REVIEWS

CRYSTAL GROWTH*

IN times past, well-developed clear crystals were a rare gift of nature and were highly valued. Their lustre and regularity of shape have been a source of pleasure to the layman through the centuries and a cause for speculation to the naturalist and philosopher. In recent years, however, the demand for single crystals has outstripped nature's bounty. The need for large crystals free from flaws for spectroscopy, piezo-electric measurements and the various purposes of the electric industry cannot be met from the diminishing natural sources, nor do those give a sufficient variety. This has led to researches on the methods of accurate control of crystallisation from the vapour phase, the melt, from supersaturated solutions and from hydro-thermal processes under high pressure simulating those in nature. The present brochure is the outcome of a general discussion on the theoretical and experimental aspects of artificial crystal growth held at Bristol in April 1949. Almost all the important workers in this field numbering more than sixty from England, U.S.A., Holland, Germany, Belgium and Switzerland contributed papers and took part in the discussion. The contributions are partly theoretical and partly experimental. The experimental papers fall fairly sharply into two classes—those dealing with rapid growth and those dealing with extremely slow growth.

The volume is divided in the main into four parts with the headings (1) Theory of crystal growth, (2) Nucleation and normal growth, (3) Abnormal and modified crystal growth and (4) Mineral synthesis and technical aspects, each being followed by a general discussion. The first part deals with the theoretical studies of the forms of equilibrium of crystals, surface structures of crystals, influence of dislocations on crystal growth and that of foreign material on habit modification. The principal contributors are, Stranski, Moliere, Burton, Frank and Egli. In Part II, the kinetics of crystallisation which includes two processes, namely the formation of three dimensional nuclei and the growth of these critical nuclei to microscopic dimensions has been discussed by Dunning and others in some detail both from the experimental and theoretical standpoints. The numerous anomalies observed in the process of crystal growth and also the conditions under which crystal growth are modified are discussed in Part III. The last part of the symposium is mainly concerned with many of the recently developed methods for growing CaF_2, LiF quartz and such other crystals of high commercial value. Anybody who is interested in the techniques of growing crystals will find this part and especially the contributions by Stockbarger, Menzies, Holden and Robinson very useful.

R. S. K.

* *Crystal Growth.*—Discussions of the Faraday Society (London), No. 5, 1949. (Gurney & Jackson, 98, Great Russell Street, London.)

Excited States of Nuclei. By S. Devons, *Cambridge Monographs on Physics.* (Cambridge University Press, Bentley House, N.W. 1) 1949. Pp. 152 Price 12|6.

The volume under review conforms to the general plan of the Cambridge Monographs on Physics, and presents the results of most recent research on the excited states of nuclei mainly from the experimental standpoint. The experimental methods of study and the important and typical results obtained therefrom have been described in some detail. No attempt has been made nor is this to be expected in a small brochure of this kind, to give a comprehensive survey of all the experimental data which are accumulating at a very rapid rate. On the theoretical side, only the results of recent theories have been indicated without going into much detail.

The short introduction is followed by four chapters. The first two deal in turn with the excitation of "bound" and "virtual" states of nuclei. The term "bound states" is applied to the case if the only transition possible is by electromagnetic radiation, while the term "virtual states" is applied to the case if the dissociation from nucleus of one or more nucleons is energetically possible. The next chapter deals with the radiative transition between nuclear states, while the last chapter is devoted to the general problem of interpretation of data concerning nuclear spectra.

Specialists working in the field of nuclear physics will find the monograph particularly useful.

R.S.K.

Electricity and Magnetism: Classical and Modern. By G. B. Deodhar and K. S. Singwi. (Students' Friends, Allahabad and Benares), 1949. Price Rs. 15.

The book under review is intended to give "an introductory account of the main topics of electricity and magnetism". It consists of two parts, classical and modern, of which the former deals with electrostatistics, magnetostatistics and electromagnetism and the latter treats with the more recent developments since the discovery of the electron. The book is intended primarily to fulfil the needs of students going for the B.Sc. (Pass and Hons.) examinations and there is no doubt that it would eminently serve this purpose as most topics are dealt with in a manner readily capable of being reproduced in an answer paper. However, it is not certain that a student, reading only this book, can obtain a good understanding of the fundamentals of electricity and magnetism. The book reminds one of lecture notes rather than a text-book, ideas which are developed in later sections being freely used in earlier ones, with no indication to the reader as to where he can find these explained. There are a number of inaccuracies of statement and errors even in mathematics. For instance, one finds in p. 174 "The practical unit of mutual inductance is also *henry*. It can be defined as the e.m.f. in volts when the current is changing at the rate of one ampere per second". Again, on p. 182, the solution of case (2) of the growth of current in a circuit containing inductance, capacity and resistance is wrong and occurs from the fantastic assumption that, when the two roots of the auxiliary equation of a second order differential equation in t are equal ($=\alpha$), then the solution is $e^{\alpha t}(A+B)$. Misprints are also many, some of which occurring in the mathematics are likely to lead to confusion.

In spite of the above defects, the experimental portions are well described and the second half of the book, dealing with modern physics, contains a good account of the recent developments. It is to be hoped that these defects will be remedied in a later edition.

G. N. R.

The Adsorption of Gases on Solids. By A. R. Miller. (Cambridge University Press), 1949. Pp. viii + 133. Price 12/6 net.

The phenomenon of adsorption has been engaging the attention of scientific workers for some time from theoretical as well as practical points of view. In the latter category it has found extensive application in a wide variety of fields, such as "outgassing" in the manufacture of discharge tubes and wireless valves, removal of the last traces of gas in the production of perfect vacuum, manufacture of gas masks, ion exchangers in water purification, etc., and the recently developed technique of chromatography. While the technical applications of adsorption processes are impressive and can be compared with those of the closely related phenomenon of catalysis there is still much to be done with regard to the theoretical aspect.

A few years ago all that was known of this phenomenon could be expressed by an empirical equation known as the Freundlich isotherm. A distinction had to be made between the purely surface action and the reaction taking place in the interior of the solid. Adsorption relates to the first, while "absorption" is used to denote the second. McBain (now Director of the National Institute of Chemistry, India) recommended the word "sorption" to cover both. Adsorption again is of two types, one due to physical or van der Waals forces, and the other due to chemical forces. The former is *van der Waals adsorption*, while the latter is known as *activated adsorption* or *chemisorption*.

A clearer understanding of the subject was made possible by the contributions of Langmuir relating to his famous unimolecular theory of film formation, followed by a host of others. At low pressures the phenomenon of adsorption is concerned with the formation of a film only one molecule thick. Multimolecular films are produced near the B. P. of the gas or below the critical temperature. Langmuir derived a general equation from first principles, which reduces to Freundlich isotherm under restricted conditions of temperature and pressure.

Langmuir's experiments showed the importance of keeping the surface clean in all studies of reactions between a solid surface and gas, and many of the discrepancies between experimental and theoretical results could be traced to the impurities which had not been removed. One of the earliest to recognize this fact and to pursue this aspect of the problem was the late J. K. Roberts of Cambridge, who initiated a scheme of research, the results of which were published in 1939 in a monograph entitled "Some Problems in Adsorption". After the death of Roberts the duty of bringing out a second edition was taken up by his collaborator A. R. Miller, according to whom "it was necessary to discard much of the original text

and to rearrange the presentation of the remainder to confom to the new material which was to be introduced".

The word "impurity" occurring in the very first sentence of the book sounds a little odd. This however is a minor criticism. The problem of adsorption is treated systematically first from the point of view of the kinetic theory of gases, followed by the modern statistical theories. Mobile and immobile films are distinguished, the effect of dipole interactions considered, as also the variation of the potential field provided by the adsorbing surface. One of the paragraphs is entitled "The kinetics of adsorption and evaporation in a mobile film on 110 plane of tungsten when each adsorbed particle precludes occupation of neighbouring sites". This should give an idea of the complicated nature of the problem. A sound mathematical equipment on the part of the reader is needed to appreciate the trends of modern research in connection with the phenomenon of adsorption. The book is meant for and strongly recommended to research workers and advanced students of physics and physical chemistry.

M. R. N.

Physical Chemistry. By G. V. Krishnamurti, (Ghantasala Publications, Eluru, Madras), 1949. Pp. 133. Price Rs. 2.

This book or booklet with its pompous title is meant to cater to the needs of Intermediate students, as its ten chapters cover the Intermediate syllabus only. As stated in the Preface "The explanations of important *theoritical* (author's spelling, not printer's devil, as the spelling is repeated in other pages in the text) principles are talked out as the author would to his own students." He has thus forgotten that his lectures are brought to the notice of a very much larger audience of varying degrees of knowledge and critical faculty, where he has no further chance of explaining or correcting his statements. All this implies that extreme care is needed in the publication of a book, especially a text-book. The author's language and style may be judged from a few samples of sentences chosen from different pages: "This book sets out to give an outline of the principles of physical chemistry in a clear and simple manner as to help the reader obtain an understanding of the essential concepts and ideas on the subject" (Preface). "We do not find atoms flying about singly in oxygen but the element oxygen is made up of molecules each of which is a pair of oxygen atoms" (p. 8). "The hydrogen atom was chosen as the standard of comparison so that its weight was taken precisely as unity" (p. 9). "Gases are sparsely populated with molecules as thinly as Africa or Australia which would therefore admit of large immigration and extensive colonisation" (p. 10). "Of the three states of matter the behaviour of gases is in general much simpler" (p. 24).

As examples of scientific accuracy we have the following:— "These atoms are indivisible, indestructible, and existent from eternity to eternity" (p. 8). "As a few elements like silver do not combine with oxygen or displace it ...." (p. 4). The model answers worked out on p. 77 for calculating the degree of ionisation of NaCl and another substance are wrong; the values 1·92 and 3 represent not ionisation constant but the van't Hoff factor.

In addition there is the exasperating sentence on p. 4: "Refer to Intermediate Experimental Chemistry by the same author....." in the body of the text.

The Indian teacher has an enormous responsibility towards his students and his country. The least that he can do is to inculcate in the young minds the importance of accuracy, accuracy of facts and accuracy of expression. Judged from this standpoint this book falls far short of the ideal and cannot therefore be recommended to students.

M. R. N.

Surface Tension and the Spreading of Liquids. By R. S. Burdon. (Cambridge University Press), 1949. Second Edition. Pp. xiv+92. Price 12/6 net.

This is one of the Cambridge monographs on Physics edited by N. Feather and D. Shoenberg. The major aim of this series will still be (as it was with the Cambridge Physical Tracts out of which this series of monographs has been developed), "the presentation of results of recent research, but individual volumes will be somewhat more substantial and more comprehensive in scope, than were the volumes of the older series. This will be true in many cases of new editions of the Tracts, as these are republished in the expanded series".

The monograph under review seems to be an exception to the above in that "no attempt has been made to do more than extend the tract by including some account of work published in recent years". Any specialist reader would find quite a few fundamental advances missing; the monograph extensively deals with the spreading of liquids but does not make any

reference to the theory of contact angles. Nevertheless, the book is written in a simple and elegant style and presents in an intelligible way many of the recent trends in the field of surface tension and spreading of liquids.

K. S. G. D.

Industrial Hygiene and Toxicology, Volume II. Prepared by a group of specialists under the editorship of Frank A. Patty, Director, Industrial Hygiene, General Motors Corporation, Detroit, Mich. (Interscience Publishers, New York, London), 1949. Pp. 535+1138. Price $ 9·00.

Volume I of this invaluable work on industrial hygiene was reviewed in this journal a few months ago. It was devoted to a detailed survey of the conception of industrial hygiene from ancient time and described in detail the importance of environmental hygiene for the welfare of the workers and its contribution to industrial efficiency.

Toxicology is usually considered a very dry subject, but as dealt with by the eminent authors in Vol. II, it makes fascinating reading. The subject-matter is so beautifully classified and arranged that even lay persons can derive some pleasure in going through it. Immense pain has been taken to describe every kind of chemicals used in industries, small or large. Each individual or group of chemical has received adequate attention according to its importance, e.g., lead, arsenic, mercury, alcohols, aldehydes, various hydrocarbons, etc., have been described exhaustively in relation to their source, use, physiological response and toxic incidence and mode of hazards; others of lesser importance are grouped together and described in detail. The volume can be commended as indispensable not only to those interested in industrial organisation, but even to general medical practitioners, engineers and others associated with industrial establishments. The book is handsomely got up and well printed.

K. P. MENON.

The Sensory Line System and the Canal Bones in the Head of Some Ostariophysi. By Bertil Lekander. (Alb. Bonniers Boktryckeri, Stockholm), 1949. Pp. 131. Price not given.

The author has carefully described the development of the sensory nervous system and the canal bones of a number of species of fishes of the sub-order—*Leuciscus ratilus* L., *Phoximus phoximus* L., *Alburnus alburnus* L., *Tinca tinca* L., *Nemachilus barbatula* L., *Siluridæ*, etc., of the cryprinids and cobitids families. The development of the sensory system and the canal bones from the early formation in the embryo has been described in detail. Uptil now the available information has been based on studies on adult fishes only. In this investigation the author has shown the interrelation of the lamellar and the latro-sensory components of the canal bone and the genesis of the two components. Students of marine zoology will find the monogram very interesting.

K. P. MENON.

Fungi and Plant Disease. By B. B. Mundkur. (Macmillan & Co. Ltd., London), 1949. Pp. x+246, 130 figs.

Dr. Mundkur's book, the first to be written by an Indian, is meant to serve as a text-book for students and describes about 48 diseases of Indian crops. A summary of the salient features of the fungi precedes the detailed consideration of the types belonging to the different families. Under each type, the important diseases caused by it are described. The aim is not to be exhaustive, but only to rouse and sustain the interest of the undergraduate ; in this, the author must indeed be said to have succeeded.

The first five chapters are devoted to a study of the structure of the fungi, their reproduction and metabolism, symptoms of diseases, and methods of studying them and classification and naming of fungi. The four main classes are reviewed in the next four chapters, and the diseases caused by them described. There is a short chapter on bacterial diseases and another on virus diseases. The last chapter discusses the control of plant diseases. Here the technique for the determination of wheat rust races is included, which might well have found a place in Chapter IV on methods of studying plant diseases. There are literature references to each chapter, but their worth might have been enhanced if cross references had been given in the body of the book. There is a good index.

The book is not without some blemishes. Of the 157 references, there are very few to the work done in Madras and Mysore, more than two-thirds being on work done in America and Europe. The oospores of *Phytophthora arecæ*, *P. colocasiæ* and *P. parasitica* are stated to be amphigynous, when the description should apply to the antheridia. Notwithstanding a few such instances of ambiguous terminology and some misprints, the book will be of real

service to those for whom it is intended. It is to be hoped that necessary corrections will be made and additional chapters written in its second edition.

The book has been well got up, on excellent paper, in bold type and moderately priced. It should find a place on the shelf of every student of mycology in India.

S. V. VENKATARAYAN.

Natural History of Marine Animals. By G. E. MacGinitie and Nettie MacGinitie. (McGraw-Hill Book Company, Inc., New York), 1949, Pp. 473. Price $ 6·00.

All those interested in the natural history of marine animals will welcome the appearance of this book. It has for its subject the behaviour of sea animals in general, and of the Pacific Coast of North America, in particular. The authors have aimed at making the book useful not only to the students and the teachers engaged in a serious study of marine zoology, but also to the "layman uninitiated to the zoological terms". This extremely difficult task of satisfying both these classes of persons has been sought to be achieved firstly by reducing the scientific jargon to the minimum and secondly by giving easy definitions of unavoidable technical terms and Latin words; the result, however, is still a partiality towards student readers and it seems to be ambitious to expect the layman to patiently go through all the meanings and definitions, although, if he does so, he will find the information presented in the book very interesting.

There are 31 chapters in the book followed by a short list of useful publications relating to marine animals and an index. The first hundred pages, divided into twelve chapters, are devoted to a variety of general considerations namely food, comparison between the fauna of land and ocean, groupings of animals, animal-relationships, growth rates, burrowing, variation and succession and geological records left by animal activities. One is bound to feel that in this part of the book there is too much of a jump from one subject to another; but probably this could not be avoided as it has not only to give the student an idea of the ocean as an environment for animals but also to provide the first lessons in general zoology to the uninitiated. The remaining part of the book deals with the various groups of animals inhabiting the sea from Protozoa upwards. Under each group is given a brief account of the distinctive characters of the same followed by a simple and interesting discussion of the habitat, feeding, locomotion, reproduction, etc. of the typical forms with special reference to the local marine species. Those animals most frequently met with and those with most interesting habits have been chosen for purposes of discussion. A list of the general habits of phyla and classes has been appended at the end of the text, which is particularly useful to students. The book is well illustrated with a number of good photographs and drawings. The style is in general simple and pleasing, though sometimes a little pedagogic. The get-up and the print are excellent

The keen interest that the authors have in the subject of marine zoology is evidenced by the profuse and lucid references in the book to their personal observations on the habitat and behaviour of many of the marine animals on the west coast of America. In spite of the local nature of some of the forms chosen for detailed reference, the general problems discussed are of such wide importance and interest that the book will be very useful to all students of natural science as well as to the general reader.

B. S. BHIMACHAR.

Principles of Insect Pathology. By Steinhaus. (McGraw Hill Publications in the Agricultural Sciences, 1949). Pp. x+757.

This book—a companion volume to the author's "Insect Microbiology"—deals specifically with the microbial diseases of insects as well as with certain amicrobial diseases, injuries and abnormalities. Intended originally as a text-book for the use of students, specialising in Insect Pathology, this book has, since, proved itself highly valuable to lecturers and research workers in various fields.

The field of Insect Pathology deserves to be more widely known, as it has made vastly significant contributions to general biology, agriculture and medicine. The author's masterly treatment of it deserves high praise by everyone interested in biology and medicine.

Both as regards the study of diseases caused injurious insects affecting crops and man and the biological control of insects by means of such diseases, this book will be of immense value to workers in such important fields as Medical Entomology, Insect Toxicology, Insect Physiology, Insect Ecology, Economic Entomology and Insect Taxonomy.

The subject has been dealt with in fourteen chapters under highly representative and practically useful aspects like Resistance and Immunity—Symptoms and Pathologies—

Bacterial Infections—Fungus Infections—Virus Infections—Protozoan Infections—Nematode Infections and Biological Control. The historical aspect of Insect Pathology has also been briefly narrated. Authors and subjects indices have been appended. Copious references to the various aspects of Insect Pathology are cited. The diagrams, photographs, photomicrographs and electron micrographs—are very well brought out, and highly descriptive and instructive in character.

In the chapter dealing with Applied Insect Pathology and Biological Control, Insect Control through the agency of pathogenic micro-organisms has been thoroughly discussed and it is well shown how the greatest stumbling block is the general ignorance about this specialised subject, and man's poor control over the various environmental factors. Nevertheless, the author recognises that whatever microbial control *does* take place in Nature, is of great economic importance.

The printing and general get-up of the volume are highly satisfactory and leave nothing to be desired.

B. K. M.

Annual Review of Biochemical and Allied Research in India, Vol. 18. (Society of Biological Chemists, India, Bangalore), 1947. Price Rs. 3 or 6 *sh*,

This publication reviews the researches in the field of Biochemistry and their applications to pharmacology and nutrition. Though appearing towards the end of 1949, it is purported to deal with the activities of 1947. Yet, not infrequently, citations to literature published in 1948 have been made; they are mostly confined to the author or to his immediate environs. Giri has, as usual, ably reviewed the work on enzymes under appropriate heads, though in just a 3-page review dealing with 12 references, 6 relate to 1948. Nutrition has been dealt with under 2 sections, general and animal nutrition. The section on General Nutrition reveals a more widespread activity during the year. Considerable attention has been given to the processing of foodstuffs, particularly soya bean, and to methods of conserving the existing stocks of grains. The fact that India loses annually 317,000 tons of rice through infestation and spoilage shows the magnitude of the problem. The various deficiency syndromes investigated during the year have been well summarised and help to give the reader a fairly cogent picture. "The use of hydrogen peroxide as a milk preservative is suggested by Banerji" (p. 14) gives the impression that Banerji is the originator of the method whereas a study of his paper will reveal that Romani worked this method with success in Italy in 1944. The same paper has been reviewed admirably and without ambiguity on p. 61. Despite the expert treatment given to the Section on Animal Nutrition, the feeling is irresistible that much of what is reviewed does not relate to 1947 but to earlier years. Less than one-fourth relates to 1947. The chapter on Vitamins is really refreshing and represents a clear and succinct account of the work in this field without any of the blemishes apparent in the earlier sections. David's review of Pharmacology and Dastur's on Dairy Science are extensive and leaves the impress of a critical study of the work done in the respective fields.

Almost the first reaction on turning the pages of the *Annual Review* is that the output of work during the year 1947 has been very much on the low side, a feeling given vent to by some of the contributors. The Editorial Board could have done better in scrutinising the contributions and avoided such blemishes as citatations to 1948 publications, wrong references (a glaring instance is reference 10 on page 7), summary of work done in 1941, 1942, 1943, etc. and absence of the year in most references to the section on Protein and Fat Metabolism. That some of these lapses are traceable to contributors who happen to be in the Editorial Board is regrettable.

S. RANGANATHAN.

SOUTH AFRICAN FISHERIES*

THE Nineteenth Annual Report of the South African Division of Fisheries issued by Dr. von Bonde, the Director, speaks of the gradual return to activity of the Department after the war. Extensive survey operations are reported on the West Coast between the Dassen Island in the South and the Orange River mouth in the north, bounded shorewards by the 100 fathoms contour, and seawards by the 300 fathoms contour to study and demarcate the profitable trawling grounds for the hake or the Cape stockfish (*Merluccius capensis*). It is of interest to note that there has been further development of the deep-sea fisheries as well as of the inshore fisheries of

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* 1. *Annual Report of the Division of Fisheries, South Africa for 1947.* 2. *Investigational Reports*, Nos. 9, 10 & 11, Fisheries and Marine Biological Survey Division, South Africa. (Govt. Printer, Pretoria), 1949.

S. Africa owing to substantial expansion in the trawling and inshore fishing fleet. According to the report, the pilchard industry (now estimated to be dealing with about 102,500 tons of pilchard per annum) and the soupfin shark industry, which have both rapidly expanded in recent years, have begun to indicate needs for suitable measures of conservation. The laboratory investigations carried out by the Department include hydrological, biochemical and biological studies and some of the results have been published in the Investigational Reports.

Vitamin A content of the liver oils of the stockfish (*Merluccius capensis*), the Cape spiny dogfish (*Squalus acutipinnis*) and the vaalhaai or soupfin shark (*Galeorhinus zyopterus*) are dealt with by J. A. M. Archer in Investigational Reports, Nos. 9 & 10. Report No. 11 is a study of the food of South African fishes by D. H. Davies with notes on the general fauna of the area giving much valuable information on the food habits of the stockfish which is by far the most important commercial species in South Africa.

N. K. P.

OBITUARY

PROF. AUGUST KROGH

THE death of Prof. A. Krogh which occurred in Denmark in September 1949 has removed from the scientific world one of the most outstanding personalities in the field of comparative physiology. Krogh was born in 1874; he graduated in 1899 and soon made his mark as an original investigator by his Doctorate thesis on the skin and lung respiration in the frog, a work which was the forerunner of a series of brilliant studies in animal physiology. In 1916, he became Professor of Zoophysiology at Copenhagen, when funds were placed at his disposal for the establishment of a laboratory for animal physiology. This institution which he founded and is now world famous had Krogh as its chief till last year when he retired from official life, but not from scientific work to which he was devoted till the last days of his life. After retirement, he set up a small laboratory at his home to study problems concerning insect flight.

Among his numerous scientific achievements may be mentioned the elucidation of the role of capillaries in circulation, more especially the relation of muscular work to the filling of the capillary vessels. This piece of research formed the basis for the award of the Nobel Prize for Physiology and Medicine in 1920. Problems of marine biology, and of respiration and osmoregulation in animals received his active attention wherein his demonstration that active uptake of ions from the surroundings plays a most important part in the salt regulation of the body fluids of animals deserves special mention. Apart from a large series of original papers, Krogh published important reviews from time to time; his books "Respiratory Exchange of Animals and Man" (1916), "Anatomy and Physiology of Capillaries" (1921&1929), "Osmotic Regulation in Aquatic Animals" (1939) and "Comparative Physiology of Respiratory Mechanisms" (1941) will continue to inspire and influence physiolological work for several years to come. Krogh was honoured by many countries and was connected with various scientific bodies including the Indian Academy of Sciences of which he was an Honorary Fellow.

All those who have had the pleasure of knowing Krogh will remember his kindliness and thoroughly international outlook which made his leadership of zoophysiological work at Copenhagen so very successful and they will realize in his death the loss of a most valued and active figure in scientific work and understanding, transcending all national barriers.

N. K. PANIKKAR.