

Reviews.

THE USE AND MISUSE OF LAND. By R. Maclagan Gorrie. (Oxford Forestry Memoirs, No. 19, 1935.) Pp. 80. (The Clarendon Press, Oxford.)

It was long the fashion for the Agriculturist to think of the Forester as his natural enemy. This view, born of ignorance, is gradually disappearing but not yet dead. There is as yet, however, no widespread appreciation and occasionally not even recognition that sound Forestry instead of being incompatible with flourishing Agriculture, is an important and even integral part of it. The Forester and the Agriculturist are both vitally interested in the quality and quantity of their common basic commodity—the Soil. But, strangely enough, books which take a long-term view of Forestry and correlate its fundamental bearing to soil are all too few. It is for this reason that Dr. Gorrie's interesting Memoir is to be welcomed.

The book deals primarily with grazing and its relation to Soil Erosion. Indeed, the author who at first set out to trace "The Correlation of Erosion Damage and Grazing in Forest Lands" subsequently enlarged the scope of his enquiry because he felt that "if land as a whole could be put to its best uses.....the menace of over-grazing would automatically disappear". The value of Dr. Gorrie's book lies as much in this significant standpoint of the author as in the suggested solutions of the problem. Much the greater part of the data in the book relating to Land Erosion are from the United States and some at least of the lines of attack interest us in India as showing how the problems are tackled elsewhere rather than as how they should be here. Such concepts as "Palatability" of fodder to livestock, "Forage Factor" (defined as, Average Type Palatability \times Average Type Density) dealt at some length in the Memoir are of little more than academic interest to the Indian student.

The volume opens with a fascinating account of "Forestry as a Factor in Land Management". A survey of some aspects of grazing leads the author to a consideration of Grazing as a primary cause of Soil Erosion. The control of stream flow is then discussed and there is a separate chapter on "Farm Erosion and its Control". The title of the last chapter "Public and Private

Control of Land" almost suggests a discussion of socio-economic theories of land ownership of which, however, the author steers clear and gives short accounts of Erosion Control and Regional Land Planning as practised in the United States.

The use of the expressions "concave upwards" and "convex upwards" in describing Soil Profiles (p. 38) is a little jarring. The units employed in the tables are not always happy. Thus land erosion in Table I (p. 50) is expressed in "cu. yds. per sq. mile" while in Table II (p. 51) the soil loss is quoted in "tons per acre". A couple of Americanisms, "on to which" (p. 74) and "Alinement" (p. 76) are noticeable.

A bibliographic list is given at the end of each chapter. But for a semi-jocular reference to Wang's "Grundriss der Wildbachverbauung" in the text (p. 49) and a reference to Cabianca's paper (p. 60), the selection ignores the work of the Continental schools of thought. A few appropriate references to the pioneer work of the great German and specially Russian pedologists would very considerably add to the value of the Bibliography.

The Memoir should be read by every one interested in the intelligent utilisation of land.

EMMENNAR.

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THREE PHILOSOPHERS. By W. R. Aykroyd. (William Heinemann, Ltd., London, 1935.) Pp. 227. Price 10s. 6d.

In the history of every nation there are periodically recurring moments when the nation awakens to a national consciousness. To the French people such a historic moment came, when the public discovered the injustice of the verdict of the sanguinary Tribunal of the Revolution, to guillotine Lavoisier. The story of the life and work of this pioneer of modern chemistry makes fascinating reading to which a pathetic turn is given by the exceptionally tragic circumstances that attended his end.

In the present volume, the author gives primarily a biography of Lavoisier to which are added the lives of the two eminent English scientists, Priestley and Cavendish. These latter two were Lavoisier's contemporaries and rivals in the field of science. As an excuse for the inclusion of these two biographical sketches when his main purpose seems to be to lay bare the rather unfamiliar

life-history of the French scientist, the author suggests that the achievements of no scientific worker can be studied with advantage without reference to those of his contemporaries whose work no doubt must dovetail with his own. This method is amply justified in as much as certain obscure points in regard to claims for priority of discovery raised by some biographers have been set at rest. The lives of the three great figures of modern science are pursued on parallel lines and wherever appropriate, their attainments as men and scientific workers are critically compared.

Lavoisier came from the solid middle class and had a good start in life. The family traditions would have shaped out an entirely different course for young Lavoisier, but his native genius triumphed and made him elect a scientific career. To him the attainment of scientific distinction was of paramount importance. His chief claim to our remembrance and admiration rests on the laurels he won in the field of science, though he rendered signal service to the state and society as an administrator of the Revenue Farm and as the able head of several commissions on social reform. To Priestley all the advantages which birth and wealth could give were denied by nature, and his early education took place in an atmosphere of dissenterism. So it is small wonder that his mental horizon was dominated by theology in the light of which all other considerations were unworthy of serious attention. The scientific career of Priestley was spasmodic and all his major discoveries were made in fits and starts. Scientific research to him was a source of profound amusement that could fitly occupy his leisure. Like Saul, who came upon a kingdom when he was seeking his father's asses, he stumbled upon great discoveries. The history of the social life and scientific career of Henry Cavendish is a study in contrasts. Although coming of an aristocratic stock he inherited none of the gifts that go to make men successful in society. Aversion to society and in particular to women, was but one among a host of curious sadistic tendencies. Strange tales are current of how he avoided all contact with women. Coupled with this remarkable psychosis was an intellect, which, to say the least, was of the first rank. Science was the one light that relieved the genuine gloom of this singular mind.

Apart from the biographical interest in the book the serious student of chemistry

finds much food for thought. The refutation of the infamous theory of "phlogiston" which was obstructing the progress of chemistry for more than a century, by Lavoisier and unwittingly by Priestley himself has been developed at length in its historical and logical sequence. Another topic of general interest is the establishment of the composition of water by Cavendish which is all the more striking as nothing like scientific technique existed then. Lavoisier was the first to study metabolism and related phenomena which have culminated in the vast and fruitful science of Nutrition.

The background of these biographies is undoubtedly the troubled times of the latter half of the eighteenth century. The lives of at least two of the personages are coloured by the French Revolution, and unfortunately one of them was victimised by its bloody tyranny. The passages where the Reign of Terror is depicted, speak eloquently of the author's abilities as a descriptive writer. The mock trial of the Revenue Farmers before the Revolutionary Judges is at once vivid and pathetic in the extreme.

Like many a great man Lavoisier owed in great measure his success to the unrelenting devotion of his wife. Any sketch of his life would be incomplete without a reference to Marie-Annés who was his collaborator and inspirer. The author has done her ample justice by clearly indicating the nature of the co-operation which subsisted between them, which in great measure contributed to their joint successes. In the closing chapters of the book her history after the death of Lavoisier is narrated which serves to vindicate her character though she accepted the suit of the Count Rumford.

Speaking of the style of the author we admit without hesitation, that, though he is a specialist in a highly technical branch of science, his power of exposition may well be coveted by any literary man. The narrative is very lucid and is enlivened by anecdotes relating to incidents in the lives of these three scientists. English writers have meted out scant justice to Lavoisier who has been accused of appropriating other's discoveries to his credit. But in Dr. Aykroyd the French Chemist finds an enthusiastic champion.

Of the essential accomplishments for good citizenship, one of the most necessary factors

is perhaps the development of the historical sense. Among those that foster the cultivation of this sense most are the biographies of great men who have contributed to the public weal. To all those who wish to make a beginning in this direction Dr. Aykroyd's *Three Philosophers* is eminently suitable. The book provides the necessary background and the materials to build upon. The multiplication of such books will obviate the keenly felt desideratum as the literature of this kind is none too profuse. Meanwhile we extend our most cordial congratulations to the author for having won this signal distinction in the field of the professional historian.

C. N. R. R.

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HEREDITY AND THE ASCENT OF MAN. By C. C. Hurst. Cambridge. (The University Press, 1935.) Pp. ix+136. Price 3s. 6d. net.

Human history is in reality only a special aspect of natural history, dealing with the succession of events having to do with the human species. It is continually asked, what has man been doing through the long ages of his existence? The answer is furnished in part by the answer to the even more fascinating question—what will he become in the ages to come? Modern research in biology has taught us that minute particles of living matter with definite composition pass unchanged from generation to generation. We have learnt further that the human individual is extremely complex and is made up of materials, which while deriving their salient traits from ancestral germ-plasm are arranged in new ways so that it is rarely possible for two individuals to come into the world with the same inheritance of living stuff. In the fifties of the last century Gregor Mendel, an Austrian abbot, discovered the fundamental unit of life and mind the 'gene', but like many a great discovery it was completely ignored by Mendel's contemporaries. It was not until the beginning of the present century that scientists accorded to this discovery full recognition, for want of which biologists found themselves confronted by well nigh insurmountable difficulties. Since then the progress of genetics has been both steady and considerable. Among the experiments whose work has contributed most to this progress, the name of Dr. Hurst stands pre-eminent, whose work *Experiments in Genetics* has been considered to be a classic in the field. The present book

is a sequel to this more elaborate work, and is a very popular epitome of the recent work and achievements of the geneticists.

The book is devoted to a description of the fundamental unit of life and mind—the gene—which is the determining factor in the behaviour of all living organisms. Authority is implicit in this narration inasmuch as the author is a man of science and of recognised authority. The enthralling story of the evolution of living things is told in plain and simple terms making it intelligible to the lay reader. An unique feature of the book is that interesting speculation is set forth concerning the future of the human race. The author by a consideration of experimental facts comes to the universally interesting conclusion that the genetical work of the past few years may bestow freedom and power on man to shape his destiny. This sounds in striking contrast to the classical saying that "there is a Divinity that shapes our ends". Another thesis of especial interest to the statesman is that the nation which adopts scientific methods of race improvement will inherit the earth. Recent events in countries such as Germany, Turkey and Italy, under dictators, have at least in part justified this claim.

It is impossible to emphasise the importance of genetical science to the horticulturist and the breeder, but the aim of the author in this book seems to be to attract the man-in-the-street whose interest in this subject must be aroused and inspired to pursue the study at greater length. It will not be too much to expect that the volume will make an instant appeal to all those who wish to acquaint themselves with what is going on in one of the most rapidly progressing branches of biological research which has done so much to change the order from natural selection to human selection and enabled man to take a hand in creative evolution.

C. N. R. R.

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COSMIC RADIATION. By Prof. P. M. S. Blackett. Part I—General Survey. 22 pages. Price 10 fr. Part II.—The Wilson Cloud Chamber Method. 24 pages. Price 8 fr. Part III.—The Effect of the Earth's Magnetic Field. 19 pages. Price 7 fr. Part IV.—The Loss of Energy by Ionisation. 17 pages. Price 10 fr. (Actualités Scientifiques et Industrielles. Hermann et Cie, 6, Rue de la Sorbonne, Paris.)

These papers were read before the four conferences on Cosmic Radiation, held in

May 1934 by the College of France in Paris, and have been printed practically as read. It is unfortunate that they were not published more than a year earlier. They contain in concise form an account of the main lines of development of our knowledge of cosmic ray phenomena and would therefore prove valuable to those who wish to view this field through the eyes of one who has had a share in its development.

The introduction to the subject in the first paper begins with a quotation from an enthusiast who wrote without exaggeration: "Cosmic Radiation is a subject unique in modern physics, in the minuteness of the phenomena, the delicacy of observations, the adventurous expeditions of the observers, the subtlety of the analyses and the grandeur of the deductions."

After a very brief historical statement, there follows a correspondingly condensed account of cosmic ray intensities at various depths below the top of the atmosphere and under water in deep lakes, as measured by ionisation chamber methods. Intensity variations with time; geomagnetic latitude and longitude and their significance are discussed. It is pointed out that these data leave little room for doubt that the primary rays are electrically charged particles. Results obtained by means of counter-tube controlled cloud chambers are discussed in a little more detail and the paper ends with an all too brief consideration of the origin of this mysterious radiation.

The second paper should be of special value to those who wish to do experimental work with cloud-chamber apparatus. It begins with a discussion of the formation of tracks, their width, number of ions per unit length, and other matters. A few details of construction of apparatus used by the author are given. The latter half of this paper is devoted to a discussion of the production of "showers" and "bursts", investigated chiefly by means of Geiger-Muller counter-tubes.

The author shows that observations are best explained by assuming that electrically charged primary rays of high energy, in their passage through matter, produce at intervals, along their paths, a non-ionising radiation of the gamma-ray type, which in turn is absorbed with the emission of positive and negative electrons which ionise all along their paths. The production of a relatively small number of these tertiary rays at one time is called a shower but, occasionally as a result

of some catastrophic process, millions of these tertiary rays are produced and this is spoken of as a "burst". It is not clear that these two phenomena are of exactly the same type. In all cases it seems certain that practically all the energy involved in these phenomena comes from the primary particles.

The subject-matter of the third paper is especially important because it shows very conclusively that the primary radiation consists chiefly of electrically charged particles, most of which are positive. The author deals at some length with the theoretical work of Störmer and of Lemaitre and Vallarta, *i.e.*, with the motion of high-speed electrons and protons in the magnetic field of a di-pole, the earth. Observational results, in the light of theory, indicate clearly that only a small percentage at most, of the softer portion of the penetrating radiation can possibly be of terrestrial origin, while all of the harder rays must come from beyond the confines of our own galactic system. Thus the term "cosmic radiation" seems to be fully justified.

The fourth paper deals with the various processes by which the energy of a cosmic ray particle is dissipated while passing through matter. The cosmic ray may (*a*) cause excitation or ionisation by passing near an electron in matter; or (*b*) directly hit an electron giving rise to a secondary high energy ray; or (*c*) make a direct collision with an atomic nucleus, resulting in the production of many high-energy photons, as mentioned above, and probably other complications.

For process (*c*), the effective area of cross section is only a small fraction of the area of the nucleus of the atom concerned, while in the absorption of the photons, the effective area is proportional to the atomic number, which in the case of heavy elements is many times greater than the area of cross-section of the nuclei.

In such papers as these it is of course impossible to give details of construction and use for the many types of apparatus mentioned. For such information and indeed for any serious study of the subject a bibliography listing more than a hundred well-selected papers is appended. Another worthwhile feature of this work is a set of fifteen excellent reproductions of some remarkable cloud-chamber photographs by C. D. Anderson and of several by the author.

LES SPECTRES DES NEBULEUSES GAZEUSES. Par P. Swings. (Actualités Scientifiques et Industrielles. No. 241, 1935.) Pp. 1-26. Prix. 10 fr.

This is perhaps one of the smallest volumes in the Actualités collection running to twenty-six pages only out of which 15 pages are devoted to a table, two appendices and the title pages. It is remarkable that in the remaining short space of 11 pages the author should be able to present such a clear and up-to-date account of the subject. This has been made possible because in the first place the author himself has done, in collaboration with B. Edlén, very important work in this field and in the second place there already existed the beautiful article of Bowen (*Ap. J.* 1935, 81, 1) giving a synthesis of the ideas on the subject.

The author treats fully the mechanism of excitation consisting of primary process of ionisation by absorption of stellar radiation and the secondary processes of ionisation by secondary radiation, excitation by the same and excitation by secondary electrons. On the other hand, the treatment of that part of the subject dealing with chemical composition must certainly be considered to be inadequate although the author has given a resumé on p. 16. It might be remarked, in passing, that this resumé reads almost like a literal translation of the first paragraph on page 16 of Bowen's article mentioned above.

B. S. M.

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DE'NOMBREMENTS D'E'TOILES. Par H. Mineur. (Actualités Scientifiques et Industrielles. No. 225. 1935.) Pp. 1-56. Prix. 15 fr.

This volume forms, as the author states in the preface, an indispensable complement to the volume on the measurement of positions and magnitudes of stars which has already been reviewed in these columns (*Curr. Sci.*, 1934, 3, 223). The attempt to condense in a short space the very latest work done in the field has resulted in making the treatment necessarily sketchy and the material is not presented in a logical sequence as was done in the author's volume on "Photographie Stellaire". There is neither a table of contents nor an index nor a bibliography.

The work is, however, quite authoritative and there are no errors of a serious nature. The large number of tables and graphs interspersed throughout the volume adds

much to the clarity of the exposition. Of particular interest is the representation, by means of formulæ, of the number denoting stars more brilliant than magnitude m , as based on the work of Chapman and Melotte, Van Rhijn and Seares. As a preliminary to the actual subject of star counts, the author has briefly reviewed the principal star catalogues and charts and assessed their relative importance from the point of view of Stellar Statistics. Importance has rightly been given to the Harvard photometric sequences, this being the source on which the author mainly relies.

This is an indispensable book for an astronomer, theoretical or practical.

B. S. M.

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PHENOMENES D'INTEGRATION DANS LES CULTURES DES TISSUS. By B. Ephrussi. (Actualités Scientifiques et Industrielles. Hermann & Co., Paris, 1935.) Price 8 fr.

Tissue Culture, undertaken mainly by workers on Cancer Research, has, in practice, involved the solution of many problems of General Biology. One such problem, as Vogt puts it, is "the individuality of cellular culture..... After several transplantations what type of formation is represented by a culture of fibroblasts?..... Is it a Unity like that of the whole organism or a part of the organism?" We venture to paraphrase it in common language as follows: Is it (the culture of tissue cells after several transplantations or passages) a chip of some block or are there as many blocks as there are chips or cells? Albert Fischer, the author of the best book on Tissue Culture, so well qualified to speak on such a problem, says in one of his papers, "The transplanted tissue obeys all the laws of physiological integrity..... We are here dealing with a partial organism and not with cellular organisms." The reasons for such an opinion have been based on certain differentiations which appear among cells on culturing a tissue. For example, the epithelium of the Thyroid begins to form the colloidal substance only in the centre while the cells on the periphery of the same culture continue to multiply undifferentiated. M. Ephrussi rightly compares a culture of tissue to an organism, for cells sometimes show division of labour even though the main function leading to the division of labour may not be apparent; he calls this oriented heterogeneity. He summarises the following points of identity between the

culture of tissue cells and an organism as a whole: (1) The tendency towards a definite shape. (2) The limit of sub-division (for single cells of tissue do not grow). (3) The power of regeneration which naturally regulates the shape. (4) Oriented heterogeneity. M. Ephrussi further finds two problems common between the science of Tissue Culture and General Biology: (1) What limits the growth of a tissue in culture? and (2) What determines the development of a cell? That there is a regulating factor inherent in a culture of tissue is inferred by the presence of a similar substance in a colony of *Vorticella* as previously shown by the renowned French Biologist, Faure Fremier, under whose editorship the present brochure has been issued. Such a substance, although hypothetical at present, is probably also found in an egg where it regulates the growth of the embryo. M. Brachet has called it "Genetine". M. Ephrussi has given a clear exposition of the subject within 22 pages of printed matter using some 10 diagrammatic figures for illustrating the important points. For the modest price of 8 francs nothing more could be expected but many a reader would have welcomed a longer essay perhaps with some micro-photographic illustrations which would have given a more realistic representation of the phenomenon discussed so ably by the author. The subject appears to be of very recent origin, for no paper in the bibliography dates earlier than 1922.

S. M.

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HEAT. By Hutchinson. (University Tutorial Press, Ltd., London.) Pp. 284. Price 3s. 6d.

This is an excellent work by a well-known author and fits in admirably with the Intermediate syllabus of Indian Universities. The chapter on "Radiation" is the only chapter where the author could have adopted a fuller treatment by the addition of the "Theory of Exchanges" and Richie's experiment.

A historical background is provided throughout the book by detailed description of classical experiments. The utility of the book is greatly enhanced by the mention of all the practical applications of heat in industries and engineering. Heat engines have received particular attention in the last chapter.

The worked and unworked examples are as interesting as they are varied in type.

Solutions to the examples are, unfortunately, omitted and would be a welcome addition to the book.

One cannot help wishing that the cover of a book, whose get-up in other respects is excellent, were of a different colour. The bright orange cover "strikes" one in the eye. Would not a light green or blue be more suitable for a study?

P. A. MADHAVA RAO.

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ORGANIC SYNTHESSES. Vol. XV. Edited by W. H. Carothers. (Messrs. Chapman & Hall, London, 1935.) Price 8s. 6d. net.

The book under review is the fifteenth member of the series of publications entitled "Organic Syntheses". The present one contains description of usefully workable methods of thirty different preparations. The inclusion of substances like 5:5-dimethyldihydroresorcin, diazomethane, 2:4-dinitroaniline, *p*-iodophenol, 1-methyl-2-pyridone, etc. and an experiment describing the preparation of anhydrous hydrogen bromide, obtainable continuously for hours, make the book quite useful. Amongst the types of reactions dealt with in the present volume are to be found examples of (1) addition of hydrocyanic acid to a ketone, (2) substitution reactions, (3) reduction with tin and hydrochloric acid, (4) Grignard's reaction, (5) malonic ester condensation, (6) decarboxylation with concentrated alkali at high temperature, (7) halogenation with halogen acids, and (8) oxidation with selenium oxide. The get-up of the book and the disposition of the contents are exactly as in the previous volumes.

P. C. GUHA.

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LABORATORY MANUAL OF PHYSIOLOGICAL CHEMISTRY. By Prof. Meyer Bodansky and Marion Fay. Third Edition. (John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London, 1935.) Pp. vii+274. Price 10s. net.

This is the laboratory companion to Professor Bodansky's well-known *Introduction to Physiological Chemistry* (cf. review in *Current Science*, 1935, 3, 318) and the latter should be consulted at every stage to understand the bearing and significance of the experiments dealt with. As an elementary laboratory manual useful to students preparing for a degree in Medicine, the book serves a real need. It comprises both qualitative and quantitative experiments, systematically arranged. The subjects dealt

with are few, but vital and within the limits imposed by the size of the manual; the authors have succeeded in placing before the readers, a comprehensive array of the salient features of physiological chemistry. While the book cannot lay claim for completeness, it serves as an excellent introduction and if supplemented by collateral reading of easily accessible literature with the assistance of the references cited throughout the book, the student cannot fail to obtain a working knowledge of the subject.

The get-up of the book is excellent and leaves nothing to be desired. We are confident that the revised edition will receive a warm reception.

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INSECT PHYSIOLOGY. By V. B. Wigglesworth. (Methuen & Co., London.) Pp. viii + 134 with 13 Illustrations. 1934. Price 3s. 6d.

This little book maintains the high standard reached by other monographs on biological subjects published by Methuen & Co., Ltd. It will be welcomed by the agricultural and medical professions and will be of great value to students of general zoology. The general physiology of the group of Insects which are the most numerous in species and the most varied in structure and habits, is apt to be observed by the practically endless specializations of these animals, but the author has retained only the material points, linking all the general factors into a single system, in illustration of his theme.

Though the early scientists like Hooke, Malpighi and others have studied the morphology of insects and have given us correct and valuable information about their physiology, the subject did not receive further attention nor any impetus till entomologists were confronted with the ravages caused by the insects in the spheres of agriculture and public health. Subjects like responses to stimuli, reactions to parasites, acclimatization and the action of toxic sprays and gases upon these, have engaged the attention of economic entomologists within recent years. We, therefore, congratulate Dr. Wigglesworth and welcome his largely illustrated monograph in which the author says that "the sketch which follows is based on the study of nearly 2,000 publications, and on a certain amount of original work".

The first chapter deals with the integument and it is very well known that a large amount of insect physiology depends upon

the nature of its cuticle. The cuticle which consists of thin epi- and a thick endo-cuticle is shed from time to time. The unimpregnated endocuticle is very elastic and this is proved by the fact that the first stage larva of *Rhodnius* can receive into its abdomen more than 12 times its own weight of blood. During moulting, a large part of the cuticle is dissolved; the endocuticle when unimpregnated with cuticulin undergoes dissolution, when the epicuticle remains untouched. Possibly this digestion of the cuticle is brought about by the secretion of enzymes (a chitinase or protease) by the dermal glands into the moulting fluid present between the new and old cuticle. The epicuticle is torn by the pressure of the blood. Chapters II and III deal with the respiratory and circulatory systems. The diffusion theory of insect respiration is briefly described and an account of the respiration in aquatic forms like *Hydrophilus*, *Dytiscus* (metapneustic respiration) and *Notonecta* is given, and among parasites mention is also made of the aquatic larva of *Donacia* possessing special siphons which are inserted into the air-containing tubes of aquatic plants, and thus remain submerged permanently. The wounds in many insects are merely closed by a plug of cells and the blood does not clot in that region. The blood-cells or hæmatocytes are phagocytic and accumulate on the sides of the dorsal blood-vessel forming phagocytic organs.

In the chapters on digestion and excretion, besides giving important and interesting information regarding salivary glands, the author has given excellent description of digestive enzymes, Malpighian tubules, the holocrine and merocrine types of secretion. The former is a cellular disintegration to form the juice while the latter is merely a secretion from the epithelium.

The next two chapters deal with nutrition and metabolism, and reproduction and growth. The importance of symbiotic organisms is discussed in insects like *Cimex*, *Glossina* and *Pediculus*. With regard to the subject of metamorphosis, it is believed that this is initiated by a hormone which is different from the one responsible for moulting.

The last chapter gives an account of the nervous system, sense organs and behaviour. There is a large list of references given at the end of the book so that students requiring detailed information may refer to the original papers. The get-up of the book

is neat and attractive and we have no doubt that it will be appreciated by the scientific workers for whom it is intended.

L. S. R.

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HELMINTH PARASITES OF THE DOMESTICATED ANIMALS IN INDIA. By G. D. Bhalerao. (Scientific Monograph No. 6 of the Imperial Council of Agricultural Research.)

The study of helminthology has, in recent years, revealed its importance not only in medicine and public health, but also in veterinary and agricultural sciences. Unfortunately this branch of science has, till recently, been neglected in India. Mr. Bhalerao's Monograph on the "Helminth Parasites of Domesticated Animals in India" has adequately put forward its claims in veterinary science and is a valuable asset to the helminthologists and veterinarians alike. The aim of the monograph is to provide a collective account of the helminth parasites of our common domestic animals and to facilitate their identifications. Each helminth group—Trematoda, Cestoda, Nematoda and Acanthocephala—is considered separately, beginning in a general way with the morphology and life-history, followed by a systematic account of the group under review. Elaborate keys for the identification of the parasites belonging to each group form very useful part of the work. The descriptions, though concise, are suitably illustrated by clear diagrams, many of which are claimed to be original. The bibliography given at the end of the book is exhaustive and renders the volume of service even to advanced workers. The author has successfully achieved his object and the work compares favourably with any other in the field.

No work of this kind can be perfect in every way and there is always a danger of its becoming out of date, even prior to its publication, especially when continued research is daily adding new forms to the helminth fauna. There appear to have been certain omissions and unfortunate errors in this volume. The author has been rather modest in omitting his important forms described in recent years. In the interest of the subject, these and certain others described by other authors from India ought to have been included in the book. Mention of the presence of receptaculum seminis in the family Psilostomidæ is rather curious, as its absence has been emphasised in many standard works (*vide* Führmann in Kükenthal's *Handbuch der Zoologie*).

There are some slips as well and these though trivial, are blemishes in an otherwise admirable piece of work.

The general get-up of the book is nice and the paper used is good. The book is particularly welcome as it comes from the Research Staff of the Imperial Institute of Veterinary Research, Muktesar, where most of the officers of the Veterinary Department now complete their training. Mr. Bhalerao is, therefore, to be congratulated on this successful venture of a zoologist. The book is the first of its kind from India and will undoubtedly well serve the purpose intended. It should meet the requirements of both the student and the practising veterinarian, and would, besides, form a useful addition to the zoological libraries.

G. S. T.

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FUNDAMENTAL PHYSICAL PROPERTIES OF LAC—PART I. MECHANICAL PROPERTIES. By Lal C. Verman. (Technical Paper No. 3. London Shellac Research Bureau.) Pp. 28.

This neat brochure heralds the publication of a series of four dealing with various aspects of the Fundamental Physical Properties of Lac, *viz.*, Mechanical Properties, Thermal Properties, Electrical Properties and Optical Properties. It was pointed out by Mr. Gibson, sometime ago, that, among other things, compilation and publication of exact data on the Physical, Chemical and Mechanical Properties of Shellac, with special reference to use in industrial processes, would go a long way to consolidate the position of lac as a raw material in industry; Dr. Lal C. Verman has taken great pains to collect and collate the floating facts and present them in such a concise form for ready reference. After a brief outline of the methods and their limitations, values are given for the specific gravity of shellac, film-hardness, adhesive strength, ultimate tensile strength and modulus of elasticity of various types of shellac and shellac compositions. Wherever possible the corresponding values for other natural and synthetic products are also given for comparison.

A perusal of this booklet brings to light certain striking properties of lac which can be turned to commercial exploitation. The removal of the wax from lac seriously impairs the scratch-hardness and abrasion resistance of shellac films, and the author's own work indicates that the natural wax is far superior to added plasticisers in conferring hardness and especially abrasion resistance

to shellac films. It has been clearly pointed out that the hardness of the film depends on the nature of the base to which it is attached and the subsequent baking. Another remarkable property of lac brought into strong relief is that its adhesive quality is something enormous compared with fish glue and gelatin, the drying period being relatively negligible at that. In spite of this the film produced from shellac varnish can be "flatted" by sand-paper. An adequate bibliography at the end considerably enhances the usefulness of this brochure.

This publication is all the more welcome at this juncture when lac is faced with a crisis. By bringing to the fore the outstanding qualities of lac, it may help the lac industry to hold its own against the onrush of synthetic products. It is hoped that, ere long, the other parts also will come in print.

A. V. S.

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INDIAN SUGAR INDUSTRY (1935 ANNUAL). By M. P. Gandhi, Secretary, Indian Sugar Mills Association; Secretary, Indian Chamber of Commerce, Calcutta. (G. N. Mitra of Messrs. Book Co., Ltd., 4/3 B, College Square, Calcutta.) Pp. xvi+57+22. Price Rs. 2-4-0 (postage extra). Foreign 7s. 6d.

At the time when the Indian Sugar Industry is making rapid strides of advance under the Government's protection policy with all its beneficent influence on the agriculture of the country, this publication by Mr. M. P. Gandhi must be of immense interest to industrialists as well as to the general public. The author has presented briefly all sides of the industry and its inherent problems. The earlier part of the book contains tables of all the necessary data about production, exports, imports, costs, consumption and many other pertinent topics. The main text confines itself to a detailed explanation of practically the same topics with the author's views and arguments. The reader has herein an opportunity of knowing a short history of this important industry, its present position and the future possibilities.

The fifteen tables inserted in the book are useful as permanent references because they include besides the figures for the year under consideration those for several of the preceding years and also here and there estimates for the coming years. The appendix contains an outline of world sugar industry with a special section on Java. The mono-

graph ends with a very useful list of all the sugar factories in India.

For purposes of easy comparison quantities must be expressed in the same unit, for example, as tons or as maunds and though it is appropriate to use both the units it will make comparison of data more difficult. We find also different ways of numeration adopted even in one and the same table as for example in Section (9) of "The Indian Sugar Industry at a Glance" where the quantity of cane crushed is expressed as lakhs of tons and other quantities as millions of tons. Attention to these small details is bound to enhance the value and usefulness of the work.

It is hoped that the author undertakes this publication every year for the use of the public who are interested in the welfare of one of our important national industries.

G. G. R.

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CANDLE MANUFACTURE. By Professor Dr. N. N. Godbole, assisted by R. N. Mehta. (Benares Hindu University, Benares, 1935.) Pp. iv + 29. Price Rs. 2. Foreign 4s.

This small book of 29 pages embodies the practical experience of the authors in the industrial laboratories of the Benares Hindu University and also includes information collected elsewhere.

The first chapter presents a brief survey of the historical and economic aspects of the industry. The raw materials of the industry are described in the second chapter, which gives in addition an elementary idea of the process of the "splitting" of fats and hydrogenated oils. Auxiliary materials such as ceresine and bees-wax as well as the recently developed I-G waxes, and their assistance in the manufacturing process are indicated in the fourth chapter.

A short account of preparation of candle-wicks and the significance of the melting and congealing point of candle-material is followed up by a very brief description of the manufacturing process as carried out with modern machinery. Some hints are also given regarding the manufacture of fancy material such as coloured, medicated or perfumed candles.

The tables given in the appendix contain information concerning (1) size of wick and diameter of candle, (2) shape, size and weight, and (3) melting points of some types of candle-material.

It is hoped that this book will be read by all persons interested in candle manufacture.

UNIVERSITIES YEAR BOOK, 1935. Published for the Universities Bureau of the British Empire. By G. Bell & Sons, Ltd., London, 1935. Pp. xxxi+1057.

The latest edition of this well-known year book has all the merits of its predecessors, authoritative character, comprehensiveness and excellent get-up. First published in 1914, the Year Book has become more and more indispensable to the members of universities and colleges, government departments, clubs, school masters, etc., who find in it much information of interest regarding members of other universities, colleges, etc. The publication has been brought up-to-date and the arrangement of matter is so designed as to make ready reference possible and in this, considerable assistance is afforded by the excellent name and general indices.

Each section under Universities (of Great Britain and Ireland, of Canada, of Australia, of South Africa and of India) comprises a directory of the officers and members of the staff of the universities, general information and reports of events of outstanding interest which occurred during the previous year. There are 31 appendices, which provide such varied information as professions and careers, post-graduate scholarships, centres of scientific and industrial research, etc. Considerable space is devoted to Indian universities not only in the earlier chapters, but also in the appendix. The publication is indispensable to all libraries where it will occupy an important place among reference volumes.

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LES ASSOCIATIONS BIOLOGIQUES AU POINT DE VUE MATHÉMATIQUE. By M. Vito Volterra and M. Umbreto D'Ancona. Pp. 97, 28 Figs. (Actualités Scientifiques et Industrielles. Hermann & Co., Paris, 1935.) Price 20 fr.

This brochure is a guide to the study of the rise and fall of population among animals and lower organisms by the application of mathematics. The late E. F. Smith, the author of *Bacterial Diseases among Plants*, who has done more than any one else to increase our knowledge in this branch of science and as such deserves to be considered a great biologist, says in his book, "Nothing is more discouraging to the general reader than a book or paper full of mathematical formulæ." He further writes, "Biologists, for the most part, are very far from being

able to express themselves after the manner of mathematicians. Their language and ours is unlike almost to mutual exclusion. If your liking for mathematics is second only to your love of biology, then you may study it as long as you feel inclined. You will be a kind of white blackbird among your fellow biologists but this need not disturb you since you will be able to do some things which they cannot do." If any ambitious biologist wishes to make himself such a "white blackbird", he cannot do better than start with the work of Volterra and D'Ancona under review for it gives as easy and simple an introduction to the subject as possible. Volterra's mathematical theory of the struggle of life has proved of such significance that it has offered others like Gause and Severtzoff material to elaborate on. Master of his field Volterra's treatment of the subject can hardly be surpassed in lucidity and selection. However, as the authors themselves state, their publication, on account of its small size, can hardly serve as anything more than a guide and they refer the interested reader to other literature in the bibliography. Here we note several serious omissions. E. Fischer's name occurs in the text on p. 82 but none of his papers is listed at the end of the book. At the University of Oslo, Prof. Hjort, collaborating with Drs. Ottstad and Klem, has made a mathematical analysis of yeast growth as a model of increase in population and applied this and similar results to study the fluctuating population of the whale. These three Norwegian scientists have published excellent "Essays on Population" in 1933 but no reference is made anywhere to their work. Influenced by the application of mathematics to the study of insect epidemics, H. E. Prof. Escherich, the present Rector of the Munich University, has explained "The New Aspect of Forest Entomology", in *Forstwiss. Cen.*, 1930, Heft 12; while from his Institute Prof. Zwölfer has published several classical papers, among others a mathematical essay entitled, "The Theory of Insect Epidemics", *Biol. Zentr.*, 1930, Bd. 50, Heft 12. These papers also appear conspicuous by their absence. Like most French books the publication under review is an inexpensive one and Messrs. Hermann & Co. have the readers' thanks at the fine get-up and the absence of all errata.

The Structure of Metallic Coatings, Films and Surfaces.*

THE papers read at a symposium on this subject conducted by the Faraday Society and the discussions thereon appear in a special number of the *Transactions of the Faraday Society*. A number of well-known workers in this field have taken part and in all there are about thirty papers.

In Part I, Professor Finch and his collaborators have given a complete account of the study of surfaces by electron diffraction methods. Their paper serves as a valuable monograph for workers in this field. It is made quite clear that although there are still a few points to be cleared regarding the interpretation of experimental results, the method of electron-diffraction is probably the most powerful available for the study of surfaces. The evidence given by this method towards the clarification of the "vexed question" of the Beilby layer on polished surfaces is in favour of the existence of such a layer. In the general discussion on this problem Professor Kirchner makes the observation that diffuse bands of the type given by polished surfaces can also be obtained by reflection from suitably prepared, sputtered or evaporated films which however give sharply defined rings by transmission. But sputtered or evaporated films and the polished layer are two different things which are not directly comparable, and thus the evidence against the existence of the Beilby layer is not overwhelming. Hopkins finds that the Beilby layer is about 30 Å thick while Zees finds a layer of oriented crystals separating the Beilby layer from the polycrystalline layer underneath.

In the second part there is a very interesting paper by Professor Andrade, incorporating some remarkable results obtained by him recently. He has followed various stages in the growth of crystals in thin films of silver on heat treatment, by microscopic methods. Spherulites, *i.e.*, uniaxial crystal fibres radiating from a centre, are first formed on heating such films. These gradually grow into single crystals with their \parallel planes parallel to the surface of deposition, on

increasing the temperature. This observation is in agreement with the results obtained by previous workers by X-ray and electron-diffraction methods as to orientation of crystallites in metallic films on heat treatment.

The remaining papers deal with metallic coatings obtained by electro-deposition, hot dipping and spraying. Macnaughton and others present the results of a study of the hardness of electro-deposited nickel in relation to grain size, pH value of the electrolyte, etc. Blum and Kasper find that deposits obtained with nickel chloride solution are fine-grained and relatively smooth, strong, hard and brittle. Those obtained with sulphate baths are rough, coarse-grained, soft and ductile. Professor Kohlschütter's paper on "Somatoids" is valuable in understanding the formation of abnormal growths on the cathode during electro-deposition. Hothersall has studied the influence of the substrate on the structure of metallic coatings obtained by electro-deposition. Wood has made a thorough study of the differences between electrically-deposited metallic coatings and the normal metal by X-ray methods. He finds a broadening of the lines in the X-ray diffraction pattern of such deposits of nickel and chromium and points out a correspondence between this line broadening and the hardness of the deposit. He also finds that the brightness of the deposit was greater in the deposits showing more perfect orientation of the crystallites than in others.

The papers and the discussions which follow them provide a more or less complete survey of the subject. The discussions especially are highly stimulating and in them several interesting points are raised which may form subjects for further work. It is clear from a study of these that the method of electron-diffraction is invaluable for the examination of the structure of surface layers. But other methods involving the use of X-rays, optical properties of the surfaces and microscopic studies are also essential.

S. R.

* *Transactions of the Faraday Society*, 1935, 31, Part 9a.