REVIEWS

Radium Therapy—Its Physical Aspects. By C. W. Wilson. (Chapman and Hall, London), 1945. Pp. 224. Price 18 *sh.*

Of the many special branches of modern Medicine none is better built on a foundation of scientifically established facts than the radiation therapy. This has been accomplished by those few physicists who have been guiding and co-operating with the radiologists in this speciality. Dr. Edward Chamberlain, a leading Professor of Radiology of Philadelphia, recognises this fact when he says: "Physicists have not only supplied us with answers to our questions and apparatus to our needs, often they have had to show us what we wanted, what our needs really were." And Dr. Wilson's book furnishes another illustration of this close and fruitful co-operation between the physicist and the physician in the domain of radium therapy.

If radium therapy developed more slowly than did roentgen therapy it is not only because radium was very expensive and difficult to obtain but also the problems of practical dosimetry and the creation of increasingly flexible and effective apparatus have been more difficult of solution with the tremendously more penetrating gamma-rays from radium. The crucial subject in this domain which still needs further study and greater clarification is the measurement and control of gamma-ray dose and its distribution in the irradiated field. Dr. Wilson has done well to clearly stress this point and to indicate the need for further investigation.

The book is on the whole a well-balanced account of the fundamentals of radiation physics and their application to the solution of problems of treatment with radium and as such will be found most useful by curietherapists. The important question of protection from gamma-rays of both the patients and the staff is thoroughly discussed in the light of the recommendations made in 1943 by the British X-ray and Radium Protection Committee.

However, the usefulness of the book would have been decidedly greater had Dr. Wilson gone more critically and in greater detail into the question of radon service and the requirements of an up-to-date radon laboratory. There is no doubt as to the general agreement at present that the future of radium in therapy is more towards interstitial and contact application and less in the form of bombs for telecurietherapy. Supervoltage apparatus are already available that are capable of producing X-rays of one to two million volt energy. These units are safer, enormously more powerful and are very much less expensive than any existing radium bomb and patients suitable for telecurietherapy are already being advantageously treated with such apparatus. It is, therefore, not unreasonable to assume that the future use of radium is certain to be for contact application in which form it has some well-established advantages over any other form of radiation therapy. Radon service is definitely superior to the direct utilisation of radium salts in any medical centre of importance which aims at making the most of its resources for extensive radium therapy.

R. NAIDU.

Colorimetric Analysis. By Noel L. Allport. (Chapman and Hall, Ltd., London), 1945. Pp. xii + 452. Price 32 *sh.*

The ceaseless search of the analyst for simpler and more rapid methods of analysis has resulted in a widespread adoption of physical methods such as colorimetric, conductometric and potentiometric methods. The popularity of colorimetric methods can be attributed to the improvement of apparatus of measuring the absorption of light, and colorimetric methods have been developed for practically every element, radical and physiologically active compound. There is a large volume of literature devoted to the application of colorimetric methods of analysis in every field of scientific research.

Unlike the monumental work of F. D. Snell and C. T. Snell, the volume under review does not attempt to give a theoretical discussion of the methods or a description of the instruments employed for the determinations. The author's aim has been to offer a practical and concise handbook on colorimetric analysis. Only those methods which are known to be reliable and of which the author has first-hand knowledge as a research chemist in the *British Drug House, Ltd.*, have been included in the book. Special attention has been given to the application of colorimetry to the examination of natural and manufactured products. The limitations of each method are indicated, thereby enabling the analyst to choose the one which satisfies his requirements. When the colour tests are of general utility, the descriptions have been supplemented by detailed procedures for their more important applications. The approach is critical throughout.

For convenience, the book has been divided into five sections. The first deals with the colorimetric determination of some important metallic elements chosen for their biological or industrial significance. The platinum group of metals have been omitted as gravimetric methods are more reliable. Altogether 25 metals have been dealt with and 357 references to original literature have been included.

The second section refers to the methods for the estimation of acid radicals. Most of the methods are widely used in biochemical investigations and their application demands elaborate care. As many as 15 radicals have

been dealt with including tartarates, salicylates, oxalates, lactates, *p*-hydroxy benzoic acid and its derivatives. 121 References are included in this section.

Substances of clinical and biochemical importance with special reference to biological fluids such as urine, blood and spinal fluids, are covered by the third section. The 30 fluids to which attention has been given have been chosen for their importance and their representative character. 304 References are included in this section.

Section IV deals with the methods for alkaloids, hormones and vitamins. 12 Important alkaloids and 3 hormones are included. Colorimetric evaluation of hormones has not, so far, led to any important results and the author has rightly included only 3 of them. Among the vitamins, vitamin A and its precursor carotene, vitamins of the B group, and vitamin E are dealt with exhaustively. There are 184 references in this section.

The last section includes methods of determination of miscellaneous substances whose selection has been based mainly in consideration of their general interest, and also with a view to make up any possible omissions in the earlier sections. Some 20 substances have been treated under this head and there are 109 references to original literature.

The volume would have been self-contained and its usefulness enhanced, if a chapter on instruments had been included. Colorimetric analysis is tending towards instrumentation. The accuracy of the estimations which has been stated to be ± 5 per cent., has been greatly improved by the use of filter photometers and spectro-photometers. Nessler's tubes are only relics of the past and objective methods of measurement by the use of photoelectric cells have largely eliminated personal errors and fatigue factors incidental to visual observations. The author has chosen to keep out nephelometric methods from consideration. While it is true that nephelometry is not colorimetry, the two methods have a family affinity. Both are based on the measurement of light that reach the observation point after passing through test solutions. The measuring equipment is more or less similar in both cases, and many of the nephelometric methods are of great value and convenience. The volume is well written and documented. There are very few books of this type in the English language, and it should prove useful and handy in all analytical and research laboratories.

A. K.
B. N. S.

Manufacture of Lead and Slate Pencils, with Special Reference to India. By N. N. Godbole. ("*Leader*" Press, Allahabad), 1945 Pp. 40. Price Rs. 4.

It is difficult to understand the purpose of this publication. In his Foreword, which has been written because the author feels that "it is customary for an author to write a foreword", it is stated that the contents were published in a popular magazine nearly three decades ago. A study of the booklet makes one feel that they should have been left where they were. There is little in the book that is of practical value to a prospective pencil manufacturer. The author's advice is to import refined graphite "rather than take up the responsibility of purifying the Indian graphite", to import wood, and with these to manufacture pencils with the machinery that may be fabricated in India. In view of this advice, one should not expect the author to suggest processes for refining graphite or for treating the large quantities of second grade wood available in India to render them suitable for pencil manufacture. The only reference to the purification of graphite, which is casually mentioned, is "a simple process in which water is largely employed and on which it floats though specifically heavier". It is stated that in America "graphite purified by the air-blowing method is used". Apart from these illuminating references, there are no suggestions of practical value with regard to the purification of graphite. Regarding softening of wood, the author makes a passing reference to softening in Japan "by a process of heating". Clay of the right kind is said to be available in plenty in India. But one looks in vain for a definition of the characteristics which renders a clay suitable for pencil manufacture.

The publication is mostly padded with personal anecdotes of the author's ramblings in the forest regions of India in quest of pencil woods, which have been described as "both sensational and romantic" and which sometimes have "shaken the life out" of the author. There are several references to the author's opinions regarding forest managemnt in various areas. These anecdotes may be quite amusing but are, by no means, beneficial to the reader. The four pages of the leaflet on "Indian Woods for Pencil Making", recently issued by the Forest Research Institute, give more information of value than the bulk of the book under review which deals with the author's cursory survey of Indian forests.

The omissions in the book are too many to be dealt with in a review. The book covers but 40 pages. The price is too high for a book which at best may be only of historical interest.

A. K.
B. N. S.

Root Disease Fungi. By S. D. Garrett, M.A., D.I.C. "Annales Cryptogamici et Phytopathologici," Vol. 1, 1944. (Waltham, Mass., U.S.A., The Chronica Botanica Co., Calcutta: Macmillan & Co., Ltd.). Pp. xv + 177. $ 4.50.

This is the first of the publications under the series "Annales Cryptogamici et Phytopathologici", edited by Frans Verdoorn, and forms a notable contribution to the study of the epidemology of root disease fungi, detailing methods of control. The book is divided into fifteen

chapters with suitable subclassifications and subject and author indices. The author of the work, Mr. S. D. Garrett, who is an acknowledged authority on the subject, reviews our present knowledge of the root disease fungi in an elegant manner as to arouse further interest in the subject in all those interested in plant pathology.

The profound influence exercised by environmental factors on the parasitism of soil-borne fungi, as first pointed out by the Wisconsin school of investigators under Prof. L. R. Jones, has become an established fact. The saprophytic microflora of the soil inhabiting fungi, differentiated by Waksman and others into "soil inhabitants" and "soil invaders", is shown to play an important part in the control of the root diseases. The fungi of the soil inhabitant type, might, according to their nature, spread external or internal to the host. In the former case the disease usually spreads by means of rhizomorphs, the extent of the spread of the disease being determined by the "food base". In those cases where the spread of the disease is internal, as in trachcomycoses, the spread of infection is brought about after the disintegration of the parasitised tissues.

In Chapters 4 to 7, the various soil conditions that influence the spread of the disease are reviewed. These exert direct influence on the growth and spread of the fungi in those cases where the mycelium is external, and indirect in those fungi which are internal within the host by affecting its metabolism. The soil temperature, for instance, might not only determine the intensity of infection, but also the type of infection within the host. The other factors such as, humidity, texture of the soil and others which also take part in influencing the severity of the disease are discussed.

The perennation of the root parasitising fungi within the soil over long periods as active saprophytes on decaying matters, or surviving within the invaded tissue saprophytically by the formation of sclerotia, etc., and their importance in the control of the disease are finely dealt with. The various scientific methods of control of root diseases are explicitly presented in the last seven chapters. The crop rotation, which is the oldest and most efficacious method known, use of healthy sets and seeds for propagation purposes along with other sanitation methods, are discussed in detail. The problems concerning root disease fungi of plantations in virgin areas as expatiated by Napper and others, control of root infections by isolating the infected plants by trenching and other special methods of root disease control by amelioration of soil temperature, etc., are bound to be of great interest to plant pathologists. The book is very well produced and may be heartily recommended to all those workers interested in the study of soil-borne fungi.

M. J. T.

Village Industrialisation. By Sir M. Visvesvaraya. (A.I.M.O. Brochure No. 3, Bombay) 1945. Pp. 33. Price Re. 1-4-0.

Plans for an all-out drive for the industrialisation and properly balanced rehabilitation of the country, both agriculturally and industrially, are all very thoughtfully drawn up and almost to the last detail with samples of tabular forms for stock-taking, investigations, etc. Here are some excerpts. "The fact should be brought uncompromisingly to the cognisance of our rural population that they as a community have been left weak and inefficient because there is no tradition or organisation in local areas to enable the people to work in combination or co-operation and to put forth disciplined labour or observe regular hours of work. By observing regular hours of daily toil, whatever be the vocation, by adhering to business hours fixed for the beginning and end of the day's labour, and by constant attention to self-education and promoting the working capacity of head and brain, the purchasing power of every village will grow and the homes of even the very poor will begin to glow with happiness and good cheer. ... No rural family or individual should be without some subsidiary occupation to employ its or her spare hours. Cottage industries like home gardening, poultry keeping, spinning and hand-weaving, bee-keeping, mat making, and also breeding of sheep or pigs, etc., are within the grasp of every village resident, even the very poorest. With a little enterprise, numerous similar occupations can be created ... As the rural population is not generally used to development work of any kind, special measures will be necessary, according to the conditions of each unit area, to induce the population to adopt and work the scheme ... Unless people in each locality give up unprogressive habits and begin to think for themselves and increase their knowledge, skill and income, they will have no future."

Sir Mokshagundam appeals to the co-operation of all the intelligent and progressive elements of the population to plan and execute and improve by studying the results, on the lines suggested in this pamphlet, an organised movement for making the people industry-minded.

The reviewer is not a pessimist, but believes that an even more radical movement is necessary for making the people realise the evils of idle-leisure, and over-indulgence in coarse enjoyments such as in cinema theatres or in listening to endless music programmes on the radio, etc. These entertainments have their place but one cannot help remarking that they are making detrimental inroads into the lives of many rural and urban communities and are tending to wean them away from even the few traditionally practised useful hobbies they were hitherto deriving pleasure from. People have almost stopped to think for themselves, as everything is thought out for them over the radio and the press. The ennobling pleasures to be derived from useful hobbies, social service, study circles, etc., are belittled by the obviously more intense pleasures that can be more easily had, and at so very little cost!

We do hope Sir M. Visvesvaraya's sage counsels will be taken up in earnest by many local communities. Several practical suggestions for the selection and adoption of small-scale industries are included.

M. A. G. Rau.

Scope of Chemical Industry in India. By H. G. Biswas, M.Sc. (The Bengal Chemical and Pharmaceutical Works, Ltd., Calcutta), 1945. Pp. 44. Price Re. 1-4-0.

The author has in this monograph surveyed rather succinctly and largely in the light of his experiences, the present and future prospects of the chemical industries in this country. The inorganic and organic industries are dealt with separately, and under the subsections of (*a*) mineral acids, (*b*) salts and alkalis and (*c*) metals in the former, and in the latter as (*a*) acids, alkaloids, sugars and essential oils of vegetable origin, (*b*) fermentation industry, (*c*) coal-tar distillation products and allied industries and (*d*) synthetic organic chemicals of aliphatic group of the industries dependent upon them.

The chemical industry occupies a key position in the economy of every country, and its scope can be truly said to be unlimited because of the number of varieties it already comprise and the possibilities for fresh developments with progressive research, both in the pure and applied sciences. All of this is intimately bound with a sound knowledge of chemical engineering design and the facilities to fabricate the required equipments in this country. Mr. Biswas has however not touched on this aspect of the problem. Within the limitations he has set himself, he has reviewed the present production and the possible demands in the country for various chemical products and has emphasised those that may be regarded as urgent. It is needless to single out any of his suggestions for special mention. Quite naturally this author from Bengal has laid great stress on the utilisation of the coal resources of the country, and he has rightly also drawn the reader's attention to the great scope for fermentation industries.

This informative review with its exhortations to the reader will be found to be a useful matter for study and application.

M. A. G. Rau.

Disposal of War Surplus Stores and Ordnance Factories. By N. D. Sahukar. (A.I.M.O. Monograph No. 8, Bombay), 1945. Pp. 19. Price Re. 1-0-0.

Mr. Sahukar reviews a live problem of the day. All these surplus materials are, in the main, tax-payers' property, and it behoves that the disposal of these surpluses must be carried out on a planned basis, involving the least loss in cash to the tax-payer, the minimum of disturbance to the normal level of trades and industries, and the greatest benefit to the community as a whole.

The several Government enactments in U.K., U.S.A., and India, in order to achieve their disposal successfully, are surveyed and compared, and the imperative need for co-opting unofficial public men from trade and commerce and of technical personnel, is strongly urged. The author rightly points out that sufficient consideration has not been given by the government for the utilisation of some of the stores by educational institutions. There is bound to be many an item of stores, and particularly those of a scientific nature, which could well be utilised by such institutions. As far as possible government might donate such stores as a gift to them. If for any reason, it is considered that a free gift of such stores could not be made, the first option for their purchase, and at a special reduced price, could and must be given to these educational institutions. No better way of utilising surplus stores could be found than this. After all, educational institutions which can use surplus stores are very few in the country, and it is the government's duty to consider their claims over surplus stores in preference to the claims by other public bodies or Provincial and State governments.

The utilisation of ordnance factories for fruitful purposes is another matter of great importance. Many of them are first rate chemical industries, with several valuable equipments of multiple use, acquired at priority rates and pressed into service. A co-ordinated policy of reconstruction and reorientation of the output from these factories for meeting various civilian needs is a matter of primary concern, and should also be properly undertaken in co-operation with non-official public and technical personnel.

This pamphlet forcibly points out the need for a greater realisation of the various possibilities for utilising these surpluses to the greatest benefit of the nation.

M. A. G. Rau.

The Directiveness of Organic Activities. By E. S. Russell, O.B.E., D.Sc., F.L.S. (Cambridge University Press.) Pp. 196. 8*sh.* 6*d.* net.

The biologist, whether he takes to routine teaching or does intensive research, hardly finds any time to examine or review at frequent intervals the enormous data that is accruing in the various biological fields of thought. In giving food for thought from this angle, the reviewer considers that Dr. Russell's little book is brilliantly and authoritatively written. The author, with very apt examples, mostly Zoological than Botanical, takes the reader into a vastly intriguing field of what appears to be speculative thinking but which, as a matter of fact, is a logical theme supporting his conclusion that the mechanistic outlook must be mistaken, and that the teleological character of biological events must be accepted. Directiveness, or purposiveness, of different biological activity in the maintenance and restoration of structural and functional norms; in the satisfaction of metabolic needs; in the relation of goals to biological ends have been superbly presented with choice examples from the animal and plant kingdoms.

One cannot more aptly summarise this book than in the author's own words, "the mechanistic conception of the living organism being inadequate and restrictive, it is necessary to replace it by a more realistic conception, which shall take account of the fundamental or irreducible characteristics of living things,

those, namely, which are shown by no inorganic system, and without which no living organism is conceivable, characteristics therefore, which cannot have arisen during the course of organic evolution, for life of any degree presupposes them".

Thus, the philosophical implications presented in the book are likely to have strong supporters for and against and whatever side one might take there would be no stinting of praise to the author on the excellent examples chosen for a forceful exposition of his viewpoint.

T. S. SADASIVAN.

A Laboratory Handbook of Organic Qualitative Analysis and Separations. By V. S. Kulkarni. (Dastane Brothers' Home Service, 456, Raviwar Peth, Poona 5), 1945. Pp. 40. Re. 0-15-0.

The text presents material for college students of B.A. and B.Sc. classes for their guidance in organic qualitative analysis and separations. The first 16 pages introduce the student to a simple scheme for identification of simple organic compounds. Pages from 16 to 28 present a list of commonly occurring organic substances, their formulæ, melting-point or boiling-point, and in some cases, their derivatives. Fairly complete and accurate directions for the preparation of derivatives of common organic substances are given in pages from 28 to 37. The suggested methods enable the student to work successfully without constant assistance of the teacher. The rest of the pages contain a scheme for the separation of simple organic mixtures.

In the choice of substances and the general reactions given, the author has obviously in view, the reduced syllabus given for practical course for B.Sc. chemistry during war-time. Nevertheless, the reactions given and the methods suggested are fairly comprehensive and will serve the needs of the college students of B.A. and B.Sc. classes. The booklet on the whole provides a fairly well balanced introductory course in organic qualitative analysis for the college students. Further, textbook writing industry in this country has to make much headway. Books of the type under review show a happy augury and deserve encouragement.

M. S. MUTHANNA.

The Grasses of Burma. By D. Rhind. (Baptist Mission Press, Calcutta), 1945. Pp. 99. Rs. 5 or 7*sh.* 6*d.*

The work is a compilation by the author of available information found scattered in Government bulletins, forest publications and various other published and unpublished records. The compilation is meant to serve the purpose of a guide-book to grasses of Burma rather than of an exhaustive work of reference. The list of species recorded has been compiled by examination of specimens that had been preserved in the herbarium of the Mandalay Agricultural College, Burma, and some of the important herbariums in India. In listing the grasses, the bamboos in which Burma abounds and which comprise the major part of the flora of the country, have also been included. Descriptive notes follow the lesser known species of grasses of Burma but no descriptions accompany the better known ones and those previously described in readily accessible floras. This perhaps accounts for the small size of the publication. The importance of the present publication lies in having brought together information on grasses of Burma that were previously scattered and were inaccessible. It thus provides a handy source of referencee to workers on grasses. However, it is to be hoped that a more exhaustive work on the grasses of Burma, including a description of those collected but yet undescribed species would be forthcoming in the future.

A glossary and a list of fungi found on grasses in Burma form useful additions at the end.

L. S. S. KUMAR.

Sixth Annual Report, 1944—*The Tuberculosis Association of India.* (Published by the Tuberculosis Association in India, New Delhi.)

This Report consists of an introductory section dealing with the object of the Association followed by the annual report of the activities carried on by the Association, statement of accounts and several appendices dealing mainly with summaries of the reports of the Provincial and State Tuberculosis Associations.

As in the previous few years, the work of the Association during 1944 has been carried on under difficult war conditions. However, the quality and quantity of the work has been maintained at a satisfactory level. During the year under report there has been a further increase in the tuberculosis institutions in India; eight clinics, four sanatoria and two hospitals have been opened. One clinic and one sanatorium are under construction and proposals for the opening of two more clinics and three hospitals are under consideration. Information received from Administrations and States, as a result of enquiry, show that very useful work has been carried on by a majority of them, such as starting of sanatoria, building of clinics and special wards, hospitals, etc., while some States are awaiting the end of the war for active antituberculosis work. Due to the war, it had not been possible to appoint a full-time Medical Commissioner; but the Association has been fortunate in securing the services of Dr. P. V. Benjamin, who devoted a considerable portion of his time to the affairs of the Association and visited several centres to tender expert advice. One great difficulty that is being encountered is the death of trained workers and adequately qualified specialists. This is being partially met by holding post-graduate refresher courses and training health visitors, but for various reasons these courses had to be limited. The T.D.D. courses instituted by the Madras Government have been exceedingly popular. The Mysore Government has recently introduced a T.D.D. course and

most probably Calcutta and Delhi will follow soon. The full development of the Publicity and Propaganda Section, whose value is generally acknowledged, has been greatly hampered on account of the war, but the activities are carried on by means of pamphlets, charts and other useful materials. The Indian Medical *Gazette* has been of the greatest service to the Association, by publishing special Tuberculosis Numbers for the past seven years, but it is felt that the time has arrived when the Association should have a journal of its own.

During the year under report the Lady Linlithgow Sanatorium has further consolidated its position. The New Delhi Tuberculosis Clinics have continued to play important role in the prevention, diagnosis and treatment of tuberculosis and also by arranging home visits and contact examinations, training post-graduate students, health visitors and nurses and continuing the scheme of organised home treatment. A summary of reports of the Provincial and State Tuberculosis Associations is given in Appendix VIII, and a perusal of the same shows that uniform progress has been maintained by them in antituberculosis campaign and there has been further stabilisation and co-ordination of the work of the various institutions.

N. N. D.

India and International Economic Policies. (All-India Manufacturers' Organisation, Bombay), 1944. Pp. 97. Price Rs. 2-8-0.

This interesting brochure contains a statement of the views of the All-India Manufacturers' Organisation on the Agenda of the International Business Conference held in November 1944 at Rye, New York.

In the introductory pages the need for a new conception of India in the international world is pointed out and the basic assumption underlying the views of the A.I.M.O. is explained, *viz.*, the establishment of responsible National Government for the whole country. There are nine chapters and they are devoted to the consideration of provisional items included in the Agenda for the Business Conference, *viz.*, maintenance of private enterprise, commercial policy of nations, international currency problems, protection of international investments, industrialisation of new areas, shipping, aviation and world supplies of materials.

The national point of view is emphasised throughout, pointing out the need for intensive industrialisation so as to provide full employment and for treating India as an equal and independent unit by herself, participating freely in any international agreement relating to trade, industrial policy, shipping, aviation or currency arrangements. International co-operation in the disposal of raw materials for the rehabilitation of war-devastated countries and the establishment of a stabilised currency are advocated as necessary for the establishment of a better basis for international economic relations in the world. The urgent need for the liquidation of Sterling Balances is also pointed out. Several chapters contain, at the end, a summary of the views and this is very helpful to the reader.

The defence of private enterprise in an age, wherein economic forces appear to be swinging to the other end, cannot be accepted in total. Making a reference to American experience during war-time, it is urged that the evils of private enterprise may not exceed its good points. They advocate the maintenance of private enterprise in the initiation and operation of industries, trade and commerce and services including transport by air, sea or land. Many may not agree with the authors on this point. There are such statements elsewhere in the book which set the reader thinking about the correct economic policy for the country.

The get-up of the book is very attractive. Taking into consideration the intentions of A.I.M.O. in publishing their books and pamphlets, the price for this publication must be considered high.

The book may be read with profit by all those interested in the economic advancement of India.

B. R. S. R.

A Text-Book of Heat. By G. R. Noakes, (Macmillan and Co., Ltd., London), 1945. Pp. viii + 469. Price 10*s.* 6*d.*

In spite of the large number of text-books of heat now available, this new text by the author of the well-known books on Electricity and Magnetism and Light forms a welcome addition to the literature. The same up-to-dateness of outlook and treatment and attention to practical and everyday applications that were noticed in the same author's two previous books are noteworthy even in the present volume. Mr. Noakes proves himself to be a very good teacher both by the choice of topics and the method of handling them. In the present book the principles which guided the design of apparatus and the limits of accuracy obtainable are prominently dealt with. The ground covered seems to be ample for the B.Sc. Pass standard of our Universities, and the large number of problems provides ample opportunity for the student to make himself thorough with the subject. As compared with other text-books this volume is characterised by descriptions of most modern work which cannot fail to produce in the student the conviction that the subject is a live and growing one. The treatment of the dimensions of thermal quantities and the sections on meteorology are very useful additions to the usual run of subjects. The arrangement of material, particularly in calorimetry, is somewhat unusual and mixed up, and from the present writer's point of view, the frequent insistence on the difference in the various thermometric scales rather than on their approximation to one absolute scale may lead to greater confusion than to clarity. Some topics like the description of the Callendar & Griffiths' bridge, the derivation of van der Waals' equation and the

proof of Cornot's theorem will gain in clearness if the present treatment is somewhat amplified. The printing shows a number of instances of dropped letters, reminding us of the war-time production of the book. The reference to Fig. 159 has the letters C_1, C_2 &c., in wrong order and on p. 365 we have $(\theta-\theta)^{5/4}$ instead of $(\theta-\theta)^{5/4}$. These minor blemishes can easily be remedied in the next edition. We have no hesitation in heartily recommending this modern text to the attention of teachers and students of the Pass degree standard and we would also wish Honours students to go through the work if they want to obtain a clear grasp of the physical principles underlying the subject.

T. S. S.

The Arc Spectrum of Iron, FeI—Part I. By H. N. Russell and (Miss) C. E. Moore; and Part II. By (Miss) Weeks. *Transactions of the American Philosophical Society*, Vol. 34, Pt. II. (The American Philosophical Society, Philadelphia), 1944. Pp. 97. Price $2.25.

Eminent investigators have, from time to time, reviewed the state of our knowledge regarding the structure of the spectra of various elements; in one such recent survey, Dr. Shenstone has graded the then available knowledge of the arc spectrum of iron as 'B', where the letters 'A', 'B', 'C', 'D' are used to denote progressively incomplete knowledge. The iron arc is the source of most of the lines that have been chosen as secondary standards of wavelength, and the sun's spectrum contains numerous lines of iron. It was, therefore, a serious gap in our knowledge which was indicated by the letter B in Shenstone's survey. Now a veteran in the analysis of spectra—Dr. Henry Norris Russell—has filled the gap and raised the FeI spectrum to a grade better than 'A' by publishing the present monograph with the collaboration of Miss Moore and Miss Weeks. That other pioneer in the analysis of complex spectra—Dr. Catalan—has been responsible for much of the advance embodied in the monograph, and the authors say that his name would have figured as joint author but for the difficulties of postal communication in these times of international stress and strife. We can form a conception of the singular devotion of these investigators to the pursuit of knowledge when we realise that their interest in the spectrum of iron has remained unabated during decades despite the vicissitudes of peace and war. And when the authors say that the arc spectrum of iron still promises 'attractive' and 'remunerative' problems, we can appraise the significance of the adjectives in the light of their love of knowledge for its own sake. The lavish scale of American equipment for research is here exemplified by the results on the Zeeman effect of iron lines, studied by means of the great Bitter magnet producing 83000-87000 oersteds and Dr. Harrison's automatic measuring machine which prints on a film the wavelengths of lines to three decimals and also their intensities measured photoelectrically. The substantial advance embodied in the monograph can be seen from the fact that it lists 464 levels (while Goudsmit & Bacher's book gives 287), accounting for 3606 lines observed in laboratory sources and 1254 lines observed only in the solar spectrum, while the Zeeman effect of 1033 lines has been listed leading to 'g' values for 392 out of the 464 levels. Apart from the wealth of these data, there is the high accuracy, the average error of a level being only $\pm 0{\cdot}05$ cm.$^{-1}$ Stress must also be laid on the fact that grouping into term multiplets and assignment of electron configurations have been carried out almost exhaustively, with full details of the evidence for the correctness of the assignments. The ionisation potential is estimated at 7·858 volts. The terms, in spite of their numerousness, are found to accord with Hund's theory except for two levels designated X_2 and X_3 which seem to be difficult to reconcile with its predictions. As the authors say, not much remains to be done by way of analysis unless a new source is discovered, which can produce iron lines with a profuseness approaching that found in the sun.

The tables present one peculiarity, *viz.*, that the levels are listed according to parity and multiplicity and not according to energy values. Thus the even levels classified into singlets, triplets, quintets, septets, occur in this order and then the odd levels in a like order. From one point of view this is an advantage but the arrangement fails to show the importance of the various levels as being concerned in the emission of observable lines. The wavelength data extend from 11973 Å to 1855 Å, various sources having been laid under contribution. King's temperature classification has also been included.

In such an extensive mass of data so carefully compiled, it is idle to try and locate errors without detailed checking, but one or two obvious misprints that caught the eye of the writer may be mentioned. Thus in Table 7 on p. 118, the first column, first line has $n^*=1{\cdot}3170$ while it should be 1·3130. In the second line the limit is given as 63630 while calculation gave it as 63610. In the third line, third column, Δn^* ought to be 1·0720 instead of 1·0723. In Table 10, p. 121, the number of ^5P terms to be expected is given as 6, and the number of ^5P terms observed is given as 7. This seems to show that more terms have been found than theory predicts, but the contradiction is not a real one. The number of ^5P terms assigned to the configuration concerned is, according to Table A, 6 and not 7, the 7th ^5P term being assigned to a different configuration.

Summing up we have no hesitation in saying that the paper is a model of what such work should look like, and that too a model worthy of close scrutiny but probably hard to imitate by anyone undertaking similar studies. Every practical spectroscopist should possess a copy of the paper and con over it time and again with the certainty of deriving profit each time from such a study. The price is probably not high for such literature.

T. S. S.