NATURE of April 14, p. 508, of my pamphlet on the tides implies that I have completely misunderstood "the theory of the tide-generating force on the principle of gravitation." Regarding this I would like to present to your readers, very briefly, just one point in that theory: Newton, Herschel, and many other authorities compute the principal tide-raising force as the difference between the moon's attraction at the earth's centre and at the earth's surface. Now this is exactly the method

that would be employed if the sea were about 4000 miles deep. But the sea is only about 2 miles deep, in which, obviously, the tide would be practically insensible compared with that in a sea 4000 miles deep. The height of the tide is measured from the sea bottom; so that whatever elevation by tidal action of that bottom, which takes place, is not added to the height of the tide at all. Why, then, should the action of the tide-raising force beneath the bottom of the sea be added to that action within the sea itself (as is invariably done) to obtain, or explain, the ocean tide?

There are many other points of the tidal theory discussed in the pamphlet referred to which are equally difficult of explanation according to the theory of gravitation. To a statement of these difficulties it is really a rather unsatisfactory answer to say merely that their presentation betrays "a complete misunderstanding of the theory." Facts should be given to show of just what the misunderstanding consists; and truly such facts would not be a waste even of the columns of NATURE, but would undoubtedly prove edifying to many of your readers besides the present writer.

The "Tides" pamphlet will be sent free on request to any one interested. EVAN M'LENNAN.

Corvallis, Oregon, U.S.A.,
May 26.

To any one who understands the theory of gravitation, Mr. M'Lennan's letter is a complete justification of the note. To those who would think that there might possibly be something in it, nothing less than chapter v. of Sir G. H. Darwin's popular book on tides would be of any use. There are too many important and pressing demands upon the space of NATURE to permit a full discussion of the points put forward by Mr. M'Lennan. We can only remark that the tides are due to the difference between the response of the oceans and the solid earth to the attractions of the sun and moon. The motion of the solid earth as a whole is determined by the forces at its centre, so that the differential motion of the oceans is determined by the vectorial excess of the forces at the earth's surface over those at its centre. Of this excess it is the component *tangential* to the earth's surface which is effective in producing the tides. THE WRITER OF THE NOTE.

Barometric Pressure in High Latitudes.

IN his letter (NATURE, May 12, p. 634) on the subject of the causation of anticyclones, recently under discussion, Mr. R. M. Deeley makes two statements which cannot, on the most liberal interpretation of their face value, be reconciled with the real facts of the case as they are well known to meteorologists.

First of all he says: "Another clear effect of surface temperature is the fact that the North Pacific cyclone and the North Atlantic cyclone (the eyes of the North Polar cyclone) are more powerful during the summer than they are during the winter." This is in direct opposition to the truth, as any one will find who refers to charts of mean pressure for January and July, wherein he will find the Icelandic and Bering Sea minima greatly accentuated in winter and nearly obliterated in summer. Moreover, these mean or average charts are merely the generalised expression of one of the most obtrusive facts of seasonal climatology; namely, the frequently violent cyclonic mood of the North Atlantic ocean in midwinter, and its generally much milder state at midsummer, together with the many more gales we experience in England in December and January than in June and July.

Secondly, Mr. Deeley refers to "the striking facts that throughout the year the great low-pressure areas are over the frigid poles." Now though there may be relatively low pressure with cyclonic circulation at higher atmospheric levels round the poles, the modern work of Dr. G. C. Simpson for the Antarctic, and of Prof. Mohn for the Arctic, indicate that the *surface* pressure at both poles is relatively high, supplying an outflow of air towards the low pressure belts about latitudes 60° N. and S. In the Antarctic there is a true glacial anticyclone; in the Arctic the land areas round the polar basin complicate the distribution of pressure, but the pressure over that basin is relatively high throughout the year, particularly in winter, when it links the interior glacial anticyclone of Greenland with the continental anticyclone of Siberia.

Moreover, if the Polar Front theory of Prof. Bjerknes is true—and though there are justifiable doubts as to whether that theory is a full dynamical explanation of cyclonic circulation, no weather forecaster will dispute that it provides an excellent geographical background of reference for the facts associated with that circulation—there *must*, on the average, be relatively high surface pressure about the poles.

With regard to the effect of surface temperature on pressure it is quite true (as Mr. Deeley observes) that in the northern hemisphere, where there are such violent contrasts of continent and ocean, the continents command the excess of air in winter on account of the cold, but lose it to the oceans in summer on account of the heat. But this relationship between surface temperature and pressure is only very rough. There cannot be high or low pressure *everywhere*; and the actual result is a highly complicated regional compromise. If the northern hemisphere were all land or all water, there could not be those marked seasonal or monsoonal disturbances, so conspicuous on the January and July charts of mean pressure, of the simple dynamic belts of wind and pressure, namely, low at the equator, high at about 30° N. and S., low again at about 60° N. and S., high again at the poles, to which one gets an approximation on the annual chart and also on those for April and October. One must grant that the circulation of the atmosphere is initiated and maintained by the general thermal gradient between the equator and the poles; but the rotation of the earth and the seasonal contrasts of temperature between continents and oceans combine to impose an exceedingly complex structure upon the circulation. L. C. W. BONACINA.

27 Tanza Road, Hampstead, N.W.3,
June 14.

Ionisation Potentials of Copper and Silver.

IN their book on "The Origin of Spectra" Foote and Mohler assign ionisation potentials of 7·692 and 7·542 to copper and silver. These are calculated from spectroscopic data. I have recently succeeded in obtaining low voltage arcs in the vapours of these two metals. For copper, a voltage of 7·8 was found, agreeing with the value given above as closely as one would expect from observations on a low voltage arc. For silver vapour, however, the value found and verified by many observations was 6·0 volts. There were indications of a resonance potential at about 3·1 volts.

This work is being continued especially into the spectroscopic region. A. G. SHENSTONE.

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The Problem of Cancer.

ONCE again the public is being made to focus its attention on cancer through the activities of the recently constituted British Empire Cancer Campaign. The object of this so-called campaign is to collect large sums of money which will be devoted to the further study of this disease, which annually sweeps away about 40,000 people in England and Wales alone. The new campaign is taking place under the direction of a committee which has been described as influential, but we search in vain for evidence that the committee, as a whole, possesses the necessary qualifications to direct or to suggest research on what is admittedly one of the most difficult problems in biology. There can be no harm in raising money for medical research—it is, in fact, a highly praiseworthy object—but in the interests of those who have provided the money, it is essential that it should be used in the best way, and it does not appear that the new committee, composed largely of medical men practising among the political, wealthy, or aristocratic sections of the community, is a suitable one to direct cancer research.

The *raison d'être* of the new committee is indeed obscure, for there already exists an Imperial scheme—the Imperial Cancer Research Fund—which has been hard at work with the problem of cancer for twenty years. This committee is under the presidency of the Duke of Bedford, who, as a Fellow of the Royal Society and a man of science, has associated himself very closely and practically with the problem for many years. In addition to a large general committee of Imperial flavour, there is also an executive committee specially composed of men in the highest ranks of the profession, practical and scientific. The work of the Imperial Cancer Research Fund is universally admitted to be of a very high order, and, although it has not been possible to elucidate the cause or causes of malignant growths, a flood of light has been thrown and many foolish views have been exposed and confuted by the researches first of Bashford and later of Murray, who have been the scientific directors of the Imperial Cancer Research Fund. Their work has placed the Fund in the forefront of institutes devoted to the special study of cancer.

It is difficult to understand why a second cancer fund —also Imperial—should be started to do the same work as that which has already been admirably done by the first and older Imperial Cancer Research Fund. From several sides comment has been made on this apparent anachronism, and it has been suggested that, while the new campaign might collect money, its distribution should not be left in the hands of the new committee but should be dealt with by scientific bodies like the Royal Society or the Medical Research Council, acting alone or in co-operation with the Imperial Cancer Research Fund; for, after all, the problem is one of the most difficult now being studied in science.

The Position of Cancer Research.

The subject has passed beyond the realms of clinical observation, and clinicians do not possess the requisite education either to add to or even to supervise work which demands highly-trained biologists. It is, indeed, becoming more and more apparent that cancer is not merely a human problem but one of general biology.

There was a time when the word "tumour" was used to include almost every kind of abnormal swelling that was more or less circumscribed. A great many such swellings have now been separated off, as they have proved to be of inflammatory nature. Even among true tumours a distinction has been made into those that are benign and those that are malignant. Formerly tumours were classified according to their shape or consistence, and many terms employed in this period still prevail, although with an altered significance. Examples of this kind may be cited in such names as "fungus," "polypus," "encephaloid," and "sarcoma." Even the word "cancer" is derived from the supposed resemblance of the cut surface of the tumour to the spreading limbs of a crab.

Up to the first third of last century it was commonly held that cancers and suchlike tumours were something foreign to the body; but with the discovery of the cell, Theodore Schwann showed that there was nothing in any tumour that was really heterologous. His researches, continued by Lebert, were immensely extended by Virchow in his great work "Die krankhaften Geschwulste" (1863–67), to which but little has been added or subtracted from a purely pathological viewpoint. He showed that every tumour is the result of a tissue-forming function derived from the constituents of the body, and the real problem of tumour formation to-day is to find what starts this and causes the tissues to behave in an abnormal way. Every tumour represents a breach in the continuity of some tissue, so that, although arising in a tissue and due to the proliferation of that tissue, the new growth, tumour, or blastoma, as it is called, is really inimical to the well-being of the tissue. Its growth is progressive and unlimited. The cells of which every tumour is composed are bolshevistic, anarchical, or autonomous in varying degree. The laws that govern the behaviour of the cells of a tissue towards each other or other cells are violated. The tumour cells are in some mysterious way set free from restraining influences, and, having attained their liberty, behave in a riotous rather than an orderly manner. Although it is common to speak of cancer as something special, there is the same process at work in all tumours, but the degree of autonomy varies in each. If left to themselves, even the most innocent tumours grow progressively, and may become harmful in virtue of their magnitude. Some of the largest tumours known are benign in a clinical sense, while some of the smallest in point of size may be of deadly malignancy.

Basing the classification of tumours on their origin—histogenesis—Virchow separated them into three great classes according to their components. In his first group—simple histioid tumours—there was only one tissue, whereas in the second or organoid tumours two tissues were involved, one being connective tissue, the other epithelial. In his third group—teratoid tumours —the new growth was composed of several tissues arranged in organ-like fashion. Whatever starts the

cells off, the later growth of a tumour is due to the division of its cells. As this growth proceeds, one of two things happens. Either the tissues become pressed upon and flattened out so that the tumour is said to grow "expansively," or the tumour cells invade the other tissues, gradually destroying them, and finally insinuating or infiltrating themselves into lymph-vessels or blood-vessels. Thus they may be swept away and transported to the most remote ends of the circulation, where, being arrested, they again start to grow and produce a secondary or daughter tumour which is a copy more or less perfect of the primary growth.

It is this last peculiarity which compels us to place true tumours or blastomata in a class outside the swellings caused by inflammatory processes, even although the latter present a certain superficial resemblance to blastomata. The tumour cell itself is or carries the actual exciting agent to continued cell growth, and it is when we come to the question of the cause of this extraordinary cell growth that we are in Cimmerian darkness. We do not know whether there is one or many causes of new growths, and our methods of treatment, especially of the more autonomous or malignant growths, are hopelessly defective.

Theories of the Origin of Malignant Growths.

Naturally, various causes of malignant growths have been suggested, and three at least have been seriously studied; namely, irritation, the action of a parasite, and embryonic aberration.

(1) It is widely held that some irritation, physical or chemical, applied over a long period may incite the cells to unusual growth, which ultimately takes an abnormal blastomatous course. In the last few years, many experiments have concurred to show that tar products may be active incitors to tumours both in men and animals. Cancers in man are not infrequently to be seen in association with some chemical or infective irritation.

(2) A second current of thought has centred round the possibility that tumours, and especially cancers, are due to an exogenic parasite of some kind. From the structure of primary and secondary growths it is necessary to assume that if there is a parasite it must not only incite the cell to division, but also actually be intracellular, for the cells of a secondary distant tumour are the descendants of those that compose the primary tumour. For example, a cancer may arise from the liver. It is composed of liver cells; it may actually, although in an imperfect way, secrete bile. Such a tumour may be carried to the brain, and there we again find that the tumour is composed, not of brain but of liver cells, and it may actually produce bile. If such a tumour is due to a parasite the latter must be inside the tumour cells. Many attempts have been made to find parasites. It must be admitted, however, that up to the present no one has found a parasite in the cells of a tumour which produces a similar tumour in the homologous or heterologous species.

(3) The failure to find a parasite led to another theory—that tumours arise from some embryonic aberration. This view is associated with the names of Durante and Cohnheim, and in certain cases is undoubtedly to be accepted as the probable cause, if it is agreed that there is a high degree of specificity among cells. There is much reason to believe that cells retain their specific characters, or, as Bard has expressed it, "Omnis cellula e cellula ejusdem generis." If this is correct, as it appears to be, one can explain the occurrence of heterotopic tumours best upon an embryological basis. Thus the occurrence of a tress of hair, a tooth, a piece of cartilage, and fragments of lung or intestine in a dermoid tumour of the ovary of a virgin is explicable best on some embryological aberration. It is impossible to believe that the occurrence of 1000 teeth in a tumour of the jaw can be produced by a parasite.

While, however, Cohnheim's theory may explain some growths, there are others which do not come into this category. The degeneration of the process of growth, which is one of the main features of tumours, is evidently some very fundamental process, for growths benign and malignant are found in all animals from fish upwards. Although this fact does not explain the cause of cancer, it dispels many of the foolish theories which have been brought forward to explain cancer in man.

Up to the present time, the histological structure of tumours has been very extensively studied all over the world, but it is increasingly apparent that this method alone has great limitations. In consequence, it has given way to the study of malignant tumours which can be successfully transplanted from one animal to another of the same species. Many facts connected with the origin and spread of, and immunity to growths have been established by this kind of investigation.

In more recent times the physiological processes in cancer tissue have been investigated, as well as the production of malignant tumours in animals, by the application of chemical substances like tar or the chemical substances produced by the concurrent development in the animal of certain animal parasites, as was shown by the extended researches of Johannes Fibiger in Copenhagen.

Another line of work has concerned itself with the growth of tissues *in vitro*. It is probable that much light will be thrown upon the whole of the blastomatous processes by work of this kind. The field of cancer research in man is limited on account of the fact that he is outside the pale of experimental analysis. Methods of treatment may be tried to cure such a desperate disease, but it is reasonable to demand that there should first be some experimental basis for the treatment.

The main point, however, is that all over the world the highest class of scientific workers are busily engaged in trying to solve one of Nature's great mysteries which affects both man and almost all known animals. Cancer is a dreadful, inscrutable disease, and, however blunted medical men become from constant association with other diseases, they never become immune to the sufferings of the cancer patient. Although the main cause of the trouble is unsolved, it is not to be imagined that the research world is standing still. On the contrary, there is everywhere a pulsation which indicates that we are getting nearer the solution of the mystery.

W. B.

The Rotation of the Earth and its Influence on Optical Phenomena.[1]

By Prof. H. A. LORENTZ, For. Mem. R.S.

THERE are different ways in which, by means of optical phenomena, the motion of a system can be detected. I shall speak of them successively, with a view especially to the rotation of the earth, briefly considering also the optical effects that are due to the annual motion, which can be taken to be a translation.

1. DOPPLER'S PRINCIPLE.—In the first place there is Doppler's principle. If r is the distance from a luminous source to an observer (or to the slit of the spectroscope), $v_r = dr/dt$ the relative velocity in the direction of the line r, and n the real frequency of the light emitted by the source, the observed frequency will be $n + \delta n$, where

$$\delta n = -\frac{v_r}{c} n,$$

c being the velocity of light. The corresponding change of the wave-length λ is given by

$$\delta\lambda = \frac{v_r}{c}\lambda.$$

The velocity of the earth's translational motion is 30 km./sec., *i.e.* $\frac{1}{10000}\,c$. It can give rise for yellow light to a change in wave-length of about half an Ångström unit. The displacement of spectral lines produced by it is perfectly observable; in fact, star velocities of some 50 km./sec. are measured with a considerable precision.

If the observed shift of the spectral lines of a star is corrected for the motion of the earth, one finds the velocity of the star with respect to the sun. In the case of many spectroscopic binaries, the determination of the elements of their orbits would be wholly impossible if the motion of the earth were not taken into account.

The velocity of a point of the earth's surface due to the rotation is much smaller than the translational velocity. Even for a point on the equator, it amounts to no more than 0·46 km./sec. The displacement of a spectral line corresponding to this is, for yellow light, about 0·009 Å.U., 1/660 part of the distance between the D-lines. This can scarcely be observed. If it were somewhat greater, one would see that the lines in the solar spectrum lie somewhat more towards the violet at sunrise than at sunset. It must be remarked that the consequences which one draws from Doppler's principle would remain true whatever might be the state of motion existing in a medium surrounding the earth. The question only is whether two successive vibrations emitted by the source take equal or unequal times to reach the slit of the spectroscope.

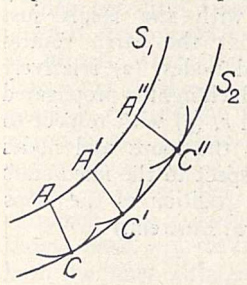

FIG. 1.

2. HUYGENS'S CONSTRUCTION.—In the second place, the propagation of waves and rays of light may be modified by a motion of the system, a modification that can be found by means of Huygens's construction. Let S_1 (Fig. 1) be the wave-front, *i.e.* the surface that is reached at a certain time t by a vibration emitted by the source at some previous instant. Then, around each point A, A′, A″ . . . of S_1 one can describe the elementary wave formed in a time dt. The surface S_2 tangential to them all will be the new position of the wave-front. The lines AC, A′C′, . . ., joining the centres of the elementary waves to the points where they are touched by S_2, are elements of rays, *i.e.* of the lines which determine the lateral limitation of beams of light. The velocity of a ray is given by

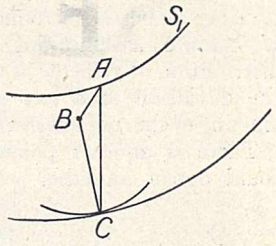

FIG. 2.

$$u = \frac{AC}{dt}, \quad . \quad . \quad . \quad . \quad . \quad (1)$$

and the course of a ray of light s between two given points A and B is determined by the condition that

$$\int \frac{ds}{u} \quad . \quad . \quad . \quad . \quad . \quad (2)$$

is a minimum (Fermat's principle).

This general method can be applied to the case of ether moving through the diagram with respect to which one wants to know the propagation of light. The elementary wave around a point A (Fig. 2) is a sphere with radius cdt (c velocity of light in ether), but drifting along with the ether. The centre of the sphere will be at B, if AB is in the direction of the velocity v with which the ether moves across the diagram and has the length vdt. From the triangle ABC one finds, if θ is the angle BAC between the velocity of the ether and the ray AC, and if terms of the order $(v/c)^2$ are neglected,

$$\frac{ds}{u} = \frac{ds}{c} - \frac{v}{c^2}\cos\theta ds. \quad . \quad . \quad . \quad (3)$$

The figure also shows to what extent the ray AC deviates from the normal BC to the wave-front.

3. STOKES'S THEORY OF ABERRATION.—In this theory it is supposed that the ether is set in motion by the earth, like an incompressible fluid, the velocity of the ether at any point of the surface being equal to the velocity of the earth. At some point P just outside the region where there is an appreciable velocity of the ether, the light coming from some star S will have its wave-front at right angles to PS. The above construction gives the direction of the ray, *i.e.* the direction in which the star is observed; the result agrees exactly with that of the well-known elementary theory of aberration. Stokes further supposes that the motion of the ether is irrotational, so that v depends on a velocity potential. In this case (3) shows that (2) may be replaced by $(1/c)\int ds$ plus a term that is independent of the path; the ray of light is therefore a straight line, and the ordinary

[1] Lecture delivered at University College, University of London, on May 17.

theory of aberration not only holds for the point P, but also for the point where the ray reaches the surface of the earth.

Stokes's theory cannot, however, be maintained, because the two assumptions that there is a velocity potential and that all over the surface the ether has the velocity of the earth contradict each other.

4. ETHER WHIRLS.—It can be imagined that a rotating planet is surrounded by a whirl in the ether. If definite assumptions are made concerning the distribution of velocity in this whirl, one can determine the deviation of a ray passing through it and the amount of diurnal aberration thus produced.

There is another phenomenon still by which one could detect an ether whirl. If the planet Jupiter were surrounded by a whirl, there would be a deviation that could be observed in the case of the occultation of a star, and that is found to be quite appreciable if plausible assumptions concerning the extension of the whirl be made. Nothing of the kind has ever been observed. This speaks in favour of the hypothesis that the ether is not set in motion by the planet.

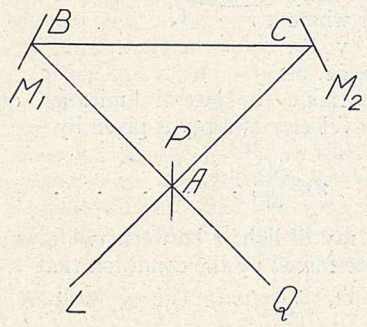

FIG. 3.

5. FRESNEL'S THEORY OF ABERRATION.—Fresnel assumed that the earth is absolutely permeable to the ether, so that it can pass through the ether without in the least setting it in motion. So far as the subject of this lecture is concerned, this assumption leads to the same results as the theory of relativity. The annual aberration is now immediately explained by what was said in § 3. As to the daily aberration, it is determined in the same way as the annual aberration by the motion of the observer. If an astronomer placed at a point on the equator observes a star situated in the plane of that circle, at an altitude h, the aberration amounts to $0{\cdot}32'' \times \sin h$. It would be possible to observe it if the distance of two stars far apart could be measured to within $0{\cdot}1''$. If, for example, two stars A and B in the plane of the equator follow each other in their daily motion at a distance of 60°, their distance will be diminished by $0{\cdot}16''$ when A has reached the zenith, and increased by the same amount when B has reached that point. In reality, however, the existence of the diurnal aberration has not been proved, though astronomers correct their observations for it.

6. MICHELSON'S INTERFERENCE EXPERIMENT.—Prof. Michelson has devised an experiment in which two rays of light propagated in opposite directions along the sides of a great triangle ABC (Fig. 3) in a horizontal plane are made to interfere; M_1, M_2 are mirrors, P a dividing plate of glass; the course of one ray is LACBAQ, and of the other LABCAQ.

In general, let L and Q be any two points having a fixed position in the figure, which is attached to the earth. The ether (supposed not to share the earth's rotation) has a motion through the diagram, consisting in a rotation about the axis of the earth. From what has been said in § 2, one can deduce the time that is required for the passage from L to Q. Let s be the course of the ray if there were no rotation, s' the actual course. One has to calculate the value of (2) for s', but if one neglects terms of the second order, one can substitute for it the value for the path s, because the integral is a minimum for s'. The influence of the earth's rotation is given by the integral of the last term in (3), and is found in the case of Fig. 3 to be proportional to the area of the triangle ABC, to the angular velocity of the earth, and to the sine of the geographical latitude. The effect would be of equal magnitude but of opposite sign for the two interfering rays, and so the position of the interference fringes will be slightly changed by the rotation of the earth. It may be hoped that it will be possible to observe the effect by a suitable method of observation.

7. AN IMAGINARY EXPERIMENT.—Suppose two parallel metallic wires (perfect conductors), such as are used in Lecher's experiment, to be placed round the equator of the earth, each forming a closed circle. Let standing electromagnetic waves be produced between these wires. One may confidently expect that the loops and nodes will travel around the earth from east to west in 24 hours, and this can be considered to be a proof of the earth's rotation.

If the statement that the earth rotates is to have any meaning one must assign some system relatively to which the rotation takes place. If the imaginary experiment were performed with the result just mentioned, one could say that the earth rotates (1) relatively to the loops and nodes, (2) relatively to a system of co-ordinates in which light is propagated in straight lines with the speed c, (3) with respect to the stationary ether in which the loops and nodes have their seats, or (4) with respect to the fixed stars by the influence of which the position of the loops and nodes is determined. (Mach, Einstein.)

A Large Refractor for Johannesburg.

By FRANK ROBBINS.

TWENTY years ago, and soon after the close of the Boer War, the South African Association for the Advancement of Science petitioned the Transvaal Government for the establishment of an observatory for the sciences of meteorology and astronomy. The reply was immediately favourable as regards meteorology, but it was not found possible to organise an astronomical department for some half-dozen years or so. In the meantime, by loan or by gift, a few instruments were obtained, and quite soon attention was forcibly directed to the very exceptional climate and sky of Johannesburg by means of work actually done there by the aid of a modest 9-inch refractor. In consequence, early in 1909 the Minister for Lands

made provision in his estimates for the erection of a visual refractor of 26 inches clear aperture, and a contract with Sir Howard Grubb and Sons, Ltd. was signed in November of that year. Discs for the objective were ordered at once from France, but the production of optical glass of that size is a slow and uncertain process, and in 1912 efforts were made to obtain a supply from Messrs. Chance Bros. and Co., Ltd., of Smethwick, near Birmingham.

Trials and disappointments followed, parallel and in series too. At this time Sir David Gill, the designer of the telescope, had inspected the equatorial and reported "Nearly complete and exceedingly satisfactory"—this was in the summer of 1912. There followed two years full of hope passed in fresh efforts and experiments. Then the Great War put a stop to everything. . . . The Armistice came at last, and when the smoke of battle cleared away it was found that the Admiralty had silently transferred Sir Howard Grubb's workshops from Rathmines, near Dublin, to St. Albans, and there in the confused heaps of material, tools, patterns, periscopes, range-finders, and waste, lying on the new workshop floors, it was said the famous telescope was lying dismembered and for the most part unrecognisable.

It was necessary to start again, not quite from the beginning but very nearly so, and this necessitated conferences, new estimates, and references to Pretoria, but finally order arose out of chaos. Fresh contracts were made in November 1922, and in the following March Messrs. Chance Bros. reported complete success. On their invitation a few astronomers journeyed to Birmingham to view these long-desired discs, and there the visitors experienced moments, nay minutes of tension. The room containing this precious optical glass proved unsuitable for the examination, so two workmen carried the flint disc weighing some 240 lbs. in their four bare hands through a narrow doorway across an uneven floor, wending their way between great blocks of glass into another room. Perhaps it was not as dangerous as it looked, but to the interested spectators it seemed a passage perilous, where the labour of thirteen years might have been lost by an unlucky step.

These two discs, when tested for striæ and annealing, satisfied the optical expert, and they were taken to St. Albans, where the rough grinding of the flint is proceeding as shown in Fig. 1. To the objective it is intended to give the form now generally familiar to astronomers: a double convex crown fronts the stars and is followed at a distance of some six inches by a double concave flint, the fourth surface being of extremely long radius. In its mounting a close-fitting sliding band will make it possible to clean either or both the inner surfaces, and here it has been essential to pay special attention to the complete exclusion of dust, of which Johannesburg easily obtains its share. The rough discs measured 26⅞ inches, and are to yield a finished objective of 26 inches clear, with a focal length of, say, 35 feet, giving a ratio just over 16.

The dome for the telescope has been ready and in position for so long that its appearance in any photograph of the outskirts of Johannesburg must be quite familiar to many. A good photograph of the whole instrument on its equatorial as it stands in Fleet Works, St. Albans, cannot be obtained, and yet it is probably the most frequently photographed telescope in the eastern hemisphere; since Christmas last, views of it have appeared in two of London's leading newspapers, but each time it has been ascribed to Russia, and on the first occasion it was even described as the largest telescope in the world.

Fig. 2 shows the view from the south-west of the heavy castings for the stand with the polar axis carrying the right ascension circle at its lower (north) end. Most of the tube is visible, with its central cube and the extension for the counterpoise. Fig. 3 is the breech-piece with photographic plate-holder. It shows also the 4-inch finder of 60 inches focal length. This is

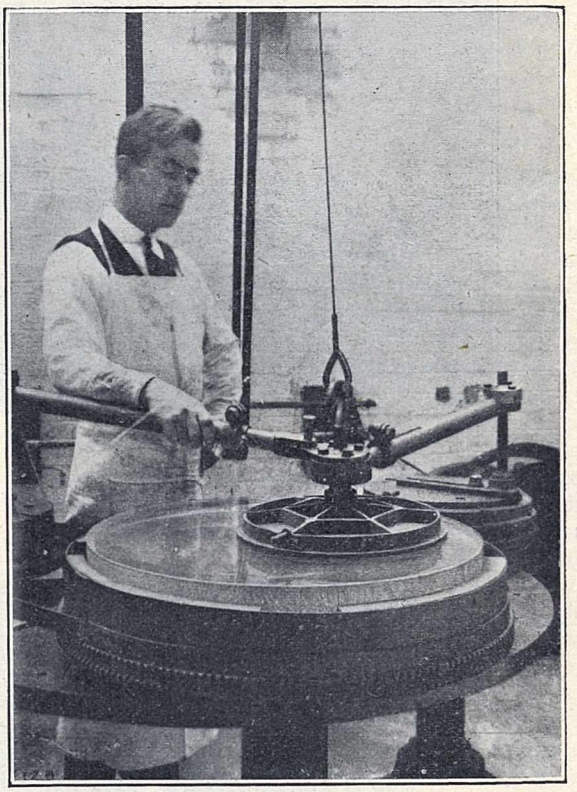

FIG. 1.—Flint disc.

provided with either a variable bright field or with bright wires as desired for the particular work in hand. Several of the circular weights are to be seen the removal of which will make it possible to fit a spectrograph if it is so desired at any time in the future. These weights equal in all 370 lbs. The motive power for the driving clock is a weight which falls a quarter of an inch every ten seconds—the rewinding is automatic and electric. The weight of the moving parts amounts to more than five tons, but the roller bearings supplied and the carefully equal distribution of the mass make it easy for the observer to shift this load with one hand.

The process of finding a faint star with this instrument is not quite as ordinarily obtains — it is more simple. The declination clamp is released, and the required declination reading is obtained; the instrument is then re-clamped. Now, because the right ascension circle is clock-driven, it constantly indicates

the local sidereal time. The right ascension clamp is released and the telescope shifted until the reading microscope shows the right ascension of the star. The right ascension is then clamped and the dome opened. The rising floor has a range of twelve vertical feet—it is not circular, and in azimuth it extends over 120° but always opposite the dome opening; for example, when the telescope is pointing to N. 270° E. the rising floor or platform lies between N. 30° E. and N. 150° E. Observers being scarce, provision is made to save them from walking over the edge. In actual work an assistant will stand at the north end of the base and in charge of the quick motion in right ascension. The slow motion is controlled by the observer alone, who also holds in his hand means of adjusting the clock rate. Both co-ordinates of a star are read very easily from the eye end, where there is a choice of three breech-pieces—one visual with four oculars, a second with a Repsold micrometer, and a third the photographic, made by Adam Hilger to a specification and design by Sir David Gill. No digging for a foundation is required; the pier will be bolted directly to an outcrop of solid rock.

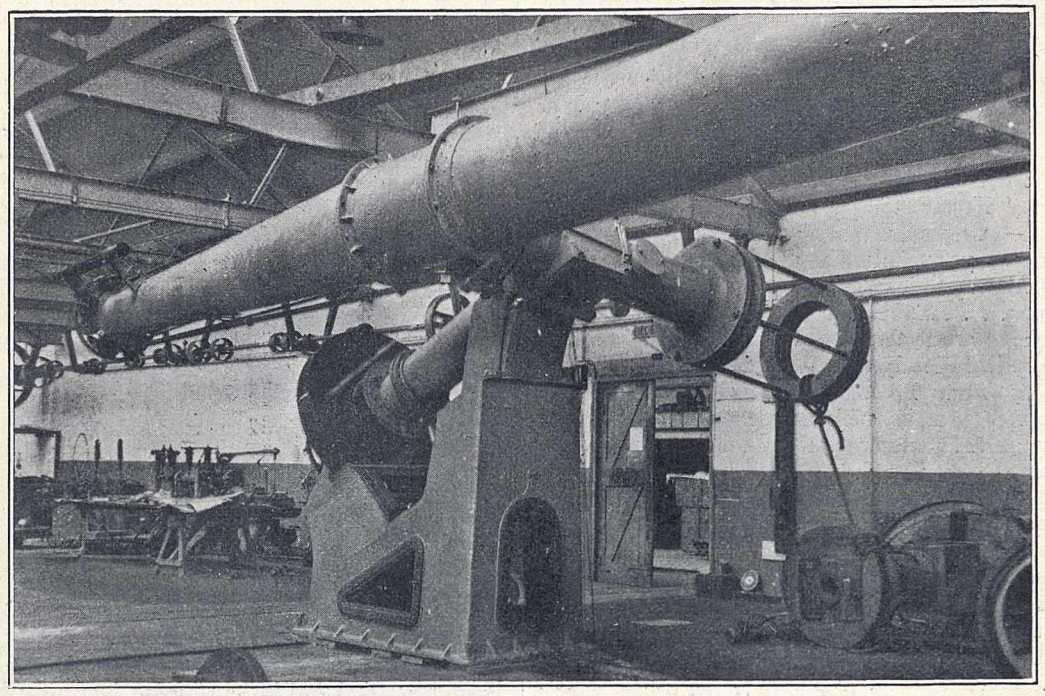

FIG. 2.—Equatorial with steel tube.

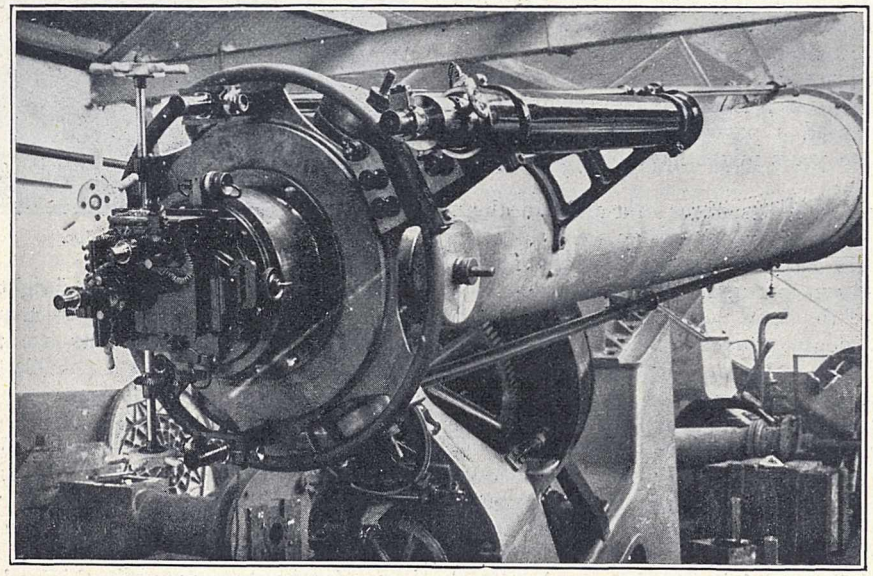

FIG. 3.—Eye-end 26-inch refractor.

It remains to add a few words on the environment of this much-needed addition to the meagre list of large

telescopes south of the equator. Every one has heard of the Witwatersrand as the source of much of our gold. This range of hills lies in latitude 26° 11′ south, just north of Johannesburg, and here, at an altitude of 5925 feet, a thousand miles from Cape Town, and 240 miles from the sea, is the observatory. Antares is four minutes of arc south of the zenith, and is the only clock star required. The average height of the barometer is 24·35 ins.—one-sixth of the atmosphere is below and the part remaining is here less subject to vagary than in almost any other part of the habitable globe. The climate is remarkably sunny, and the sky is free from cloud to a very high degree. Astronomical observations are possible on 300 or more nights in each year; on 200 of these one could observe for ten hours continuously.

Think what this means; work can be planned months ahead with a certain assurance of favourable skies. There are no nights wasted watching for a possible break in the clouds, which, coming, is gone before it can be utilised, but good observing weather in quantity, the incidence of which can be predicted 99 times out of a 100. Cloudiness on the average equals 30 per cent., and even in the rainy season seldom exceeds 44 or 46 per cent. Humidity for the year is 57 per cent., January 71 per cent., July 42 per cent. Rainfall 25 to 30 inches, but there are only 85 wet days and not more than 190 wet hours. Of course there is a drawback: high easterly winds with dust; and such dust—clouds of it, equal in density to a fog, but not more than two or three days in a year are as bad as this. The seeing is exceptional—not optically perfect perhaps, but so nearly ideal that the fame of its quality is spreading abroad, and rumours are heard of northern observers intending to enlarge and complete their researches by a sojourn in the Union of South Africa.

Current Topics and Events.

WE have on several occasions expressed regret that no provision seemed to have been made for the display of achievements of pure science and their relation to industrial and Imperial development at the British Empire Exhibition to be held next year. We are glad, however, now to be able to announce that at the request of the Exhibition authorities the Council of the Royal Society has appointed a Committee to organise a central exhibit to illustrate the fundamental principles of certain departments of pure science, with special reference to the share taken in developing those principles by the Empire. A small sum of money has been placed at the disposal of the Committee and space allotted in the Central Pavilion. The Committee, which is a strong one, represents all branches of science. Sir Richard Glazebrook is chairman, with Sir Herbert Jackson and Mr. F. E. Smith as vice-chairmen. Mr. Woolcock, the chairman of the Association of British Chemical Manufacturers, who is taking the leading part in the organisation of the chemical exhibit, has become a member of the Committee.

THE Empire Cotton Growing Corporation has recently been considering the necessity for organised research at the universities and colleges of Great Britain, and has decided to offer retaining grants to certain universities where highly specialised research is already going on. The Imperial College of Science and Technology, South Kensington, has accordingly been offered the sum of 1000*l.* a year for a period of five years from October 1, the money to be devoted to plant physiology and plant pathology in the Department of Botany. The research work will be undertaken in the new Botany Building, recently opened by the Duke of Devonshire, to which the Rubber Growers' Association of the City of London subscribed about 30,000*l.* about two years ago. These gifts are tangible evidence of the value which tropical agriculturists attach to the important research work which is being undertaken at the Imperial College, especially in connexion with plant physiology and pathology, under the direction of Profs. J. B. Farmer and V. H. Blackman.

JULY this year has established a weather record for temperature, and in many places the thermometer has exceeded records for many years past, not only for July but also for any part of the summer. The hot spell was fairly established on July 5, when at Kensington and Greenwich the sheltered thermometer rose to 84° F. On July 6 the temperature at Kensington was 87° F., and at many health resorts it was 85° F. At Greenwich on July 7 the thermometer in the shade registered 90° F., and the solar radiation temperature was 163° F. The severe thunderstorms and torrential rains so prevalent over the country on July 9 and 10 had little effect in reducing the temperature, and from July 11 the heat became more intense. On July 12 the thermometer at Andover registered 94° F., and on July 12 and 13 the temperature at Kensington was 92° F., while the minimum night temperature registered on both mornings was 68° F. At Bath on July 12 and 13 the thermometer registered 93° F. and 92° F. respectively. On the night of July 12-13 the minimum temperature was 71° F. at Hastings and Brighton. At Kew the maximum temperature was 80° F. or above for ten consecutive days, and 91° F. recorded on July 13 is a record for July; while on the same day 96° F. at Camden Square is the highest temperature reported to the Meteorological Office during the warm spell. These temperatures fall somewhat short of the London readings during the abnormal summer of 1911, when 100° F. was recorded at Greenwich and 95° F. at Kew on August 9. A new type of pressure distribution set in over the British Isles on July 14, and a drop of temperature occurred in most parts of the country.

THE following elections to Beit Memorial Fellowships for Medical Research have been made, the general subject and place of research being given after each name:—*Senior Fellowship*: Dr. D. Keilin: the life-history of parasitic Protista and the physiology of parasitic Metazoa, at the Molteno Institute for Research in Parasitology, University of Cambridge. *Fourth Year Fellowship*: Dr. Katherine H. Coward: the processes of metabolism, nutrition and growth of

young animals, particularly with reference to the so-called deficiency diseases such as rickets, at the Biochemical Laboratory, Institute of Physiology, University College, University of London. *Junior Fellowships*: Dr. J. M. H. Campbell: Oxygen consumption and pulmonary ventilation during and after work in chronic heart and lung disease; total metabolism and "efficiency" of work in these and other diseased conditions; changes in the capillary circulation in the skin in certain chronic nervous diseases, at the Department of Physiology, Guy's Hospital, London. Mr. C. G. Lambie: Influence of insulin upon fat and protein metabolism; observations upon the fate of the sugar which disappears from the blood in hypoglycæmia produced by insulin, at the University of Edinburgh. Mr. W. K. Slater: Determination of the molecular weight and heat of combustion of glycogen; an investigation of cell mechanism under anaerobic conditions, in the Physiological Laboratory, University of Manchester, and the Institute of Physiology, University College, London. Miss D. S. Russell: The relation of renal efficiency tests to the morbid anatomy and histology of kidneys, at the Pathological Institute of the London Hospital. Mr. C. P. Stewart: Investigation of the methods of isolation and chemical constitution of thyroxin; the liver perfusion of substances related to histidine, in the Department of Medical Chemistry, University of Edinburgh. Mr. H. J. Channon: The study of certain fundamental dietary factors in the nutrition of living organisms, at the Institute of Physiology, University College, London. Mr. W. Smith and Mr. L. B. Winter: Investigations on general metabolism in health and disease, with special reference to the metabolism of carbohydrates; search for alternative sources of insulin, notably from yeast, at the Biochemical Laboratory, University of Cambridge. Miss D. B. Steabben: Investigation of the mechanism of response to injection of colloidal substances, at the Lister Institute of Preventive Medicine, Chelsea Gardens, S.W., and King's College (London) Physiological Laboratory. Mr. C. S. Hicks: Investigation of the causation of goitre from a biochemical point of view, such as a close examination of the relationship of iodine in foods to the incidence of goitre; the chemistry and pharmacology of substituents in the thyroxin molecule, from the point of view of the physiological action of thyroxin, at the Balfour Laboratory, University of Cambridge.

THE Court of the Salters' Company has appointed Prof. A. Smithells to be director of the Salters' Institute of Industrial Chemistry.

WE regret to announce the death on July 15 of Sir Henry Hoyle Howorth, F.R.S., a trustee of the British Museum since 1899, at the age of eighty-one.

THE diamond jubilee meeting of the British Pharmaceutical Conference and a meeting of the International Pharmaceutical Federation will be held in London on July 23-27.

THE Royal Danish Academy at its last annual meeting elected the following honorary foreign members: Prof. Albert v. Le Coq, of Berlin, Profs. Charlier, J. Forssman, and C. M. First, of Lund, Dr. F. A. Bather, of the British Museum, and Prof. F. O. Bower, of Glasgow.

AT a recent meeting of the Institution of Electrical Engineers the following officers were elected:—*President*: Dr. A. Russell; *Vice-President*: Sir James Devonshire; *Hon. Treasurer*: Mr. P. D. Tuckett; *Ordinary Members of Council*: Mr. J. M. Donaldson, Dr. W. M. Thornton, Colonel T. F. Purves, Mr. G. W. Partridge, Mr. P. Rosling, and Mr. S. W. Melsom.

IT is announced in *Science* that on his retirement through ill-health from the directorship of the Mount Wilson Observatory Dr. G. E. Hale has been appointed honorary director. Dr. Hale will remain in charge of the general policy of the observatory, and Dr. W. S. Adams, at present assistant- and acting-director, has been appointed director in charge of operations.

AT a quarterly meeting of the council of the Royal College of Surgeons of England, held on July 12, Sir John Bland Sutton was elected president and Sir Berkeley Moynihan and Mr. H. J. Waring were elected vice-presidents for the ensuing year. Among the elections made were the following: Mr. H. E. Griffiths, Mr. V. B. Negus, and Mr. C. P. G. Wakeley to be Arris and Gale lecturers, Prof. S. G. Shattock to be Erasmus Wilson lecturer, and Sir Arthur Keith to be Arnott demonstrator.

THE Minister of Agriculture and Fisheries has appointed the following departmental committee to inquire into the operations of the Fertilisers and Feeding Stuffs Act, 1906: Lord Clinton (Chairman), Mr. E. Richards Bolton, Mr. E. G. Haygarth Brown, Dr. Charles Crowther, Mr. T. Kyle, Mr. B. S. Miller, Mr. G. Stubbs, Dr. J. F. Tocher, and Dr. J. A. Voelcker. The committee is to advise whether any, and if so what, amendments are necessary in order to render the execution of the Act more economical and effective, and to report accordingly. Mr. H. J. Johns, of the Ministry of Agriculture and Fisheries, 10 Whitehall Place, S.W., has been appointed secretary to the committee.

AMONG the subjects discussed at the recent International Navigation Congress at Westminster on July 2–6 were the latest improvements in regard to signalling at sea and on the coast. Fourteen reports were submitted to the Congress, covering the current practice in Great Britain, Belgium, France, Holland, Italy, Japan, Russia, Spain, Sweden, and the United States. Reference was made to experiments carried out by Trinity House, in 1921, in connexion with synchronous signalling, in which two types of sound-transmitters were used—one a standard submarine bell, and the other a Fessenden oscillator, in conjunction with a wireless transmitter. The signals received from these were of such a character as to enable the distance to be calculated of objects invisible in fog, but within submarine sound range. A wireless installation, lately erected at Inchkeith in Scotland, was mentioned as affording facilities for experimenting with direction messages to vessels equipped with a simple type of receiver gear. The most important advance in light-

house work in the United States has been the establishment of radio fog signals. A plea was entered for the international adoption of some system of under-water signals, by which vessels in an area of reduced visibility could transmit information as to their courses to other vessels in the vicinity, as well as obtain the bearings of such vessels. The radio compass and position-finder now enable ships to approach the coast in thick weather. It remains to provide means to ensure the safety of vessels coasting and entering port. The feeling was expressed that the subject of marine signalling was so important as to claim a larger share of the time of the next Congress.

ON July 4 Professor Dr. Ernst Beckmann completed his seventieth year. He was an apothecary originally, and changed over to the study of chemistry in 1875 under Kolbe in Leipzig. After a short stay at the Technical Highschool in Braunschweig he went to the University of Leipzig in 1884, where he worked first with Johannes Wislicenus and later with Wilhelm Ostwald. It was about this time that Beckmann made the observation that ketoximes are transformed by pentachloride of phosphorus into acid amides. This Beckmann transformation has shown itself to be a very productive reaction for the investigation of the stereo-isomeric nitrogen compounds. At the same time Beckmann elaborated the well-known methods for the determination of molecular weights by observation of lowering of the freezing point and rise of the boiling point of solutions. The use of Beckmann's apparatus is now widespread, as well as the Beckmann thermometer employed in these operations, which combines accuracy to one-thousandth of a degree Centigrade with a very simple regulation for the most varied ranges of temperatures. After having been for a short time at the universities of Giessen and Erlangen, Beckmann returned to Leipzig in 1897, and remained there as director of the laboratory for applied chemistry until 1912. During this time he showed great activity in numerous investigations in pure chemistry, foodstuffs, and drugs; further, he constructed the burners fitted with sprays which allow of continuous working with coloured flames for spectroscopic and other optical work. In 1912, Beckmann undertook the organisation of the newly founded Emperor William Institute for Chemistry in Dahlem, where Willstätter, Stock, O. Hahn, and Lise Meitner have done much of their work. He resigned from the directorship of this institute in 1921, but is still untiring in research and literary work.

THE rise and growth of scientific and technical journalism is one of the most characteristic features of modern civilisation. Some day the upward trend of this movement must show a flattening tendency; but of the approach to this phase there is at present little evidence. The "List of Serials received in the Library of the U.S. Department of Agriculture" (Washington: Government Printing Office), exclusive of U.S. Government and State Agricultural College and Experiment Station Publications, which has recently been received, includes no less than 5586 distinct serials. If the excluded serials were added o the above figure and the publications currently received by the U.S. Weather Bureau were also thrown in, a grand total of at least 7000 serials would be recorded. All these serials, of course, are not exclusively devoted to agriculture, but they have, at any rate, been collected with the view of the furtherance of the work of the Department. As regards the purely agricultural serials, the list is practically a bibliography of the subject. The auxiliary sciences are adequately but less completely represented. The list, which is an 8vo volume comprising 358 pages, is divided into four parts. Parts 1 and 2 form a register of the entire collection. Part 3 is an admirably compiled subject classification of the serials set forth in parts 1 and 2. This part includes the U.S. Government and State publications. Part 4 is a regional distribution of the data contained in parts 1 and 2. The list is admirably compiled and clearly printed. The librarians of the Department are to be congratulated upon its production.

REFERRING to Dr. J. S. Owens' letter in NATURE of June 23, p. 848, regarding the haze overlying southern England on Derby Day, Mr. F. R. Farquharson states that he made an exposure on the course, using the widest aperture of the lens on a Kodak film, when the horses suddenly appeared out of the mist barely a hundred yards away. The result when developed showed over-exposure, thus proving that the mist had not that light-stopping power common to the normal London mist. Dr. J. S. Owens writes: "The obstruction caused by a haze depends not only on its density but also on the length of path of the light through the haze. The distance between camera and object was short and thus obstruction correspondingly small, while it is probable also that the vertical thickness of the haze was small and thus plenty of light penetrated. Anti-cyclonic weather, which is often accompanied by an inversion of temperature gradient a little above the ground, provides suitable conditions for a shallow dust haze. The dust being unable to penetrate the 'lid' formed by the temperature inversion, may travel for great distances along the ground obstructing visibility of objects at a distance, but having little effect on the quantity of light reaching the ground from the sky. In a London smoke fog both the number of particles per c.c. and their size are usually greater, while the thickness of the layer of fogs is probably also much greater than in a haze such as that on Derby Day."

MR. T. H. DIGGES LA TOUCHE, who is so well known by his published work in connexion with the Geological Survey of India, has prepared the catalogue and subject-index of literature added to the library of the Geological Society of London during the years 1915–1919. This volume of 545 closely printed pages fills the gap in the valuable lists issued by the Society, which are now complete to the end of 1922. Its price (10s.) is moderate, and for libraries the collection of the records for several years into one continuous series facilitates reference. The subject-index, occupying half the volume, is a monument to the careful reading and judgment of Mr. Digges La Touche, and it must be remembered that, for the period named, the work represents very fairly the

geological literature of the world. We cannot find here lists of the publications of geological surveys; these are indexed under their authors and the districts with which the memoirs deal. Maps separately issued are not regarded as "literature"; but, under the heading "Maps," there is a very useful list of those included, and often concealed, in printed papers, with indications of their scales.

IN connexion with the mechanism whereby pollen is able to induce hay fever, a correspondent has suggested that possibly the pollen grains in the presence of moisture on the mucous membranes might protrude their pollen tubes; these might penetrate the mucous membrane. A view somewhat similar was developed by Blackley half a century ago in his famous "Experimental researches on the causes and nature of Catarrhus aestivus." He showed that neither the size nor the nature of the covering of the pollen can be the essential cause of hay fever, but from prolonged observations he believed that the moisture on the mucous membrane might cause the pollen to swell and to protrude its tube into a mucous gland. While this might explain some of the initial phenomena in an attack of hay fever, he was strongly of opinion that the obnoxious element of pollen was the granular matter in the centre, a view universally accepted to-day.

Our Astronomical Column.

LARGE METEOR.—In strong twilight on the evening of July 11 a fine meteor was seen at $9^h\ 9^m$ G.M.T., by Mr. E. W. Barlow of Wadhurst, Sussex, who considered the object as bright as Venus at its best. The nucleus was pear-shaped and bluish, and a red train followed it along an arc of about 10°. The duration of flight was 4 seconds and the path from 95 Herculis to η Ophiuchi.

Mr. E. H. Smith of Hanwell, W., also saw the object and describes the path with reference to the stars Altair and Antares. The height of the meteor was about 66-54 miles over the English Channel; length of path 90 miles, and velocity about 22 miles per second.

The fireball was also observed by the Astronomer Royal and by Dr. Crommelin at the Royal Observatory, Greenwich, and they give the azimuth of the end point as 15° W. of south.

THE SPIRAL NEBULÆ AS DUST-CLOUDS.—Mr. J. H. Reynolds discusses in Mon. Not. R.A.S. for May the recent suggestion of Prof. Lindemann that the spirals are dust-clouds expelled from the Galactic system by radiation pressure, and shining by reflected starlight. He gives a diagram of the distribution of the spirals, and of their radial velocities, determined by Prof. Slipher. The data as regards size, inclination, and radial velocity appear to fit in fairly well with Lindemann's theory, if one adopts the eccentric position of the sun in the Galaxy, as given by Prof. Shapley's determination of the distances of globular clusters. The spirals nearest to the Galactic centre would have the highest velocities, but would appear small to us, owing to distance. Those nearest to us would appear large, but would have small radial velocities, their motion being nearly across the line of sight. There is one feature of the spirals, however, that Mr. Reynolds regards as negativing the theory of their shining by reflected starlight. This is the dark absorption stripe which is seen to cross the centre of many of the spirals that are seen nearly edgewise. On the reflection hypothesis, this should be bright and not dark; its presence seems to prove that the illumination of the spirals comes from within them. Some years ago Mr. Reynolds put forward the view that the spirals were shining by reflecting the light of some bright body in their centre, basing this on measures of the relative brightness of different regions. He now repeats this suggestion, and adds that it may be possible for the condensed matter in the middle of the spiral to give a spectrum of type F or G, without being in a stellar state. He quotes in support some recent experiments on the spectra given by exploded wires.

STARS IN THE MILKY WAY AND AT THE GALACTIC POLE.—The Harvard College Circ. No. 242 contains a very interesting comparison of a Milky Way field with one at the South Galactic Pole made by Mr. Solon I. Bailey. The aim of such investigations is not only to give an estimate of the total number of stars that exist or rather can be photographed, but also to form an idea of their distribution in space. Star gauges were made by the Herschels a century ago, but since then studies of the distributions of stars have been completed by Argelander, Seeliger, Pickering, Celoria, Kapteyn, Chapman and Melotte, and others. It was generally deduced that there were only twice as many stars in the Milky Way as elsewhere up to about magnitude ten, although Herschel's counts gave a maximum of about 20 times as many stars in the Galaxy as at the Galactic poles. An increasing Galactic concentration with decreasing apparent brightness was shown by Kapteyn, and a similar but less rapid degree of concentration was deduced by Chapman and Melotte. Mr. Bailey discusses photographs taken with the 24-inch Bruce photographic telescope at Arequipa, Peru, the longest exposures showing stars fainter than the nineteenth magnitude. He gives a very instructive table indicating the relation of length of exposure to limiting magnitudes photographed, showing that as the stars become fainter, longer and longer exposures have to be made to gain every extra magnitude. Selecting a square degree area in Sagittarius in the Galaxy, one of the richest star fields of the Milky Way, and comparing this with the similar area at the South Galactic Pole, he obtains the following counts:

Exposures. m. s.	Limiting Magnitudes.	Number of Stars. Galaxy.	Pole.	Ratio.
0 1	10·1	13	5	2·6
0 3·3	11·2	47	13	3·6
0 10	12·4	111	29	3·8
0 30	13·5	349	62	5·6
1 29	14·6	1,945	104	18·7
4 27	15·6	9,160	151	60·7
13 20	16·5	21,895	225	97·3
40 0	17·4	36,260	359	101·0
120 0	18·3	57,130	494	115·6
360 0	19·2	61,595	551	111·8

It will be seen that, up to about magnitude 10, the number of stars in the Milky Way is about 2·5 times that at the pole. After magnitude 13, the ratio increases with great rapidity, until at about the 17th magnitude the ratio is more than 100. If the stars were everywhere as dense as in this part of the Galaxy their number would be 2·5 billions, while if the density were that at the pole, their number would be 23 millions.

Research Items.

DEPOPULATION OF PRIMITIVE COMMUNITIES.—Mr. J. H. Hutton, whose monographs on two branches of the Naga Tribes in Assam have been received with much favour by ethnologists, reviews in *Man in India* (vol. 2, No. 4) the work of the late Dr. Rivers on depopulation in Melanesia, in the light of his experiences in Assam. He notes that, as in the case of the Kava of Melanesia, the influence of missionary societies in Assam, who discourage the use of the mild rice beer, is driving their converts to opium. The appearance of consumption in recent years in the Naga hills may be attributed to the wearing of European clothes, which is also responsible for the spread of dysentery, itch, and yaws. The absolute prohibition of head-hunting has led to serious interference with all sorts of dependent activities, and ultimately leads to a total lack of interest in life, and so to the limitation of families, or even to the total refusal to procreate children. These facts, which corroborate the conclusions of Mr. Henry Balfour in the presidential address recently delivered before the Folklore Society, deserve the serious attention of all those who are responsible for the welfare of primitive societies.

BRONZE AGE WEAPONS IN THE HULL MUSEUM.—In *The Naturalist*, No. 795, for April, Mr. T. Sheppard reports further valuable additions to the collections in the Hull Museum. Some of these pieces formed part of the Scarborough hoard, of which twenty-three are now in the museum. The new examples include some interesting axes and palstaves. An analysis of one of the axes by Prof. Cecil H. Desch shows that it contains 80·25 per cent. of copper, 16·39 per cent. of tin, and minute quantities of lead, nickel, and sulphur.

CONTRACTION AND DILATATION OF BLOOD-VESSEL.—Special interest has been aroused by the work of the Petrograd physiologist Kravkoff, who is already known for his work on the contraction and dilatation of the blood-vessels of surviving organs. Kravkoff usually employs rabbits' ears, which retain their vitality for a long time. Even after keeping these organs for several days and weeks he obtained a definite reaction with adrenalin. In his investigation he devised two methods for preserving the ears. As the ears usually perish from infection contracted at the cut surface, he seals that end by dipping the excised ears into a vessel with molten paraffin. When the paraffin solidifies the ears stand up in the vessel like plants in a flower-pot, and in this way the vital properties of the vessels are preserved for a long time. The second method is that of drying. The ears are dried in an evacuated desiccator over sulphuric acid until the moisture content is 5-6 per cent. Such preparations can be kept for about three months, and after soaking they respond to chemical stimuli. In this way also organs of higher animals show parabiosis after drying. It was also found convenient to employ human fingers, from amputations or later from corpses, for the study of the blood-vessels. These organs are just as sensitive in responding to poisons and adrenalin and can be utilised as anatomical specimens as well. They can also be preserved and dried. These surviving organs also possess the property characteristic of living animals, that their skin reacts to cantharadine, producing a focus of local inflammation with a blood-vessel reaction and tissue œdema.

THE ALLANTOIC PLACENTA OF MARSUPIALS.—One of the results of the visit of the British Association for the Advancement of Science to Australia in 1914 was the establishment of a committee to promote the collection of material for the study of the marsupials, with special reference to their embryology, a task rendered imperative by the rapid extermination of the native fauna. The principal part of the work of this committee was entrusted to Prof. T. Thomson Flynn of the University of Tasmania, who gives us the first instalment of his embryological results in a memoir on the Yolk-Sac and Allantoic Placenta in Perameles, published in the current number of the *Quarterly Journal of Microscopical Science* (vol. 67, part 1). It was in Perameles that Prof. J. P. Hill first discovered the existence of an allantoic placenta in the supposedly "non-placental" marsupials. Prof. Flynn confirms and extends Hill's observations, and endeavours, apparently with success, to reconcile the supposed discrepancy between the development of the marsupial allanto-placenta and that of the primitive eutherian type, maintaining that the difference between the two is one of degree rather than of kind. He draws a close comparison between the early stage of the allanto-placenta in Perameles and that of the dog, and holds that both can be derived from a common ancestral condition. He agrees with Hill in attributing the absence of an allantoic placenta in the majority of the Marsupialia to degeneration.

THE PLEISTOCENE OF NORTH AMERICA AND ITS VERTEBRATES.—The Carnegie Institution of Washington has issued as its Publication No. 322 a substantial volume by Mr. O. P. Hay on "The Pleistocene of North America and its Vertebrated Animals from the States east of the Mississippi River and from the Canadian Provinces east of longitude 95°." By the author, who is obviously a thoroughgoing glacialist, "the Pleistocene is regarded as being equivalent to what is known as the Glacial Period," and is divided by him into nine stages, five glacial and four interglacial, while the Blanco is held to belong to the upper, or uppermost, Pliocene. His Pleistocene is, therefore, obviously not quite homologous with the period that passes under that name with British geologists. The various vertebrates are first dealt with mostly in groups, cetaceans, mastodons, etc., but sometimes by individuals, as in the case of three species of Elephas; and their occurrences in each State, county by county, is recorded and charted on maps. To this succeeds a section on the Pleistocene geology of the several States, with the assemblages of animals found in the various beds. Whether the value of all this painstaking work will prove commensurate with its bulk of 500 octavo pages, time alone can show. The author's conclusions as to the dates of advent and disappearance of the different forms that are summed up in the table on pp. 14-15 depend obviously on the correctness or otherwise of the determination of the age of the individual deposits in which their remains occur, a matter concerning which the author himself appears frequently to be doubtful, and on whether all the fossil contents of a given bed truly belong thereto, as the author seems always to assume, or may in some cases be mixed with others derived from older horizons. In any case this memoir will prove most useful to all interested in the subject, whether from the geological or palæontological point of view.

VIRUS DISEASES OF PLANTS.—The brief report in *Phytopathology*, vol. 13, No. 4, of the symposium upon mosaic diseases by the Physiological Section of the Botanical Society of America and the American Phytopathological Society records proceedings which

should be of outstanding interest to students of plant pathology and ultimately perhaps of very great importance to agriculture. As a result of the papers communicated at this meeting, it appears that several cases of leaf mosaic and even that important economic disease problem, the leaf roll of potato, may have to be removed from the category of virus diseases and assigned to the category of diseases of which the causal agents are protozoa. Ray Nelson is reported to have produced photomicrographs illustrating definite flagellate protozoa found constantly associated with leaf roll of potato and the mosaic of bean, clover, and tomato. In the light of this paper, the tendency seems to be to regard the intracellular bodies reported by L. O. Kunkel, and by H. H. McKinney, Sophia H. Eckerson, and R. W. Webb, in cases of mosaic disease, as also protozoal in nature. It will be remembered that Kenneth H. Smith briefly reported in NATURE of November 18, 1922, p. 668, the presence of curious intracellular bodies in the case of mosaic of potato, and demonstrated these at the meeting of the Association of Economic Biologists devoted to a discussion of virus diseases. A joint discussion upon this subject between the Sections of Botany and Agriculture is put down for the Liverpool meeting of the British Association, and it is much to be hoped that upon this occasion something may be heard of this new work upon the subject, as the report in *Phytopathology* concludes with the statement that "without doubt this symposium marks an important milestone in the progress of plant pathology."

JAPANESE UROMYCES.—Seïya Ito, professor of phytopathology, College of Agriculture, Hokkaido Imperial University, has contributed a monograph on the Uromyces of Japan, which forms Pt. 4, vol. xi., of the Journal of the College. He describes fifty-six species of Uromyces and three of Pileolaria, giving figures of the spores; 19 species are endemic, 23 common to Europe, and 23 to America. One new species is described, *Uromyces Viciæ-unijugæ* Ito. Eight of these species had not previously been recorded from Japan. Japanese rust fungi will in future be known to us mainly through the investigations of Japanese mycologists, and yet it was only in 1858 that M. J. Berkeley and M. A. Curtis described the first two rust fungi recorded from Japan.

SIZE AND FORM IN THE VASCULAR TRACTS OF PRIMITIVE PLANTS.—Continuing his studies of the influence of size upon form, Prof. F. O. Bower, in the Proceedings of the Royal Society of Edinburgh, vol. 43, Part 1, concludes, mainly as the result of a reconsideration of the figures of the axial stele and petiolar trace in the fossil Cœnopterideæ, that increase in size is followed by decentralisation of the vascular tracts. Various factors, such as mechanical necessities, requirements of tissue ventilation, and so on, may co-operate in bringing about this result, but the author concludes that "there is certainly some other factor which it is more difficult to define than it is to point out its consequences." In the light of the considerations now advanced Prof. Bower is prepared to see a "writing down" of the value of primary vascular characters for the purposes of comparison and phylesis, as such characters may result from homoplastic change consequent upon change in size. The same consideration raises the query whether simplicity of structure is to be associated with small dimensions, so that fossils of small size, like the Rhynie plants, may be anticipated to be primitive.

ABNORMAL WEATHER IN THE BRITISH ISLES.—Exceptional weather conditions in England, either abnormally cold or warm, are of sufficient interest to warrant scientific inquiry, especially with the view ultimately of forecasting such extreme weather changes. The *Meteorological Magazine* for June contains an article by Mr. C. E. P. Brooks of the Meteorological Office on "Sea Temperature, Pressure Distribution, and Weather of May 1923." It is clearly shown that the abnormally cold and showery weather of May was due to persistent north-westerly winds associated with a steep pressure gradient between an anticyclone over the North Atlantic and a depression over the south of Norway. The author attributes the abnormal conditions to the consequences of the abnormal summer of 1921. That summer, which will be remembered as abnormally fine and dry over England, was marked by open stormy conditions in the Arctic Ocean, which set free large quantities of polar ice. This reached Iceland in the spring of 1922, and lowered the temperature of the surrounding ocean; in consequence the pressure rose and the tracks of depressions were driven southward, causing the unfavourable British summer of 1922. Towards the close of 1922 the bulk of the ice passed into the Labrador current, and this helped to lower the temperature of the Gulf Stream. The combined conditions caused an abnormally cold spring this year in the United States. The mean sea temperature immediately to the westward of the British Isles was about 2°·5 F. below the normal, and this low temperature is said to have been partially the cause of the high pressure over the central Atlantic during May. It is to be hoped that the abnormally hot weather of July, with its associated thunderstorms, will be subjected to a similar searching inquiry.

OIL AND GAS RESOURCES, OSAGE, OKLAHOMA.—In Bulletin 686 of the United States Geological Survey is incorporated in one volume the several advance chapters issued between 1918 and 1920 dealing with this important oil-bearing territory in Oklahoma. Apart from the excellent structure-maps included with the geological text, Mr. David White, chief geologist, contributes a significant introduction. The work done on this Osage Reservation is a direct response to what Mr. White rightly terms "the imperative need for increasing to the utmost the petroleum supply of the United States." The area demanded special attention in this connexion for six reasons: it contains a great acreage of unleased oil-lands, the productivity of certain developed areas is already high, the structures are favourable, the oil is of high quality, transport and refinery facilities are already at hand, and the Office of Indian Affairs (which administers lands held in common by the Osage Indians) has been offering leases to competitive bidders. Unfortunately many of these leases, including some already taken up, are, geologically speaking, unfavourable, while others which have been neglected have great possibilities. In these circumstances organised geological survey was essential, and by means of a system whereby reports were published as soon as delivered by the geologists, prospectors and others interested were able to get first-hand information to guide them in their choice of land. The lucid description of structural principles and geological terms employed, together with the explanatory remarks in the introduction, renders this bulletin much less formal in character than is usually the case with technical productions, though a short comprehensive summary of the principal geological and economic features of the whole region might have been included with advantage for the benefit of those unconversant with local detail.

The Liverpool Meeting of the British Association.

I.—LOCAL ARRANGEMENTS.

THE preliminary programme and invitation circular for the meeting at Liverpool of the British Association in September has recently been issued, and the subjects of the various presidential addresses and the chief sectional discussions have been mentioned in NATURE for June 16, p. 825. A short account of the local arrangements may, however, be of interest to members of the Association who intend coming to Liverpool, as well as to others who are as yet undecided about their attendance at the meeting.

The Reception Room and the General Offices will be at St. George's Hall, though accommodation will also be provided at the University for meeting rooms, etc., for offices and members if required. St. George's Hall, though rather more than half a mile from the University, where very many of the sections will hold their meetings, is admirably situated in the centre of the city, close to the railway stations and easily accessible by tram from all parts. The experience of the last meeting showed how excellent a reception room it proved, while its beautiful tessellated floor adds a decorative value most reception rooms lack.

Section E (Geography), and Section F (Economics) will meet in St. George's Hall, the former in the concert room and the latter in one of the large rooms used ordinarily for purposes of the assizes. These rooms being in the same building as the Reception Room itself could not be more convenient. Section H (Anthropology) will meet in the lecture theatre belonging to the Public Museum, not more than a few minutes' walk from the Reception Room. The other sections will all meet in the University buildings. For convenience of getting to and fro between the Reception Room and the University, it is proposed to run a service of motor buses.

The inaugural meeting and presidential address, as well as the evening lecture by Prof. Elliot Smith, will be held in the Philharmonic Hall, which has a seating capacity of about 3000. Citizens' lectures will be given in the Picton Hall, Liverpool, as well as in several of the neighbouring boroughs, and it is also intended to give a few lectures to young people, as these proved such a great success at last year's meeting at Hull.

The Lord Mayor is giving a reception to members of the Association in the Walker Art Gallery and Museum and Library (all three buildings being "en suite") on Thursday evening, September 13, and for that occasion it has been arranged to exhibit the greater portion of the permanent art collections of the city as well as to show exhibits of interest in the Library and Museum.

On the last evening of the meeting, Tuesday September 18, a scientific soirée will be held at the University. This gathering, based on the lines of the Royal Society functions, will, it is believed, be of the greatest interest, as a very large number of exhibits and experiments illustrating recent developments in science will be on view. There will also be a series of lecturettes by eminent men of science. It may be mentioned that the committee engaged in the organisation of this soirée at the University hope that as many members of the Association as possible will wear full academic dress on that occasion.

During the whole of the meeting, an exhibition of scientific apparatus, specimens, diagrams, etc., representative of the work of all the thirteen sections of the Association, will be on view in the Central Technical School, kindly placed at the disposal of the local committee by the Technical and Commercial Education Sub-Committee of the Corporation. This exhibition should prove of interest to all members, if one may judge from the small sectional exhibits which have been features of the Association meetings on several occasions during the last decade. All members of the Association will be admitted free.

A comprehensive series of excursions and visits to works and places of interest in the neighbourhood is being arranged, and the local committee hope the programme will provide interest for all.

A special handbook is in preparation. It will contain a number of articles dealing with the whole district of which Liverpool is the centre, rather than being restricted to the city and its immediate environs. It is hoped members will find it of more than merely ephemeral interest, as the articles are all by authors well qualified to write on their particular subjects.

Every effort is being made by the local committee to make the meeting a signal success. It is hoped very much that all those interested in science, even if not actually professional scientific workers, will attend. The local programme is developing week by week, and there is no doubt that by the date the meeting commences, provision will have been made for every minute of the member's day. ALFRED HOLT.

The Thunderstorm of July 9–10 over Southern England.

THE thunderstorm which visited London during the night of July 9–10 will find a place on the list of famous storms rather for its duration and for the spectacular effect produced at night by the incessant lightning, than for the quantity of rain associated with it or the damage done, though neither of these was by any means negligible. It is too early yet to attempt anything like a complete account of the storm, but data already at hand, and personal observations generously placed at my disposal, render a preliminary note possible.

Apart from the long duration, the most noteworthy general characteristics appear to have been the sudden development with little in the way of sky signs to aid the isolated observer, the general lack of hail, the absence of any marked squalls of wind at the surface, and the very marked preponderance of cloud-to-cloud discharges, without which the damage might have been very much worse.

The storm[1] first made its appearance about 8.30 P.M. (Greenwich time) on the south coast, where it was seen approaching from the south-east. It then progressed N.N.W., in the direction of London, where a corresponding phase was reached about two hours later, the system having advanced at a speed of roughly 25 miles per hour. This rate of movement appears to have been maintained in the same direction across Bedford and Peterborough, and then, rather faster, on to Hull and Middlesbrough. Thunderstorms which occurred later on July 10 at Berwick,

[1] The disturbance as a whole is referred to as the storm, but the system undoubtedly had several nuclei.

Aberdeen and in the Shetlands, all on the continuation of this line, were not improbably related to the same general cause, though the continuity of the advance of the original system cannot be verified.

The main rainfall was confined to a belt between 30 and 40 miles in width, lying along the track of the storm. In this zone, falls were probably everywhere greater than 1 in., at least as far north as the Wash, while they equalled 2 in. in many places, and reached 3 in. in isolated patches. On the south coast this belt of heavy rain extended from a point between Worthing and Brighton to a point between Eastbourne and Hastings, while central London lay in the middle of the affected zone. Outside this band, amounts fell off quickly, particularly on the eastern side, where the boundary was sharply defined; for example, while Eastbourne received 1¾ in., Hastings and places further east escaped rain, and while Tunbridge Wells experienced nearly an inch, there was none at Maidstone.

Over the southern portion of the track, including London, rain fell practically continuously for more than 6 hours, so that, allowing the speed of 25 miles per hour, the main travelling rain system responsible for this belt of precipitation was here probably about 150 miles long in the direction of its motion, and 35 miles broad.

In the north, the amounts and duration of rainfall appear to have been rather less than in the south of England.

Striking agreement in time is shown by the hyetograph and microbarograph records at South Kensington between sudden changes of pressure and intense bursts of rain, particularly just after 2 A.M. (G.M.T.). There is also agreement between the sudden changes of pressure at South Kensington and those recorded at Kingsway, London, W.C.2, by the Dines float barograph, which shows the absolute magnitude of the pressure changes. It is interesting to mention that an observer in Hampstead noted quite independently that the worst crashes, followed immediately by torrential rain, occurred at 2.15 A.M. and 3.45 A.M. (G.M.T.). The first of these was about 10 minutes after the occurrence of the very pronounced peak in the Kensington microbarograph record and corresponding heavy rain shown by the hyetograph record. Thus, allowing 4 miles between the places of observation, we again find phenomena associated with the storm travelling at about 25 miles per hour.

Although a closer investigation is desirable before putting forward an explanation of the storm with full confidence, an examination of the weather charts and upper air data available brings to light some very suggestive facts. Measurements of upper winds on the evening before the storm show that between about 6000 feet and 18,000 feet above the surface there was a general wind current over the affected area agreeing very closely indeed in direction and speed with those of the movement of disturbance itself, and observations of the drift of cirrus cloud show that above this the air motion was probably from about S.W. Now the weather charts for July 8 and 9 show an anticyclone over the Continent and a depression almost stationary off the West of Ireland, and, further, a current of air of undoubtedly polar origin, and therefore probably having a low upper-air temperature, circulating round the latter.

It seems very likely that some of this polar air, in arriving, at some upper level, over the south-west districts of England and endeavouring to work its way northwards, side by side with the very warm air of continental origin over the eastern districts, spread laterally over the latter, producing the travelling area of instability necessary to explain the phenomena described above. M. A. GIBLETT.

The Pascal Commemoration on the Puy de Dôme.

THE tercentenary of the birth of Blaise Pascal (born June 19, 1623, died August 19, 1662) was celebrated at Clermont-Ferrand in a series of fêtes at which the President of the French Republic, M. Millerand, and the most distinguished French scholars and philosophers met to do homage to his great genius.

The culminating interest of the celebrations was the visit to the summit of the Puy de Dôme on Sunday, July 8, to commemorate the experiment devised by Pascal and carried out successfully by his brother-in-law Florin Périer, an experiment as famous in its day and as decisive in its significance as the eclipse expedition of May 1919 has proved to be in our day. In demonstrating that the atmosphere has weight it destroyed a principle of the old physics which had become authoritative, the principle that Nature abhors a vacuum, and at the same time it inaugurated a new scientific concept in physics. The rain poured as we gathered on the summit where, above the ruins of an ancient temple of Mercury, a modern meteorological observatory has been erected. Those who were so fortunate as to find room in the small cupola of the observatory, however, are not likely to forget M. Painlevé's discourse. Round the President were grouped the Prefects of the Departments, the Mayor of Clermont, the Rector of the University, Senators and Deputies, the representatives of the Institut de France, and the foreign guests of the Municipality. In an eloquent oration M. Painlevé described the inception of the great experiment and discussed its significance.

No one of that large company (the Municipality entertained three hundred guests at the *déjeuner* on the mountain) who had ascended the mountain by the modern means of electric traction with luxurious comfort in little more than an hour can have failed to reflect on the different conditions which prevailed in Pascal's time, and on the enormous difficulties of the original expedition. Those who are interested may read the full and careful report of it in Périer's letter to Pascal. It was arranged that first of all two sets of apparatus should be tested side by side to see that they gave identical measurements, that is, to see that each column of mercury in the inverted tubes (barometer tubes) remained at the same height. One set was then carried up to the top of the mountain and the other left behind in the church of the Minimes at Clermont. The experiments with each set were made at the prearranged hour and precisely recorded. The significance of the experiment was its uniqueness. It differed entirely from observations which any one might make with the scientific intention of recording facts; it differed entirely, for example, from observations such as those of Tycho Brahe. It was uniquely designed to test a physical theory which would stand or fall by the result. It had been known practically by engineers for a long time that there was a natural limit to the action of a pump, and in the crucial experiment of Torricelli with the column of mercury in the glass tube closed at one end and immersed in liquid at the other it was shown that the principle was

the same as that which was applied to the action of pumps, with the difference presumably due to the density of the liquid.

The problem was not the fact but its significance. The Aristotelians held that it had been definitely established that the atmosphere had no weight, and what is quite certain is that no means of discovering its weight, if it had any, then existed. It is therefore strikingly analogous to the case of the hypothetical ether when physicists were engaged in devising means of revealing its presence. Descartes, though entirely opposed to the Aristotelians, yet held on *a priori* grounds that the universe was a plenum. He needed the concept in order to explain the vortex motion which in his view accounted for the variety of material forms. The apparent vacuum in the Torricelli tube he supposed to be due not to an absence but to the presence, or rather to the entrance under the conditions of the experiment, of a very subtle matter. Pascal, on the other hand, to quote M. Painlevé, " s'inspirant de Galilée et Torricelli, entre la science d'Archimède et la science moderne, jette un pont par-dessus vingt siècles. La presse hydraulique, le baromètre observé à diverses altitudes, ce sont les illustrations d'une statique nouvelle qui embrasse à la fois, dans les mêmes principes, l'équilibre des liquides et celui des gaz." Let us imagine, he went on to say, that through some disaster everything which we now know about Pascal had been lost to us save only his scientific writings. In what light would he appear to us ? We should be right to point him out as the first of the positivists methodically disengaging facts from the confusion of words, discrediting purely verbal definitions, " cet air subtil qui aurait des inclinations," " cette lumière qui est un mouvement luminaire de corpuscules lumineux."

Other memorable discourses followed, in particular one by M. Picard, before we sat down to the sumptuous banquet which the Municipality offered its guests. When this was concluded the President of the Republic rose and to the enthusiastic applause of the company, though, it must be admitted, to the general surprise of those who were thinking of Pascal, delivered an impassioned and truly eloquent speech on the politics of the hour, which was immediately transmitted round the world. The rain ceased, and we made the return journey to Clermont favoured by a clear sky and splendid view over the grand Auvergne country. The city was gaily decorated for another celebration in the square over which the statue of the seated Pascal presides. H. WILDON CARR.

An Advance in Photometry.

HERR E. STEINKE, in an investigation into the accuracy of the Wien-Planck law in the ultra-violet region of the spectrum, has recently made use of Elster and Geitel's potassium photo-electric cell, as neither the thermopile nor the bolometer was sufficiently sensitive to measure the minute quantities of radiant energy involved (*Zeits. f. Physik.*, 11. 4 and 5, pp. 215-238, 1922).

Herr Steinke has found it possible to increase the sensitiveness of the cell enormously, by increasing the voltage between the potassium anode and the platinum cathode; and has carefully investigated the behaviour of the cell under these conditions. For red light, $\lambda = 630\mu\mu$, an increase in voltage from 20 to 210 multiplies the sensitiveness by 1045, and for violet light, $\lambda = 462\mu\mu$, by 1595. This is due to the increased ionisation from collisions between the greatly accelerated electrons and the argon contained in the cell.

It was not possible to apply such a high voltage to the cell suddenly without a luminous discharge; it was necessary to raise it gradually for hours or even days at a time, and it was then possible to reach the 210 volts already mentioned. At 212 volts luminous discharge took place, after which the cell discharged at 162 volts, recovering if left to itself for some days, so that the potential could again be raised to 200 volts. In forming the cell, as above, for high voltages it was found that each time the voltage was increased there was a strong " darkness " current at first; which diminished in the course of time to zero for lower voltages, and at 210 volts to a moderate value after several days.

When the cell is prepared in this way, and is illuminated, a fatigue effect is observed, the time required for the thread of the Lutz-Edelmann electrometer to move from a certain division on the scale to another (85 to 65) gradually increasing to a limiting value, which in one experiment was reached in about fifteen minutes. This limiting value was determined in all the experiments. These were always made in the order of increasing illumination, as it was found that a high illumination produced a kind of after action, and a small illumination measured shortly afterwards showed a higher value than the real one. For the high voltages employed the limiting value of the photo-electric current was not proportional to the illumination, as it was found to be by Elster and Geitel for moderate voltages; but the following relation was proved to exist, $I^z = ML$; where I is the photo-electric current, L the flow of radiant energy, and z and M are constants. The cell constant z varies with the wave-length, and with the voltage applied to the cell; for small voltages it scarcely differs from unity, and the law becomes identical with that of Elster and Geitel; for $\lambda = 316\mu\mu$ z was observed to be 1·3495, with 208 volts on the cell terminals, and intermediate values were found for other wave-lengths and voltages.

Using the method described, Herr Steinke has measured the exponent c_2 in Planck's formula $E\lambda = \frac{C}{\lambda^5} \frac{1}{e^{c_2/\lambda T} - 1}$ for a number of different wave-lengths, including $340\mu\mu$ and $316\mu\mu$ in the ultra violet. The mean value is 14,385, the largest variation from this being 0·63 per cent., and the mean probable error 0·16 per cent. The actual probable error is rather greater than this, owing to the difficulty of determining the wave-length of the rays employed, which were separated from the light of a carbon incandescent lamp by filters. The value agrees satisfactorily with that determined by previous observers for visible radiations. The observations also show that carbon radiates, throughout the range of wave-lengths investigated, as a grey body. Herr Steinke proposes to continue the investigation, and to measure the constant C in the above formula.

It would appear that the improved method of using the photo-electric cell should prove of the highest value in work on the spectrum, particularly in the ultra violet.

International Conference on Nature Reserves.

THREE Associations in France entitled, respectively, the Société Nationale d'Acclimatation de France, the Ligue Français pour la Protection des Animaux, and the Société pour la Protection des Paysages de France, recently invited the Royal Society for the Promotion of Nature Reserves to send delegates to attend a conference " Pour la Protection de la

Nature." This Conference was held in Paris on May 31-June 2 last, and at the request of the Society for the Promotion of Nature Reserves it was attended by Lord Ullswater, Mr. E. G. B. Meade Waldo, and Mr. Percy R. Lowe (British Museum, Natural History).

The Conference was presided over by M. Mangin, director of the National Museum of Natural History in Paris, and was divided into five sections: (i.) fauna, (ii.) flora, (iii.) geological, (iv.) sites and landscapes, (v.) general.

At the sittings of the various sections papers were read in French by many members upon a great variety of topics. Most of the speakers dealt with the subject matter of the Conference so far as it affected their own country or their own special part of it, and few treated the subject from a general point of view. The paper read by the Swiss delegate was a striking exception to this rule, while M. Burdet's lecture, illustrated with slides, which dealt with the Nature reserves of Holland, was a very useful and practical contribution to the Conference.

It was felt by the representatives of the Royal Society for the Promotion of Nature Reserves that in any similar future conference a series of resolutions, not too many in number, should be prepared and circulated some weeks before the Conference, so that there might be ample opportunity for their discussion, emendation, adoption, or rejection. Such resolutions should deal with the subject matter from a general point of view, and should indicate the best method of establishing Nature reserves, whether by State legislation or private enterprise; in what manner such reserves might be best administered; how funds might be obtained for the purpose; how the rights of individuals in the lands in question are to be protected, modified, or abolished; how the selection of the proposed public parks or nature reserves is to be determined; and in what manner subordinate questions arising therefrom are to be answered.

University and Educational Intelligence.

GLASGOW.—Prof. Andrew Gray has intimated his desire to retire from the chair of natural philosophy on September 30 next, on grounds of health. Prof. Gray has occupied the chair since 1899, when he succeeded Lord Kelvin. During his tenure of office the fine institute of Natural Philosophy, which was designed and erected under his direction, has been added to the numerous new scientific buildings of the University. Some 1100 students a year are accommodated in its spacious laboratories and class-rooms.

CAMBRIDGE.—In connexion with the recent international conference of chemists in Cambridge honorary doctorates in science were conferred upon a number of distinguished foreign chemists. In introducing them to the University the Public Orator spoke as follows:

Multa nobis antiquitas tradidit quibus adhuc nititur humana vita; multa recentiores reppererunt et quotidie nova profert usus. Quantas omnium mutationes induxerit vapor domitus et quasi freno subditus, quantas explorata res chemica, nulli non est notum. Inter se ergo consociati sunt illi qui, sive ipso veritatis amore, sive commercii causa promovendi chemica tractant, et quotannis concilium convocant. Hoc anno patriam nostram petierunt et inter urbes Britannicas Cantabrigiam. Multarum gentium legatos praesentes videre laetamur; abesse adhuc dolemus nonnullarum. Universitas nostra voluit e tanta frequentia quosdam titulo doctoris decorare, quo patefactum sit omnibus quanto honore et haec studia et qui eis se dederint universos habeamus.

Primum vobis praesento ALBINUM HALLER. Quidquid enim in scientiis apud Francos agitur, in Academiam suam Scientiarum conferunt; hoc in circulo conveniunt omnes qui haec studia prosequuntur; huic quasi senatui curiaeque quotannis praeficitur vir egregius. Quem ergo fraternitas sua honore tali dignata sit, illum et nos honorare volumus.

Sequitur WILDER DWIGHT BANCROFT et studiis et affinitate nobis conjunctus, qui alter Ulixes multorum providus, novam Ithacam novis artibus illuminavit.

Itidem provenit ERNESTUS JULIUS COHEN, quem in Academia sua Rheno-Trajectina, ut Ovidium alterum

> in nova fert animus mutatas dicere formas
> corpora.

Francus et alius insequitur, apud Parisios in Collegio Francorum professor, CAROLUS MOUREU, non ille rerum contemptor minutissimarum sed inquisitor acerrimus.

Hodie, dum procul horrificis tonat Aetna ruinis, non usitato salutamus Italum, RAFAELEM NASINI, quem nobis misit urbs Etrusca, Vergilio nota, Alphaeae ab origine Pisae. Hic explorandos sibi Volcani delegit vapores,

> qualis sese halitus atris
> faucibus effundens supera ad convexa volarit,

necnon et Albunea qualem

> exhalet opaca mephitim.

Helvetius quoque adest, iam senior, Universitatis Genevensis professor, AMATUS PICTET, qui bases rerum inspexit, ad investigandum curiosus quae vacuum per inane fieri possint.

Gandavensis item Academiae professor advenit, cuius si velitis opera recognoscere sunt qui possint oratione fluentiore vobis exponere; constat tamen illorum qui talia tractant nullum FREDERICO SWARTS antecellere.

> Felix qui potuit rerum cognoscere causas!

Credo equidem, sed non omnibus omnia concessere Parcae. Arcadiam nactus sum, Musarum antiquiorum aedituus indignus, contempto in fano ministrare laetus. Vos quorum est prodigia tractare e terra Cham exorta, quaeso mihi ignoscite, si linguarum nescius singularum Latine vos gaudere iubeam universos.

LIVERPOOL.—Following on the death of his widow, the estate of the late Prof. Campbell Brown has been handed over to the university under the conditions stated in his will. These provide that: (1) A Campbell Brown chair of industrial chemistry shall be established with an endowment of 1200*l*., the first professor to specialise in oils, fats, and waxes. In the first instance the salary shall be 1000*l*. per annum. (2) The income of a sum of 5000*l*. shall be placed at the disposal of the professor for the upkeep of his department. (3) A Campbell Brown fellowship, value 150*l*. per annum, for senior and honours chemistry students, not necessarily trained in Liverpool, shall be established; and (4) The balance of the bequest shall be invested and accumulated until sufficient income accrues to enable entrance scholarships of the value of 80*l*. per annum, tenable for three or four years, to be offered.

LONDON.—The following doctorates have been awarded: *Ph.D.* (*Science*): Mr. L. Hall (Battersea Polytechnic) for a thesis entitled "The Study of

Optical Activity"; Mr. H. Phillips (Battersea Polytechnic) for a thesis entitled "The Relation between Chemical Constitution and Optical Rotatory Power"; Mr. A. Brammall (Imperial College, Royal College of Science) for a thesis entitled "The Mineralogy, Structure, and Petrology of the Dartmoor Granite"; Mr. H. Schofield (Imperial College, Royal College of Science) for a thesis entitled "The Measurement of Thermal and Combustion Efficiency of High Speed Multi-Cylinder Internal Combustion Engines by the use of a new Optical Indicator," and Mr. R. L. Smith-Rose (Imperial College, Royal College of Science and City and Guilds College) for a thesis entitled "On the Variations of the Apparent Bearings of Fixed Radio-Transmitting Stations." *Ph.D.* (*Engineering*): Mr. H. F. G. Letson (East London College) for a thesis entitled "The Experimental Determination of the Temperature Distribution, and Calculation of the Thermal Stresses in a Diesel Engine Cylinder Liner."

Applications are invited for the William Julius Mickle fellowship, of the value of at least 200*l.*, awarded annually to the man or woman resident in London and a graduate of the university who is deemed by the Senate to have done most to advance medical art or science within the five preceding years. Applications must reach the Principal Officer of the University, South Kensington, S.W.7, by, at latest, the first post of October 1 next.

ON July 27, the summer meeting of the University of Oxford Delegacy for the Extension of Teaching opens with an inaugural lecture by Sir Michael Sadler. We have already referred to the excellent programme which is being provided this year (NATURE, May 19, p. 688), which includes lectures on the functions of universities, the economics of English country life, and research in organic chemistry. Special railway facilities are being offered for those desirous of attending the meeting. Full particulars can be obtained from the Secretary, University Extension Delegacy, Examination Schools, Oxford.

THE jubilee celebrations of the Cambridge University Local Lectures began on Friday, July 6, with a special Congregation for the conferment of honorary degrees for distinguished service in the cause of university extension, namely, the degree of LL.D. on Sir Michael Sadler, Mr. R. G. Moulton of Christ's College, and Mr. Albert Mansbridge, and the degree of M.A. on Mr. G. P. Bailey, Mr. J. H. Fisher, and Mr. Alfred Cobham. On the Saturday and Monday there were meetings of a conference on extra-mural teaching. Speeches at the conference emphasised the far-reaching effects of the movement initiated in Cambridge by James Stuart in 1873, which has spread not only throughout the British Empire but to most of the civilised countries of the world, attaining its greatest and most various developments in the United States. The speeches dwelt also on the value to extra-mural lecturers of the stimulation they receive from lecturing to (and being cross-examined by) adult audiences, contrasting their eagerness with, and perhaps exaggerating, the lethargy and "anxiety to curb an exhibition of enthusiasm" of the normal undergraduate student. In the opinion of the Master of Balliol, those who are responsible for the further development of the movement are at a parting of the ways, and careful guidance will be needed if it is not to suffer the usual penalty of success and become absorbed in its own mechanism. Progress will depend largely on co-operation between universities, local authorities, and voluntary bodies.

Societies and Academies.

LONDON.

Mineralogical Society, June 19.—Dr. A. Hutchinson, president, in the chair.—L. J. **Spencer**, with chemical analyses by E. D. **Mountain**: New copper-lead minerals from the Mendip Hills (Somerset). Mendipite ($2PbO \cdot PbCl_2$), which occurs as crystalline nodules in manganese-ore, is recorded from new localities. Chloroxiphite ($2PbO \cdot Pb(OH)_2 \cdot CuCl_2$) as green monoclinic blades resembling epidote, and diaboleite ($2Pb(OH)_2 \cdot CuCl_2$) as bright-blue tetragonal plates resembling boleite, both occur embedded in the mendipite. Hydrocerussite ($2PbCO_3 \cdot Pb(OH)_2$) is abundant, sometimes as large crystals (*i.e.* crystallised "white lead"). Crednerite ($CuO \cdot Mn_2O_3$) forms fan-like aggregates of thin plates. Pyromorphite was, some centuries ago, evidently an important ore of lead in the Mendips. Wulfenite and mimetite have been found at Higher Pitts near Priddy. The various minerals show progressive stages of alteration with some well-marked pseudomorphs: mendipite → hydrocerussite → cerussite; chloroxiphite → hydrocerussite + malachite I → cerussite + crednerite → malachite II.—W. F. P. **McLintock**: On a petalite-bearing rock from Devonshire. The well-known aplite from Meldon in Devonshire develops in certain parts of the intrusion a soda-lithia phase rich in the rare lithium-aluminium silicate, petalite. This mineral, not previously known from Britain, occurs as one of the final products of consolidation of the aplite either in coarse-grained veins of pegmatite associated with quartz, orthoclase, albite, a lithia-bearing mica, tourmaline, and apatite, or as irregularly shaped masses throughout the rock itself. The petalite gives rise by decomposition to the pink clay, montmorillonite, so well known from this locality. Certain other veins, free from petalite, are also present, the most interesting constituents of the rarer types being prehnite, axinite, and a pleochroic cordierite. The apatite in the aplite is a pneumatolytic mineral occurring not only in the rock as ophitic patches enclosing quartz and felspar, but also impregnating certain xenoliths of peculiar type.—A. **Brammall** and H. F. **Harwood**: The accessory minerals of the Dartmoor granite. Tourmaline, which is one of the minerals identified, originated at two stages in the cooling history of the intrusion: (1) pre-solidification—primary and secondary; (2) post-solidification—secondary. The more severe and widespread pneumatolysis and the lodes are referred to a post-solidification stage.—Seitarō **Tsuboi**: (1) Optical dispersion of three intermediate plagioclases. The principal refractive indices, α, β, γ, of (*a*) oligoclase from Hawke mine, Bakersville, North Carolina, (*b*) andesine from Maeyama, Shinano, Japan, and (*c*) labradorite from County Down, Ireland, for light of 9 different wave-lengths, and the optical orientations of the first and the third of these felspars, for light of 5 different wave-lengths (700, 644, 589·3, 535, 508·5$\mu\mu$) were determined. (2) A dispersion method of determining plagioclases in cleavage-flakes. The method is based on the principle of H. E. Merwin's improved immersion method. By means of a diagram a quick and exact determination of plagioclases is possible. It is applicable to small crystals such as are common in rocks.—C. S. **Garnett**: The "toadstone-clays" of Derbyshire. The olivine-dolerites ("toadstones") of Derbyshire undergo two types of alteration: (1) by ordinary weathering to limonite or ochreous deposits; (2) in the absence of oxidising agents under a limestone covering, they may pass through dolerite-greenstone and "green-earth" to a greenish-white

or almost white clay ("toadstone-clay") with the composition $2Al_2O_3 . 6SiO_2 . 3H_2O$. — G. T. **Prior**: (1) The meteoric stone which was seen to fall at Ashdon, near Saffron Walden, Essex, on March 9, 1923. The stone, which weighed about 1300 grams, is a white chondrite showing on one face well-marked radiating lines of flow of the fused crust. (2) The Sinai meteorite. The meteoric stone of 1455 grams which was seen to fall near Kantara in the north of the Sinai Peninsula in July 1916 is an intermediate hypersthene-chondrite, having a percentage of nickeliferous iron of about 8·6 in which the nickel amounts to about 15 per cent.—G. **Greenwood**: Communications from the Crystallographic Laboratory of the University of Manchester. No. 1. The detection of rotatory polarisation in an orthorhombic crystal exhibiting crossed axial dispersion. A plate perpendicular to the acute bisectrix of a crystal of triphenyl-bismuthine dichloride when in the extinction position transmits a brilliant green monochromatic light due to circular polarisation.—A. F. **Hallimond**: The chemical classification of the mica group. I. The acid micas.

Linnean Society, June 21.—Dr. A. B. Rendle, president, in the chair.—E. **Heron-Allen** and A. **Earland**: The Foraminifera of Lord Howe Island, South Pacific. Some 199 species of Foraminifera, identified from material collected by Prof. R. Douglas Laurie at Lord Howe Island in 1914, and including two new genera and seven new species, were described. The chief feature of the collection is the prevalence of forms in the condition of reproduction, (*a*) by viviparity, and (*b*) by budding.—T. A. **Dymes**: Seeds of the marsh orchids. The marsh orchids fall into two groups: (1) Maculatæ, and (2) Latifoliæ. The seeds of Maculatæ differ from those of the Latifoliæ in that the testal cells are sculptured. Seeds even from the same plant may vary greatly, though *Orchis majalis*, Reich. has uniform seeds. —A. **Dendy** and Miss Leslie M. **Frederick**: On a collection of sponges from the Abrolhos Islands, Western Australia. There are forty-eight determinable species, of which twelve are regarded as new. The Calcarea identified include a number of fine specimens of the rare *Grantiopsis cylindrica*, and there is a new species of the rare and remarkable "Pharetronid" genus Lelapia, and a new genus of Leucascidæ. The Tetraxonida form the bulk of the collection. The sponge fauna of the Abrolhos Islands is mainly intermediate in character between that of the more westerly Indian Ocean and that of the more easterly Australian coasts; but it contains a small element apparently derived from the north.—Ethel N. Miles **Thomas**: Observations on the seedling anatomy of the genus Ricinus. The presence of *alternate* or *root* xylem in the hypocotyl and cotyledons of several species of Ricinus, including *R. communis*, is established. At an early stage the alternate or radial elements *alone* are lignified. The tissue groupings associated with root structure are only found low in the axis, while above the collet eight stem bundles are found which are continued upwards as the four equally spaced bundles of the cotyledons. In addition, there are alternate xylem elements in the cotyledonary plane, *i.e.* that passing through the centre of each cotyledon. The existence, as well as the resorption, of these elements, which are usually in direct continuity with the cotyledonary root poles, has now been established in a large number of dicotyledonary species.—C. H. **O'Donoghue**: Opisthobranchiata collected in the Abrolhos Islands.

Royal Anthropological Institute, June 26.—Mr. H. J. E. Peake in the chair.—Hazzledine **Warren**: The palæolithic succession of Stoke Newington. The latest group which is found upon the Stoke Newington "floor" is a clearly-defined Mousterian industry, with fine examples of both *racloirs* and of the equally characteristic trimmed-flake points. Delicately finished pointed and ovate implements are also found. This "floor" occurs in the upper sandy beds of the terrace deposits, associated with a temperate flora, *Corbicula fluminalis*, and the northern migrating animals. The series of intermediate age are found in the underlying gravels of the terrace, and they constitute an equally well-defined late Chellean group. They are contemporary with the gravel. The third and apparently oldest series are greatly abraded derivatives, and they frequently exhibit a second series of abrasions and chips that are later than the patination of the flint. The dominant form of implement is a rude, thick, ovate type, made with a minimum of flaking, although occasionally better-finished examples are found. The pointed form occurs, but is less common. This series is comparable with the "Hill group" described by Prestwich from the Kentish plateau, and is considered by some to be of Early Acheulean date. There is, however, much cumulative evidence from other localities, besides Stoke Newington, which would appear to suggest that the derivative series of Stoke Newington may be older than the Chellean group as defined by Commont from the Somme Valley.

Aristotelian Society, July 2.—Prof. A. N. Whitehead, president, in the chair.—M. **Ginsberg**: The category of purpose in social science. The interpretation of purposive activity as consisting in the realisation of conscious factors involved in voluntary behaviour is misleading when applied to creative work and practical activity, and it breaks down in the biology of the lower organisms. The purposive must be related to the teleological. A comparison of mechanical, organic and purposive wholes shows the importance of viewing purposive wholes as a species subsumed under a wider genus, conational wholes. These may be defined as systems which maintain themselves as wholes by the striving of their parts towards mutual adjustment. They vary enormously in the degree of integration achieved, and the explicitness with which the ends of the system are realised by the parts of which they consist. Perhaps organisms are conational wholes. There are all sorts of organisms belonging to different levels of integration. So there are all sorts of social wholes, varying in plasticity, articulateness, and comprehensiveness. It is important to recognise integrations of different orders or levels, and the kind of integration achieved by societies is not the same as that which characterises the holding together of mental processes in one stream of consciousness. Institutions and tradition may be regarded as the result of trial-and-error experiments towards mutual adjustment.

DUBLIN.

Royal Dublin Society, June 26.—Prof. J. A. Scott in the chair.—H. G. **Becker**: Improved methods of evaporation under laboratory conditions. A special form of oil bath incorporating a wind-tunnel was used to determine the rate of evaporation of distilled water at different temperatures from 30° C. to 100° C., and in currents of air of different speeds, the rate of evaporation being measured by observing the fall of a glass float in the liquid. The rate is proportional to the vapour pressure up to 90° C.; above this temperature it increases more rapidly. By maintaining the water at 95° C. in a current of air of 500 ft.

per min. a sevenfold increase in the rate of evaporation was obtained as compared with the rate of evaporation on a water or steam bath. A new form of laboratory evaporator described consists of a glass bulb, containing the liquid, mounted on fibre bearings, and rotated by a small motor, while it is heated directly by a bunsen burner. The rotation prevents the liquid in contact with the glass bulb from becoming super-heated, and, besides keeping the liquid mixed, spreads it out in a thin film on the upper surface of the bulb while a current of air or indifferent gas can be blown through the bulb. It is possible to obtain rates of evaporation up to twenty-four times as great as that on the water bath.—H. G. **Becker** and W. E. **Abbott**: A rapid gasometric method of estimating dissolved oxygen and nitrogen in water. The gas is expelled by dissolving an electrolyte in the water, the displaced gas being liberated in a partial vacuum, collected, and measured. Caustic potash is the most satisfactory electrolyte. The analytical results are comparable with those obtained by the Winkler and boiling-out methods. The advantages claimed are simplicity of apparatus, rapidity, and smallness of the water sample required for a determination.—W. R. G. **Atkins** and M. V. **Lebour**: The hydrogen ion concentration of the soil and of natural waters in relation to the distribution of snails. The hydrogen ion concentration of the soil is a factor limiting the distribution of snails, which are far more numerous between P_H7 and P_H8 than elsewhere. Of 27 species of snails found in the districts studied, 4 species occurred at P_H5, 20 species at P_H7, and 14 species at P_H8. Snails with hyaline shells occur over a wide range, but those with calcareous shells are limited to the more alkaline soils. Granite and quartzite regions have few species, basaltic districts have a more numerous fauna, and limestone areas are rich both in variety of species and number of individuals. The distribution of some species within the British Isles is probably explained by the "age and area" theory of Willis, rather than by a limitation through unfavourable ecological factors. *Cochlicella barbara* appears to have a western, and *Theba cantiana* an eastern, origin.

PARIS.

Academy of Sciences, June 25.—M. Albin Haller in the chair.—Maurice **Hamy**: The determination of small diameters by the interference method.—P. A. **Dangeard** and Pierre **Dangeard**: Second note on the vitality of leaves of Aucuba preserved in a vacuum. The Aucuba leaf after being in a vacuum for twelve months resembled, macroscopically and microscopically, a freshly plucked leaf. It retained its original green colour, and the vitality of its cells was undiminished.—Morin **Molliard**: The determining factor in the formation of conidia in *Sterigmatocystis nigra*. The formation of conidia is determined by a deficiency of phosphorus or other nutritive element in the culture fluid, together with an excess of potassium.—V. **Grignard** and R. **Escourrou**: The methylheptenols: their ketonic decomposition.—F. H. van den **Dungen**: Calculation of the simple poles of a meromorphic function.—Gino **Fano**: The congruence of the normals to a quadric.—L. **Décombe**: The analytical theory of irreversibility. Elementary isokinetic transformations.—C. **Gutton**, S. K. **Mitra**, and V. **Ylostalö**: The high-frequency discharge in rarefied gases. The frequency range in these experiments varied between 50 and 2,140,000, and tubes with internal and external electrodes were used, the gas being dry air. The potential varied with the frequency, and for tubes with internal electrodes the difference of potential always increased with the frequency; for tubes with external electrodes the pressure of the gas affected the relation between potential and frequency.—Jacques **Errera**: Colloidal supports for obtaining the emission spectra of solutions. The spark is passed between rods of gelatin containing the salt under examination; the method has the advantage that fewer lines are introduced into the spectra by the electrodes than when metal or glass supports are used for the solutions.—M. **Duffieux**: The mass of the particles which emit the secondary spectrum of hydrogen. The experiments described lead to the conclusion that all the lines examined in the secondary hydrogen spectrum must be attributed to the molecule of hydrogen.—Mlle. St. **Maracineanu**: Researches on the constant of polonium. Published values for the period of polonium vary between somewhat wide limits, 134·5 to 143 days. The value 139·5 days is regarded as the most probable. Deposition of radioactive substances on glass is preferable to deposition on metal plates in researches of this nature.—G. **Dupont** and L. **Desalbres**: A curious case of separation of optical isomerides by distillation and by crystallisation. A partial separation of active and inactive pinene can be made by fractional distillation with a very efficient column; evidence of a similar separation has been obtained by fractional crystallisation at −75° C.—M. **Geloso**: Isotherms of the adsorption of salts by manganese dioxide. Experimental results of the adsorption of copper, nickel, and iron by precipitated manganese dioxide: a simple expression is deduced which accurately expresses the experimental data.—Paul **Pascal**: The magnetic properties of cyanic and cyanuric compounds. From a study of the magnetic susceptibility of compounds containing the groups (CNO) and $(C_3N_3O_3)$ and assuming the law of additivity, conclusions are drawn concerning the constitution of these compounds. Cyanuric acid is regarded as possessing a structure similar to the benzene nucleus, but isocyanurates and cyamelide differ in structure, although containing a six-atom ring.—André **Charriou**: The reciprocal displacement of substances carried down by precipitates. Chromic acid is carried down by a precipitate of aluminium hydroxide, and this cannot be washed out with water or with solutions of salts of monobasic acids; the chromic acid, however, can be removed completely by washing with solutions of salts of dibasic or tribasic acids (sulphate, oxalate, phosphate).—Henry E. **Armstrong**: The origin of osmotic effects. Hydrono-dynamic transformations in aqueous solutions. Discarding the Arrhenius theory as irrational and in disagreement with the facts, a résumé of the hydrone theory is given, and this is regarded as explaining all the properties of aqueous solutions.—Alfred **Gillet** and Fernand **Giot**: It is common knowledge that treatment of the fibre before dyeing with copper salts in some cases increases the fastness to light. It is shown experimentally that a preliminary treatment of the fibre with cuprous salts exerts a strong protective action against light for the dye 2B diamine blue.—Max and Michel **Polonovski**: The constitution of eserine.—Raymond **Delaby**: The action of formic acid on ethylglycerol. Conversion into β-ethylacrolein. The decomposition of the crude mixture of formins from ethylglycerol gives two unsaturated alcohols, vinylethylcarbinol, $CH_2:CH.CH(OH).C_2H_5$, and β-ethylallyl alcohol, $C_2H_5.CH:CH.CH_2(OH)$, the latter being new.—M. **Pariselle**: A new working method for the preparation of camphene. In the ordinary method of preparing pinene hydrochloride a yield of 55-65 per cent. is obtained: the yield can be raised to 75 per cent. by conducting the saturation with hydrochloric acid in two steps, with a two days'

interval. For the conversion of the chlorhydrate into camphene, the substitution of the sodium derivative of cresol for sodium phenate gives a purer product in nearly quantitative yield.—L. **Barrabé**: The continuity of the drift series of the eastern Corbières between la Berre and Narbonne.—F. **Delhaye** and A. **Salée**: The Central African *Graben* between Lake Tanganyika and Lake Albert Edward.—Adolphe **Lepape**: The relations between the radioactivity, temperature, and hydrogen sulphide of the springs of Bagnères-de-Luchon. Explanatory hypothesis.—MM. Allyre **Chassevant** and **Chouchak**: The measurement of the degree of ionisation of mineral waters.—de Montessus **de Ballore**: The local prediction of the weather.—V. **Lubimenko** and Mlle. O. **Sžegloff**: The adaptation of plants to the duration of the bright period of the day. Green plants show a specific adaptation to the period during which they are illuminated.—Louis **Desliens**: Venous hæmodynamometry. Cardiac hæmodynamometry.—J. **Beyne**: The origin of the accidents caused by strong atmospheric depressions, and on the protection of the aviator against troubles of anoxhæmic order. For moderate reductions of pressure it is sufficient to supply so much oxygen that its partial pressure should be nearly 21 per cent. of an atmosphere. At low pressures, corresponding to high altitudes (more than 10,000 metres), even when the wants of the organism as regards oxygen are met, there are still troubles which must be ascribed to other factors.—Jules **Amar**: The organisation of work with the spade.—L. J. **Simon** and E. **Aubel**: Is pyruvic acid one of the terms of decomposition of glucose in the course of glycolysis? Pyruvic acid is not transformed by the elements of the blood. It is not produced during the process of glycolysis, and cannot be considered as an intermediary product of the decomposition of glucose into lactic acid.—Ch. **Bedel**: The toxic power of a polymer of hydrocyanic acid. The experiments were made on the polymer possessing the composition $(HCN)_4$. This was found to be much less toxic than hydrocyanic acid.—Albert **Berthelot**: Researches on pyruvic acid considered as a factor in anaerobiosis.—Maurice **Wolf**: The importance of calcium and potassium in the pathological physiology of cancer.—Charles **Pérez**: The castration of decapod Crustacea carrying Epicaridæ as parasites.

WASHINGTON, D.C.

National Academy of Sciences (Proc. Vol. 9, No. 5, May).—H. S. **Jennings**: (1) Crossing over and the theory that the genes are arranged in the chromosomes in serial order. Assuming that the genes are arranged linearly and that the occurrence of a break interferes in some way with the occurrence of another break at any joint within a certain distance, the cross-over ratios can be calculated. The theory is in accord with Morgan's work on Drosophila. (2) Some consequences of different extents of interference, in the crossing-over of the genes. For interference extending to a distance of 30 units (one unit being the distance between genes to give 1 per cent. of the crossing-over), no cross-over ratios greater than 50 per cent. are produced. With greater distances of interference, the cross-over ratios oscillate about 50.—J. A. **Detlefsen** and L. S. **Clemente**: Genetic variation in linkage values. In *Drosophila melanogaster*, the crossing-over ratio can be varied, but not necessarily to the same extent with regard to each part of the chromosome.—C. **Barus**: The displacements of the capillary electrometer, for progressive dilutions of the electrolyte. The negative meniscus is always displaced more rapidly than the positive meniscus, though the whole cycle is retarded by increasing dilution.—W. **Duane**: The transfer in quanta of radiation momentum to matter. It is assumed that the laws of the conservation of energy and momentum apply to these transfers. From a consideration of the reflection of X-rays by a crystal, equations expressing the momenta transferred to a crystal are developed. Applying dimensional reasoning, other expressions can be obtained which lead to the Braggs law of crystal reflection and the general equations of defraction of X-rays by a crystal. The reflection of X-rays characteristic of the chemical constituents of the crystal can be explained. The theory is also applied to the phenomena of light and radiation generally.—I. **Roman**: Mutual electromagnetic momentum and energy of a system of moving charges.—R. C. **Tolman**, S. **Karrer**, and E. W. **Guernsey**: Further experiments on the mass of the electric carrier in metals. A hollow copper cylinder was rotated inside a coil of 60 miles of copper wire (0·1 mm. in diameter), which served as the secondary of a transformer. The secondary was connected through an amplifier to a vibration galvanometer. The inertia of the electrons in the rotating cylinder causes them to lag and sets up an E.M.F. detected by the galvanometer. The deflections obtained were compared with those caused by the known E.M.F. accompanying transverse oscillation of the cylinder in the earth's magnetic field. The average value for m/e was $5{\cdot}18 \times 10^{-8}$ grams per abcoulomb, indicating that the mass of the carrier in copper is about the same as that of an electron in free space.—T. H. **Morgan**: Removal of the block to self-fertilisation in the ascidian Ciona. Eggs of *Ciona intestinalis* can be fertilised with sperm from the same individual if the egg-membranes are removed. The normal obstacle to self-fertilisation is the test-cells (between the membranes and the ovum) or something secreted by them; these cells are produced by maternal tissue and not from the ovum.—H. W. **Brinkmann**: On Riemann spaces conformal to Einstein spaces.

Official Publications Received.

The National Physical Laboratory. Report for the Year 1922. (Published for the Department of Scientific and Industrial Research.) Pp. 227. (London: H.M. Stationery Office.) 9*s*. net.

Mysore Geological Department Records. Vol. 20, 1921. Part 2. Pp. viii+167. (Bangalore: Government Press.) 2 rupees.

Bulletin of the National Research Council. Vol. 6, Part 1, No. 32: Proceedings of the Second Annual Meeting of the Advisory Board on Highway Research, Division of Engineering, National Research Council, held at Washington, D.C., November 23, 1922. Edited by William Kendrick Hatt. Pp. 89. (Washington: National Academy of Sciences.) 1.25 dollars.

Imperial Department of Agriculture for the West Indies. Report on the Agricultural Department, Antigua, 1921–22. Pp. iv+19. (Barbados.) 6*d*.

Department of Commerce: Scientific Papers of the Bureau of Standards. No. 468: Formulas and Tables for the Calculation of the Inductance of Coils of Polygonal Form. By Frederick W. Grover. Pp. 737-762. 10 cents. No. 471: Methods of Measurement of Properties of Electrical Insulating Materials. By J. H. Dellinger and J. L. Preston. Pp. 39-72. 15 cents. (Washington: Government Printing Office.)

United States Department of Agriculture. Department Bulletin No. 1151: Silver-Fox Farming. By Frank G. Ashbrook. Pp. 60+4 plates. (Washington: Government Printing Office.) 15 cents.

The Rockefeller Institute for Medical Research — Organisation and Equipment. Pp. 25. (New York.)

Report for 1922 on the Lancashire Sea-Fisheries Laboratory at the University of Liverpool, and the Sea-Fish Hatchery at Piel. (No. 31.) Edited by Prof. James Johnstone. Pp. 99+6 plates. (Liverpool.)

Transactions and Proceedings of the Royal Society of South Australia (Incorporated). Vol. 46. Edited by Prof. Walter Howchin, assisted by Arthur M. Lea. Pp. viii+676+42 plates. (Adelaide.) 22*s*.

Royal Society of South Australia. Index to the Transactions, Proceedings, and Reports, Vols. 25-44, 1901–1920, and to the Memoirs, Vols. 1-2, 1899–1912. Pp. 189. (Adelaide.) 5*s*.

Fifty-Fourth Annual Report of the Trustees of the American Museum of Natural History for the Year 1922. Pp. xx+263+15 plates. (New York City.)

Annuaire de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique, 1923. 89e année. Pp. 98+293+8 plates. (Bruxelles: M. Lamertin.)

Uganda Protectorate. Annual Report of the Geological Survey Department for the Year ended 31st December 1922. Pp. 15. (Entebbe.)