

REVIEWS

Protective Coatings for Metals. By Burns, R. M., and Schuh, A. E. (Reinhold Publishing Corporation, New York; Chapman & Hall, Ltd., London), 1939. Pp. 407. Price \$6.50.

The art of coating of metals with a view to affording protection against corrosion as well as for ornamental purposes has been practised since antiquity. It is only in recent years that the mechanism of protective action has begun to be understood, as a result of which the number of available types of coatings, both organic and inorganic, has rapidly multiplied. In this book an attempt has been made to cover the whole field of protective coatings that are employed in the various branches of present-day industry. The field is so wide that each chapter of the book could well be expanded into a full-sized volume. The authors have, however, succeeded in condensing the material in such a way as to present a well-balanced account of the various aspects of the subject-matter, without sacrificing the essential details.

The book opens with a lucid and masterly summary of the mechanism of corrosion of metals, which serves as a guide to the general understanding of the subject-matter of the rest of the book. Then follow eleven chapters dealing with inorganic metallic coatings of various types, such as zinc, cadmium, tin, nickel, chromium, copper, lead, aluminum, brass, cobalt, tungsten, tantalum, noble metals, etc. Each of the types of coatings is discussed from different points of view—historical, technique of production, properties, field of application, limitations and defects, safeguards to be adopted against defects, etc. One of these chapters is devoted exclusively to the surface preparation processes applied prior to coating and another to the methods of testing serviceability of coatings.

Organic coatings of the paint and varnish type have been disposed of in three chapters, which deal with the composition of paints, varnishes, lacquers, etc., mechanism of film formation, testing and evaluation of protective films, painting practices, etc. Although this section of the book is somewhat brief, from the point of view of the importance

and extent of the subject-matter, yet it cannot be denied that the material dealt with has been presented in a lucid and useful manner.

The final chapter is devoted to a brief discussion of other miscellaneous types of protective coatings not covered by the earlier chapters; these include electrolytic oxide coatings on aluminum, slushing compounds, chemical dip coatings, vitreous enamels, etc.

Throughout the book, literally hundreds of references are cited to original literature, which immensely increases the value of the book for use of students, research workers, and technologists engaged in industry. Author and Subject Indexes are also included.

The book as a whole is well-planned, well-written and faultlessly produced with very few, if any, typographical errors. No technological or scientific library can afford to do without a copy of such an excellent book.

L. C. V.

Application de la Methode du Champ Self-Consistent aux Noyaux Atomiques. By M. Matricon. (*Actualités Scientifiques et Industrielles*, Hermann et Cie, Paris, No. 654), 1938. Pp. 1-83.

In the theory of the heavier nuclei which is not susceptible to rigorous treatment, the first approximation is the statistical method; but the results obtained by this method are more of a qualitative than of a quantitative significance. The next higher approximation is the Hartree method of the self-consistent field which is the topic systematically dealt with in this book.

After a short introduction to the principles of the method, the author establishes the general systems of equations for the determination of the individual wave functions, and the exact form of the energy expression. In addition to the self-consistent field arising on account of the Coulomb interactions, there is also a systematic consideration applied to an assembly formed by two sorts of distinct particles acted upon by exchange forces. The equations and the energy expression are obtained in a convenient form so as to bring out clearly the modifications they undergo when simplifying assumptions are made regarding the individual wave functions.

The second part, which is numerical, deals with the method of integration of the equations of the self-consistent field. A number of refinements are effected in the usual methods of numerical integration. A generalisation of Fock's method, and an application of the method of W. E. Milne (*Amer. Math. Monthly*, 1926, 33, 455) to determine the eigen-values and eigen-functions of Schrodinger's equations are two of the notable features of this chapter. The methods developed are applied to the treatment of the Helium nucleus and it is shown that the value of the energy thus obtained is nearer the experimental value than the value given by the usual Ritz method.

This book is bound to be of the greatest service to workers on nuclear physics. In the bibliography at the end of the book one notes with surprise the omission of all reference to Bethe and Bacher's report in the *Reviews of Modern Physics*.

B. S. MADHAVA RAO.

L'espace Hermitien Quantique. By J. Pacotle (*Actualités Scientifiques et Industrielles*, Hermann et Cie, Paris, No. 635).

This small brochure of about 60 pages is a semi-mathematical, and semi-philosophical introduction to the geometrical foundations of quantum mechanics. The three chapters in the book might be roughly described as, respectively, mathematical, physical, and philosophical in outlook.

The mathematical introduction to the notion of Hilbert space—the Hermitian quantum space as the author calls it—is based on the abstract or axiomatic method, but it may be pointed out that the treatment does not appear to be perfectly rigorous. Thus while the axioms of linearity, and of the scalar product are fully dealt with, very little is mentioned about the dimensionality axiom. As is well known, in the case of an infinite number of dimensions, it becomes necessary to characterise the space by two further axioms of separability and completeness. There is no discussion of these axioms in the book.

In the second chapter, which is physico-mathematical, there will be found a number of new and refreshing ways of looking at old things—as for example, the notions of “axes of probability,” “Hermitian derivative,” and “quantum derivative”.

The last chapter deals with what the author calls “quantum ultra phenomena”, i.e.,

phenomena not of the type which can be actually verified experimentally, but those which can be subjected to “*Gedanken experimente*”. The world of ultra-phenomena is also contrasted with the noumenal world—thus the Descartes Universe of atoms would be of the latter type, while the structure of the Universe by chemical atoms is an ultra-phenomenon. The chapter contains a number of interesting and illuminating remarks, but one can hardly refrain from asking the question as to where all this speculation leads us to.

This is a thought-provoking book which one is sure to read with great interest.

B. S. MADHAVA RAO.

Réunion International de Physique-Chimie-Biologie: Congrès du Palais de la Découverte, Paris, October 1937. I. Physique Générale. (*Actualités Scientifiques et Industrielles*, Hermann et Cie, Paris, No. 731), 1938. Pp. viii + 80. Price 25 fr.

This is a report of the papers contributed to the discussions of the International Union of Physics, Chemistry and Biology held at the Palace of Discovery in the Paris Exhibition in October 1937. We have contributions from P. Debye and F. Simon on the theory and practice of producing extremely low temperatures, Wiersma on the conductivity and supra conductivity of pure metals, Sir C. V. Raman on the Optics of Colloids and on Hypersonic Waves in Liquids, M. Polanyi on the Deformation of Solids and Balth van der Pol on Relaxation Oscillations and Demultiplication of Frequency. Short reports of the remarks made by others during the discussion are also included. The papers contributed are of the nature of rather short summaries and in the case of Sir C. V. Raman's contributions we have only the titles of the topics mentioned. We do not also find extensive bibliographies as is but natural. But it is a rare opportunity provided by the Publishers for a large circle of readers to have their ideas on modern developments in physics oriented by persuing these summaries due to master-minds and recognized workers in the several fields. Though any detailed information is not to be sought for, the present report will serve admirably as a guide to those topics which are now engaging the attention of the chief workers in science. We could only wish that each contribution was a little more extensive,

One other point which strikes us is the fact that there are numerous printer's and other errors in those contributions which are not in French, possibly on account of mistakes due to the shorthand reporter. But one does not lay any stress on such a minor imperfection when one is provided with such a sumptuous fare. We can only desire that as many as possible may become acquainted with the contents of this pamphlet.

T. S. S.

College Physics. By John A. Eldridge. (John Wiley & Sons, Inc. New York; Chapman & Hall, Ltd., London), 1937. Pp. 616. Price 18sh. 6d.

The book is written by a master in the art of teaching and as such it will be welcomed by all physics teachers whose aim in the classes is to make the subject interesting and impart to the students a substantial grasp of the physical principles involved in the various phenomena. Physics that only describes and does not explain is no physics.

The title of the book is rather misleading. It is definitely not a book written more or less in the conventional style giving a mathematical treatment of the subject, and which can be used as a text-book for the Intermediate and undergraduate courses of any University, a book in short, with which a student may learn to pass an examination in physics, without necessarily liking the subject. It is written in such a style and manner that it appeals to the student who takes an interest in the subject and to whom passing an examination is but an incident.

The approach to each subject is quite modern, the notion of electrons and protons being introduced almost at once. Modern aspects of the subject are fully dealt with in an easy and comprehensible way. The language is of the popular type without in anyway sacrificing scientific accuracy.

The tables give practical and useful information. The illustrations are numerous and self-explanatory. We warmly recommend the book to every college library.

A. S. G.

A Text-Book of Heat (Part I). By H. S. Allen and R. S. Maxwell. (Macmillan & Co., Ltd., London), 1939. Pp. viii + 527. Price 10sh.

The book consists of 23 chapters covering the usual topics, *i.e.*, Temperature, Expansion, Calorimetry, Change of State, Atomic

and Molecular Theory, Gases, Conductivity, Radiation, the Earth's Atmosphere, Water Vapour in the Atmosphere, Thermal Units and Dimensions. The First Part "is mainly descriptive and experimental, and although the notation of the calculus is introduced, the mathematical treatment has been kept as simple as possible".

The authors have adopted the historical method, from the first speculations of the early philosophers on the nature of heat, to the more recent ideas connected with the quantum theory. The method not only possesses an educational value, but it also corresponds with the logical development of the principles involved.

Part I includes a number of biographical notes, arranged in alphabetical order. The legend that Galileo made the discovery of the isochronism of the pendulum by observing the swinging of a lamp in the Cathedral of Pisa is duly recorded as a fact.

The worked examples are well chosen. They clearly explain the principles involved. The questions and examples at the end of each chapter are taken from British Universities examinations. They are numerous and well worded, though, as usual with such questions, they smell too much of the school room. The figures are neat and clear.

A successful attempt is made at various places to bring the matter explained in the book in touch with ordinary life. See for instance the illustrations and applications of expansion (p. 86), some applications of calorimetry (p. 184), commercial applications of solids and liquids at low temperatures (p. 381), etc.

The two chapters (XXI and XXII) devoted to the discussion of the phenomena connected with the earth's atmosphere are most welcome.

On the whole, the book under review seems to be the work of able and painstaking teachers, excellently produced by the publishers, and fairly priced at 10 shillings. Not many Indian students will be able to buy it. But several copies ought to enter every College where Physics is taught.

D. FERROLI, S.J.

Systematic Qualitative Organic Analysis. By H. Middleton. First Edition. (Edward Arnold & Co., London), 1939. Pp. 273. Price 8sh. 6d. net.

The book deals with the methods that are to be employed in the identification

of the more common organic compounds. "The Systematic Schemes of Analysis" described in the book are based on the actual methods of investigation carried out by the author on more than six hundred compounds. The derivatives mentioned have all been prepared by the author and are found to be the most suitable for quick and correct identification. The author has also borne in mind the cost of chemicals to be employed in preparing the derivatives. Though the book deals with the identification of simple organic substances, the author briefly describes the methods of separation from mixtures of organic compounds. General and sometimes specific methods for the preparation of the derivatives have been given and this avoids the necessity of the student referring frequently to other books on preparation of organic compounds. The book will serve as a useful guide to students of the B.Sc. (Honours) class of Indian universities.

H. S. J.

A Guide to Chemical Laboratory Practice for Beginners. By H. Bassett. (Macmillan & Co., Ltd., London), 1938. Pp. 94. Price 2/6.

This small book containing the most elementary but yet fundamental matters and operations will be very useful to a beginner entering a practical class in Chemistry. It gives very useful advice to the student in regard to the manner of handling apparatus and also regarding practical operations.

M. SESHAIYENGAR.

Intermediate Readings in Chemical and Technical German. Edited by John Theodore Fotos and R. Norris Shreve. (John Wiley & Sons, Inc., New York; and Chapman & Hall, Ltd., London), 1938. Pp. 42 + 219. Price 9sh. 6d.

A knowledge of German has always been considered indispensable to the Chemist engaged in routine or research work. Hence any number of books have been written with the good intention of helping the beginner on his way. The above book is one such and is different from the generality in that, original literature has been extracted for the purpose of familiarising the student with the language.

The authors of the above book are professors of the Purdue University, the former of Modern Languages and the latter of Chemical Engineering. They have pooled their

knowledge and experience in teaching in an effort to give an easy and instructive course needed by the scientist in general and the chemist in particular. Naturally their selection of material is confined to the field of chemistry. The method of instruction follows the usual form of notes on grammar and then readings in German. It would have been much better for the student if the method followed was one in which easy reading lessons are interspersed with grammatical notes on points raised in sections already read. The purpose of books, like the above, must not be to usurp the place of a regular course of instruction in grammar but to impart as good a working knowledge of it as possible.

"The selections in this series have been made to illustrate not only variety of subject-matter, but also variation in style and progressive difficulty in reading. This book is to be used in any class that has had elementary instruction in German grammar." It would have been more effective had the natural method of teaching a language been followed—especially in the case of students who have already an elementary knowledge of grammar—by explaining the difficult words and grammatical points in simple German as has been done in the excellent little book entitled *Deutschkurs für Ausländer* and published by the Deutsche Akademie, München.

The book is well printed in clear type. It can be recommended to the student of science who has to learn the language to keep himself in touch with the literature published in the German language.

N. G. C.

Travaux Pratiques de Physique, II. Optique, Électricité. By Maurice Prost. (*Actualités Scientifiques et Industrielles*, No. 731, Hermann et Cie, Paris), 1938. Pp. 110. Price 21fr.

This is a laboratory manual in Optics and Electricity for medical students. In Optics, spherical mirrors, spherical and cylindrical lenses, the microscope, the spectrometer, the spectroscopy, the Bunsen photometer, interference (by the split lens method), the polariscope and saccharimeters (Laurent's and Soleil's) are dealt with. In Electricity we have 'J' by the electrical method, the voltameter, the Post Office Box and the Meter Bridge, the potentiometer, the ballistic galvanometer, alternating currents, and the

triode valve described. There is also a section on the absorption of β -rays. Deviations from the treatment usual in English books are found in the notation, in the lens formula (given as $\frac{1}{u} - \frac{1}{v} = \frac{1}{f}$) and in the description of some of the instruments. It is also rather peculiar that Wheatstone's name is consistently spelt Wheastone. A very refreshing feature is the discussion of possible errors, accompanying the description of each experiment. This will give a better sense of balance to students who, as the present writer knows to his discomfiture, have a knack of displaying unwarranted decimal figures in the results of rough experiments and equally persistently omitting necessary decimals in more accurate determinations. Our B.Sc. students will have a fresh light thrown on their studies if the methods of this book are followed as an interesting variation from the usual routine.

T. S. S.

Studies in Philosophy. (*Actualités Scientifiques et Industrielles*, Hermann et Cie, Paris) (790), 1930, pp. 54; (809), 1939, pp. 149; (813), 1939, pp. 87.

The publications issued under the general heading *Actualités Scientifiques et Industrielles* afford considerable striking evidence of sustained intellectual endeavour, and in the Vol. No. 790 under notice, Emile Brehier sets forth and discusses some of the significant problems of ancient Greek Thought. After a summing up of certain considerations and conclusions general in character and indicative of the main tendencies, Pre-Socratic Thought is examined. The contribution made by Plato, Socrates and Aristotle is discussed. The volume concludes with a section on "Neo-Platonism".

(2) Vol. No. 809 contains a fairly full survey of the problems connected with Psycho-Analysis by Charles Baudouin. Psycho-Analytic Theory and Practice, the technique of Freud and others have all come to stay, and the part played by them in modern psychology is prominent sometimes even to an aggressive degree. The section on "Psychotherapy and Mental Hygiene" deserves particular mention. "In memoriam" touching the demise of Alfred Adler (1870-1937) is a fitting tribute to the memory of a powerful personality in the province of psychoanalysis. During the time of the world-War, 1914-18, war-psychoses, and

war-neurosis contributed evidence of considerable importance in support of psycho-analytical theories. To-day when War again is in progress the problem of psychoanalysis gains additional significance. War-Lords, War-Mongers, by whatever name one may choose to call them, must reveal abnormal mental and physical characteristics and psychoanalysis must be indeed a vain and arid pursuit if by a successful application of its methods abnormalities of mind are not got rid of. Absence of mental hygiene is responsible for all destructive activities like Wars. The Bibliography which contains names of 44 volumes and 231 articles is needlessly exhaustive. It must be obvious not all works and articles here listed can be of the same importance or quality. One would have preferred a limited, selective Bibliography.

(3) Vol. No. 813 by le P.M.-D. Chenu, O.P., is devoted to a study of Mediæval Philosophy. The section on Arab Philosophy is a distinctive study. Trends and tendencies of the 12th, 13th, 14th and 15th centuries have been studied in a matter-of-fact manner. By no means original, the studies are useful.

R. NAGA RAJA SARMA.

Grundriss der Histophysiologie. By E. Ries. (Akademische Verlagsgesellschaft M.B.H., Leipzig), 1938. Pp. 413. Price 26 R.M.

For a long time cytological studies have been confined mainly to the nucleus. As a matter of fact, it occupied so large a part of our attention in the past that other parts of the cell, no less vital to a proper understanding of the Cellular Dynamics, were neglected or relegated to a place of secondary importance. Histology, which forms an indispensable part of zoological studies, has been taught to generations of pupils as a disciplinary course preceding Cytology, and no attempt has been made to probe deeper into the mysteries of the cell.

The antiquated methods of Cytology and of Histology have certainly outlived their usefulness, and the old-fashioned courses now only serve to train the new generation of pupils in microscopy and in microscopic anatomy. Beyond this, they have little to commend themselves. In recent years, however, more fascinating fields and pastures new have been opened out to us by Histophysiology or Histochemistry,

Not very long ago the tissue culture technique gave a new lease of life to Cytology and the recent work on Mitochondria and Golgi bodies has shown us that the nucleus is not the only box of Pandora within the cell, the cytoplasmic constituents being equally elusive and interesting. It must, however, be confessed that cytological and histological studies, even at the present time, are preponderatingly static in their method of approach and treatment. The functional phases of the cell, either in the lower organisms or in the animal tissues, have seldom been investigated with the same fervour or keenness as problems of Cytomorphology. It is no doubt true that, now and then, attempts were made to switch Cytology and Histology on to new rails but without any spectacular success.

During the last 20 years or so, Cytology has taken a new turn. Methods of vital staining and histochemistry have been tried and adopted as routine methods in some of the venturesome centres of zoological research in Europe. Judging from the results of the past few years, it is possible to hazard the opinion that these new branches of Cytology have a great future before them. In the years to come, the zoologist is bound to turn to the histo-physiological methods for the elucidation of many of the obscure points in Animal Morphology, and histochemical methods will be increasingly employed in zoological laboratories.

Not very long ago, we had an excellent manual on histochemistry by Lison and the present volume by E. Ries will be welcomed by all students of Cytology. E. Ries has provided us with a masterly survey of the whole field of Cytology and of the achievements of the past few decades. Even those who are actively engaged in this field of study will find the contents of this book informative and thought-provoking. Both the author and the publishers are to be congratulated for bringing out this useful book on this subject.

A. B. MISRA.

The Fundamental Theory of Arc Convertors. By H. Rissik. (Chapman & Hall, Ltd., London), 1939. Pp. 304; figs. 79. Price 18s.

This book forms the eighth volume of *A Series of Monographs on Electrical Engineering* under the editorship of Mr. H. P. Young. The present volume on arc convertors from

the pen of Mr. Rissik is very welcome, as he has contributed much to the English technical press on this all-important subject, including a volume on mercury-arc current convertors.

The mercury arc rectifier has undergone some very progressive and striking developments during the past thirty-seven years, since it was first devised by Cooper-Hewitt. The increasing use of this type of rectifier for supplying the D.C. anode power of valves in high power Broadcasting Stations, in Electric Traction, high currents in Electrolytic work, really needed a book of this kind for the specialist, where the design aspect has been kept in the foreground.

The book contains twelve chapters, divided into three parts: Part I deals with the normal rectifier circuits, Part II with that of the now increasingly popular 'Grid controlled rectifier', and Part III with the Invertor or Cycloconvertor. The text of Part I follows a small 'Introduction' of 11 pages being a survey of the practical applications, classification and historical development of convertors.

It is very welcome to find considerable data on the interrelationships of the different circuit quantities on the D.C. and A.C. sides of the apparatus. Perhaps, by far the most interesting part of the book is Part III where the latest information on 'Invertor'—(the apparatus for converting D.C. to A.C.)—is given. It is expected that this subject will have a great future in connection with the High Voltage D.C. electric power transmission over long distances—one of the dreams of the Power Transmission Engineer. The last two chapters of the book, in particular, contain valuable information on Cycloconvertor or the static frequency and phase changer, which is a highly complex outcome of the arc-convertor.

The Bibliography at the end of the book containing no less than 209 references, adds to the utility of the book.

It is somewhat disappointing to find that no good explanation or discussion of the arc-back problem is given. The general tone of the book is distinctly mathematical and theoretical, than practical. The book would have found favour with a wider range of Electrical Engineers had it been less mathematical and dealt more with practical applications and troubles, etc., in a descriptive manner.

The book should find a place on the shelf

of the reference library or the design office rather than in the laboratory, power or broadcasting station. It is recommended for the advanced student or an electrical engineer who wants a thorough understanding of the theoretical principles underlying the design and operation of the different types of arc convertors in vogue to-day. The general get-up of the book is excellent and the price reasonable.

V. V. L. R.

Organic Synthesis, Vol. XIX. By John R. Johnson. (John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London), 1939. Pp. 105. Price 8sh. 6d.

With the publication of this volume which describes thirty more preparations, the recording of detailed directions for 548 organic chemical reagents is completed in this series started in 1921. The following are some of the examples which may interest a general student in this volume:—acetyl glycine, dichloroacetic acid, *p*-dinitro-benzene, iodo-benzene, *o*-phenylene-diamine, the larger number being mostly of the more uncommon type. The details for the preparations are as usual very elaborate but considering the larger units used in these preparations, greater care will still need to be exercised by the less experienced to avoid risk of fire and explosion always associated with organic work.

B. S. R.

The Earliest Men. *Huxley Memorial Lecture*, 1939. By J. Reid Moir. (Macmillan & Co., Ltd., London). Pp. 32.

This little book is a worthy tribute to the significant work of the great scientist, brilliant in achievements and unrivalled in their exposition, whose memory is intended to be perpetuated by the inauguration of Memorial Lectures, by the Governing Body of the Imperial College of Science and Technology, 1925, following the celebration of the Centenary of Huxley's birth.

The book is devoted to expounding the evidence recently accumulated in order to furnish an answer to the question, "Where then must we look for primæval man? Was the oldest *Homo sapiens* Pliocene, or Miocene, or yet more ancient?" which Huxley had raised in his book, *Man's Place in Nature*. Palæontologists and archæologists are now

agreed in thinking that man existed in the Pliocene period and they are satisfied that the material at their disposal warrants such a conclusion. Whether his antiquity extends into the Miocene is a proposition on which only tentative conclusions can be reached, in view of the differences of opinion on the Eoliths in the Aurillac series discovered in the gravel deposits of Upper Miocene Age in the Cautal, France. In the case of stone implements which form in the majority of cases the sole survivals of man's past history, there is bound to be room for the opinion that they may have been of natural origin or that they were shaped and used by intelligent beings. To the third question of Huxley, whether man existed in still older periods, no answer can be attempted at present.

The author also discusses in his address the origin and antiquity of the modern type of man, with reference to the discovery of portions of a human skull of this type in the 100-foot terrace of the Thames. "To greatly extend our conceptions of man's antiquity appears a necessity" and taking into account all the available evidence, it will extend, perhaps, as far back as two million years.

The subject of man's origin and his antiquity must always exercise a strange fascination on the imagination of modern man and this story is presented in the book with all the charms of literary grace and scientific judiciousness.

Colon Classification. By S. R. Ranganathan. Revised Edition. (The Madras Library Association, Madras; and Edward Goldston, Ltd., London), 1939.

Rao Saheb S. R. Ranganathan has done a great service by publishing a revised edition of his *Colon Classification*, an original work, which, while assimilating all that is best in the standard schemes in use in Western countries, improves upon them by constructing a schedule of classification suited to India with the advice of authorities on the several subjects like Science, Linguistics, Religion and Philosophy. This is amply illustrated by the attention paid in the scheme to Hindu Religion, Indian Philosophy, Spiritual Experience and Mysticism, Sanskrit and South Indian Languages like Tamil.

The first three parts and numerous examples given in Part IV help the clear grasp

of the principles of Colon Classification and its application to advantage to the vast stores of books on Indian civilization, philosophy and culture, especially of the South.

K. KASTHURI RANGACHAR.

Plant Breeding Technique in Recent Years. By R. H. Richharia. (The Bangalore Press, Bangalore City), 1939. Pp. 73. Price Rs. 2-8.

The publication of this book has removed the long-felt want of amateur plant breeders and persons interested in the science of plant breeding, who have neither the necessary background for understanding the subject nor the proper opportunities to learn the modern technique. It will also be of

great use to students of Agriculture and Botany.

The author has divided the book into fourteen chapters describing the different aspects of plant breeding and vividly putting forth the importance of cytological investigations in understanding the problems of plant breeding and genetics, especially by the non-Mendelian methods. Chapters on polyploidy, haploidy, decapitation and effect of temperatures, chemicals and radiations are particularly interesting.

Numerous diagrams and illustrations make the reading of the book more interesting. The get-up of the book and printing are excellent.

R. J. K.

From J. J. to G. P.

Theory and Practice of Electron Diffraction. By G. P. Thomson and W. Cochran. (Macmillan & Co., Ltd., London), 1939. Pp. xii + 334. Price 18sh.

SIR J. J. THOMSON, while describing the discovery of the electron writes in his book *Recollections and Reflections*: "At first there were very few who believed in the existence of these bodies smaller than atoms. I was even told long afterwards by a distinguished physicist who had been present at my lecture at the Royal Institution that he thought I had been 'pulling their legs.'" Professor G. P. Thomson when he first published in 1927, photographs obtained by sending a beam of homogeneous cathode rays through a very thin film of collodion, could also have been accused of leg pulling. The average physicist then was either unaware of de Broglie's theory or he did not suspect that there would be such a strong coupling between the probability waves and atoms, which would permit them to form diffraction patterns of appreciable intensity. The fundamentals on which this significant achievement has been based are now recounted in this book.

The first chapter deals with the fundamental properties of wave motion and de Broglie's wavemechanics. The theory has been written from the point of view of an experimental physicist, and the physical significance of various mathematical operations has been cleverly pointed out. Thus about the Huygens' construction the authors write that it implies nothing not already given by geometrical optics. They define

group velocity as the velocity with which a peculiarity associated with the group, such as a maximum of amplitude will advance.

De Broglie started from the idea that Einstein's equation $E = h\nu$ represents a fundamental relation between energy and frequency. By the theory of relativity a particle of resting mass m_0 has associated with it energy m_0c^2 , and should therefore have an inherent frequency $\nu_0 = m_0c^2/h$. De Broglie regarded this as the frequency of a pulsation in the space surrounding the particle. The wave velocity is $V = c^2/u$ and the corresponding wave-length is $\lambda = h/mu$. De Broglie's idea that the waves act as a guide for the particles and determine their motion necessitates that the ordinary Newtonian mechanics, or rather their relativistic generalisation should be replaced by laws which involve the conception of waves. When experiments are carried out to verify de Broglie's law, it would appear that the theory holds up to as high as a million volts, to better than 5 per cent. This result is important because the theory given by de Broglie is incomplete as it takes no account of the spin of the electron; but the terms involving spin should be expected to become important for speeds near the velocity of light. Thus the equation

$$\nabla^2\psi + \frac{8\pi^2m_0}{h^2}(E - F)\psi = 0$$

is incomplete and it is therefore interesting that it still gives the right value for the wave-length.

The readers are next treated to an account of Ewald's reciprocal lattice, and