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The Interpretation of Science.

THE British Association is not the only organisation in Great Britain having for its avowed object the advancement of science. Every learned society, all the various bodies dealing with the professional interests of scientific and technical workers, are whole-heartedly devoted to the same cause. But the British Association has very special functions in addition to those of giving "a stronger impulse and a more systematic direction to scientific inquiry" and promoting "the intercourse of those who cultivate science." It was also called into being to obtain more general attention for the objects of science, for which purpose it set itself the task of familiarising the general public with the progress of scientific research and developing a consciousness of the effects of such research upon man's material and intellectual progress. Such activities are essentially complementary to those of the learned societies, the function of which it is to provide specialists with the necessary facilities for meeting others engaged in the same particular branch of science, and for the appraisement and publication of their work.

Specialisation in science is inevitable. It is indeed doubtful whether the present division of the scientific members of the British Association into sections and sub-sections corresponding with the principal branches of science is adequate to their needs. Thus, the exponents of a growing and most important branch of science like bio-chemistry may find the time quite insufficient which is allotted to them in the chemistry section, or in joint meetings of that with other sections. Again, those engaged in aeronautical research may feel that neither the Section of Mathematical and Physical Sciences nor that of Engineering gives their field of inquiry the consideration it deserves. It would occasion no surprise, therefore, if further subdivisions were made in the near future.

It is perfectly clear that the more specialisation there is in science the more need there is for the Council of the Association to exercise the greatest care and vigilance to prevent the obscuration of its main object. Even for scientific workers there are special advantages attached to membership of the Association. At each yearly meeting they are provided with unrivalled opportunities for meeting with others drawn from all parts of the world and discussing their work, for surveying the progress made in their respective branches of science and for becoming acquainted with the advances made in practically every other field of scientific endeavour.

In return for these very real privileges gained for them by the growing prestige of the Association, they could and should be expected to pay more regard to the desire of the lay members who attend its meetings, and the general public which reads the reports, for the presentation of the advancement of science in language intelligible to the non-specialist.

It must be remembered that the British Association is not purely a professional body like the British Medical Association, Iron and Steel Institute, Institution of Naval Architects, and similar organisations which hold meetings at different centres year by year. It invites the general public to become members, and many of them do so at every place where a meeting is held. If the Association were a closed corporation of workers in pure and applied science which met to discuss the position and progress of particular branches of natural knowledge, the character of the proceedings would be its own affair. As, however, a fairly large proportion of its annual members belong to the lay public, it owes a debt to them as well as to the scientific members; and we doubt whether this duty is fully met by the provision of the Citizens' Lectures, though the lecture on "Energy" delivered by Sir Oliver Lodge at Leeds was a brilliant example of what can be accomplished in this direction. We suggest that each section might appropriately devote at least one afternoon meeting to a lecture or discussion of what may be conveniently described as a Royal Institution type, that is, intended for intelligent people who are interested in advances of science and yet are not actual workers in the particular department to which the subject refers. It would be found that there are many scientific workers who would be glad to attend such accounts of progress in fields outside their own, in addition to members of the general public who join the Association in the hope of obtaining such enlightenment.

As to the presidential addresses, however specialised may be the field of research of any president of a section, upon him or her rests the responsibility not only of relating special studies with one particular branch of science, but also of making every effort to establish contacts with other fields of scientific inquiry and to demonstrate the essential unity of purpose of them all. This responsibility can be shouldered neither by the General Committee nor by the Council. But the Council of the Association obviously has the right to expect that organising committees will assist in preventing the annual meeting from developing into summer vacation meetings of a number of learned societies. If any one doubts that there is a growing tendency in this direction, let him examine the subjects chosen by authors and the summaries supplied for inclusion in the journal of transactions of the Association for the past few years. Some of the subjects are so specialised in scope that it is improbable they could have been of interest to more than a few members of the particular section to which they were delivered. Many of the summaries are couched in such highly technical language that even the special scientific correspondents of the great newspapers find them unintelligible.

There would be little occasion for lengthy comment were it only the youthful aspirants for scientific honours against whom this charge of obscurity could be brought. We could rely upon time to purge them of the conceit of demonstrating familiarity with their newly acquired forms of expression in order to win a reputation for erudition. Unfortunately, some of the addresses delivered by sectional presidents at Leeds displayed the same weakness. From the point of view of title, subject matter, and form of presentation, they were alike calculated to produce in many members of the Association a feeling of bewilderment. We do not doubt that these addresses are noteworthy contributions to the problems of particular fields of work, but as they are printed we suggest that they need not be read in the section rooms, or at any rate only those parts which can be followed intelligently by the section as a whole. There may still be some members of the general community whose respect for science is in inverse proportion to their capacity for understanding what is presented to them; but they are a dying race. Thanks to the reforms brought about in our national system of education since the beginning of the century, there is a large and ever-increasing army of people equipped with enough knowledge of science to be hungry for more. The publication and large sales of certain popular handbooks on scientific subjects is a clear indication of this interest in the activities of our research workers.

The members of the general public who attended the Leeds meeting are in a position to judge of the quality of the communications presented as addresses and papers. Those who perforce had to rely on newspaper accounts of the proceedings will be mystified by the paucity of the references to those subjects which they regard as the exclusive domain of the scientific worker. While this can partly be attributed to the contempt which some reporters and editors have for the level of intelligence of their readers, most of the fault lies with the authors of papers. They are prone to ignore the fact that with so wide a range of choice of subject matter for copy, the press representatives will invariably seize upon that which is presented with such clarity as to dispense with the need for interpretation. For this reason the sections dealing with education, agriculture, and economics receive more than their proportionate share of attention in the newspapers.

It may be urged that certain subjects cannot be presented in a form calculated to appeal to a wide public. If that be the case, they should either not find place in the proceedings of the British Association, or alternatively, the papers given at the annual meeting should be divided into two categories, those which are intended to appeal to a wide public and those which are for the exclusive benefit of specialists. It is inconceivable that in any of the branches of science represented by the thirteen sections there should not be sufficient material each year upon which to base an address to non-specialists; and presidents of sections, as well as other authors of papers, would be well advised to prepare summaries of the main features of their addresses for advance distribution to the press. They can rest assured that unless they can first interest the newspaper reporters they will have little opportunity of interesting the public in their work. They need not fear, moreover, that a reporter will rest content with a summary. A test of good journalism is the originality with which a subject is treated. Given a summary as a setting, the reporter will find jewels with which to adorn it.

The advancement of science depends upon the encouragement of research. The public must be better informed if it is to appreciate to the full the need for more and more research. It will not willingly endow what it cannot understand. Let scientific workers who attend the yearly meetings of the Association ask themselves why, in its wisdom, the Council holds each meeting in a different centre of population in the country. Presumably it is done for its propaganda effect. Bringing scientific workers into personal relationship with various sections of the community helps to destroy the illusion that we are a race apart. Clear exposition of science should also dispel the idea that scientific experiment is mere legerdemain, its mysticism heightened by a rigmarole of complex terminology. Explicit statement is the necessary precursor of wide publicity, without which there cannot be general appreciation of the aims and methods of science, of what science has achieved and what it might achieve for the human race.

Science in Literature.

The Short Stories of H. G. Wells. Pp. 1148. (London: Ernest Benn, Ltd., 1927.) 7*s*. 6*d*. net.

NOTHING is so significant of the power of the old classical tradition as the extent to which the literature of fiction remains comparatively unmoved under the shock of scientific discovery. For the intellectual revolutions which have been effected during this past century by a mere handful of blandly inquiring scientists can be matched only by the social and industrial transformations to which they have unconsciously contributed in no small measure.

To a scientist a new field of human experience and expression is opened up. He sees life unfolding, not merely as the old interplay of human emotion and passion, but rather in response to the widening environment developed by man's increasing knowledge. In the field of science, for him who has eyes to see, dramatic material is not far to seek, but current fiction remains singularly aloof. Here and there a detective, a pathologist, or a medical practitioner is created who plays his part against a suggestive background of mysterious knowledge, but there is no novelist, with the exception of Mr. H. G. Wells, in whom the dramatic element in scientific discovery evokes a sufficient response to urge him to action.

The strong human impulses associated with love and sex which have formed the keynote of so much of modern fiction are not absent in the work of Wells—far from it—but the psychological behaviour of the scientist, his interests, his urges, the material he handles, and the stage he treads, constitute a region into which none other than Wells has dared to enter.

Coming to literary work from the field of technical knowledge, Wells has made the amazing discovery that a scientific training, far from being a handicap, is a positive blessing. A good novelist, if he is anything, is pre-eminently a psychologist. It is his function, by means of the technique of story-telling, to observe, to describe, and to analyse the thoughts and actions of mankind, and not merely that aspect of mankind constant throughout time, but mankind in the making. He stands at the point of vantage who absorbs with understanding the newer knowledge. Being artistic, such an analysis—in the creation of a novel it is really a synthesis—is not scientifically systematic. It differs from a study of a scientific problem in this respect, that no two novelists in their treatment will produce the same result. The final product is dependent on the mentality of the solver. Thus the psychological study developed by the novelist is, as often as not, a reflected study of the author. Wells stands at this point of vantage; and in describing his vision opens up his mind.

Here, then, in the present group of short stories, we see Wells, a young imaginative artist, striding boldly into the field and with a few strokes creating a world which hums strangely in the ears of the old classical school. Tuned to the mentality of the scientist and alive to the trend of scientific thought, Wells enters the arena of fiction armed with weapons denied to his professional colleagues. He may manœuvre in regions of the arena with assurance where others must hesitate to tread, and the earlier stories in this extraordinary collection show Wells disporting himself gaily and masterfully among the fantastic notions born of much of the speculative science of the late Victorian era.

Early hesitant knowledge of time and space are handled with assurance and imagination in "The Time Machine," "The Plattner Story," "The Strange Case of Davidson's Eyes." Sometimes his boldness is preposterous, as when in "My First Aeroplane" he makes a machine in 1912 stand up to treatment that no self-respecting aeroplane in 1927 would possibly tolerate without destruction. At other times it is almost prophetic, as in "The Land Ironclads," where in 1903 trench warfare and tanks are described in unerring detail. Again and again he traces the emergence of a world of wheels, and shafts, and furnaces.

It is easy to say that, in those early days of Wells's literary work, the young man is merely tickling the palate of the reader with a series of extravagant ideas. While it is probably true that a number of these stories are scarcely more than this, there recurs continually the suggestion that if mankind would only realise it, the potentialities for good and evil in modern scientific discovery on the mechanical side are enormous. There is, for example, "A Dream of Armageddon," "A Story of the Days to Come," and so on. There appears the implication to the scientific man that he must give himself pause to consider whither his newer knowledge may drive mankind, and to the layman the startling question as to whether he is indeed ready to receive this strange knowledge.

The theme changes slightly as Wells borrows from his biological experience. The power of natural selection as a factor in evolution is violently forced to our notice here and there. In "The Country of the Blind," the capacity of the human organism to adapt itself to environment, and the extent to which refinement in the senses may proceed in response to needs, are brought out with the skill of a master. "The Empire of the Ants" teaches how survival of the fittest is by no means identical with survival of the most desirable. In "The Time Machine" we are projected forward into futurity and are horrified to discover that mankind has long passed the zenith of its highest development and a kind of retrogression or involution has set in, in place of the higher evolution.

These ideas may be fantastic; they may be mere examples of mental agility and imaginative strokes of a young man in a field yet unopened to assured knowledge. But we begin to perceive that in the background of Wells's mind there exists a dominating urge. Mankind itself raises a problem of colossal magnitude—how to utilise the accumulating wealth of scientific knowledge in the design of a super-race—of a civilisation devoid of the stupidities and absurdities of social life as we know it.

These stories where they touch this issue scarcely do more than raise it. Some indication of Wells's own line of approach to this difficult issue is provided by glimmerings of Utopias of various kinds that sparkle out here and there. It is in his larger and more mature works that these ideas are worked out in greater detail, but, on the whole, Wells on the constructive side is much less satisfying than at his favourite game of thought provoking. Utopias are literally as old as Adam, but it is permissible to doubt whether the mental exercise in their design ranks higher than that used in the solution of a crossword puzzle.

It is possible that in a sense they may serve the useful function of preparing the minds of some for the possibilities that might be achieved, for the ideals to which to strive. But imaginative gropings in a dim future, with roseate pictures of the dawn of a new era when man will grasp the forces of Nature in the hollow of his hand, will not provide a solution of the immediately pressing problems of production, distribution, and exchange; for the question uppermost in every one's mind, both scientist and layman, is, "What to do now?"

The kind of promise the imaginative Wells has held out in these early stories is not fulfilled by him in his later work. Doubtless, had his numerous love novels been left unwritten, the world of literature would have been enormously the poorer, but the far-reaching and vital questions which Wells himself raised have really not been faced by him. Instead, he has left it to the politicians, content to be a mere finger-post pointing towards an inaccessible region of the horizon.

H. Levy.

The Formation of Roads.

(1) *The Science of Roadmaking: a Scientific and Practical Treatise dealing with Road Construction in its Modern Forms, for the Use of Surveyors, Contractors, Asphalt Plant Managers, etc.* By John Wilfrid Green and Charles Norman Ridley. Pp. xv + 138 + 5 plates. (London: Crosby Lockwood and Son, 1927.) 10*s*. 6*d*. net.

(2) *Management and Methods in Concrete Highway Construction.* By G. L. Harrison. Pp. ix + 242. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1927.) 15*s*. net.

IT will be generally recognised that the formation and laying-out of highways and cross-roads have, until recent years, been far more in the nature of a science than an art, though art has begun to enter into its kingdom since the passing of John Burns's Town Planning Act, the first of the kind in the British Isles. Not that with the advent of art into the matter of road-making science will function to any less degree. For though it is not every one who holds the view that science must of necessity retrograde in the absence of advancing, yet it is certain that modern progress in regard to the modes of travel must carry in its train scientific progress.

When any one takes thought of road-making, the memory of what the Romans accomplished in this direction is inevitably to the fore. Without staying to consider such local routes as they constructed in the City of the Seven Hills and other places of importance, it will suffice to recall those great military highways which so aided them in the control of their vast empire. England still possesses portions of these notable enterprises—as witness Watling and Stane Streets and others—which radiated from London (the Augusta of Roman days) throwing out their tentacles in various directions.

These Roman roads were, however, undoubtedly purely military and scientific; military in their nature and purpose, and scientific in their construction; art could claim no part in them. In the magnificence of Roman conception a military road was driven from centre to circumference with as close an approximation to a radial line as could be achieved; natural obstacles were for the most part overcome by means of bridges and tunnels, according to the gradients encountered. *Mansiones* or camps were established *en route*, though it is the customary Latin word for ' camp ' which has survived to this day in the nomenclature of so many of our towns.

The Roman roads were made to endure, like the Egyptian monuments of earlier date. It is only as the nature of the passing traffic alters and its volume increases almost beyond conception, that other routes, other methods and other construction, have had to supersede a system of incomparable virtue.

Perhaps it is giving too great credit to the British character to attribute the passing of the Roman highway to the necessities of the twentieth century; for the truth is, that long before its advent, British insouciance had consigned the memory of these military trophies to the limbo of neglect, if not, indeed, of oblivion.

The Roman thoroughfares were constructed on good scientific principles; a firm bottoming was obtained by ramming small stones and bats of brick into the ground, and on this foundation was laid a pavement of large stones accurately fitted like a mosaic pattern, the interstices being carefully jointed in cement. Where large stones were unobtainable, then a species of concrete was substituted, composed of small hard stones bound together with lime.

Of course, these main highways accounted only for a mere fractional part of the means of transit necessary throughout Great Britain. Here British sluggishness of temperament asserted itself unalloyed. A mere path, sufficiently wide to enable a pack-horse to bear its burden, would gradually form itself, rather than be formed, in the required direction; even then it would not go straightforward, but would meander between and around the trees, thus in time providing us with those serpentine courses, which have a charm to the eye, even though regarded as practically undesirable. These tracks invariably followed the line of least resistance; the fordable part of a stream would be approached, whatever deviations might thereby be rendered necessary.

Thus these initially unobtrusive paths gradually became beaten tracks, widening sufficiently in time to admit of the passage of carriages meeting *en route*, though frequently even this was not accomplished. But as for any scientific construction, it can but be said that science was conspicuous by its absence. If Irish main roads were passably good (for the period), English were passably bad, whilst Scotch (according to a countryman's evidence, namely, Macadam) were atrociously bad.

In England the main idea, so late as the early years of the nineteenth century, seemed to be to barrel the roadway by arching it almost inconceivably high at the crown, with a very steep gradient to either flank. When the inevitable occurred, and the road became rutted as in a nightmare, the curative process consisted in filling up the ruts and making the crown usable by means of vegetable débris, loose stones, and general rubbish, all brought to a sufficiently smooth condition, so as to receive the cachet of the local authority (such as it was), and then—all would be *da capo*.

This period of darkness endured until about a century ago, at which time the enlightened labours of Telford, Macadam and others served to bring about such improvements as paved the way for modern scientific production. There are many who still regard the method developed by Macadam as of value, even under the changed conditions of the traffic problem—mechanical transport, heavy in its nature and dense in its massing, convulsive in its movements and rapid in its passage. But science, ever on the alert, introduces new solutions to meet altered conditions, and so we find macadamised roads giving place to the use of granite setts, concrete, wood blocks, rubber surfacing, asphalt paving, and, most interesting perhaps of all, the reinforced concrete treatment of the substructure.

The progress of science makes welcome the production of literature dealing with the subject of road-making, and the two books under notice would seem to be one the corollary of the other, or perhaps they should be regarded as mutually interdependent. Messrs. Green and Ridley consider the subject from its scientific basis, dealing successively with hydrocarbons, bitumens, asphalt, sand, tar and pitch, cement and concrete. The first chapter dealing with molecular structure and valency is peculiarly interesting, perhaps more so than many that follow. The authors have a high opinion of asphalt for the surfacing, and certainly it seems to take rank after macadam from the viewpoint of anti-slipperiness. The authors do well to state that "the reliance too often placed on maintenance guarantees by road surveyors is causing the substitution of a cheaper material, to the possible detriment of asphalt paving in general." Regarding the suitable-mixture diagram shown on page 49, there seems to be a lack of agreement with the text on the previous page; for the diagram apparently indicates the medium group as giving 12-50 per cent., and the fine group, 30-60 per cent., whereas the text reverses these figures.

It is properly remarked, that "in taking a sample of sand for the mechanical analyses or grade composition, care should be taken to secure same from the inside of the heap"; and the recommendation of tar macadam surface for motor traffic is well advised. But why should such solicitude be expressed on page 71 for fish, respecting the use of tar?

The practical consideration of construction is developed in Mr. Harrison's book in a very interesting and masterly manner, and the business aspect is thoroughly regarded. Indeed, the main adverse criticism to be offered arises from the inadequacy of many of the half-tone illustrations, which often need the base reference to produce intelligibility. It is a fact also, that some people might think that there is too great a fetish made of timekeeping to a second, but this meticulousness is recommended in the interests of the contractor. It is not possible to agree with the author (see page 184) that the table in fig. 7 shows a large percentage of time lost due to water trouble, though such loss is made manifest in the next figure. The series of sixteen chapters is well worked out, and the graphs and diagrams in general are clear. It is not to be disputed that (within certain limits) the greater the method which can be introduced into a contract the more it makes for final satisfaction. This was eloquently manifested recently in the erection in Piccadilly of the new Devonshire House, which was worked out upon a schedule prepared by its American architect on lines of exactitude, such as Mr. Harrison recommends in his book on concrete highway construction. Percy L. Marks.

Brain and Mind.

(1) *Thought and the Brain.* By Prof. Henri Piéron. Translated by C. K. Ogden. (International Library of Psychology, Philosophy, and Scientific Method.) Pp. xvi + 262. (London: Kegan Paul and Co., Ltd.; New York: Harcourt, Brace and Co., Inc., 1927.) 12*s*. 6*d*. net.

(2) *The Mind and its Mechanism: with Special Reference to Ideo-Motor Action, Hypnosis, Habit and Instinct, and the Lamarckian Theory of Evolution.* By Paul Bousfield and W. R. Bousfield. Pp. vii + 224. (London: Kegan Paul and Co., Ltd.; New York: E. P. Dutton and Co., 1927.) 9*s*. net.

(1) THE last thirty years have witnessed the inauguration of a new era in the study of mental phenomena, the introduction of the discipline of scientific induction into a field of inquiry in which the deductive procedures of the

scholastic method had run riot for many centuries. The study of the evolution of the nervous system and the experimental investigation of its mode of working prepared the way for the understanding of the biological processes that express themselves as mental phenomena. Such researches as are associated with the names of Sherrington and Pavlov are clearly of fundamental importance for the interpretation of the working of the mind and for correcting the assumptions of introspective psychology. Armed with the results and the methods of experimental physiology, the psychologist has devised tests of his own to apply the method of experiment to the phenomena of mind and, under the leadership of Spearman, has attempted to express in mathematical form the fundamental analysis of mental ability so that it can be measured and subjected to the test of experiment.

Perhaps the most fruitful field of psychological inquiry has been provided, however, by the clinical study of the mental effects produced by injuries to the nervous system—in particular the vast experiments provided by bullet wounds in the War. Moreover, the anxiety states created by the abnormal stress and strain of trench warfare, and the moral and intellectual damage resulting from encephalitis lethargica since the War, have shed important light upon the emotional side of the mind's working. It is no exaggeration to claim that these three departments of clinical study have provided a new revelation of the dependence of mental and emotional expressions upon neural mechanisms. In the technical medical journals a vast amount has been written upon these subjects: in his great monographs on sensation and aphasia, Head has given his interpretation of the mental significance of nervous phenomena: many other books have been published dealing with the expression of the emotions and the psychological significance of the activities of the brain: but it remained for some psychologist to expound in generally comprehensible terms the new light shed upon the workings of the mind by recent research in clinical medicine.

This difficult task has been attempted by Prof. Henri Piéron, of the Collège de France. He has subjected to a critical but sympathetic examination the medical reports on the results of injury to brain and nerves, and has succeeded in giving a fair and reasoned analysis of the results achieved. It is particularly interesting to find a French author expounding so lucidly Head's researches on sensation and aphasia. Though his acceptance of Head's views is qualified, he has given his readers an unbiassed account of the methods and results and a generous appreciation of their significance to psychologists. His discussion of aphasia is particularly instructive. Summing up the history of research into the significance of speech-defects resulting from injuries to the brain, he gives a clear and just estimate of the contributions of Gall, Broca, Bastian, Charcot, Wernicke, and Pierre Marie; he concludes: "At present, in an atmosphere of thought impregnated with Bergson's powerful critique, so quickly assimilated that it has become impersonal, it is the intellectual analysis of the function of language, such as that attempted by Head, which has come to the front, and we are returning to the profound views of Hughlings Jackson, which were obscured by the brilliance and prestige of Charcot." This frank admission is distinctive of the fairness and impartiality of the author.

In translating this book into idiomatic English, Mr. Ogden has successfully accomplished a task of no mean difficulty. But it is unfortunate that he did not submit the proofs to an anatomist: for several of the technical terms, though literally translated, have emerged in curious forms. Thus the intracortical fibres known as the stria of Gennari, often referred to by French anatomists as the band of Vicq-d'Azyr, are called in this book (p. 254) "the bundle of Vicq-d'Azyr," which is the name of a very different kind of structure in another part of the brain. The figures also contain many inaccuracies—in particular Fig. 2 on p. 6. Special mention is made of these defects, because this book is one that will be particularly useful to the medical student; and some teachers might hesitate to recommend a work containing such lapses. In a new edition it would be wise to provide an entirely new set of illustrations. For the book deserves better treatment in this respect.

(2) The book by P. and W. R. Bousfield is a speculation that attempts to give concreteness to McDougall's conception of a psychical structure as part of the mechanism of mind. Thus the authors claim that they "have endeavoured to expand this more or less metaphorical conception by the hypothesis of a real psychic structure which is an essential part of the organism."

This search for an elusive mind-stuff seems to have been prompted chiefly by McDougall's claims that "the progress of our knowledge of the brain has shown conclusively that there exists no one part in which all sensory paths converge and which might be regarded as a *sensorium commune*" (p. 17), and further, "that there exists in the brain no such physical medium of composition, and that the processes of the several sensory nerves simultaneously excited do not affect any common material medium to produce in it a complex physical resultant" (p. 18).

More than a quarter of a century ago I invented the term 'neopallium' for the definite cortical area where all sensory paths *do* converge and pour their currents into a continuous sheet of grey matter, which is a most definite and indubitable 'physical medium of composition.' Hence I am unable to accept the basal assumption of this book.

G. Elliot Smith.

Oxford Histology.

Histological Technique: for Normal Tissues, Morbid Changes and the Identification of Parasites. By H. M. Carleton. Chapters vii. and viii., in collaboration with Frederic Haynes. (Oxford Medical Publications.) Pp. xv + 398. (London: Oxford University Press, 1926.) 16*s.* net.

THIS book has been written by a young Oxford histologist who was trained in the Department of Zoology and Comparative Anatomy of Oxford. The author has had special experience in medical parasitology and a training in the various recently developed techniques for the study of the cytoplasmic inclusions of the cell. The present volume is not intended to be an exhaustive work on microtomy for the research worker in the same way as "The Microtomist's Vade-Mecum," but is planned to act as an introduction to the subject, and to lead up to more advanced investigations.

The first book on modern histological methods which emanated from Oxford was that of Gustav Mann, entitled "Physiological Histology," 1902. When the reviewer was histologist at Oxford, there was a faded piece of paper pinned behind the histology *sanctum sanctorum* which set forth the sales of Mann's book. So far as the paper showed, the book was a failure—that is, commercially——but "Physiological Histology" even now contains material not found in any other text-book of microtomy, and was a decade or so before its time.

Another noted Oxford histologist, Dr. S. G. Scott, was a splendid type of the medically trained scientist. Scott specialised in the precise application and standardisation of the better-known laboratory techniques, such as those of hæmatology and colour reactions. Much of this worker's success was due to his special knowledge of the dyeing industry of Leeds. Scott died during the War, and his book was never written. Both "The Microtomist's Vade-Mecum" and "Histological Technique," however, contain many of Scott's formulæ and 'tips.'

In recent years, owing not only to the kindly interest which Sir Charles Sherrington has shown in this subject, but also to Dr. Carleton's enthusiasm, the Oxford Histology Department has been enlarged, and its facilities have been brought up-to-date; "Histological Technique" will show that nowhere else is histology better taught and histological methods better understood.

Much of Dr. Carleton's book will be familiar to users of the "Vade-Mecum," and "Mallory and Wright," but it is not to be imagined that the author has not cut new ground. The exposition of the carefully weeded out material is clear and concise, and undoubtedly the most admirable part of the volume, from the student's point of view, is the arrangement of "Tables of Faults." Why do sections curl? Why does the tissue fall out of the block? Why does the ribbon refuse to form? and so on. In three columns, we have "Fault," "Diagnosis," "Remedy," as for example, "Sections crumble," "Paraffin too soft," and "Cool the block," as the remedy. Thus, a person working alone will find every facility for tracing out his difficulties and eliminating them. Some of the statements regarding the difficult chemical side of the subject found in Chaps. vii. and viii., which were written in collaboration with Frederic Haynes, are a little doubtful, and one feels that this is the least happy part of the book.

We are convinced that "Histological Technique" fills a long-felt want, and that the book is certain to go into many future editions. The author is to be congratulated.

J. Brontë Gatenby.

Citrus Fruits.

The Cultivation of Citrus Fruits. By H. Harold Hume. (The Rural Science Series.) Pp. xxi + 561. (New York: The Macmillan Co., 1926.) 21*s.* net.

THE position of the genus Citrus amongst fruit crops cannot be over-estimated, for it includes fruits of such general use as the orange, lemon, lime, and grape-fruit, with others of less economic importance. This being the case, comprehensive books upon the subject are necessary from time to time, in order that growers in the many countries where these fruits are cultivated may be kept informed of improved varieties and better methods of cultivation and marketing as they are evolved.

All these points and others are dealt with in the work under notice; in fact the scope of the book is scarcely described by the title, for although a good many pages deal with the cultivation of Citrus fruits in a concise and altogether excellent manner, historical, botanical, and marketing problems are dealt with quite as succinctly.

Although the author only sets out to describe the position that Citrus fruits hold in the United States of America, he gives a fund of information that will be found to be of value to growers in other parts of the world. Commencing with a chapter on the "Commercial Importance of Citrus Fruits," the author indicates by tables the growth of the industry in Florida and California from the years 1886–87 to 1923–24 inclusive. His records are taken from the number of boxes of fruit handled by the railway companies during that period, and it is illuminating to learn that whereas in 1886–87 1,260,000 boxes were despatched from Florida and 840,560 from California, in 1923–24 Florida sent away 20,399,614 boxes and California 24,292,800 boxes. In the chapter dealing with the botany of the Citrus fruits, the author gives descriptions not only of the species bearing marketable fruit but also of allied species and the few interesting hybrids that have been raised. He takes a limited view of both genera and species. The trifoliate-leaved section, for example, that is so well represented by *Citrus trifoliata* Linn., he places under the generic name of Poncirus, whereas the Kumquat group appears under Fortunella. He also limits the range of the species retained in Citrus. Thus the lemon appears as *C. medica* Linn., the lime as *C. aurantifolia* Swingle, the shaddock as *C. maxima* Merrill, the pomelo or grapefruit as *C. paradisi* Macf., the sour or Seville orange as *C. Aurantium* Linn., and the sweet orange as *C. sinensis* Osbeck. The cultivated groups of Citrus fruits are then divided up and the varieties cultivated in America are dealt with. Some 49 varieties of sweet orange are described under the sub-heads Spanish oranges, Mediterranean oranges, blood oranges, naval oranges. Sixteen varieties of pomelo or grape-fruit are described, with numerous limes and lemons.

The cultural part of the book deals with all operations from propagation and planting to the care of the mature trees. Manuring, treatment of diseases, pruning, collecting the crop, and many other aspects are discussed. Handling the crop and marketing is also a very useful section. The author is to be congratulated upon the production of a very complete and useful book. W. D.

The Calculus of Variations.

Calculus of Variations. By Dr. A. R. Forsyth. Pp. xxii + 656. (Cambridge: At the University Press, 1927.) 50*s*. net.

PROF. FORSYTH'S latest work appears opportunely at a time when there is quite a notable revival of interest in the calculus of variations. To those who desire an account of the subject which, while modern, sound, and practical, is free from the extreme rigour so popular in certain quarters, this volume will be most welcome.

The first chapter contains a discussion of the early investigations associated with the names of Euler, Legendre, and Jacobi. Here the discarding of the irritating δ-notation originally introduced by Lagrange has greatly clarified the exposition. In the second chapter an account is given of Weierstrass's modifications of the analysis when both the independent and the dependent variable are subjected to variations. The four following chapters deal with extensions to the cases in which the integrals involve derivatives of higher order than the first and more than one dependent variable.

Up to this point the variations considered are of such a nature that one smooth 'characteristic' curve is deformed into a neighbouring smooth curve. Such variations are described as 'weak' variations. In order to obtain complete solutions of the problems of the calculus of variations, it is necessary to consider the possibility of small 'jagged' or 'strong' variations. The discussion of such variations has shown that, while the tests employed in the older analysis are necessary, they are by no means sufficient; and, indeed, it has been found that some of the most important results believed to have been established by the older methods are no longer valid. Weierstrass investigated one simple type of these 'strong' variations, and an account of his work, and of his E-function, is given in chapter vii.

The eighth chapter deals with relative maxima and minima of single integrals, and the remaining four chapters contain extensions to double and triple integrals, the analysis in these naturally becoming more complicated. Throughout the book there are numerous examples fully worked out.

Though the calculus of variations has been studied spasmodically for some two hundred years, its development has scarcely yet reached a stage at which it would be possible to write a compact account of the subject suitable for use as a college text-book; but, to original workers, this treatise should prove both useful and stimulating.

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.*]

Spectra of High-frequency Discharges in Super-vacuum Tubes.

The experiments of Kirchner (*Ann. d. Phy.*, **4**, 77; 1925) and of Gill and Donaldson (*Phil. Mag.*, **2**, 129) have shown that a tube, pumped down to what is usually termed a non-conducting vacuum, will give a brilliant discharge if excited at comparatively low voltage at a frequency corresponding to a six- or seven-metre wave, the current being fed to the tube through external electrodes of tin-foil. During the past summer we have made a further study of the phenomena exhibited by these high-vacuum tubes, with especial reference to the spectra of the discharge.

The tubes were first given a drastic cleaning with caustic potash, alcohol, chromic acid, and distilled water. They were then dried and exhausted with a Holweck molecular pump, the walls being heated repeatedly during the process. A tube provided with internal electrodes, in the pump circuit, showed no discharge when connected to an induction coil giving a two-inch spark. We then excited the tube provided with electrodes of tin-foil with an oscillating circuit giving a three-metre wave. A brilliant blue discharge at once appeared (hydrogen spectrum), the general appearance of which would have led one to believe that the pressure must be of the order of a millimetre.

Discharges under the above conditions are attributed, by their discoverers, to a to-and-fro oscillation of the electrons, the time of transit down the tube being less than the time of the half oscillation of the electrical circuit.

We found that, if the pump was kept in action while the tube was excited, the blue hydrogen spectrum gradually disappeared, being replaced by the olive-green discharge characteristic of pure oxygen, while the tube walls phosphoresced with a very brilliant ruby-red light. A photograph of the spectrum showed the line and band spectra of oxygen, together with many carbon lines, the pair of double lines in the region $\lambda 2850$ being especially prominent. On continuing the pumping and excitation for an hour the oxygen spectrum faded away, followed by the carbon lines, until only the double pair remained, at least with moderate exposures. The red phosphorescence was present with tubes of soft glass, pyrex glass, and fused quartz.

A similar red phosphorescence has been noticed by one of us during an investigation of the hydrogen spectrum, with a very long tube, brought to the 'white-stage' (that is, with the walls thoroughly dehydrated by long operation with a heavy current and continuous pumping). On exhausting to a high vacuum and admitting a little oxygen, the walls phosphoresced with a pink colour under the influence of the discharge.

Later in the summer, one of us made some further experiments with one of these tubes in collaboration with Prof. T. R. Merton at his private laboratory. The tube had been sealed from the pump in Tuxedo, and as a result of continued operation showed the red phosphorescence but feebly when excited by an oscillation of a seven-metre wave-length. On substituting an oscillator giving a thirty-metre wave we obtained a fairly strong red glow on the walls. Using one electrode only, we found that a magnet, brought close to the walls, caused a concentration of the red glow on the near side of the tube, the deflexion of whatever caused the phosphorescence of the glass indicating negative electrons moving away from the electrode. At the other end of the tube, the magnet repelled whatever caused the glow to the further wall of the tube, indicating electrons moving towards the electrode.

We believe that phosphorescence is associated in some way with the presence of positive ions of oxygen, but the exact mechanism of its production has not been ascertained. An investigation of the inner wall of the tube by polarised light, to detect possible changes in the surface layer of the glass, will be made in the near future, for it seems probable that the oxygen is derived from the silicon oxide. The carbon undoubtedly is due to vapour from stop-cock grease.

R. W. Wood.
A. L. Loomis.

The Alfred Loomis Laboratory,
Tuxedo Park, N.Y.

The Fields of Force in the Atmosphere of the Sun.

On me signale une note de G. Hale, insérée avec le même titre dans votre journal le 14 Mai dernier. La note est consacrée aux petites lignes noires, plus ou moins courbes, qui apparaissent tout autour des taches dans les images monochromatiques de la couche supérieure de l'hydrogène, et auxquelles Hale a donné le nom caractéristique de "Solar Vortices." On distingue le cas de la tache simple isolée et le cas de deux taches voisines ayant des polarités opposées, et formant un groupe bipolaire. Dans ce dernier cas, les lignes noires autour des deux taches rappellent parfois les lignes de force d'un barreau aimanté.

Or mon nom est cité comme attaché à une explication spéciale du solar vortex; mais l'explication qui m'est attribuée est inexacte ou insuffisante. Je suis conduit à préciser certains détails et à donner mon opinion actuelle sur tous les points soulevés par Hale et Buss dans votre journal les 14 et 28 Mai 1927.

I. Mes premières idées sur la question ont été résumées dans les *Comptes rendus de l'Académie des Sciences*, Paris, le 10 Janvier 1910, les 29 Mai et 6 Juin 1911. Le solar vortex n'est pas la cause du champ magnétique de la tache; il peut être simplement un effet du champ magnétique général du Soleil sur les files de gaz ionisé qui, dans les couches supérieures, se rapprochent de la tache (Evershed). On peut invoquer aussi la rotation de l'astre et le principe d'inertie. Le champ magnétique général, peut-être un peu modifié par le voisinage de la tache, est analogue au champ terrestre; sa direction est plus ou moins vers le nord et assez éloignée de la verticale. Dans ces conditions, il courbe dans le même sens les files gazeuses de deux quadrants opposés;[1] mais, dans les deux autres quadrants, il a surtout pour effet d'élever les gaz ou de les abaisser. Or ces différences se retrouvent dans la plupart des images de l'hydrogène photographiées à Meudon. D'ailleurs il faut considérer non seulement les actions aérodynamiques et électromagnétiques, mais les actions électrostatiques, qui peuvent donner un champ identique à celui d'un barreau aimanté.

Finalement, dans mon esprit, le solar vortex était un phénomène secondaire; l'attraction de la couche supérieure par la tache et la répulsion de la couche renversante avaient pour moi une importance plus grande, la cause de cette attraction et de cette

[1] On peut objecter que la raie $H\alpha$ de l'hydrogène est émise par l'atome neutre; mais, aux températures élevées de l'astre, l'atome passe souvent de l'état neutre à l'état ionisé, et inversement.

répulsion étant d'ailleurs mal connue, comme aussi la cause du fort champ magnétique de la tache, qui reste le fait le plus curieux et le plus énigmatique.

II. Dans ces dernières années, mes idées ont évolué. Le rayonnement corpusculaire des couches solaires, longtemps ignoré ou méconnu, a une importance capitale; et plusieurs faits nouveaux m'obligent à admettre que la partie la plus intense de ce rayonnement est émise par des corps radioactifs. Dans les couches solaires successives, les deux rayonnements, ondulatoire et corpusculaire, se substituent l'un à l'autre incessamment; mais le rayonnement corpusculaire, beaucoup plus absorbable, est vite arrêté, et la terre en reçoit seulement une petite partie, qui produit nos aurores polaires (Carl Störmer) et les orages magnétiques simultanés.

La petite aiguille aimantée apparaît ainsi extrêmement précieuse, puisqu'elle nous révèle un rayonnement nouveau de l'astre. A Meudon, nous enregistrons ses variations sur un papier sensible qui noircit sans développement, et l'astronome a sous les yeux les pointes de la courbe de déclinaison, au moment même où elles se produisent. De plus on prend comme horloge le Soleil qui tourne; et la pointe est représentée dans le temps par la longitude du centre du Soleil au même moment. Or on constate que les pointes des orages magnétiques sont séparées, en longitude, par des intervalles qui sont des multiples de 60°, 30°, et 15°. Un certain ordre apparaît là où la confusion était d'abord la note dominante, J'ai présenté ce résultat comme un fait d'expérience dans votre journal le 30 Octobre 1926. Le Dr. Chree, il est vrai, a fait quelques objections; mais j'estime qu'elles sont écartées dans les deux notes que j'ai publiées ultérieurement aux *Comptes rendus* le 26 Décembre 1926 et le 4 Juillet 1927.[2]

Finalement, tout se passe comme si le rayonnement corpusculaire de nos orages émane d'une couche solaire profonde qui tourne comme un corps solide; et cette couche offre au moins 24 volcans permanents, répartis uniformément autour de l'axe de rotation, et d'activité variable, qui rejettent au dehors la matière ionisée ou radioactive des masses intérieures. Cette division régulière est celle des corps à symétrie circulaire qui se refroidissent. Cependant, les particules rejetées par les divers volcans ont à peu près les mêmes vitesses, exactement comme si elles étaient émises par les mêmes corps radioactifs. De plus les recherches poursuivies à Meudon depuis 1925 par Mlle Maracineanu ont montré que le rayonnement solaire peut modifier ou provoquer la radioactivité dans les corps (uranium, plomb, cuivre); il doit avoir à un plus haut degré la même propriété dans le Soleil lui-même. Il est donc légitime d'admettre que les volcans solaires rejettent des corps radioactifs.

Le rayonnement corpusculaire de la couche profonde a été présenté par moi dès le début comme la cause première de tous les phénomènes (taches, facules, filaments, protubérances) observés sur le Soleil et ses dépendances. Si les corps radioactifs interviennent, plusieurs faits singuliers s'expliquent aisément.[3] Chaque corps radioactif se décompose en donnant naissance à un autre corps, le plus souvent aussi radioactif; il est caractérisé par sa période et la nature de son rayonnement (α ou β ou $\beta\gamma$). Si la période est courte, le phénomène est vraiment explosif, et on a d'une part un orage à commencement soudain, et d'autre part les points brillants des protubérances éruptives, qui émettent des jets lumineux dans plusieurs directions. Lorsque le volcan rejette un corps à particules β et un corps à particules α, un groupe bipolaire de deux taches se forme; les particules s'élèvent pendant que les corps radioactifs s'abaissent. Le champ magnetique général du Soleil déplace les deux corps dans des directions opposées et les sépare; de plus les deux corps forment avec leurs particules deux courants électriques, parallèles et de sens opposé, qui donc se repoussent. Plus tard, lorsque le rayonnement a diminué, les deux corps, qui ont des charges électriques opposées et croissantes, s'attirent.[4] Chaque corps donne une tache lorsque l'énergie des particules émises par elle atteint un certain niveau, les deux taches pouvant naître et disparaître à des moments différents.[5] Les particules qui s'élèvent en s'écartant repoussent les gaz de la couche renversante, et donnent naissance aux petits filaments de la pénombre, dirigés vers le centre de la tache.[6] On retrouve tous les détails de l'observation.

Le champ magnétique élevé des deux taches et aussi l'opposition de leurs polarités sont plus difficiles à expliquer, comme aussi la température plus basse de la tache, au moins lorsqu'on n'a pas recours à de gros tourbillons, dont la cause première nous échappe; mais la place manque ici pour exposer tous les points de la question. Je remarquerai seulement que cette étude des orages magnétiques conduit à des idées nouvelles sur la constitution du Soleil.

III. Dans sa note, Hale expose quelques résultats obtenus avec son nouvel appareil, le spectrohélioscope, qui est difficile à réaliser, et lui fait certainement honneur. L'appareil décèle, quoique d'une manière indirecte, les mouvements radiaux qui échappent au spectrohéliographe; il a été employé à la reconnaissance de petits filaments ("long dark flocculi") animés de mouvements rapides, qui aboutissent à une tache. Hale ajoute que le spectrohélioscope est seul capable de déceler ces phénomènes solaires qui sont fugitifs.

Cette dernière assertion me paraît exagérée. Nous avons à Meudon, à côté des spectrohéliographes, des spectroenregistreurs des vitesses, qui, en service depuis 22 ans, ont décélé souvent des phénomènes analogues à ceux décrits par Hale. Je partage aussi l'opinion de A. Buss, qui annonce avoir observé souvent les mêmes faits avec le spectroscope ordinaire. A ce sujet je remarque que, en 1892–1894, le simple spectrographe a reconnu les propriétés générales des vapeurs enregistrées par le spectrohéliographe, et qu'il a révélé seul leur position exacte dans le Soleil; l'épreuve du spectrohéliographe est l'image de la chromosphère entière.

En fait, pour les phénomènes étudiés récemment par Hale, ce qui importe, ce n'est pas tant l'appareil que la continuité de l'observation. L'astronome solaire, avec les appareils simples qui sont un spectroscope à réseau et une boussole disposée comme cidessus, fera des observations très utiles, en particulier sur les phénomènes fugitifs, s'il a la patience de suivre le Soleil pendant de longues heures.

H. Deslandres.

(Directeur des Observatoires de Paris et Meudon.)

le 25 Août.

[2] Dans sa critique, le Dr. Chree considère seulement la période qui correspond à 60° de longitude; mais, dès le mois de Mai 1926, j'ai annoncé les périodes de 30° et de 15°, aussi intéressantes que celle de 60°.

[3] L'intervention de corps radioactifs a été admise aussi par Lenard et Brester.

[4] En général, le rayonnement corpusculaire est le plus fort au moment où le corps radioactif est rejeté par le volcan solaire. Les taches et facules, d'autre part, ont un rayonnement corpusculaire plus faible, et les points ordinaires de la surface un rayonnement encore plus faible. D'où les différents effets observés avec l'aiguille aimantée, lorsqu'un volcan et une tache traversent le méridien central de l'astre.

[5] D'après cette explication, les deux taches du groupe bipolaire peuvent avoir des différences dans leurs spectres, et la durée de la tache est liée à la période de ses corps radioactifs.

[6] La répulsion de la couche renversante implique un tourbillon cellulaire, déjà admis par moi en 1910, adopté aussi par Bjerknes en 1926; un autre tourbillon cellulaire, superposé et de rotation contraire, correspond à l'attraction des gaz de la couche supérieure.

Temperature and Salinity Observations in the Gulf of Aden.

OBSERVATIONS of the warm bottom current flowing out of the Red Sea have been made in the past by the surveying ships *Pola*, *Vitiaz*, and *Stork* in the Straits of Bab-el-Mandeb, and the abnormally high temperatures below the surface in the Arabian Sea have been attributed to this source. Advantage has now been taken of some tests of deep-sea thermometers made in April and May of this year in H.M.S. *Ormonde* (Commander C. W. Rice) under the direction of Rear-Admiral H. P. Douglas, Hydrographer of the Navy, to follow this outflow eastwards.

At all the positions *A* to *E* (Fig. 1) there was either an increase in the temperature and salinity at a depth greater than 200 m., or at least a considerable decrease in their rate of fall; this probably marks the upper limit of the water containing an admixture from the Red Sea. The axis of the current was at a depth of from 750 m. to 1000 m. at *A* to *D* and at a slightly smaller depth at *E*. The temperature and salinity on the bottom at *E* in 1750 m. are such as might reasonably be expected at this depth in the open sea. The *Valdivia* in 1899, at practically the same position, found 3·7° C. on the bottom, which is in close agreement if allowance is made for a depth greater by 90 m. The salinity determined at the same time, 38·47, has always seemed doubtful in combination with such a low temperature, and there can now be little doubt but that it is erroneous. The *Vitiaz* at *Vz* found a slight rise of temperature, which was probably due to the outflow, but her observations did not go deeper than 800 m.

The analysis of a few samples specially preserved with toluene show that the average content of phosphorus in and off the Gulf of Aden was equivalent to 0·03 mgm. of phosphorus pentoxide per litre in the upper 50 m.; from 200 m. downwards it increased, reaching 0·143 mgm. at 1750 m. Atkins and Harvey (NATURE, Nov. 28, 1925) analysed samples collected by R.R.S. *Discovery* in the region between Portugal and the Canary Islands, and directed attention to the increase of phosphorus with increasing depth; they found none in the upper layers and about 0·075 mgm. at 2000–3000 m. The remainder of the special samples from the Gulf of Aden were mixed in two lots and examined for total arsenic by the Government Chemist. He found the equivalent of 0·005 mgm. per litre of arsenious oxide in the depths 500–1750 m., but the upper 50 m. contained less than 0·001 mgm. per litre. It appears, therefore, probable that arsenic is removed by plankton organisms much as phosphorus is.

I have to thank the Admiralty for permission to publish these results. DONALD J. MATTHEWS.

The Admiralty, S.W.1,
Aug. 31.

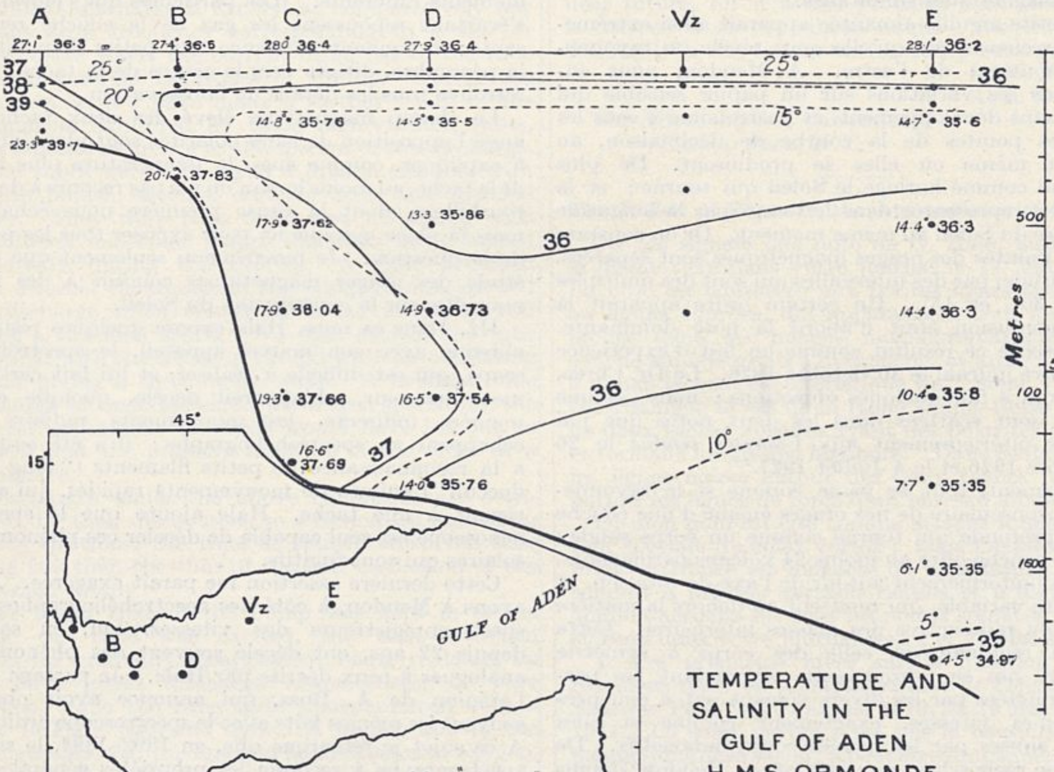


FIG. 1.

Imperial Science Services.

IN the leading article in NATURE of Sept. 17 in relation to the Imperial Agricultural Conference, it is pointed out that in some branches of science there is "a lamentable deficiency" of young men coming forward to take up research. Special reference is made to research in genetics, but the statement applies to most branches of applied biology. Whilst such positions as are available in the British Isles are eagerly sought, those in tropical colonies, and to a less extent in the Dominions, are not generally attractive to university graduates in biology.

It appears to me that the main reasons for this state of affairs are: first, that biologists in such posts are largely isolated and lose touch with progress in their science; and, secondly, that once they have embarked on such a career they have little prospect of returning to a good position at home. This second reason is obviously partly due to the first, but it is largely also due to the fact that men in the Dominions and Colonies rarely get the chance of applying for the vacancies that occur in the British Isles. Such vacancies are usually advertised in the leading English papers and in NATURE, but by the time these papers reach readers in the more distant Colonies and Dominions, the date for sending in applications has usually passed.

For example, forty-four posts of various kinds in the British Isles were advertised in NATURE in July and August this year. I find that the average length of time from the first appearance of the advertisement to the latest date for receiving applications was twenty-one days. The period varied from three to fifty-nine days, but in only ten of the forty-four was it greater than four weeks. It seems obvious that most of those responsible for fixing the terms of application for scientific posts in Great Britain have not yet learnt to think imperially.

Positions in Government departments and official institutions in the Dominions are generally only advertised locally. For example, in two of the Australian States the position of Government Entomologist recently became vacant, and in each case was filled after advertisement only in Australian papers. Probably there were numerous entomologists in India and the tropical Colonies who would have applied for these positions if they had had the opportunity.

The recent Colonial Conference recommended the formation of a Colonial Agricultural Research Service directed by a Council, one of the functions of which would be "the organisation of a 'pool' of scientific workers." The pool would probably be more attractive to such workers if a channel is constructed from it leading to positions in the home country and the Dominions. Experience in the tropics has obvious attractions for young biologists, but after a time they naturally look for positions in temperate climates where they can make homes and bring up their families. The proposed Council might perhaps act for members of the research service in the same way as the employment bureaux of our universities act for their graduates, by helping them to find such positions. The disadvantage to the Colonial Service which would result from the loss of more of its best workers would probably be more than compensated by the increased attractiveness of the Service which would result from such a policy, and the Empire as a whole would certainly benefit by it.

At the present time, when official appointments are made, preference is given to candidates with records of service in the War. In future, perhaps we may see advertisements announcing that preference will be given to candidates who have served in other parts of the Empire.

The Colonial Conference also recommended that the proposed Council should act as "a clearing house for information." The problems of the Empire are similar to those of other parts of the world, so that the necessity of a special imperial bureau of information seems scarcely apparent in view of the existence of the International Institute of Agriculture, which is "a clearing house for information" for the world. At the present time the number of research workers in the British Empire who regularly see the abstracts prepared by the International Institute is probably only a very small proportion of the whole. They should surely be supplied to every agricultural research station. At present they are generally to be found only in the central libraries in the capital cities.

Abstracts are of course chiefly valuable to a research worker as a guide to publications bearing on the problems which he is investigating. Some organisation for supplying him with copies of the papers he desires to consult would be of great benefit to the isolated worker, who cannot afford to subscribe to a large number of journals on the chance of seeing papers of interest to him. An Imperial organisation for this purpose should surely receive the support of all the Governments of the Empire.

W. B. ALEXANDER.

Croydon, Sept. 26.

An Unusual Case of a Natural Graft.

SOME months ago a large elm tree (*Ulmus campestris*) growing on the grounds of this station was blown down. When it was being sawn into blocks recently an interesting structure was observed. This was so unusual as to be considered worthy of notice.

The diameter of the tree was about three feet, and, judging by the number of annual rings, the age of the tree was in the region of one hundred and twenty years. At a point in the middle of the trunk and about four feet from the ground a distinct cavity was noticed. On careful examination it was found to be a definite air-space. On either side was a protoxylem area—what is technically called a crown. The accompanying photograph (Fig. 1) illustrates the appearance of the trunk, where there were two distinct protoxylem areas.

FIG. 1.—Two similar 'crowns' and a bark-lined enclosed cavity within the trunk of an elm tree.

The distance between the crowns was roughly five inches, and the width of the slit was less than a quarter of an inch; its length at the longest portion was ten inches, and it extended some two feet vertically in the trunk. There were fifteen annual rings between each of the crowns and the cavity. Above and below that region the stem was quite normal.

The cavity was lined with bark which had retained its normal appearance.

What appeared to have happened was that the tree, while still young, had, for some reason, forked equally; perhaps the terminal bud had been injured and the two forks had grown apart for some years until each was fifteen years old. Previous to this something had caused the two forks to anastomose, and the subsequent growth of the tree had enabled the cambial activity to form a solid xylem cylinder round the portions of the two forks which had not fused together. So far as one could judge, great pressure had been brought to bear on the inner halves of the two forks, since the enclosed portions of the bark were, as can be seen in the illustration, quite straightened out. There remained only a thin lens-shaped cavity in the middle of the trunk. This cavity was lined, as has been noted, with bark, which had preserved its structure during the hundred odd years it had been enclosed. The sap-wood immediately below this bark had long since lost its function, and had assumed the appearance and, presumably, also the properties of the heart-wood.

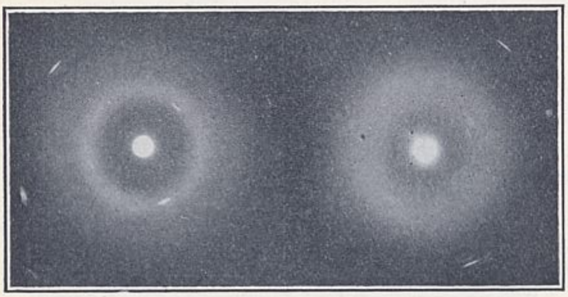
Nothing can be found regarding the history of the tree, and it would be interesting if any readers of NATURE could suggest how the rejoining of the forks came about, if that be what happened. There was nothing to suggest that it had been brought about artificially. JOHN CALDWELL.

The Scottish Plant Breeding Station,
Craig's House, Corstorphine, Midlothian,
Sept. 1.

X-Ray Diffraction in Liquids.

THE experimental studies described in a previous note in NATURE (April 23, p. 601) have been continued by one of us (C. M. Sogani) and the structure of some thirty-five liquids has been studied by X-radiation. The present note indicates briefly some of the outstanding results of the investigation.

The twenty aromatic liquids examined indicate a remarkable variation of the structure of the diffraction halo with the form, position, and mass of the substituent groups which replace the hydrogen atoms in benzene. Ortho-, para- and meta-compounds are



a b

FIG. 1.—Diffraction haloes. *a*. Aniline; *b*. Nitrobenzene.

readily distinguished by their X-ray liquid haloes. When the benzene ring is loaded in an unsymmetrical manner, there is a broadening of the halo, which is the more striking the heavier the mass of the substituent group. The research furnishes numerous examples of this effect, a striking illustration being the difference in the haloes due to aniline and nitrobenzene respectively (Fig. 1 (*a*) and (*b*)). In several of the liquids, the halo becomes doubled, a good example being that of mesitylene, where the two rings are of nearly equal intensity.

The aliphatic liquids examined include several of the paraffins, some alcohols, and an extended series of the fatty acids ranging from formic acid up to brassidic acid, which has a chain of 22 carbon atoms. The results confirm the prediction of Raman and Ramanathan (*Proc. Ind. Ass. Cult. Sc.*, vol. 8, p. 154; 1923) that with such asymmetrical molecules, we may have more than one halo, the sizes of which correspond to different special configurations of neighbouring molecules relatively to each other in the liquids. The most striking illustrations of this are furnished by acetic acid and glycerine, each of which gives two haloes, corresponding respectively to the mean distance between neighbouring molecules which lie side by side and those which lie end to end. With very long molecules, however, only the former type of halo appears on the plates, and its size, as expected, is found to be independent of the length of the carbon chain. With the earlier members of the aliphatic series, noticeable variations appear both in the size and the character of the halo with increasing length of the chain.

The case of liquid mercury, which has also been examined, is of great interest in view of the monatomic character of its molecules, and also in view of the theoretical proof by Raman and Ramanathan (*loc. cit.*; 1923) that the X-ray scattering by liquids at small angles would be determined by the compressibility of the liquid. Mercury has the smallest compressibility of all known liquids ($3{\cdot}9 \times 10^{-12}$), and in agreement with the theory of Raman and Ramanathan, it is found to give a halo with a sharply defined inner margin and a very clear space within.

Further details will be found in papers appearing in the *Indian Journal of Physics*. C. V. RAMAN.
C. M. SOGANI.

210 Bowbazar Street,
Calcutta, Aug. 25.

The Influence of Insoluble Materials on the Physical Properties of Liquids.

BAKER in his recent presidential address before the Chemical Society (*Jour. Chem. Soc.*, **131**, 949; 1927) directed attention to some interesting observations on the changes in the vapour pressure and the surface tension of a number of liquids brought about by the presence of insoluble foreign materials. Charcoal, thoria, platinum black, and finely divided nickel, materials already well known for their power of catalysing chemical reactions, were used, and he found that they brought about a change in vapour pressure, increasing with time to a constant value and, furthermore, that whilst heating increased and cooling diminished this difference it gradually returned to the original maximum. Baker attributed these changes to alterations in the complexity of the molecular association of the liquid with the establishment, eventually, of a new equilibrium. It appeared to the present writers that any change in the degree of association must necessarily be accompanied by a more or less corresponding alteration in the density of the liquid, and it seemed to be desirable to apply the delicate method of density determination now available (Robinson and Smith, *ibid.*, **129**, 1262; 1926) to the elucidation of this question.

As a result of the preliminary experiments of this investigation, in which water and ethyl ether were used, it appears to be established that considerable alteration in density occurs when these liquids, at 15°-20°, are brought into contact severally with catalysts. The density of water at about 14°·1 in contact with carbon was found steadily to increase, $+0{\cdot}000080$ in 48 hours, $+0{\cdot}00019$ in 96 hours, $+0{\cdot}00020$ in 150 hours, at which value it appeared to be constant. With ethyl ether and carbon, changes of greater magnitude were recorded, the increase in density at about 14°·8 being in this case $+0{\cdot}0009$ in 18 hours, $+0{\cdot}0011$ in 42 hours, and $+0{\cdot}0013$ in 90 hours, this value being the same after 130 hours. Water at about 18°·5 in contact with thoria showed first a depression of $-0{\cdot}00017$ after 24 hours, $-0{\cdot}00002$ after 48 hours, followed by an increase above normal density of $+0{\cdot}00001$, after 96 hours, $+0{\cdot}00011$ after 192 hours, and $+0{\cdot}00015$ after 209 hours. It is interesting to note that with this catalyst the change in density at about 23°·3 showed a much greater initial drop, namely $-0{\cdot}00040$ after 24 hours, while the final increase above normal density after 209 hours was only + 0·00004. The actual change in density between the first and last reading was, however, approximately the same, namely, + 0·00032 and + 0·00044 respectively.

Further work on this subject with other liquids in contact with a variety of surfaces is being actively undertaken and will form the subject matter of a detailed communication to be published elsewhere; meanwhile it seemed to be desirable that these results, substantiating as they do those of Baker, should be briefly indicated.

J. B. Peel.
P. L. Robinson.
H. C. Smith.

University of Durham,
Armstrong College,
Newcastle-upon-Tyne, Sept. 10.

Water-spouts and Tornadoes.

When at Frinton recently I was interested to notice a series of whirls like water spouts on a small scale forming on the beach. The smooth, sandy beach at Frinton is protected by a series of low wooden groynes consisting of planks supported at intervals by posts some nine inches square driven into the sand. The planks rise to about a foot above the sand and the posts project somewhat more, as shown in the sketch (Fig. 1). The wind

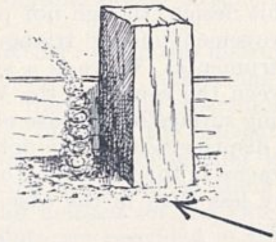


Fig. 1.

was blowing up the beach slantwise to the groynes in the direction of the arrow, and in the corner between each post and groyne a perfect little tornado or water-spout was formed. The breaking waves were throwing up foam which was trapped in the shallow pools behind the posts, and this foam was whirled round and lifted into the air by the eddy, the foam thrown by each successive wave being quickly carried away over the groyne. Thus far the phenomena described scarcely call for comment, as the wind blowing round the post would, naturally, cause an eddy in the corner, but the remarkable fact was that the eddies were of such violence that not only foam but drops of water were lifted and, at times, a raised cone of water was visible in the centre which appeared to be at least ¼-inch high. Where did the suction come from?

An outstanding problem connected with water-spouts and tornadoes is the means by which the suction is maintained at the top. The centrifugal force will prevent inflow at the sides, but the whirl cannot be endless, and it has always been a matter for conjecture why air does not flow in from the end and destroy the eddy. Mr. F. J. W. Whipple some years ago suggested that cloud pendants, a similar type of phenomenon, might always occur in pairs, each pair being joined above the clouds and forming a single vortex both ends of which rested on the ground. There seems some difficulty in accepting this view, and the miniature water-spouts at Frinton were certainly each self-contained. It is very difficult to see what force at the top balanced the suction, which was clearly shown at the bottom by the raised cone of water. The wind was of Beaufort force 4 or perhaps 5; it can scarcely have exceeded 15 miles per hour just above the surface of the sand. If this wind passed over an orifice of the most favourable shape it could not produce a suction equal to ¼-inch of water. The matter might repay further study at Frinton or elsewhere.

Mr. W. Hayes, of the Meteorological Office, has kindly made from my description of the occurrence the sketch which illustrates this letter.

J. S. Dines.

78 Denbigh Street, S.W.1,
Sept. 15.

Early Experiments on Ultra-Filtration.

A paper by Wilibald Schmidt, entitled "Experiments on the Velocity of Filtration of Different Liquids through Animal Membranes" (*Ann. der Phys. u. Chem.*, **99**, p. 337; 1856), records an observation which appears to have escaped the historians of colloid chemistry.

The author states that the concentration of the filtrate was compared with that of the original liquid and was found to agree with it when the solutions filtered contained sugar or salts. He then continues: "A different behaviour was shown by solutions of gum arabic and of white of egg, which gave perceptibly less concentrated filtrates, although the solutions had previously been filtered; the former repeatedly through linen, the latter through paper."

This demonstration that an animal membrane is much less permeable to colloids than to sugar or salts antedates Thomas Graham's papers on dialysis by five or six years. Schmidt's procedure, however, is really what is now called ultra-filtration, namely, the separation of colloid particles from the dispersion medium by means of a suitable septum, generally a gel (C. J. Martin, 1896).

Schmidt did not follow up his observation, but confined himself to studying the rate of filtration of true solutions with the view of testing whether it agreed with Poiseuille's law.

Emil Hatschek.

10 Nottingham Mansions,
Nottingham Street, W.1, Sept. 24.

The Sources of Supply of Vitamins A and D.

Messrs. Rosenheim and Webster, in their very interesting letter to Nature of Sept. 24, have suggested that it should be possible to make margarine into "a perfect biological substitute for butter" by incorporation of a suitable content of the vitamins A and D. It would appear from this communication and from other recently published statements that it is not generally known that this problem has actually been solved, and that to-day it is possible to purchase margarine containing regular and uniform quantities of both vitamins of the same order as the quantities found in butter.

Researches carried out in our laboratories have led to the development of a large-scale method of obtaining from cod-liver oil a palatable extract containing in highly concentrated form the vitamins A and D, and it has been found possible to incorporate this concentrate in margarine without loss of vitamin efficiency. The potency of the concentrate has been established by colorimetric and biological tests, and extensive feeding trials have shown the vitamin margarine to be equal to butter in its power to promote calcification and restore growth in rats fed on a deficient diet. We shall be glad to send samples of these products to any scientific worker who may be interested in the subject.

P. W. Tainsh.

Research Laboratories,
Port Sunlight.

Metallurgical Photomicrographic Apparatus.

As a result of the important advances that have been made in Great Britain in the design and production of optical elements for the microscope, it may be claimed that microscope lenses are now being made in England equal, if not superior to, any made abroad. The excellence of an optical instrument such as the microscope depends, however, not on the perfection of its optical elements alone. Mechanical arrangements must be provided by means of which these elements may be held in definite relation to one another without shake and be capable of adjustment in a manner which is convenient to the user. It is well known, for example, that any lack of true centration in the optical parts or of perfect alignment in the optic axis of these parts produces more serious deterioration in the resulting micro-image than does almost any other single factor. The possibility of such deterioration can largely be prevented by proper attention to the details of mechanical construction and design.

An examination of four modern types of metallurgical photomicrographic outfits at present in use, three of British and one of Continental manufacture, gives examples of the variations in construction and design adopted by different manufacturers in their attempts to fulfil the mechanical requirements. In each case the various parts are supported in such a way as to be capable of moving along an optical bench. In the instrument by R. and J. Beck, Ltd., and also in that by James Swift and Son, Ltd., this bench consists of an elongated triangular prism machined on its two upper surfaces. V-shaped saddles, carrying the various optical fittings, slide on this prism. If the inner surfaces of the V were machined so as to make accurate contact with the corresponding slide surfaces of the triangular bar at every part of its length, freedom of movement of the saddle along the prism and accuracy of adjustment might be obtained. It is, however, impossible to machine these surfaces to the required degree of accuracy to avoid shake. A certain manufacturing tolerance is necessary both on the angle of the V and on the angle of the prism. A deviation from the geometrical form is thus produced, and consequently, when the saddles are clamped, rocking or rotation takes place and the alignment is disturbed. It is thus impossible on such a bench to make the accurate adjustment necessary in an optical system designed for critical work.

These defects would not occur if kinematical contacts were adopted instead of plane sliding surfaces. This system, the advantages of which have for long been recognised in theory, has been adopted by some of the most progressive manufacturers of scientific instruments ; but its adoption in microscope manufacture has not been effected on any large scale. In accordance with the system the correct method of designing the saddle is, as has been suggested by Prof. Alan Pollard, to allow it to make contact at three points on one surface, and at two points on the other surface, of the slide. This restricts the freedom of movement of the saddle to that of sliding along the length of the bench. If the last two points make contact along a line parallel to the axis of the slide, the saddle will automatically fit the bench notwithstanding slight inaccuracies in its machining. With such a saddle no alteration of its position is produced as a result of its being clamped to the bench.

In the Continental apparatus referred to above, which is made by Reichert of Vienna, the essential part of the optical bench consists of an openwork metal girder, in bridge form, suitably webbed to secure rigidity. The girder is supported at each end and fitted with four levelling screws. Along the whole length of the upper surface at one edge is a plane machined surface. The upper edge parallel to this is triangular in section with machined surfaces. The base of the stands carrying the optical parts have, at one side, a V-shaped groove which fits into the triangular prism of the bench and, at the other, a plane machined surface which slides on the flat machined surface of the girder. A bench of this design, though not perfect, represents an improvement on the triangular bench of the other instruments. There is a span of about 4 inches between the centre of the V and that of the plane sliding surface of the base of the carriers, and thus any displacement of the optical elements due to inaccuracies in the machining of the surfaces is considerably less than in the case of the single triangular bar.

In the fourth apparatus, made by W. Watson and Sons, Ltd., the optical bench consists of two metal tubes, cylindrical in section and supported on three brackets. The carrying-pieces rest on these bars, which make contact with the sides of two V-shaped machined grooves in the lower surface of the base of the carriers. In order to ensure accurate adjustment in this case, not only must the grooves be accurately machined, but also the tubes must remain definitely parallel and in one plane. This condition is not easily maintained when the apparatus is in use.

The microscope in each of the outfits examined was of the Le Chatelier type, which is now so frequently used for metallurgical purposes. The object-glass points upwards and is immediately below the stage on which the specimen is placed. In the Beck and the Swift instruments the rack which supports the stage is directly fixed on one side of the stage. The weight of the overhanging stage and of the object placed upon it thus tends to produce a sagging of the rack. The longer the instrument is in use, the greater does this sagging effect become, more particularly if heavy specimens are placed on the stage. The tilting of the stage renders it impossible to focus the whole of the field. This tendency for the stage to tilt is avoided in the Watson instrument by having the stage supported by four upright tubes fixed to a plate centrally mounted above the rack which, however, is placed at one side of the upright pillar. The

Continental instrument has the rack cut on one side of a triangular pillar fitted centrally in the saddle-piece resting on the girder. The stage is supported from this pillar by three uprights, one of which is divided in order to permit of the insertion of the visual observation tube. This design tends to reduce the sagging of the rack and obviates any tilting of the stage.

In the last-mentioned instrument, and also in the Beck and the Watson, the fine-focussing adjustment actuates the object-glass and is independent of the coarse adjustment and therefore unaffected by the weight of the stage or of any object placed on the stage. In bringing an object on the stage into view, microscope users generally can tell how far they are from the actual image by the appearance of the light in the field of view. In order, however, to facilitate this preliminary adjustment, the Continental instrument is provided with a scale fixed to the pillar with graduations indicating the position to which the stage must be lowered in order to bring the object into focus for an object-glass of a particular focal length. This is an instance of the addition of a device which in use may effect a considerable saving of time on the part of the user.

The illuminating tube of this instrument contains the iris diaphragm, the condensing lens system, and a rotary disc having apertures of different sizes by means of which the intensity of the light may be varied. The condensing lens system is capable of being easily moved along the tube, the positions being marked for the two types of illuminators. Slots are provided in the tube for the insertion of coloured glass or a filter-cell. The illuminating apparatus, with the exception of the lamp, is thus self-contained and the tube is rigidly fixed in relation to the stage. In each of the other instruments the illuminating system is fitted on a separate small optical bench, rectangular in section, supported on a saddle-piece on the main bench. Each item is mounted separately and, while this may permit of greater flexibility, there is at the same time greater possibility of lack of alignment and more trouble in attaining accurate adjustment.

The camera supplied with the Reichert outfit is provided with a reflex focussing arrangement by means of which the rays can be deflected on to a focussing screen at the side of the camera. This enables the operator to control the image on the focussing screen from his seat at the microscope. An observation lens carried on a bracket on the camera-stand permits of the image being conveniently examined as a whole. In the Beck instrument the image to be photographed can be projected on to a special white disc. This method has the disadvantage that the room must be dark if the image is to be properly examined. Better definition of detail can be seen, however, on the white disc than on the ground-glass screen.

Since the study of the macrostructure of metals is now demanding considerable attention, it is very convenient if the camera of the photomicrographic outfit can be used for this purpose. Photographs under low magnification are frequently required of, for example, fractures, groups of flaws, very coarse structures, segregated areas, or of large crystals in ingot sections. The Reichert apparatus is the only one of the four referred to above which has a complete arrangement for macrophotography as an integral part of the apparatus. The illuminating system is mounted on a small horizontal prismatic bar pivoted at the back of the optical bench. The object is placed on a small pivoted swing-out stage which can be tilted and adjusted for height. The surface to be photographed can be either in a vertical or in a horizontal position. In the former case either direct or oblique illumination may be used, focussing being effected by rack and pinion adjustment of the front of the camera. In the latter case the image is focussed by vertical adjustment of the object stage. The light is directed obliquely on to the object by means of a mirror, the rays which produce the image being deflected into the objective by a prism attached to it. These macrophotographic appliances are always in position ready for use and can easily be brought into operation at any moment instead of the camera.

The four instruments differ in other details, to some of which the user may attach importance because they suit the particular method of working that he adopts. There are also certain accessories which may be fitted as additions to the various instruments for different purposes. The essential differences between the four instruments have, however, been mentioned. The V-and-plane type of optical bench of the Reichert apparatus offers greater possibility of accurate adjustment of the optical parts than does the triangular bar or the parallel bar type of bench used in the other instruments. The mounting of the elements of the illuminating system separately as in the three British instruments provides a wide range of adjustment, but objection may be offered to the method of mounting them on a bar that is rectangular in section. The design of the coarse-adjustment rack in the Reichert instrument, as compared with that of the other instruments, is such as to minimise the danger of tilting of the stage when in use. The Reichert apparatus has the additional advantage that the mirror arrangement and the magnifying lens for the examination of the image to be photographed, and also the auxiliary appliances for macrophotographic work, form an integral part of the main apparatus. It would thus seem from the above considerations that, of the four instruments examined, the Reichert apparatus is the most complete and most nearly meets the requirements as regards mechanical design.

The prospective purchaser of a metallurgical photomicrographic outfit will obviously seek for that type of apparatus which will enable him not only to obtain the best possible results from the optical elements at his disposal, but also to obtain these results with the minimum expenditure of time and effort. The efficient production of such an apparatus involves a thorough familiarity with the art of photography as applied to metals; a capacity for devising mechanical methods which simplify the process of taking a photograph of a metal section; a knowledge of the principles of scientific design and the ability to apply these principles in the mechanical devices employed; and the use of modern methods of precision manufacture and inspection. This obviously involves team work—the co-operation of user and producer. On the latter rests the responsibility for ensuring that the resulting instrument is sound in construction and design. Sound construction requires the application of the best methods of gauging and inspection of the manufactured components. Intelligent design from the manufacturing point of view tends to reduce to a minimum these costly processes; from the user's point of view it aims at ease in manipulation and efficiency in operation. These are all essential factors in the building of an instrument that is to give entire satisfaction to the user or to find a foremost place in either the home or the foreign market.

Standards of Book Selection in Science and Technology.[1]

By Sir Richard Gregory.

In these days of minute specialisation in science and technology, and of a multitude of books, both general and specific, the problem of selecting the most worthy and suitable works for a library is so difficult that some librarians give it up in despair, while others are content with a solution of it which satisfies their needs and yet does not conform to any particular postulates or propositions bearing upon the principles of selection. As a matter of fact, there are no definite or accepted standards by which the worth of such books can be accurately measured; but the same comment might reasonably be made of works in any other branch of literature — fiction, art, history — with which libraries are concerned. Of the thousands of works of fiction published, what determines their admission to or exclusion from the shelves of public or other libraries? Chiefly the reputation or authority of the authors. So it must be with books on science and technology. When an author is known to have devoted particular attention to the subject of his book, then the work is obviously one to be given serious consideration. A careful compilation may be just as useful an addition to a library, but it cannot have the same authority and therefore belongs to a different category.

There still remains, however, the practical problem of deciding what books are by original authorities and what by writers without the particular knowledge which gives distinction to a scientific or technical book. What librarians would probably like is a monthly list in which such books were grouped in classes of say *A*, *B*, and *C*, according to their importance, but the difficulties in producing such a list are almost insuperable. Failing this, such a list as the "Technical Book Review Index," issued quarterly by the Technology Department of the Carnegie Library of Pittsburgh, provides a most helpful guide to the selection of books on pure and applied science. The Index is arranged in alphabetical order according to authors' names; and it gives extracts from reviews in scientific, technical, and trade journals expressing the scope and value of the works mentioned. It is not supposed that reviews furnish an infallible index to works of outstanding importance, but they do provide a practicable source of information, and a useful purpose is served by bringing them together, as is done in the "Index" of the Carnegie Library.

The recent "Report on Public Libraries in England and Wales" recognises that good and necessary books declare themselves slowly, and that there is an insufficiency of competent critics to help the librarian in his task. The Public Libraries Committee says in this Report:

> Attempts to provide a guide for book selection for librarians, some fairly good, have from time to time been made, but for various reasons have failed. Possibly the task is too difficult, and consequently the present method of book selection in most libraries is and can be little better than the primitive method of trial. It cannot be expected that librarians or book selection committees, however competent as literary critics, should be qualified judges of all scientific and technical publications, and reliable reviews of these are usually the most difficult to find and the most belated in appearance. Librarians would, we believe, welcome assistance in the choice of books by the issue of authoritative surveys of new publications by a panel of competent judges. It is, however, essential that such surveys should not be too long delayed, and it is not easy to find qualified critics who are able and willing to devote themselves to the prompt evaluation of new books. Such surveys are, however, issued by the American Library Association, and are found helpful by librarians in America.

There is no central organisation in Great Britain which affords the same kind of competent guidance in the selection of books as that given by the American Library Association, Chicago. Each month a tentative list of all books received during the previous month is sent to representative librarians, who vote on books they have personally examined; and these votes, together with references to notices of the books in leading journals and opinions from a panel of voluntary workers, are considered by a staff which reads the selected books and prepares notes upon them for subscribers to the list. In the case of new editions (especially of scientific and technical books) libraries are advised whether the alterations are sufficient to make it desirable that the older editions should be replaced by the new.

Here, then, is a system which at any rate provides a sieve by which the more substantial works

[1] Paper read at the fourth conference of the Association of Special Libraries and Information Bureaux at Cambridge on Sept. 25.

are separated from those which pass through the mesh. The Public Libraries Committee suggests that the Carnegie United Kingdom Trust, which has done so much for library work and organisation, might very appropriately promote the establishment of a similar scheme in Great Britain; and we are sure that librarians would welcome such an experiment. Another plan would be to make the Science Library at South Kensington responsible for the selection of scientific and technical books of outstanding importance. The Public Libraries Committee contemplates that this library will be the principal source on which the Central Library will depend for the supply of books needed by research students in science, and the facilities it possesses or could acquire for selecting the best works on science and technology might readily be made available to libraries generally.

The task of deciding what are the best books in any subject is, however, one which no individual or institution can lightly undertake. Lists alone are not sufficient, and if they are annotated then great responsibility is placed upon the judges unless the comments are purely explanatory. There must be different standards for different types of book, and no single touchstone will be sufficient to separate the gold from the baser metal in all the classes. For our present purpose we may distinguish three groups, namely (1) popular works, (2) text-books, (3) works of reference, to each of which a different standard of selection must be applied.

(1) *Popular Science*.—Popular books on scientific and technological subjects vary from childishly simple essays to closely reasoned accounts of the most recent additions to knowledge. They may, however, be divided into two main classes distinguished both by authorship and style. One class consists of books by writers who have the literary art of attractive presentation of scientific fact or conception. They are able to state the case for atoms and electrons just as clearly as for cells and chromosomes. They are not expert witnesses but counsel having the faculty of seeing essential points and expounding them to the court. Every librarian knows the names of some authors of this type who are popular with their readers. The works are often superficial, and scientific critics may regard the treatment as unsatisfactory, yet they serve a purpose in leading readers into realms of knowledge previously unknown to them.

Between this type of popular book with its everyday vocabulary and sentimental appeal and the book by an exponent who knows his subject by first-hand experience there is usually a great gap. Few original investigators in scientific fields are capable also of presenting them in attractive and intelligible language. They use technical words and terms which convey no clear meaning to general readers, and their books are for study rather than for reading as recreation. It is impossible to set a definite standard of suitability for books of this kind or for those of the more elementary type. All that can be done is to be guided by experience as to authors whose works are most popular with particular groups of readers.

A list of one hundred "Popular Books in Science" is issued by the American Library Association. This list was prepared by a special committee of the Washington Academy of Sciences; and it gives, in addition to full bibliographic particulars, a descriptive paragraph about each book and notes upon the various groups of scientific subjects under which the books are classified. The list, though a very useful guide to sound popular works in science, is not altogether satisfactory from our point of view. It certainly includes about forty English books which are available from publishers in the United States; but there are, of course, many popular scientific books which have never been taken over in this way, and these seem to have been left out of consideration.

The principles followed by the Committee in compiling the list are, however, of general application, and are stated as follows:

> Would the average reader who uses a public library, after reading the book in question, read it through to the end and come back to the librarian for another on the same subject? Such a book should be included. Or would he lay it down after a little while and turn to some other kind of book as being more interesting and not return to the subject again? Such a book should not be included, however accurate, thorough, and complete it might be from the standpoint of a specialist.
>
> It is also desirable that the book should not be professedly a text-book, nor should it be written in text-book style; that is, it must not be a book intended primarily for the seeker after information regardless of whether the information be interesting reading or not. It is perhaps needless to add that it should have been written by an author who knows his subject thoroughly and should not be so old as to be obsolete in its facts and speculations.

(2) *Books for Students*.—Text-books for use in school or college belong to a different category from that of popular works for general readers. Their function is not so much to inspire as to instruct, and they sacrifice the flow of language to concise and precise statements of ascertained fact and established principle. The usual standard by which a text-book is measured is that of a proximate or ultimate examination. In Great Britain a school text-book which has no relation to examination requirements has little chance of success however original it may be; indeed, it may suffer by the very originality of its qualities. A list of the best text-books in any subject, therefore, would differ according to the point of view adopted—whether that of original and stimulating treatment or that of preparation for particular examinations. There are few books of the former type and many of the latter. In the text-book field the name of an author does not carry so much weight as it does in more popular literature, and new authors are continually competing with old for first place. Each teacher or professor has his own idea as to what are the best books for his students, so that any list of text-books published by a body

representing the teaching profession tends to become a list of nearly all books available, with no comments on their value.

Two such lists are published, by the Science Masters' Association and the Association of Women Science Teachers respectively. The lists are useful catalogues of titles of class-books and works of reference upon various branches of science, but a librarian or student wishes to know which are the best two or three books in each of the groups, and neither list affords that kind of guidance. In almost any usual school subject of scientific study, there are twenty or more 'best' books, and only individual preference selects one rather than another. It may be doubted whether librarians should include such books on their shelves, or limit themselves to text-books of an advanced type which students may not be able to afford to purchase or which may be of service for reference.

The only sound standard of school-book selection is that of successful experience, and if such books are included in a public library, probably the best plan is to communicate with teachers of science and technology in the secondary and technical schools of the district as to the books in actual use. This may be an unsatisfactory course to follow, but it is preferable to placing upon a librarian the responsibility of selecting the best text-books from scores which are equally serviceable. The tendency in school text-books is towards consideration of everyday things and away from the purely academic attitude, so that some books of this class are as acceptable to many readers as are books written in what is conceived to be a popular style.

(3) *Standard Works*.—An attempt is made to provide a guide to what books are of value to students of science and technology in Sonnenschein's monumental work "The Best Books," the third edition of which appeared a few months ago. Three-quarters of the volume comes under the head of science understood in a broad sense, and there are signs by which works of outstanding importance may be distinguished from others. Such a work, however, soon gets out-of-date, and what librarians want is a periodical list in which scientific works are evaluated on a standard plan.

Almost every week sees the publication of a number of books on various topics of science and technology, and to decide which are of permanent value and which negligible puts too great a strain upon the capacity of a librarian or a library committee. What, for example, determines the works of reference which ought to be in a library and those which may be omitted? Every department of science and technology is now minutely specialised, and for most of the many aspects of them there are special books. Probably the chief means by which the worth of these is measured are reviews in leading journals devoted to science and technology, but such notices are often long delayed; and even the best reviewers have different standards of value. When, however, a work is actually purchased for the library of a leading scientific or technical society, or accepted from one of its fellows, this fact provides positive evidence of its substantial quality. If, therefore, arrangements could be made to compile a monthly list of such purchases, librarians would be provided with titles of works of outstanding importance from which to select what would be most suitable for their reference shelves.

Science and Industry in Australia.

THE Council for Scientific and Industrial Research of the Commonwealth of Australia has decided to issue a quarterly journal which will provide a means of disseminating general information respecting Australian scientific problems and the scientific research work in progress throughout the Commonwealth. In a foreward to the first number of the new *Journal of the Council for Scientific and Industrial Research* [1] (August 1927), the Prime Minister (the Right Hon. S. M. Bruce) stresses the importance of making the best possible use of the relatively small personnel which is available for the scientific investigation of Australian problems. To this end, a Trust Fund of £250,000 has been created for the use of the Council during the first few years of its existence, while the interest on a further sum of £100,000 will be applied to the training of research students, particularly in the biological sciences. On the manufacturing side, the co-operation of the Council with the British Department of Scientific and Industrial Research will be facilitated by the recent visit of Sir Frank Heath to Australia (NATURE, **117**, 460, 697; 1926), and it is hoped that co-operation in agricultural activities will be considered at the Imperial Agricultural Research Conference being held in London this month.

Sir George Pearce contributes an informative article dealing with the organisation and work of the Council, in which he summarises the progress of investigations on plant problems, irrigation settlement problems, entomological problems, animal pests and diseases, stock nutrition, forest products, the preservation and transport of foodstuffs, fuel problems, etc. In addition to this general treatment, special articles are included on "The Commonwealth and Agricultural Research" (Prof. A. E. V. Richardson), "Animal Nutrition Problems" (Prof. T. B. Robertson), and "The Biological Control of Prickly Pear" (A. P. Dodd). There are also reports on co-operative research in the wool industry, and on the Australian meat industry (freezing of beef), together with notes on the investigation and eradication of poisonous plants, astronomical work in Australia, the Australian Radio Research Board, and other matters.

The enormous losses occasioned by imported plant and animal pests have shown the need of

[1] Edited by G. Lightfoot, and published by the Government Printer, Melbourne, at 5s. per annum, post free.

submitting such pests to scientific control, and their investigation figures largely in the work prosecuted under the ægis of the Council. Public opinion in Australia is now fully alive to the economic significance of work of this kind; so that even the construction of the transcontinental railway was not undertaken without the introduction of precautions against the spreading of sparrows and starlings from the eastern States into Western Australia.

The most important plant problem is undoubtedly presented by the prickly pear (Opuntia), which covers some sixty million acres in Queensland and New South Wales, with an annual rate of increase of about a million acres. The two main pest pears are *O. inermis* and *O. stricta*, and the remarkably rapid spread of the former species in Australia "is regarded as one of the botanical wonders of the world." Eradication by mechanical or chemical methods is usually impracticable on account of the density of the growth and the low value of the infested land. Efforts have therefore been concentrated upon the application of biological control, and the striking results of introducing such American prickly pear insects as cochineal (*Dactylopius tomentosus*, *D. indicus*, and *D. newsteadi*), boring caterpillars (*Cactoblastis cactorum*), the prickly pear red spider (*Tetranychus opuntiæ*), plant-sucking bugs, etc., have "altered the hopeless attitude from which the control of prickly pear was formerly viewed. There is every reason to believe that, as the insects multiply and spread, the area covered by the pest will gradually diminish, and the land be reclaimed for pastoral and agricultural purposes." Researches are also in progress at the Waite Agricultural Research Institute, South Australia, on 'tomato wilt,' a disease, originating near Melbourne in 1915, which has caused great destruction in all the tomato-growing States; while in Queensland attention is being concentrated upon two diseases ('bunchy-top' and 'squirter') which have occasioned enormous losses to growers of bananas. "The major part of the investigations on 'bunchy-top,' a disease which has practically wiped out the banana plantations in certain areas, has been completed, its cause and the means by which it is spread have been discovered, and recommendations for control have been made to the State authorities."

The development of the Murrumbidgee irrigation scheme has raised problems in connexion with citriculture, viticulture, rice-growing, etc., and these are being investigated in the research stations at Griffith and Merbein; in addition, a soil survey is being conducted under the direction of Prof. J. A. Prescott, of the Waite Institute.

The entomological work is concerned at present mainly with the grass-grub, the buffalo-fly pest, and dried-fruit pests. It is feared that the buffalo-fly, if allowed to spread, may affect the Australian cattle industry even more seriously than the cattle-tick has done; the problem of control is difficult, but a beginning has been made by collecting information regarding this formidable pest from entomologists in the Dutch East Indies, the Philippines, and Hawaii. Another animal pest, of a very curious and embarrassing nature, is the 'flying fox,' a large fruit-eating bat, the depredations of which were recently described in NATURE (Aug. 6, p. 189) by Prof. A. C. D. Rivett.

Investigations of forest products, which are of peculiar interest in Australia, have been directed largely towards the possibility of utilising indigenous woods in the manufacture of news-print, the annual import of which exceeds 100,000 tons. Those pioneer workers on Australian forest products, R. T. Baker and H. G. Smith, pointed out some years ago that certain species of Eucalyptus were suitable for this purpose; recent work carried out under the auspices of the former Institute of Science and Industry, and extended by the present Council, has done much to establish the economic possibility of preparing from such sources a mechanical pulp, suitable for blending with chemical pulp of the same origin, in the production of news-print. There are also prospects of utilising Australian woods as the raw material of high-grade celluloses, suitable for the manufacture of artificial silk. Further, the pulp from *Pinus insignis*, an imported pine which grows very rapidly in Australia, has been found to lend itself particularly to the manufacture of kraft paper.

For many years it has appeared paradoxical that Australia, which is exceptionally rich in plant astringents, should import tan-bark and tannin extracts from South Africa; from the Australian point of view the paradox becomes painful when it is realised that a good deal of this imported material is derived from varieties of wattle originally cultivated in South Africa from Australian seed! It appears from the *Journal* that a comprehensive survey of Australian sources of tannin has been accomplished, and that a small extraction plant has been erected for the investigation of barks from suitable species of Acacia and Eucalyptus, and also from mangroves. To these should certainly be added a number of species of Callitris, notably *C. calcarata*, which is so widely distributed on waste hilly land and 'pine ridges' throughout the eastern States of Australia. In spite of such investigations, one fears that the economic production of tannins in Australia will continue to be handicapped by the disparity between the wage accepted by South African bark-strippers and that required by the Australian 'bush-whacker' for the same work.

The almost complete dependence of Australia on other countries for the supply of liquid fuels has led to a consideration of the low-temperature distillation of coal and shale, but on account of the general attention which is being devoted to this matter in other countries, it is not considered justifiable by the Council to undertake researches of the kind in Australia. No doubt current work on the utilisation of brown coal as a basis of liquid fuels will be followed in Australia with equal interest. An inquiry is also being made into the reasons underlying the economic failure of the Australian shale-oil industry. Researches on the production of power alcohol are at present limited to experiments which are being conducted under the supervision of Prof. N. T. M. Wilsmore, dealing with the hydrolysis and fermentation of the commoner Australian hardwoods.

It is evident from a consideration of this interesting new publication that the Commonwealth Council for Scientific and Industrial Research is making encouraging progress with the multifarious problems presented by this isolated and fallow land-mass of the southern hemisphere, which until recently has remained free from the disturbances and developments following in the train of permanent civilised settlement. The future record of the Council's activities should be full of interest to workers in all branches of science.

JOHN READ.

The Centenary of Marcelin Berthelot.

FRENCH chemists will be supported by their colleagues of many nations in the forthcoming celebration of the centenary of the birth of Pierre Eugène Marcelin Berthelot, the famous Parisian chemist whose researches, particularly those dealing with thermochemistry and with the synthesis of organic compounds, were as revolutionary—rather, as evolutionary—in their effect on the aims and outlook of chemistry as those of Lavoisier.

Berthelot was born in the Place de Grève, now Place de l'Hôtel de Ville, on Oct. 25, 1827, and died, also in Paris, on Mar. 18, 1907. The centenary celebrations commence on Sunday evening, Oct. 23, with a reception of the members of the official delegations in the Salons of the Sorbonne. On the following day the guests will be present at the opening of the exhibition of Berthelot souvenirs in the Faculty of Pharmacy, and will visit the savant's monument and laboratory at the Collège de France. There will follow a reception at the Hôtel de Ville, and a commemorative assembly at the Sorbonne.

On Tuesday, Oct. 25, the proceedings will commence with a ceremony at the Panthéon; the delegations will also attend a banquet at the Palais de Versailles and a soirée at the Théâtre National de l'Opéra. On Wednesday, Oct. 26, the foundation-stone of the "Maison de la Chimie" will be laid, lunch will be taken at Chantilly, there will be a reception by the Institut de France, and the celebrations will terminate with a reception in the Palais de l'Élysée by the President of the French Republic. The arrangements are being made under the presidency of M. Paul Painlevé. The "Maison de la Chimie," which is to be erected in Berthelot's honour, will provide a centre at which various international committees may establish their bureaux; it is intended also to provide a library, and suitable accommodation for gatherings of an international character.

Berthelot's contribution to scientific progress was amazing in its extent, marvellous in its accuracy, logical in its prosecution, clear in its expression, and far-reaching in its effects. Only in 1843, Berzelius had expressed little hope of the synthesis of more than a few exceptional organic compounds; the barrier between mineral chemistry and the chemistry of living things was still not only real, but also apparently permanent. Berthelot's synthesis of ethyl alcohol, formic acid, methane, ethylene, acetylene, and benzene destroyed that barrier with a completeness which has been emphasised by the subsequent systematic architecture and construction of the wonderful edifice of synthetic organic chemistry as it exists to-day. Evidently Berthelot realised something of the proportions of that edifice when he said "Le domaine où la synthèse chimique exerce sa puissance créatrice est plus grand que celui de la nature actuellement réalisé." Out of an observation of the sluggishness of the formic acid synthesis there developed an extensive series of investigations on thermochemistry, a subject in which considerable progress had already been made by Thomsen and others; recognition of the principle of mass action can be traced to Berthelot's work on the interaction of glycerol and acids; the fixation of nitrogen interested him, and it is noteworthy that, in the face of considerable criticism, Berthelot asserted that free nitrogen could be assimilated by plants. He was also the first to ascribe this power to the activities of bacteria in the soil. In the latter half of his life, Berthelot took an active interest in public affairs. Thus, during the siege of Paris in 1870, he became president of the Scientific Committee of National Defence, an appointment which led directly to his systematic study of explosives and the theory of explosions, and to a new conception—that of the detonation wave. Later he became Minister of Public Instruction and then Minister of Foreign Affairs.

The dominant aim of Berthelot's life was the discovery of truth and the service of mankind. It was fitting that the medal struck in his honour on his seventy-fifth birthday should have borne the inscription, "Pour la Patrie et la Vérité." It is quite impossible in these columns to express in any but the most general and colourless terms the debt which human progress owes to Marcelin Berthelot. Those who, without studying the great number of his original papers, desire to know more both of the man and of his work would do well to refer to Prof. H. B. Dixon's Berthelot Memorial Lecture (*Journal of the Chemical Society*, **99**, 2353; 1911), to a longer notice by M. Émile Jungfleisch (*Bulletin de la Société Chimique de France*, 1913, 260 pp. separately paginated), to a brief article by Prof. Camille Matignon (*Chimie et Industrie*, **16**, 3; 1926), and to an appreciation by Dr. C. Graebe (*Berichte der Deutschen Chemischen Gesellschaft*, **41**, 4805; 1908).

Obituary.

Prof. Adrian Stokes.

The death of Dr. Adrian Stokes, Sir William Dunn professor of pathology, of Guy's Hospital Medical School, University of London, has robbed pathology, and therefore medicine, of one who, though he had already accomplished much, had not yet reached the height of his powers, and his loss, at the early age of forty, is the more poignant because of the tragic circumstances which surround it.

Adrian Stokes was the youngest son of Mr. Henry John Stokes, and was born at Lausanne in 1887. There was a strong medical tradition in the family, for many of his forbears had left names to conjure with in Irish medicine. At Trinity College, Dublin, where he graduated in 1910, he early gave promise of brilliance, for he not only gained numerous academic distinctions, but he was also a keen athlete and was a worthy member of one of the strongest cricket elevens that has represented his Alma Mater.

After doing the usual house appointments, Stokes spent eight months at the Rockefeller Institute in New York, and then returned to Dublin where he joined the staff of Prof. O'Sullivan. Henceforth he devoted himself whole-heartedly to the study of pathology and bacteriology, and he had become an expert in laboratory technique when the War broke out in 1914. He at once obtained a commission in the R.A.M.C. and served in France throughout the War. Although actually attached to a casualty clearing station as a specialist in pathology and bacteriology, Stokes took the broadest view of his duties and responsibilities. He equipped his motor cycle and sidecar with an incubator, setting up what was in effect the first mobile laboratory in France, and his work did much to restrict the incidence of typhoid fever in the early days of the War.

Of the original work which Stokes carried out during this time, his investigations into the cause and mode of transmission of spirochætal jaundice was probably the most important. He identified the spirochæte and demonstrated its presence in the bodies and urine of trench rats, a discovery which led to the suppression of what might have become a very serious epidemic. But it was not only in his own particular branch that Stokes did brilliant work. He was the inspiration of the mess in which he lived. Full of energy and ingenuity, he not only lent a hand wherever one was required, but also he tackled the problems of others and applied his knowledge of laboratory technique to solving their difficulties. He kept himself up to date in the various new methods of treatment and, as soon as he was convinced of their superiority, he never rested until they had been adopted in his immediate vicinity. 'Brass hats' were to him the means of obtaining what he felt was necessary for the good of the sick, gassed and wounded, and his vehement, but clear and cogent, demands for apparatus, drugs, etc., were very rarely unsuccessful. All this he effected while maintaining his own special department at the height of efficiency. Those who served with him aver that he did more than any other single individual to improve the medical treatment of the troops and to diminish wastage.

On demobilisation in 1919, Stokes was appointed to the chair of bacteriology and preventive medicine at Trinity College, Dublin, but in 1920 he was invited by the Rockefeller Foundation, who had been greatly impressed by his work on spirochætal jaundice already mentioned, to join the West African Yellow Fever Commission. It happened that during his visit to Africa very few cases of yellow fever occurred, and his work was necessarily indeterminate.

In 1922, Stokes was appointed to the Sir William Dunn chair of pathology at Guy's Hospital Medical School in the University of London, which he occupied at the time of his death. He did much to improve the status of pathology in the School, and he was tireless in his efforts to arouse interest and to stimulate research. Intensely practical in his teaching, he succeeded in attracting brilliant students, and, given the time, he would have created a school of pathologists keen to tackle problems whose solutions might lead to advances in medicine.

In April of this year Dr. Beeuwkes, the head of the Rockefeller West African Yellow Fever Commission, asked for Stokes's help, for the problem of yellow fever in West Africa was little nearer solution than it had been in 1920. Indeed, it was still uncertain whether it was identical with the yellow fever of South America. The latter disease is carried by *Stegomyia fasciata*, the common domestic mosquito, and Noguchi has described a leptospira as the causative organism. Stokes obtained leave of absence from Guy's for six months and sailed for Lagos in May. He was not particularly hopeful of succeeding where others had failed, and his first letters spoke of negative results. In July the outlook was brighter, and in the middle of August he wrote that he had succeeded in transmitting the disease from the human patient to monkeys, both by blood infection and through the medium of mosquitoes. No leptospiræ had been found, and he was satisfied that the cause had not yet been isolated. He was then engaged in the microscopical examination of infected mosquitoes in serial section. "It is infuriating to know that one has the virus under one's eyes and cannot see it," he wrote at that time.

Then on Sept. 16 came a cable to say that Stokes was seriously ill. He was removed that day to the European Hospital, where he died of yellow fever on Sept. 19. How he contracted the disease is not yet certain, but it would appear highly probable that he infected himself accidentally in his laboratory. Time alone can show the value of his work on the disease to which he fell a victim; but if, as appears certain, he has helped materially towards the discovery of the cause of yellow fever in West Africa, he would not have counted the cost.

In Stokes's public and private life, transparent honesty and sincerity irradiated his every word and every action ; outspoken and candid, he never left any doubt as to his meaning and 'to beat about the bush' was foreign to his nature. His energy and his capacity for work were amazing, and all the more so when one remembers that his greatest enemy was insomnia, and that for him five hours was an unusually good night's sleep. As a teacher, he preached the gospel of scientific truth with an earnestness born of conviction. His students absorbed from him the right critical attitude towards their work, and the best of them became infected with his own zeal for research. He was generous to a fault, and many a lame dog was helped over a stile without ever knowing whence his help had come. An Irishman by everything but the accident of his birthplace, he loved his country as deeply as he hated those whom he regarded as being responsible for her unhappy state, which was a source of real grief to him.

Stokes died in harness, as he would have wished to die, but his premature death will be widely mourned by all who are interested in the advancement of medical knowledge, and especially by those who were privileged to come into intimate contact with a personality so vigorous, so stimulating, and so kindly.

T. B. J.

We regret to announce the following deaths :

Prof. Svante August Arrhenius, For. Mem. R.S., of the Nobel Institute, Stockholm, from which he received the Nobel prize for physics for 1903, on Oct. 2, aged sixty-eight years.

Prof. Willem Einthoven, For. Mem. R.S., professor of physiology in the University of Leyden, and Nobel laureate for physiology for 1924, on Sept. 28, aged sixty-seven years.

Dr. George Andrews Hill, senior astronomer at the U.S. Naval Observatory, Washington, on Aug. 29, aged sixty-nine years.

Prof. A. Liversidge, F.R.S., emeritus professor of chemistry in the University of Sydney, on Sept. 26, aged seventy-nine years.

Dr. H. D. Thompson, for more than thirty years professor of mathematics at Princeton University, who was known for his work on hyperelliptic functions and on geometry, aged sixty-three years.

News and Views.

The annual general meeting of the Australian National Research Council was held in Melbourne on Aug. 25–26. Particular attention was given to the financial position of the Council in relation to present and future work. The offer of the Carnegie Corporation to provide a sum of £5000 as the nucleus of a research fund was accepted with most cordial thanks, and with this sum and more than £1000 available from other sources, such a fund was formally instituted. A strong committee was appointed to take action for securing additional contributions from Australian sources, and it is hoped that before long the Council will be in a position to give considerable aid to Australian workers in pure science. Amongst several satisfactory reports on the year's work was one from the Anthropology Committee outlining the progress made since the initiation of the Department of Anthropology in the University of Sydney. This step followed upon a resolution by the second Pan Pacific Science Congress of 1923 and was made possible by contributions from the Commonwealth and State Governments and the Rockefeller Foundation. The new Department is now in full swing and is taking active steps to organise investigations both on the mainland and on the neighbouring Pacific islands. The following new members were elected to the Australian National Research Council, the total membership of which may not at any time exceed 100 : Mr. C. R. P. Andrews (Director of Education, Western Australia) ; Prof. A. R. Radcliffe Brown (Anthropology, University of Sydney) ; Prof. A. N. S. H. Burkitt (Anatomy, Sydney) ; Prof. A. J. Ewart (Botany, Melbourne) ; Dr. W. A. Hargreaves (Government Chemist, South Australia) ; Prof. J. W. Paterson, (Agriculture, Perth); and Dr. H. R. Seddon (Veterinary Research Station, New South Wales).

The Trustees of the Commonwealth Science and Industry Endowment Fund in Australia are this year making £1250 available in small grants for the assistance of scientific workers in Australia. The lines which will be followed in making the grants will be similar to those which have been proved to be satisfactory by the Department of Scientific and Industrial Research in Great Britain. The Commonwealth Fund has an invested capital of £100,000, and it is provided by Act of Parliament that the interest from it shall be employed for the dual purposes of training students in the methods of scientific research and in providing assistance to persons engaged in research, irrespective of whether their work has an obvious practical application or not. At present, the income is being devoted mainly to the first object, but as time goes on it is expected that an increasing sum will be available annually for distribution in grants.

Prof. J. A. Prescott, professor of agricultural chemistry at the Waite Institute, University of Adelaide, has been appointed adviser on soils problems to the Commonwealth Council for Scientific and Industrial Research. Prof. B. T. Dickson, of Macdonald College, Quebec, has been appointed chief mycologist to the Council and will take up his duties in Australia towards the end of the year.

The interest in the relationship between science and religion, which was revived by Sir Arthur Keith's address to the British Association on the descent of man, has been further stimulated by the sermon preached by the Bishop of Birmingham in Westminster Abbey on Sept. 25, and the opinions of eminent divines thereon which have been collected by the *Morning Post*. As a further reaction, the Sociological Society, aiming at resolving the conflict in a higher synthesis, has arranged a series of addresses expounding the 'sociological approach' to religion in which a 'higher' science, accepting the data of a 'lower,' will deal with the religious process as a striving after a purpose which renews itself from generation to generation in purifying and ennobling man's life in its quest for mastery of self and the environment. The series of addresses will be opened on Oct. 18 by Sir Francis Younghusband, president of the Society, who on this and the succeeding Tuesday will deal with what is termed the 'attack' on religion and the reply, though no actual attack has been made by science. He will be followed on succeeding Tuesdays by Mr. Farquharson, Dr. Saleeby, and Mr. V. Branford. The addresses will be delivered at 1.15 P.M. in All Hallows Church, Lombard Street.

THE tornado which caused so much damage and loss of life at St. Louis on Sept. 29 appears to have been a typical example of the most violent of all types of atmospheric vortex. Along the narrow strip of country—generally less than a quarter of a mile wide—visited by a tornado, destruction is generally complete, for no building can withstand the enormous pressure exerted by the winds, which are believed to exceed a speed of 200 miles an hour; moreover, the reduction of statical pressure in the central core is so great that buildings, which tend to retain air at pre-existing pressure, frequently burst. Tornadoes reach their fullest development in the United States, particularly in the great lowlands east and west of the central and upper Mississippi and lower Missouri valleys. They generally occur to the south or south-east of cyclonic depressions that have, extending southwards from the centre, a pronounced 'trough,' often of V shape, separating warm moist southerly winds from the Gulf of Mexico from relatively cold westerly to north-westerly winds lying farther to the west, and normally arise a little to the east of the line of discontinuity which marks the boundary on the ground between the two wind currents. The tornado is clearly due to instability of moist air, and therefore occurs most often at that time of the year when conditions are most favourable for a steep vertical gradient of temperature, or 'lapse-rate,' that is, in the spring and early summer, when solar heating is becoming powerful and yet the upper atmosphere retains much of its winter coldness; however, unlike the far larger 'tropical cyclone,' it may occur in any month. St. Louis was the scene of one of the most famous tornadoes of the close of last century—that of May 27, 1896—but the recent storm appears to have been the more destructive of the two.

SEPTEMBER was in most parts of the British Isles an even wetter month than was August, the total rainfall in some places being three times the normal. At Kew Observatory the total was 4·50 inches, compared with 4·06 inches in August. It is interesting to note that the records of rainfall in London since 1812 show that in two previous years—1852 and 1903—a run of wet months began in June. In 1852 the last seven months of the year yielded 28·08 inches, and in 1903, 26·81 inches, whereas the normal for the whole year is between 24 and 25 inches. In neither of these years, nor in any year previous to 1927, did the combined totals for August and September exceed eight inches; consequently the total of 8·56 inches for the last two months is easily a 'record' since 1812.

THE immediate cause of the wet weather in September was the persistence of high atmospheric pressure in the neighbourhood of Greenland. This caused frequent cold north or north-east winds over the Arctic Ocean, and these encountered warm south-westerly winds brought up from low latitudes round the anticyclone between the Azores and Bermuda. Such winds carry with them much moisture, especially in early autumn, and the interplay of the two currents resulted in the formation of numerous depressions, which were carried eastwards across the British Isles by the upper winds from the west that prevail in temperate latitudes when there is a steep gradient of temperature from south to north. Moreover, the persistence of high pressure in the far north tended to prevent Atlantic depressions from wandering up into higher latitudes, and so allowing the Azores anticyclone to make those periodical excursions north-eastwards which are responsible for so many of our spells of dry sunny weather.

ON Oct. 3, the telephone service between Great Britain and Canada was opened and messages were exchanged by Mr. Baldwin and Mr. Mackenzie King and by representatives of the *Times* in London and in Toronto. It was stated that the conversations were heard very clearly. The route taken by the signals depends at present partly on American land lines. From London the signals go to Rugby by land line, whence they are transmitted by radio to Houlton, in Maine, some 600 miles from New York. From Houlton they go by land line to any Canadian city which is required. Canadian messages are transmitted by land line to New York, thence to Rocky Point, whence they are sent by radio to Cupar in Fifeshire. From Cupar, the signals travel by land line to London. There is no suitable radio station for the Great Britain-Canada service in Canada, and it is stated that no such station is contemplated.

CAPTAIN IAN FRASER complains, in a communication in the *Times* for Sept. 29, that many of the dwellers on eastern and southern seaboards of England have their broadcast reception spoiled by the Morse signals coming from ships. He does not ask that ships be forced to scrap obsolete apparatus, but he thinks that all new radio equipment for ships should be made so as to operate closely on their own wave-lengths and consequently not trespass on the band of frequencies allotted to broadcasting. It should not be difficult to obtain this by international agreement. Until recently practically all Post Office coastal stations for communicating with ships made use of synchronous spark telegraphy. The average range of stations like those at Seaforth, Fishguard, Niton, Cullercoats, and North Foreland is about 500 miles. With the spark system adopted, only 'broad' tuning is available, and consequently the waves emitted interfere seriously with users of crystal sets. The Post Office authorities are now substituting the more modern and more efficient interrupted continuous wave system of communication for the spark systems. This will be a boon to listeners-in at places like Seaforth and Cullercoats.

In the July number of *Electrical Communication*, a journal published by the International Standard Electric Corporation of New York, there is an instructive article on "European Telephony as affected by the International Telephone Committee." It is pointed out that the War was followed by the formation of many so-called international organisations which were, however, almost purely European. They cover a wide field of activity in commerce and industry. The organisations are concerned with railways, tramways, electric traction, sleeping cars, production and distribution of electricity, telephony, telegraphy, broadcasting, etc. The formation of these unions is attributed mainly to the idea underlying the creation of the League of Nations. In 1922, Mr. F. Gill first suggested international telephony. The outcome of this was the formation of a Comité Consultatif International—now known as the C.C.I. —for organising international telephony in Europe. It was hoped that the C.C.I. would become affiliated with the League of Nations, but when the proposal was made, Germany was not a member of the League and so the C.C.I. was incorporated into the International Telegraph Union. As the Union embraces the whole world, any country can now become a member of the C.C.I. on application. Mozambique and the Union of Sovietic and Socialistic Republics (U.S.S.R.) are now members. One of the main objects of the international committee is to secure uniformity of practice, but representatives of private industry are invariably consulted. The committee has also decided to establish in Paris a Master Standard Reference System, to enable the countries of Europe to standardise their telephone apparatus. Another question which has been discussed is the construction of a special type of underground cable for the purpose of interconnecting broadcasting centres in Europe. It is concluded that the C.C.I. has fulfilled and is fulfilling a useful function.

Exception has been taken by Mr. J. M. Crosthwaite, secretary to the Scottish Society for the Protection of Wild Birds, to a "few misapprehensions" which he alleges appeared in a paragraph dealing with the 'death' of the Wild Birds Protection Bill, in our issue of July 23. In a letter to the editor on the subject, he repeats, amongst several criticisms of the Bill which have no bearing on the paragraph in question, the misleading statement against which the paragraph protested, that "this Bill adopted the extraordinary principle of securing protection only for rare birds," while at the same time he admits that for five months, covering the most important part of the year, the breeding season, it prohibited the taking and destroying of *all wild birds*. Mr. Crosthwaite considers that birds were better off without this Bill, and supports his view by statistics showing that a larger number of species is included under the present County Council orders. But the effectiveness of the protection is more important than lists on paper, and in a matter of opinion most people will prefer to be guided by skilled naturalists and legislators, such as Viscount Grey of Fallodon, Sir Montagu Sharpe, the Council of the Royal Society for the Protection of Birds, and the experienced ornithologists who advised the Government, all of whom considered that the Bill would have protected British birds more efficiently than the present Acts. Mr. Crosthwaite states that "complaints are being received of the shooting of our song birds by Italians and other aliens resident in this country." This is a matter of interest which ought to be investigated, though it is difficult to see how Italians, granted they have obtained gun licences, could deplete the song birds of the country without trespassing on private property or breaking the ordinary laws of the land.

It is curious that in Great Britain, where comparatively little timber is grown, wooden poles are nearly always used for telegraph and electric power lines. In France, Germany, and other countries where forests abound, armoured concrete poles are now becoming the rule. The advantages of reinforced concrete over wood poles are that they are neater in appearance, last longer, and want little attention. Perhaps one of the reasons why there are so many wooden poles in Great Britain is that timber has been expensive for many years and it is advantageous to creosote it thoroughly so as to increase its life. Well-shaped poles also are only used. In a paper by T. Rich, published in the *Electrical Review* for Sept. 23, examples are given of the concrete poles used on the Continent. One reason which may have had weight in changing from wooden poles is that abroad the timber for poles seems to have been selected neither for appearance nor durability, and little use seems to have been made of preserving processes. In connexion with power transmission lines, the periodical painting of steel lattice masts seems to be a costly item. In France, since the War, there seems to have been continuous progress in the use of concrete supports, for distribution lines and poles of this type are seen in almost every part of the country. The poles are made on the ground in the open air and are carried to their destination by lorries. Many of the electric lighting companies have the right to put up lines along the roads at a small annual fee for each pole. Concrete posts have now been in use for several years. Owing to our climate we think that they might now in many instances be used advantageously in Britain.

The September issue of *The Scientific Monthly* mentions a remedy devised by Dr. James Couch, U.S. Department of Agriculture, for the irritation and eruption caused by poison ivy, which might be useful against other plant irritants such as *Primula obconica*. It consists in the free application by swabbing of a 5 per cent. solution of potassium permanganate. The resulting brown staining of the skin may be removed slowly by soap and water or quickly by the application of a 1 per cent. solution of sodium bisulphite. As a *preventive* of plant rashes, Dr. James M'Nair recommends the application of a lotion consisting of a 5 per cent. solution of ferric chloride in a mixture of equal parts of water and glycerin. It is washed on all exposed parts and allowed to dry.

PERSONAL exercise of the arts and crafts at home in preference to the mechanical output of the factory is to be welcomed with every sign of ardour. Therefore a hearty greeting is due to books which may aid teachers in making the young idea shoot. The University of London Press is issuing a Handicraft Series (1*s*. 6*d*. per volume) prepared by Mr. Frederick J. Glass, whom we also know as the author of the more ambitious work upon "Drawing, Design, and Craftwork," now in its second edition. Mr. Glass exhibits more than a trace of the talent of Walter Crane in his adaptation of ornament and in the style of its portrayal. It may be noted, that the diameter must, necessarily, pass through the centre (*vide* "Pewter Craft," p. 36), and that a circle measures more than three times its diameter in circumference (*vide* "Paper Craft," pp. 49 and 51). In commending the general style of the text, we may yet express our agreement with the author's reiterated statement, that practice and observation are more educative than a textbook. Without wishing to be unduly critical, we may, however, remark, that it is irritating to be told frequently that it is "needless to say" so-and-so, when obviously so-and-so follows. But we must offer cordial approval of the illuminating notes upon the use of colour.

THE personal friends and colleagues of the late Prof. Adrian Stokes have decided to establish some form of permanent memorial in recognition of the man and his work. They feel that the endowment of medical research, through the establishment of a Stokes Research Fellowship or Studentship, which is at present under consideration by the Medical School of Guy's Hospital, is the only form of memorial that would have met with his own approval, and they are anxious that the memorial should be worthy of one who lived and died for the manifestation of scientific truth. The Dean of the Medical School, Guy's Hospital, London, S.E. 1, will gratefully acknowledge any contributions to the fund.

WITH the opening of the 1927–28 session, the Institute of Metals takes possession of its new headquarters, which include an additional library and reading room, at 36 Victoria Street, London, S.W.1.

THE thirty-ninth Congress and Health Exhibition of the Royal Sanitary Institute will be held at Plymouth on July 16–21, 1928, under the presidency of the Right Hon. The Viscount Astor.

IN recognition of his valuable services to public health, Sir Ronald Ross, director-in-chief of the Ross Institute and Hospital for Tropical Diseases, has been awarded the Harben Gold Medal for the year 1928 of the Royal Institute of Public Health.

THE Kaiser-Wilhelm Institute for Anthropology was inaugurated in Berlin-Dahlem on Sept. 15 by Herr von Harnack, the president of the Kaiser-Wilhelm Gesellschaft. Prof. Eugen Fisher, the director of the new Institute, outlined the programme. In addition to the anthropological department, there are others devoted to heredity and eugenics.

SIR WILLIAM BRAGG will deliver a lecture on "Crystallisation" at the opening meeting of the 1927–28 session of the Institution of Chemical Engineers. The meeting will be held in the Institution of Civil Engineers, Westminster, on Friday, Oct. 28, at 6.30 P.M. There will be no charge for admission, but tickets (to admit two) can be obtained on application to the honorary secretary, Institution of Chemical Engineers, Abbey House, Westminster.

THE *Chemiker-Zeitung* for Sept. 14 contains a special 30-page supplement dealing with recent advances in three important branches of chemistry. These reports, which are very highly condensed, and contain copious references to original memoirs, will be found to contain valuable summaries of progress in the following subjects: the investigation of elements and their structure during the period 1923–26, by Prof. W. Herz; the petroleum industry in 1926, by Dr. R. Kissling; and industrial inorganic chemistry from 1924–26, by Dr. Bruno Waeser.

IN order to provide for the more speedy publication of contributions to the Faraday Society, the Council has decided that future volumes of the *Transactions* shall be published in twelve monthly parts of about 48 pages each. The first part will appear on Jan. 1, 1928, and will be followed by the others normally on the first of each month. In the case of those General Discussions the report of which extends over more than one part, two (or more) parts may for convenience be published simultaneously within one cover. The subscription to membership of the Society (including the receipt of the *Transactions*) will remain as before. The *Transactions* will still be available to non-members in the volume form or in parts as issued.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A principal of the Aston Technical College—The Chief Education officer, Education Office, Margaret Street, Birmingham (Oct. 17). A head of the chemistry department of the Rutherford Technical College, Newcastle-upon-Tyne—The Director of Education, Northumberland Road, Newcastle-upon-Tyne (Oct. 29). An assistant lecturer in water supply and sewerage in the University of Western Australia —The Agent-General for Western Australia, 115 Strand, W.C.2 (Nov. 1). A professor of organic chemistry, pure and applied, in the University of Sydney, New South Wales—The Agent-General for New South Wales, Australia House, Strand, W.C.2 (Nov. 9). A research officer at the Veterinary Laboratory of the Ministry of Agriculture and Fisheries at New Haw, Weybridge—The Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, S.W.1 (Nov. 30). A superintendent of weights and measures under the Sudan Government—The Controller, Sudan Government, London Office, Wellington House, Buckingham Gate, S.W.1.

Research Items.

Palæolithic Site at Rochettes, Dordogne.—In 1925, Mm. Courtier and Emetaz gave an account at the Archæological Congress at Grenôble of the excavation of a rock-shelter at Rochettes, immediately to the south of that explored by Hauser, which revealed a series of stratifications extending from the Lower Mousterian to the Upper Aurignacian, entirely undisturbed. In the *Bulletin de la Société d'Anthropologie de Paris*, 7me série, t. 7, fasc. 4-5-6, the authors describe further investigations on the site which have produced evidence of importance on three points. First, on the transition from Mousterian to Aurignacian. The lowest stratum (No. 6), of dark yellow sandy soil, contained implements including *racloirs* of La Quina type belonging to Early Mousterian. Above this was a stratum, also of a sandy soil, lighter in colour, with *coups de poing*, oblong *racloirs*, and bones of developed Mousterian type. Above, in the fourth stratum, characterised by hearths with carbonised bone, was an industry much less highly developed than that of the stratum below, with numerous flakes, which in character are comparable to the industry of the Early Aurignacian rock-shelter at Audi. That is, the fully developed Mousterian is here followed immediately by an undeveloped industry of an entirely different technique, which is to be regarded as Aurignacian. The site, therefore, gives indubitable evidence of the sequence of one industry to the other. The second point upon which the excavation furnished evidence is the occurrence of red ochre on a Mousterian site; a piece of this material showing two grooves made by a flint implement was found in the lowest stratum, which is taken to indicate that this material, used by the Aurignacians as pigment, was also employed by the Mousterians, though for what purpose is not known. In the fifth or upper Mousterian stratum was found a bear's tooth, grooved for suspension as an amulet. This also is unique in Mousterian culture, and must be added to the small number of objects of amuletic purpose belonging to this culture already known.

Ants and Aphids.—Observations on the relations ('trophobiosis') between ants and aphids have been made by H. Eidmann near Munich (*Biol. Zentralbl.*, Band 47, p. 537-556, 1927). Certain aphids over-winter in the nests of *Lasius niger*, and these ants appear to exercise a sort of control upon the time of the going out of the aphids from the nest on to the trees. The aphids are watched and guarded by special watcher ants—workers—which remain, as marking experiments have shown, the whole day near their protégés and return each day again to the same place. So long as the nights remain cold the aphids are brought back again into the nests of the ants. In summer when the aphid colony is very large and the nights are warm, the search by the ants for the aphids takes place after nightfall. The ants avoid daylight as much as possible, but nevertheless a watcher remains behind the whole day, even in bright sunlight, near each herd of aphids. The amount of food brought into a large colony of *Lasius niger* by its workers in their crops may amount to a litre of aphid honey during the summer.

Growth of Salmon.—In a paper entitled "Some Aspects of the Growth of Salmon in River and Sea as observed from Scale Examination of Dee (Aberdeen) and Spey Salmon 1921 to 1923 inclusive" (*Fisheries, Scotland, Salmon Fish.*, 1927, I. (March 1927)), Mr. W. J. M. Menzies summarises such conclusions as are warrantable on condition, calculated lengths and times of rapid and slow growth. Examination of condition, as represented by the relationship of weight to cube of length, shows that summer fish are fatter than spring fish, and that condition improves with age and length. A study of the calculated lengths reveals the fact that it is a general rule that the subsequent growth and behaviour of the parr and smolt are determined by the first year's growth. A poor first year parr makes poor growth throughout the river life; a good first year parr increases its advantage in the second year, and probably then migrates to the sea as a smolt. Spey parr and smolts are slightly longer than Dee parr and smolts. This dependence upon the first year's growth appears to be maintained also throughout the marine life. The slow growth period extends to April, during which month rapid growth begins and reaches a maximum in August. A check during rapid growth occurs in many fish in June and July. With the accumulation of further material, the Scottish Fishery Board will be in a position to review the final distribution of the complete hatch of a single season in either Dee or Spey.

The Size of Whales.—The literature of whales and whaling has been much added to of late, and five of these recent works are made the subject of an interesting article by Mr. J. J. Bell in the July issue of *The Quarterly Review*. While the greater part of the article is devoted to a review of "Pursuing the Whale" (Murray, 1926), a circumstantial account by Capt. John A. Cook of his whaling adventures, the chief scientific interest attaches to an incident in Mr. Bell's own experience. It has been very generally assumed that the Blue Whale (*Balænoptera musculus* (L.) = *B. sibbaldii* (Gray)) attains to much greater dimensions in the Antarctic than in the Arctic Ocean, and some naturalists tend to distinguish the southern form as a distinct race. Trustworthy data regarding the upper limit of this species in northern waters are therefore of value. Mr. Bell states that in northern Iceland he measured a specimen between perpendiculars and found it to have a total length of 86 feet. This measurement would place his example among the largest recorded from the Arctic. On the other hand, he also mentions receiving "the trustworthy account of a Blue Whale killed in the Antarctic, which measured 110 feet," a record which, if really trustworthy, would tend to support the view that a greater size is there attained by this species. Perhaps, however, the true solution is that suggested by Sir Sidney Harmer (*Proc. Zool. Soc.*, p. 1089; 1923), namely, that Blue Whales of the largest size have become practically extinct in the north on account of the long-continued intense whaling in those waters.

Beach Vegetation in the Philippines.—The classical work of Schimper on the beach vegetation of the Indo-Malayan region will always form the basis for any work of that kind done in this region. Schimper, however, does not discuss the ecological anatomy of the sandy beach species. Recent work by Raymond Kienholz (*Proceedings of the American Philosophical Society*, vol. 55, No. 5 (Supplement), 1926) is thus of interest because, apart from the distribution of the various species, the author has made a detailed study of the anatomy of a number of species in relation to the particular conditions of this beach environment. The beach is divided into three physiographic areas, each with its characteristic flora: (1) Sandy beach; (2) rocky headland; and (3) muddy flats, of which only the first two are considered in the present paper.

The sandy beach is characterised by creeping herbaceous forms, such as *Spinifex littoreus*, and *Ipomœa pes-capræ*, with a shrub-tree zone on the upper beach composed chiefly of *Scævola frutescens*, *Tournefortia argentea*, *Pandanus spp.*, and various trees. The flora of the rocky headland is derived partly from the sandy beach, partly from the interior forests. In both habitats evaporation is high, wind movement strong and steady. Intense sunlight, salt spray, and rapid drying out of the sand, together with the factors first mentioned, produce a severe environment, particularly as regards the water relations of the plants. The author considers that these severe environmental conditions have affected the habit and especially the leaf structures of the species. Leaves of the twenty-two species examined exhibit many xerophytic structures—leaves more than 350 microns in thickness, large quantities of water storage tissue, sunken stomata, and thick cuticle. Very detailed measurements are given of the various structures, which are illustrated by seven plates.

STORAGE AND TRANSPORTATION DISEASES OF VEGETABLES.—In No. 81 of the *Technical Bulletin of the Agriculture Experiment Station*, Michigan State College, Ray Nelson records some work he has carried on along lines similar to those followed by Franklin Kidd, Cyril West, and M. N. Kidd for the Department of Scientific and Industrial Research (see NATURE, vol. 119, June 4, p. 830). These latter investigators found that by controlling the storage atmosphere of living fruit through a reduction in the percentage of oxygen and an increase in the carbon dioxide, the storage life of the fruit could be lengthened. The present author now traces certain non-parasitic diseases, including black leaf speck of Crucifers, red heart of lettuce and cabbage, and surface pitting of potato tubers, to inadequate supplies of oxygen in the storage chambers, or to temperatures which prevent the utilisation of the oxygen present. He has been able to reproduce some of those diseases under controlled laboratory conditions, and comes to the conclusion that both the factors of air composition and temperature are important in causation. In some of his experiments the amount of oxygen in the atmosphere fell as low as 2·5 and 1·0 per cent. He suggests that the ultimate cause of those diseases is the liberation or accumulation in certain cells of some toxic substance resulting from the interaction of a hydrolytic enzyme and a glucoside, due to a deficiency of oxygen, one of the results of this interaction being an oxidation process causing the pigmentation characteristic of many of those break-down diseases. As a control measure, proper aeration of storage chambers is recommended. On the other hand, the Cambridge investigators found that a regulated atmosphere containing a constant 10 per cent. of oxygen and a corresponding increase in carbon dioxide gave the best results. As the research stands at present, there seems to be an optimum concentration of oxygen which slows up respiration sufficiently to give increased longevity to storage fruit and vegetables, but, if decreased, it may give rise to the various pathological symptoms incidental on sub-oxidation which the author describes.

THE RAINFALL OF AUSTRALIA.—The rain map of Australia for 1926, published by the Commonwealth Government, contains, as usual, maps showing the monthly fall and departures from the normal. It is based on the records of some 1300 stations. During the year, as in the previous four years, less than one-quarter of the continent had rainfall above the average. In the south-west of Western Australia the fall was the greatest on record. There were also good rains in the northern and central areas of New South Wales and in south-eastern Australia. But some parts of the continent experienced serious drought. In Queensland the drought which began in 1925 became more pronounced and had disastrous results, causing great loss of sheep, a failure of cereals, and a much diminished output of sugar. In South Australia the rain was below the average, but on the whole there was no serious shortage. In New South Wales, Victoria, and Tasmania the rainfall conditions were generally favourable and local deficiencies were only slight.

PTOLEMY'S TORTOISE MARSHES.—Much speculation has ranged round the identity of Ptolemy's Tortoise marshes (*Chelonitides paludes*), which he placed on his river Gir in lat. 20° long. 49°. Various authorities have identified the marshes with Lake Melghir in southern Algeria, Lake Fittri in the Wadai region, or the salt lake of Merga in lat. 19° 3′, long. 26° 19′. In a paper in the *Geographical Journal* for September, on the problems of the Libyan desert, Dr. J. Ball discusses these identifications. He visited Lake Merga, and cannot reconcile it with Ptolemy's description of the Tortoise marshes. In its place he suggests the Kufra oasis. Correcting Ptolemy's positions in terms of his known errors, Dr. Ball finds that Kufra is in close agreement with the Tortoise marshes. Further, he points out that the Kufra is an extensive tract of low ground with many lakes and salt marshes and has distinctly the form of a valley. This might easily have suggested a series of marshes formed by a river coming from the south-west. Ptolemy might have mistakenly inferred that the river reached the Mediterranean.

FIRE RESISTANT CONSTRUCTION.—Special Report No. 8 of the Building Research Section of the Department of Scientific and Industrial Research (London: H.M. Stationery Office, price 1*s*. 6*d*. net.), deals with the effect of high temperatures on building materials generally, and describes experiments carried out in the endeavour to elucidate and then to improve the fire-resisting properties of concrete. It is shown that by the addition of a pozzolanic material to Portland cement, a very considerable absorption of the lime (set free on hydration of the cement) can be brought about. The presence of the lime is shown to be the most serious factor in the deterioration of cement under fire. The work described has been carried out over a period of two years, and the results are, therefore, considered to represent actual conditions fairly well. A report will be issued when the material has been under observation for five years. The report is well illustrated and provided with a bibliography, and it represents a very valuable addition to our knowledge of building materials.

THE GRAVITATIONAL CONSTANT.—A preliminary notice of a new determination of this quantity at the U.S. Bureau of Standards has been published by P. R. Heyl in the August number of the *Proceedings of the National Academy of Sciences*. The method employed was one in which a torsion balance is used dynamically. The attracting masses were steel cylinders, each weighing 66 kg., and the oscillating system consisted of two 50 gm. platinum balls on the ends of a light rod of aluminium, which was suspended by a thin tungsten filament wire a metre long; elaborate precautions were taken to ensure that the metal was homogeneous. The time of oscillation was 29 minutes when the gravitating bodies were as near as possible, and rose to 34·5 minutes when they were separated. The five values of G obtained in 1926 differ amongst themselves by less than one part in a thousand, and yield a mean value of $6{\cdot}664 \times 10^{-8}$.

The International Congress of Physics.

During the week commencing on Sept. 11, a meeting of exceptional interest was held at Como in Italy, in commemoration of the first centenary of the death of Volta. It is probable that no previous congress has ever brought together so representative a gathering of physicists, for, with very few exceptions, the leading authorities in all branches of the subject attended the meeting and gave short addresses on developments in their own fields. Fourteen countries were represented by about sixty guests who were invited to attend the congress; these included amongst their number eleven Nobel laureates. The meeting will surely be remembered as a historical one.

The programme was divided into five general sections, one for every day:

(1) Researches into the structure of matter.
(2) Electricity and its applications.
(3) Electrical theory.
(4) Physical optics.
(5) Theories of the structure of matter and of radiation.

On the sixth day, in the lecture-room of Volta at the University of Pavia, a résumé of the work which had been accomplished and of the problems discussed was presented by Prof. Lorentz representing the theoretical physicists and by Prof. Majorana representing the experimental physicists.

The scientific meetings at Como were followed by a visit to Rome. The members of the Congress were received by the Italian Premier, Signor Mussolini, who expressed his appreciation of the work which had been accomplished. Senator Marconi, who delivered an address in the Capitol on Volta's life and work, expressed the feelings of all who attended the conference when he congratulated the president, Prof. Majorana, and secretary of the Congress, Prof. Pontremoli, on the way in which the meeting was organised and conducted.

The following brief notes will indicate the trend of the discussions which took place:

Researches into the Structure of Matter.

The meeting was opened with a lecture by Sir Ernest Rutherford, on the structure of radioactive atoms and the origin of α-particles. Sir Ernest proposed a new theory which, introducing neutral particles around the nucleus, gave an explanation of many experimental facts. A general discussion followed, conducted principally by Prof. Lorentz. Prof. J. Franck of Göttingen gave afterwards a very interesting account of "Band Spectra and Chemical Phenomena," in which he put forward a new optical method of determining the energy of dissociation of normal or excited molecules.

Dr. F. W. Aston described his latest results with his improved mass spectrograph and the conception of the structure of nuclei to which they led. In his paper he referred to the theories of Sir Ernest Rutherford described above. Dr. Aston also announced the discovery of some new isotopes. Prof. Gerlach spoke about magnetic susceptibilities of gases; he developed the theory of the experiment of Stern and Gerlach, and announced that experiments made on susceptibilities of gases show conclusively that no quantisation of direction is present in diamagnetic gases. Prof. Cabren described the magnetic properties of the palladium and platinum groups and their significance in the theory of paramagnetism. Prof. Stern described a new method for studying the electrical and magnetic deflexion of molecular rays, and gave some account of experiments on the reflexion of hydrogen molecules at a highly polished plane surface. Prof. H. D. M. Bose presented some investigations on paramagnetism. Prof. W. L. Bragg gave a highly appreciated account of the diffraction of electromagnetic waves by crystals, and Prof. Smekal opened an interesting discussion on the structure of actual crystals. Prof. Langmuir described some very recent observations on the electrical discharge in gases at low pressure, and directed attention to important questions in this field. The Duc de Broglie spoke on the absorption by matter of Röntgen radiation, and Prof. Compton dealt with the action of radiations upon electrons.

Electricity and its Applications.

The discussion was opened with reports by Prof. Kennelly on the normal attenuation in electrical nets, by Prof. K. W. Wagner on electrical filters and reiterative conductors, by Prof. Boucherot on the utilisation of the cold water of the bottom of the ocean. Prof. Janet spoke on the construction of electrical machines, and Prof. Cotton described the great magnet now in construction at the laboratory of Bellevue, France, which is designed to give strong and extended magnetic fields and will require 100 kv. for its excitation. Prof. Tolman described his experiments on electrical effects due to mechanical movements of matter. Prof. Majorana demonstrated with experiments his method of transmitting speech by ultra-violet light, Prof. Wood gave an extremely interesting report on biological and physical effects produced by ultrasonic vibrations obtained with piezoelectric oscillators. The oscillator works at 500,000 periods and very curious effects are observed. In oil a very marked pressure of radiation is detected; a glass wire acted on by these vibrations gives high calorific effects, frogs and fishes are killed; the action of these ultrasonic vibrations were illustrated by means of slides, and many questions were put to Prof. Wood, whose work opens a very wide field for research. Finally, Prof. Brillouin gave an account of a problem of atmospheric electricity, and Prof. Alcobé presented a historical note on an electrical telegraph preceding the discovery of the cell.

Electrical Theory.

Prof. Lorentz, who received a great ovation, opened the discussion with a paper on some difficulties connected with the problem of rotating electrons. Prof. Planck discussed the difference of potential in diluted solutions, Prof. Corbino the theory of the voltaic cell recently proposed by him, and Prof. Hall the Volta-effect. Afterwards, Dr. Frenkel gave some very interesting views on the electronic theory of metals, and Prof. Grüneisen discussed the more recent experiments on thermal and electrical conductivities of metals. The theory of the Volta-effect and triboelectricity was also discussed in the report of Prof. Perucca. Prof. Ehrenhaft spoke on the physics of submicroscope matter, Prof. Lasareff on an electrical theory of vision, Prof. Amaduzzi on a peculiar example of photoelectricity.

Physical Optics.

Prof. Millikan reported on cosmic rays: his communication was followed with deep interest and gave rise to discussion by Sir Ernest Rutherford, Prof. McLennan, and others. Prof. La Rosa reported afterwards on the ballistic theory of light; his observations were criticised in a following lecture by Prof. Giorgi, who proposed also some new experiments as crucial tests between the Ritz-, Einstein, and Fresnel-Maxwell-Lorentz theories.

Prof. McLennan spoke on the spectrum of the aurora and our knowledge of the high atmosphere, Prof. Richardson gave an account of his work on the molecular hydrogen spectrum, Prof. Paschen dealt with some new methods of spectroscopic work, Prof. Duane with the character of the general X-radiation, Prof. Saha with the explanation of complex spectra as interpreted by undulatory mechanics. Prof. Zeeman gave afterwards a very brilliant and complete report on the emission of radiation in a magnetic field, and illustrated his account with many very interesting slides. Prof. Amerio closed the meeting with a report on solar radiation.

THE STRUCTURE OF MATTER AND RADIATION.

Prof. Sommerfeld dealt with the theory of metallic conduction and the Volta-effect interpreted by Fermi's statistics, Prof. Levi-Cività proposed a new theorem on adiabatic invariants, Prof. Debye gave an account of the recent work done by himself and his school on dielectrics and the dipole theory, Prof. v. Laue spoke on the influence of temperature on X-rays interference, Prof. Eddington on electrical conditions in stars, Profs. Straneo and Gianfranceschi on quantum theory.

Prof. Bohr gave a very clear and detailed report on the actual state of quantum theories: he illustrated the points of agreement and of discordance between the different theories and between theory and experiment, and closed his important speech with some philosophical observations on the atomic world. A general discussion followed, conducted by Profs. Born, Kramers, Heisenberg, Fermi, and Pauli, in which the actual situation of this branch of science was reviewed.

The Congress left a very deep impression on all who were privileged to be present, since it provided so complete a review of the more recent developments in all branches of physical science. The discussions were presided over by Prof. Majorana (president), and by Sir Ernest Rutherford, Profs. Lorentz, Millikan, and Cotton (vice-presidents). At the conclusion, a resolution was passed proposing that the committee which organised this Congress should be made permanent and endeavour to arrange similar meetings in future years.

Annual Visitation of the Rothamsted Experimental Station.

AT the invitation of Lord Clinton, chairman of the Lawes Agricultural Trust, a number of visitors inspected the Rothamsted station and laboratories at Harpenden on Sept. 29.

Lord Clinton, in welcoming the visitors, briefly outlined the purpose of the station, and its special opportunities in the present world-wide agricultural depression. The remedy of reduced production, he said, is a cry of despair, and the sounder way of meeting the situation is to intensify the level of production, at a relatively reduced cost.

Sir John Russell, director, reviewed in detail the recent activities of the station. The new glass houses erected with the help of a generous donation from the International Education Board, Rockefeller Foundation, are in use for the study of plant diseases and the preliminary tests of new fertilisers and accessory materials. The periodical conferences held at the station are proving very successful; they are of two kinds: (*a*) practical, when some specific agricultural problem is discussed by farmers and the station staff, and (*b*) expert or technical, in which overseas and foreign workers participate, when the position of some fundamental inquiry, as for example soil reaction, is discussed. These conferences not only serve to disseminate widely the latest developments, but are also of great help to the station in drawing up a well-balanced programme of work.

The subject of crop production and improvement naturally bulks largely in the programme of the station. The improved method of seed inoculation for lucerne is enabling the crop to be grown outside the hitherto restricted south-east area of England, and the demand from farmers for cultures is still increasing. Progress has also been made in the study and control of the elusive factor of quality in certain crops. Prominent among these are sugar-beet, potatoes, and malting barley, in which respectively the sugar content, the behaviour on cooking, and the character of the malt are as important as the actual yield. At least three-fourths of the malting barley used is home grown, but owing to the influence of nitrogen content on the malting quality, farmers are loth to use nitrogenous manures to increase the yield. Co-operative experiments with the Institute of Brewing have shown, in general, that moderate top dressing of nitrogenous fertilisers can be safely used, and the problem is now being pushed a stage further, by biochemical studies of the grain.

Thanks to mathematical study of the statistical requirements of field plot experiments, it has been possible to use greatly improved systems of replicating and randomising the plots, with a concomitant increase in accuracy of the data of yield. At the same time, by keeping the plots under close examination during the growing season valuable physiological and ecological information is being secured, both on the relation of soil and climatic factors to plant growth, and on the connexion between the life-history of the plant and its final yield.

In the field, the comparative effects of alternative systems of cultivation are being directly investigated on a variety of crops. Extended use is being made of the new dynamometer in studying the production by implements of a good soil tilth, and the field observations are being closely followed by laboratory studies of the physical and physico-chemical soil properties concerned.

Progress has been made in producing synthetic farmyard manure, and the process, developed originally in the Rothamsted laboratories, is now in use all over the world. It has been found of great value in the Empire, particularly in regions where surplus straw, etc., has hitherto been wastefully burnt. In connexion with the purification of the effluent from sugar-beet factories, the earlier Rothamsted work on sewage purification in a filter bed is proving useful.

The new glass houses have enabled the station to add the study of tropical and subtropical plant diseases to its activities. The general endeavour in this work is to aim at preventive rather than curative measures. Nevertheless, the necessity for trustworthy insecticides and fungicides to deal with heavy infestations of disease or pests will remain almost indefinitely, and therefore quantitative investigations on the relation of chemical composition to toxicity, especially of insecticides, are being continued.

Forthcoming Books of Science.

Agriculture, Forestry, and Horticulture.

Edward Arnold and Co.—A British Garden Flora: A Classification and Description of the Genera of Plants, Trees, and Shrubs represented in the Gardens of Great Britain, with Keys for their Identification, Lt.-Col. J. W. Kirk. *Ernest Benn, Ltd.*—The Diseases of Sugar-Beet, Dr. O. Appel, translated and edited by R. N. Dowling; Electro-Farming, R. B. Matthews. *A. and C. Black, Ltd.*—Plant Growth and the Soil in relation to Foodstuffs, G. N. Pingriff. *Chapman and Hall, Ltd.*—Manures and Manuring, F. E. Corie. *J. B. Lippincott Company.*—Elements of Livestock Judging, W. W. Smith; Animal Husbandry Enterprises: a Textbook on the Basis of Enterprises, W. C. Coffey, W. H. Smith, H. W. Nisonger, L. Wermelskirchen, H. P. Davis, S. Dickinson, K. C. Davis. *Macmillan and Co., Ltd.*—Text-Book of Tropical Agriculture, Sir H. A. A. Nicholls, second edition, revised by J. H. Holland. *Oliver and Boyd.*—The Potato: Its History, Varieties, Culture, and Diseases, T. P. McIntosh. *Oxford University Press.*—Grain, S. J. Duly. *Sir Isaac Pitman and Sons, Ltd.*—Seed Testing, J. S. Remington.

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University and Educational Intelligence.

THE Sir John Cass Technical Institute of Aldgate, London, offers in its prospectus for 1927–28 a wide range of choice of subjects. Among the more specialised courses are those in gas manufacture and analysis, brewing and malting, and petroleum technology. There is an important department of metallurgy in which students are prepared for the University of London degree of B.Sc. (Engineering) in metallurgy. There are also a department of arts and crafts (including silversmithing, jewelry, and engraving), trade classes, and a nautical school. The new session will be opened on Oct. 10, when Sir William Beveridge will give an address.

THE International Institute of Intellectual Co-operation issues quarterly a *Bulletin of Scientific Relations.* The issue of August last contains notices of recent and forthcoming international congresses, newly constituted scientific organisations, activities of the scientific relations branch of the Institute, and several special articles and reviews. A description is given of the new "Fondation Edmond de Rothschild," the object of which is to establish at Paris an institute of biology for the investigation of the physico-chemical basis of life. For this purpose a sum of thirty million francs has been placed at the disposal of a council of twenty-four, comprising delegates nominated by learned societies and members co-opted by the already existent Rothschild foundation for physics and chemistry. The founder holds that of late years the study of micro-organisms has tended to distract the attention of biologists from pursuing the lines of research in physico-chemical reactions associated with the name of Claude Bernard. The new institute will afford facilities for the resumption of research on those lines.

THE place of university extension work in State universities in the United States is thus defined in the 1927 "Catalogue" of the University of Colorado: the University's first duty is to teach the students upon its campus, the second to foster and develop the spirit of research on the part of the members of its faculties, the third to render to the State at large such public service as may lie within its power. This third function is exercised through the extension division which is the official representative of the university to its constituents, the whole citizenship of the State. The work of the Colorado University extension division is organised in two departments, those of instruction and of public service. The former has bureaux of correspondence instruction, of class instruction and of visual instruction (chiefly for schools and churches), home-reading courses, and lecture courses. The 'class instruction' is for teachers, club members, business men, industrial workers, and any other group having a common interest. It is comparable with the university tutorial classes of England. The department of public service has bureaux of business and government research, community organisation, library extension, and research and extension in journalism, and it conducts high school visitations and helps to operate a high school debating league. The business research activities include the making of industrial surveys and retail cost surveys, and the conduct of research on various problems connected with public utilities. 'Community organisation' stands for services in connexion with such matters as public health, child welfare, recreation, and juvenile delinquency. The University Library serves as a reference library for the people of the entire State. The journalism bureau is operated jointly by the Extension Division and the editorial association of the newspapers of Colorado and serves as a common clearing house of information for them.

Calendar of Discovery and Invention.

October 9, 1837.—Under this date, Caroline Fox records a conversation with Davies Gilbert, who "gave us interesting accounts of his interviews with George IV., William IV., and the Queen; the two former he visited in right of his Royal Society's Presidentship to get their signatures. To George IV. he went and requested that he would confirm the patent as his royal predecessors had done, and pointed out to him several of their signatures. 'Would you show me Evelyn's,' said the King. 'I have lately been reading his memoirs with great interest.' Davies Gilbert found and showed it, when the King remarked, 'He was the founder of the Royal Society.' Gilbert said it was His Majesty Charles II. who gave the first charter. 'Very true,' replied the King, 'but that was only *ex officio*; any man who had happened to be in his situation would have done that; but Evelyn was the real founder, you may depend upon it.'"

October 9, 1856.—A few days before the first Atlantic Telegraph Company was registered, Bright and Whitehouse, at the offices of the Magnetic Company in Old Broad Street, London, on Oct. 9, 1856, showed Morse that signals could be sent at the rate of 272 per minute through 2000 miles of the Company's wire between London and Manchester.

October 10, 1846.—Within seventeen days of the discovery of Neptune by Galle, the Liverpool brewer Lassell, on Oct. 10, 1846, with the aid of a fine two-foot reflector, discovered its single satellite. The study of this satellite has enabled the mass of Neptune to be calculated with great exactness.

October 11, 1867.—The modern typewriter had its birth in Milwaukee. It was the result of the joint labours of Sholes, a collector of customs, editor and printer; Soule, a farmer and printer; and Glidden, a farmer and inventor. Their machine was patented on Oct. 11, 1867, and after many improvements its manufacture was taken up by the Remington firm of gun-makers.

October 12, 1788.—One of the earliest recorded steamboat trials was made in America on Oct. 12, 1788, when one of Fitch's boats fitted with an engine having a cylinder 12 in. in diameter carried thirty passengers from Philadelphia to Burlington, a distance of about 20 miles, in 3 hours 10 minutes. Ten of the passengers afterwards signed a certificate declaring: "We, whose names are hereunto subscribed, do certify that we have been in John Fitch's steamboat of 60 ft. in length in the river Delaware, when the said boat was propelled through the water with a considerable degree of velocity regularly and without any manual labour, by the force of steam, and we are clearly of opinion that the rivers of America may be navigated by the means of steamboats, and that the present boat would be very useful on the western waters."

October 13, 1877.—The first experiment in street lighting by electricity in France was made on Oct. 13, 1877, when the Place de l'Opera in Paris was lighted by a series of 'Jablochkoff candles.' Jablochkoff was a Russian electrician who died in poverty in 1894.

October 14, 1788.—Patrick Miller's steamboat experiments in Scotland were contemporary with those of Rumsey and Fitch in America; and it was on Oct. 14, 1788, that a trial was made, on Dalswinton Loch, with one of Miller's double-hulled boats fitted with a steam engine by Symington. The enterprise being abandoned, the engine was removed to Miller's library and sixty-five years later was saved from the scrap heap by Bennet Woodcroft. It is now in the Science Museum, South Kensington. E. C. S.

Official Publications Received.

BRITISH.

The Medical and Scientific Archives of the Adelaide Hospital. No. 6 (for the Year 1926). Pp. 62. (Adelaide.)

Ceylon Administration Reports for 1926. Part 4: Education, Science and Art (E). Administration Report of the Director of the Colombo Museum for 1926. Pp. E9+5 plates. (Colombo: Government Record Office.) 55 cents.

Federated Malay States. Annual Report on the Department of Agriculture, S.S. and F.M.S., for the Year 1926. By A. S. Haynes. Pp. ii+17. (Kuala Lumpur: Government Press.)

The Institute of Chemistry of Great Britain and Ireland. Fire Risks in Industry. By Alec M. Cameron. Pp. 21. (London.)

Memoirs of the National Museum, Melbourne. No. 7. Pp. 158+14 plates. (Melbourne: H. J. Green.)

Catalogue of Indian Insects. By R. Senior-White. Part 12: Tabanidæ. Pp. 70. (Calcutta: Government of India Central Publication Branch.) 1.12 rupees; 3*s*.

Second and Final Report of the Royal Commission on Mining Subsidence. (Cmd. 2899.) Pp. 68. (London: H.M. Stationery Office.) 1*s*. 3*d*. net.

Aeronautical Research Committee: Reports and Memoranda. No. 1091 (Ae. 270): Wind Tunnel Tests with High Tip Speed Airscrews. The Characteristics of a Bi-Convex Aerofoil at High Speeds. By Dr. G. P. Douglas and W. G. A. Perring. (A.3.d. Airscrews, 99.—T. 2434.) Pp. 21+9 plates. 1*s*. net. No. 1095 (Ae. 274): Theoretical Relationships for an Aerofoil with Hinged Flap. By H. Glauert. (A.3.b. Aerofoils with Flaps or Warped, 29.—T. 2458.) Pp. 13+12 plates. 9*d*. net. (London: H.M. Stationery Office.)

Canada. Department of Mines: Mines Branch. Abrasives: Products of Canada, Technology and Application. Part 1: Siliceous Abrasives. Sandstones, Quartz, Tripoli, Pumice and Volcanic Dust. By V. L. Eardley-Wilmot. (No. 673.) Pp. xi+119. (Ottawa: F. A. Acland.) 30 cents.

Report for 1926 on the Lancashire Sea-Fisheries Laboratory at the University of Liverpool and the Sea-Fish Hatchery at Piel. Edited by Prof. James Johnstone. Pp. 167+10 plates. (Liverpool.)

List of the Officers and Fellows of the Chemical Society. Corrected to July 31st, 1927. Pp. 190. (London.)

Quarterly Journal of the Royal Meteorological Society. Vol. 53, No. 223, July. Pp. 201-326. (London: Edward Stanford, Ltd.) 7*s*. 6*d*.

Memoirs of the Department of Agriculture in India. Botanical Series, Vol. 14, No. 5: The Indigenous Cotton Types of Burma. By T. D. Stock. Pp. 177-187+5 plates. 9 annas; 10*d*. Botanical Series, Vol. 14, No. 6: A Study of Fusaria Common to Cotton Plants and Cotton Soils in the Central Provinces. By Jiwan Singh. Pp. 189-198+3 plates. 5 annas; 6*d*. (Calcutta: Government of India Central Publication Branch.)

Bothalia: a Record of Contributions from the National Herbarium, Union of South Africa, Pretoria. Edited by Dr. I. B. Pole Evans. Vol. 2, Part 1b, 31st March. Pp. 227-369. (Pretoria.) 7*s*. 6*d*.

Empire Marketing Board. A Year's Work. Pp. 40. (London: Empire Marketing Board.)

Agricultural Research Council. Council Paper No. 70: Reports on the Work of the Agricultural Research Institutes, 1925–1926. Pp. ii+106. (London: Agricultural Research Council.)

FOREIGN.

Publikation der Sternwarte in Kiel. 16: Über die Helligkeitsabnahme von Bedeckungsveränderlichen. Von Paul Harzer. Pp. 34. (Kiel.)

Bulletin of the American Museum of Natural History. Vol 54, Art. 1: The Orthoptera of the West Indies. No. 1: Blattidæ. By James A. G. Rehn and Morgan Hebard. Pp. 320+25 plates. Vol. 54, Art. 2: The Fishes of Hainan. By John T. Nichols and Clifford H. Pope. Pp. 321-394+1 plate. (New York City.)

Proceedings of the United States National Museum. Vol. 71, Art. 19: The American Moths of the Genus Diatræa and Allies. By Harrison G. Dyar and Carl Heinrich. (No. 2691.) Pp. 48+20 plates. (Washington, D.C.: Government Printing Office.)

La Revue agricole égyptienne. Numéro spécial de l'Exposition Générale Agricole et Industrielle, Mars 1926. (Traduction.) Pp. vii+123+34 planches. (Le Caire: Ministère de l'Agriculture.) 5 P.T.

Almanach 7 Sjezdu Československých Inženýrů v Mladé Boleslavi v Červnu 1927. Pp. 435. (Vydal: Mladé Boleslavi.)

Suomen Geodeettisen Laitoksen Julkaisuja: Veröffentlichungen des Finnischen Geodätischen Institutes. No. 7: Die Beobachtungsergebnisse der Südfinnischen Triangulation in den Jahren 1924–1926. Pp. ii+164. No. 8: Ausgleichung einer Dreieckskette mit lauter Laplaceschen Punkten. Von V. R. Ölander. Pp. ii+49. (Helsinki.)

National Research Council of Japan. Japanese Journal of Geology and Geography. Transactions and Abstracts, Vol. 4, No. 3-4 (1925). Pp. iii+65-103+21-27+iii+7+plates 2-5. Transactions and Abstracts, Vol. 5, No. 1-2 (1926-1927). Pp. ii+76+12+6 plates. (Tokyo.)

Department of the Interior: Bureau of Education. Bulletin, 1927, No. 5: Extended Use of School Buildings. By Eleanor T. Glueck. Pp. v+80. 10 cents. Bulletin, 1927, No. 12: Record of Current Educational Publications, comprising Publications received by the Bureau of Education during January-March 1927. Pp. 50. 10 cents. (Washington, D.C.: Government Printing Office.)

Department of the Interior: U.S. Geological Survey. Water-Supply Paper 568: Surface Water Supply of the United States, 1923. Part 8: Western Gulf of Mexico Basins. Pp. iv+168+3 plates. 30 cents. Water-Supply Paper 583: Surface Water Supply of the United States, 1924. Part 3: Ohio River Basin. Pp. vi+298+3 plates. 35 cents. Water-Supply Paper 596-B: Quality of Water of Colorado River in 1925–1926. By W. D. Collins and C. S. Howard. (Contributions to the Hydrology of the United States, 1927.) Pp. ii+33-43+1 plate. (Washington, D.C.: Government Printing Office.)

Journal of the Faculty of Science, Imperial University of Tokyo. Section 1: Mathematics, Astronomy, Physics, Chemistry. Vol. 6, Part 6: Über die Maximalordnung einiger Funktionen in der Idealtheorie. Von Zyoiti Suekuna. (Zweite Mitteilung.) Pp. 249-283. 0.80 yen. Vol. 1, Part 7: On the Distribution of the Velocities of Stars of the Spectral Type K. By Masaki Kaburaki. Pp. 285-300. 0.60 yen. Vol. 1, Part 8: Monthly Normals of Isobars in Japan at the Height of 3000 metres, by Ukitirô Nakaya: The Monthly Normal Isobars at 4000 and 6000 metre Levels over Japan and its Vicinity, by Kiiti Sinoda; On the Distribution of the Mixing Ratio of Aqueous Vapour in Atmospheric Air near the Earth's Surface, by Toraitiro Minami and Yosisige Hukumoto. Pp. 301-347+20 plates. 1.50 yen. Vol. 1, Part 9: Über die Maximalordnung einiger Funktionen in der Idealtheorie. Von Zyoiti Suetuna. (Dritte Mitteilung.) Pp. 349-371. 0.60 yen. Section 2: Geology, Mineralogy, Geography, Seismology. Vol. 1, Part 9: Tertiary Mollusca from Southern Tôtômi, by Matajiro Yokoyama; Tertiary Shells from Tosa, by Matajiro Yokoyama; Fossils Shells from the Atsumi Peninsula, Mikawa, by Matajiro Yokoyama; Fossil Mollusca from the Oil-Fields of Akita, by Matajiro Yokoyama. Pp. 313-389+plates 38-45. 2.20 yen. Vol. 1, Part 10: Mollusca from the Upper Musashino of Tokyo and its Suburbs, by Matajiro Yokoyama; Mollusca from the Upper Musashino of Western Shimôsa and Southern Musashi, by Matajiro Yokoyama. Pp. 391-457+plates 46-52. 2.00 yen. Vol. 2, Part 2: Physiographical Studies of the Great Earthquake of the Kwanto District, 1923. By Prof. Naomasa Yamasaki. Pp. 77-119+plates 9-32. 1.70 yen. Section 3: Botany. Vol. 1, Part 2: Comparative Anatomy of Japanese Cyatheaceæ. By Yudzuru Ogura. Pp. 141-350. 3.80 yen. Vol. 2, Part 1: Experimentelle Zytologische Beiträge. Von Gihei Yamaha. Pp. 214+13 plates. 4.60 yen. Section 4: Zoology. Vol. 1, Part 2: Report on Japanese Pennatulids. By Prof. J. Arthur Thomson and Nita I. Rennet. Pp. 115-143+plates 7-9. 1.80 yen. Vol. 1, Part 3: Studies on Japanese Hydromedusæ. i: Anthomedusæ. By Tohru Uchida. Pp. 145-241+plates 10-11. 2.60 yen. (Tokyo: Maruzen Co., Ltd.; Berlin: R. Friedländer und Sohn.)

Catalogues.

The Taylor-Hobson Outlook. Vol. 3, No. 6, September. Pp. 49-60 (Leicester: Taylor, Taylor and Hobson, Ltd.)

An abridged Price List of Artificial Sunlight Apparatus. Pp. 16. (London: Watson and Sons (Electro-Medical), Ltd.)

The Mutochrome: for the Production of Colour Designs. Pp. iv+16. (London: Adam Hilger, Ltd.)

Illustrated Books, 15th Century to Present Day. (Catalogue 500.) Pp. 73. (London: Francis Edwards, Ltd.)

Eastman Organic Chemicals. List No. 17, September. Pp. 79. (Rochester, N.Y.: Eastman Kodak Co.)

Diary of Societies.

FRIDAY, October 7.

Royal Astronomical Society (Geophysical Discussion), at 5.—Discussion on The Meeting of the International Union of Geodesy and Geophysics at Prague, 1927, September 3-10. Chairman: Sir Gerald Lenox-Conyngham. Speakers: Sir Henry Lyons, Prof. Turner, Prof. Chapman, Prof. Proudman, Dr. Crichton Mitchell, Mr. Lempfert, Mr. Matthews, and others.

SATURDAY, October 8.

Biochemical Society (in Biochemical Laboratory, Cambridge), at 3.—Dr. S. B. Schryver and K. V. Thimann: The Scission of Gelatin into Constituent Proteins.—G. S. Haynes and C. G. L. Wolf: The Interferometer Method for the Diagnosis of Pregnancy and Malignant Growths.—I. Smedley MacLean: The Isolation of a Second Sterol from Yeast Fat.—T. S. Hele: On the Origin of Ethereal Sulphates.—J. R. Marrack and L. F. Hewitt: The Osmotic Pressure of Iso-electric Egg Albumin.—L. F. Hewitt: Adsorption of Phthalein Dyes by Proteins.—M. Stephenson: On a Cell-free Dehydrogenase Obtained from Bacteria.

Hull Association of Engineers (at Technical College, Hull), at 7.15.—J. Shepherd: Three Years' Engineering in Mesopotamia.

MONDAY, October 10.

Royal Society of Medicine (War Section), at 5.—Surg. Vice-Admiral A. Gaskell: Professional Opportunities of the Service Medical Officer (Presidential Address).

British Psychological Society (Education Section) (at London Day Training College), at 6.—Miss E. G. Hume: Disability in Reading.

Institution of Automobile Engineers (Bristol Centre) (at Merchant Venturers' Technical College), at 6.45.—Major R. G. Beaumont: The Influence of the Automobile User upon the Automobile Engineer (Presidential Address).

Institute of Metals (Scottish Local Section) (at Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow), at 7.30.—S. E. Flack: Chairman's Address.

Institute of Brewing (London Section) (at Engineers' Club, Coventry Street, W.1).—Discussion on Season's (1926) Malts.

Medical Society of London.—H. W. Carson: Surgery in the Early Days of the Medical Society of London (Presidential Address).

TUESDAY, October 11.

Royal Society of Medicine (Therapeutics Section), at 5.—Dr. J. A. Gunn: Pharmacological Syndromes (Presidential Address).

Institution of Petroleum Technologists (at Royal Society of Arts), at 5.30.

Institute of Marine Engineers, at 6.30.—A. F. C. Timpson: A New Form of Insulating Material for High Temperatures.

Institution of Heating and Ventilating Engineers (at Caxton Hall, Westminster), at 7.—Dr. J. S. Owens: Atmospheric Pollution.

Quekett Microscopical Club, at 7.30.—Dr. W. B. Brierley: The Micro-flora of the Soil.

British Institute of Philosophical Studies (at Royal Society of Arts), at 8.15.—Dr. J. Rickman and Dr. H. G. Baynes: The Standpoints of Freud and Jung.

WEDNESDAY, October 12.

Society for the Study of Inebriety (at Medical Society of London), at 4.—Prof. W. E. Dixon: The Tobacco Habit (Norman Kerr Memorial Lecture).

Institute of Metals (Swansea Local Section) (at Thomas' Cafe, High Street, Swansea), at 7.—Capt. L. Taverner: Chairman's Address.

Folk-Lore Society (at Wellcome Historical Medical Museum), at 8.

Oil and Colour Chemists' Association (at Royal Society of Arts), at 8.—Dr. C. Beavis, Dr. L. C. Martin, Dr. S. G. Barker, Mrs. F. E. Lovibond, J. Guild, R. S. Horsfall, and others: Discussion on Colour Standardisation and Testing in the Paint and Colour Industry.

Institution of the Rubber Industry (London and District Section) (at Engineers' Club, Coventry Street, W.1).—Dr. O. de Vries: Coagulation, Structure, and Plasticity of Crude Rubber.

THURSDAY, October 13.

Royal Photographic Society of Great Britain (Colour Group), at 7.—J. C. Warburg: The Colour Slides of Lantern Plate Size, included in the Annual Exhibition, to be shown on the Screen.

Institute of Metals (London Local Section) (at Society of Motor Manufacturers and Traders, Ltd., 83 Pall Mall, S.W.1), at 7.30.—A. H. Mundey: Works' Economics (Chairman's Address).

Institution of the Rubber Industry (Birmingham and District Section) (at Grand Hotel, Birmingham).—A. E. Hemsworth: Selling.

FRIDAY, October 14.

Royal College of Surgeons of England, at 5.—Sir Arthur Keith: Results of Recent Researches into the Reproduction and Growth of Bone.

Junior Institution of Engineers, at 7.30.—F. A. Simpson: Problems created by the Rapid Development of the Motor Car Industry.

Institute of Metals (Sheffield Local Section) (in Non-Ferrous Section of the Applied Science Dept., The University, Sheffield), at 7.30.—J. H. G. Monypenny: Science and Industry (Chairman's Address).

Society of Chemical Industry (Chemical Engineering Group) (at Chemical Society), at 8.—J. A. Reavell: A Recent Development of Spray Drying.

SATURDAY, October 15.

Physiological Society (at Guy's Hospital), at 3.30.

PUBLIC LECTURES.

SATURDAY, October 8.

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

MONDAY, October 10.

University College, at 5.—J. A. Wilks: The Library of University College.—Prof. G. Dawes Hicks: A Century of Philosophy at University College.—R. J. Lythgoe: Vision. (Succeeding Lectures on October 12, 17, 19, 24, and 26.)

TUESDAY, October 11.

University College, at 3.—Prof. E. A. Gardner: The Study of Greek Sculpture.

WEDNESDAY, October 12.

King's College, at 5.30.—Prof. J. Dover Wilson: The Nation and its Schools.

London School of Economics, at 6.—L. S. King: Office Machinery: Demonstration of the Teletype.

THURSDAY, October 13.

University College, at 5.15.—Dr. T. G. Pinches: New and Noteworthy Assyrian Texts.

FRIDAY, October 14.

University College, at 5.—Dr. Phyllis M. Kerridge: Hydrogen Ion Concentration. (Succeeding Lectures on October 21 and 28.)

SATURDAY, October 15.

Horniman Museum (Forest Hill), at 3.30.—Miss M. A. Murray: Egyptian Temples.

CONGRESSES.

October 8 to 11.

International Congress of Hydrology, Climatology, and Geology (at Lyons).

October 11 to 15.

French Congress of Medicine (at Paris).

October 16 to 22.

Congress of Industrial Chemistry (at Paris).

October 18 to 23.

Jornadas Médicas de Madrid (at Madrid).