

the measurements in gas dynamics. The second, under the editorship of B. Lewis, R. N. Pease, and H. S. Taylor covers experimental techniques in combustion. Chapter headings give a good idea of the scope of this work. The first part comprises: "Density measurements," "Pressure measurements," "Velocity measurements," "Temperature measurements," "Shock front measurements by light reflectivity," "Turbulence measurements," "Condensation study by absorption or scattering of light," and "Analogue methods." The second part consists of chapters on: "Measurement of flame temperature, pressure and velocity," "Flame photography," "Measurement of burning velocity," "Mass spectroscopy," "Spectroscopy of combustion," and "Analysis of the combustion wave by pressure effects and spectroscopy." These chapters are by leading investigators in the respective fields: A. B. Arons, J. W. Beams, D. Bershader, W. Bleakney, F. P. Bundy, W. M. Cady, P. M. Chambré, G. H. Dieke, G. R. Eber, E. F. Fiock, J. A. Hipple, D. F. Hornig, L. S. G. Kovasznay, R. Ladenburg, L. Malavard, W. T. Reid, S. A. Shaaf, A. H. Shapiro, H. M. Strong, N. Thomas, F. J. Weyl, and E. M. Winkler. The writing is authoritative; the difficulties encountered in making various measurements and the devices by which these difficulties have been overcome or reduced are well presented. A good balance is maintained between the discussions of the principles of the methods used and the descriptions of experimental details. Numerous drawings and halftone plates make it easy to follow presentations. The articles are well referenced throughout and while the reference lists make no claim to exhaustiveness, they seem to have been well chosen and to be entirely adequate.

As is probably unavoidable in a cooperative undertaking of this nature, some duplication and lack of uniformity are noticeable occasionally. Thus the schlieren method and the Mach-Zender interferometer are discussed in both parts of the volume, the second presentation adding little that is not covered by the first. Some comparatively simple techniques are given more space than really necessary although this space could have been advantageously used to describe the more sophisticated methods in greater detail. The reviewer questions a few of the statements made, for instance some of those about active nitrogen (pp. 79-81) or the remark (p. 345) that sound velocity measurements in flames give translational temperature regardless of equilibrium with other degrees of freedom. Such weaknesses, however, are few in number and are not important, since on the whole the volume is extremely well written and gives the reader a clear view of the present status of experimental techniques, as well as preparing him for the study of original literature.

Legibly and attractively printed, this volume should be required reading for all those preparing to undertake research in the important area of physical sciences covered by this series.

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Biological Sciences

Genetic Homeostasis. I. Michael Lerner. Wiley, New York; Oliver & Boyd, London, 1954. vii + 134 pp. Illus. + plates. \$3.25.

In this small volume, the author has undertaken to demonstrate that Mendelian populations have self-regulatory properties, that this genetic homeostasis is related to the better-known developmental homeostasis, and that heterozygosity furnishes a common basis for both phenomena. In developing this thesis, a number of seemingly unrelated lines of evidence are cleverly selected and woven into an extremely convincing argument. The result is probably the most important recent contribution to the literature of population genetics.

Individuals of all species—perhaps to a greater extent among those that are cross-fertilizing—possess regulatory mechanisms that buffer developmental processes against capricious environmental fluctuations. Lerner, through a study of the data bearing on the relation of genotype to environmentally caused phenotypic variation, concludes that heterozygous individuals of a cross-fertilizing species have buffering capacities superior to those of homozygous individuals and, hence, possess "normal" phenotypes more frequently than do the latter. The consequences of this simple hypothesis for populations are far reaching: on the average, heterozygous individuals are favored by selection. Selection, not simple mutation pressure, is primarily responsible for maintaining the genetic variability within populations; the greater the variability, the greater the proportion of heterozygous individuals, and the greater the average fitness of the population. A program of selection, insofar as its aims are met by homozygosity, may be brought to a halt through an unsuspected counterselection for heterozygosity long before the genetic variability of the selected population is exhausted. Responses by populations to novel demands of natural selection are more rapid than they are usually assumed to be under a "homozygous individual" model. In spite of this ability to make rapid responses, the population preserves the ability to revert to its original state (or its equivalent) if the novel demands prove short lived.

As experimental evidence accumulates, details of the arguments presented in this essay will doubtlessly undergo modification. It may be, for instance, that the term *heterozygous* has been used in an operational rather than in a definitive sense. The rather long discussion concerning the pleiotropic effects of genes may eventually appear unduly cautious. Nevertheless, the main argument represents a refreshing approach to problems facing students of both natural and artificial selection; these would do well to take seriously the admonition of the epigraph: "Read not to contradict nor to believe but to weigh and consider."

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The Physiology of Insect Metamorphosis. V. B. Wigglesworth. Monographs in Experimental Biology, 1. Cambridge Univ. Press, New York, 1954. viii + 152 pp. Illus. + plates. \$2.50.

An event of immediate and enduring significance is the publication of this authoritative and lucid analysis of the physiology of insect growth and metamorphosis. The identity of the author as V. B. Wigglesworth will suffice to recommend it to biologists. However, scientists in related fields and biochemists in particular will find an evening with the volume a fascinating experience.

Wigglesworth constructs his analysis of metamorphosis around the substantial core of his own studies of the hemipteran *Rhodnius prolixus*. In addition, 386 papers are cited and woven into the discussion. By virtue of clear thinking and crisp writing the author has been able to encompass the analysis into 152 pages. There are five chapters, four pages of halftones, 45 text figures, a comprehensive bibliography, and a subject index.

The five chapters consider the origin and evolution of metamorphosis, the histological changes during moulting and metamorphosis, the physiology of growth and moulting, the physiology of metamorphosis, and differentiation and polymorphism.

Heretofore the most up-to-date summaries of the physiology of insect metamorphosis have been Pflugfelder's *Entwicklungsphysiologie der Insekten* (Leipzig, 1952, 332 pp.), and Bodenstein's chapters in Roeder's *Insect Physiology* (Wiley, N.Y., 1953, pp. 874-931). The present volume may serve as a companion piece to the Snodgrass monograph on the morphology of *Insect Metamorphosis* (Smithsonian Inst. Misc. Collections 122, No. 9) which also appeared this last year. Taken together, these two excellent volumes afford a comprehensive account of metamorphosis by the foremost authorities on insect physiology and morphology.

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Contributions to Embryology. vol. 35, Nos. 231-241. Carnegie Institution of Washington, Washington 5, 1954. 237 pp. Illus. + plates. Paper, \$12; cloth, \$13.

This, the most recent volume of the long series of *Contributions*, fully lives up to the established reputation of its predecessors.

Its 11 monographs cover a wide variety of allied subjects. Their titles and authorship follow: 231, "Early abnormal embryos of the rhesus monkey," George W. Corner and George W. Bartelmez; 232, "Development of the baboon," Christine Gilbert and Chester H. Heuser; 233, "Formation of the neural crest," G. W. Bartelmez and Mary P. Blout; 234, "Regional circulation times in the lamb," S. R. M. Reynolds *et al.*; 235, "Androgen-induced pseudohermaphroditism in the monkey," L. J. Wells and G. van Wagenen; 236, "Development of the human dia-

phragm and pleural sacs," L. J. Wells; 237, "Architecture of human umbilical cord tissues," Anna W. Chacko and S. R. M. Reynolds; 238, "Venous drainage of the placenta of the rhesus monkey," Elizabeth M. Ramsey; 239, "Early development of the human nephros," Theodore W. Torrey; 240, "Preimplantation stages of the human ovum," Arthur T. Hertig *et al.*; and 241, "Erythrocyte-forming areas in chick blastoderm," George W. Settle.

Individual comment on these studies is obviously impossible in so brief a review as this. However, contribution 236 must be cited as a valiant effort of author and illustrator to surmount the inherent difficulties present in the demonstration of their subject. Only those who glory in overcoming great difficulties resort to such arduous efforts as that shown in this study.

The report of Hertig *et al.* is a fitting climax to the remarkable series of very young human embryos previously reported by this author in collaboration with Rock, Heuser, and others.

Torrey's contribution (No. 239), in the light of his interpretation of the nephric system in general, should perhaps be emphasized.

Finally, the excellence of the illustrations, especially the superb work of J. F. Didusch, must be noted.

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The Genetics of Paramecium aurelia. G. H. Beale. Monographs in Experimental Biology, 2. Cambridge Univ. Press, New York 22, 1954. xi + 179 pp. Illus. \$2.50.

Modern genetics may be arbitrarily divided into three areas, each concerned with heredity and variation but focusing attention respectively upon the population, the individual, and the cell. In addition to sharing certain common concerns, each of these areas has its own special techniques and specific problems. Perhaps the central problem in "cellular heredity" is the solution of a riddle—how do cells of identical genetic constitution develop and maintain different hereditary traits? Although approaching a problem of general biological interest, for technical reasons much of the work in cellular heredity has been undertaken with unicellular organisms and particularly with *Paramecium aurelia*.

Investigations on this organism have been directed primarily toward an analysis of three cellular properties: the serotypes, the mating types, and the killer traits. Cells with the same genetic constitution may develop persistent differences in regard to each of these characteristics. Interestingly enough, the factors involved in initiating and maintaining these differences interact in each case in what appears to be a different pattern. Each of these patterns involves nuclear, cytoplasmic, and environmental participation and any or all may be of general biological significance.

Because of the extensive research completed on *Paramecium* since Sonneborn's review in 1947, this book by Beale is especially welcome. Both the older work and the recent one are clearly and authoritatively presented. The book will be of interest not only to geneticists, but to all concerned with the biology of the cell.

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Recent Developments in Cell Physiology. Proceedings of the 7th symposium of the Colston Research Society held in the University of Bristol, March 29–April 1, 1954. J. A. Kitching, Ed. Academic Press, New York; Butterworths, London, 1954. x + 206 pp. Illus. \$6.50.

If we no longer refer to a drinking party when we speak of a "symposium," it does not follow that a symposium must be a large convocation of the well-known specialists in a field for the purpose of reviewing their well-known work. The latter has become the common case, and when the results are published they may add to the growing archives of digested research, but seldom serve to dispel the impression that ideas are a scarce commodity. This volume is exceptional. It does not by any means cover the major fields of cell physiology. Only occasionally does it serve to bring the reader up to date on problems that have been dignified by inclusion in textbooks. The remarkable feature of it is that it is interesting.

The symposium reveals the healthiest feature of current research on the cell: its growth freedom from both vertical and horizontal restrictions. Vertically, we find problems of diffusion theory and biosynthesis of small molecules discussed along with problems of embryo differentiation and the control of cell division. Horizontally, the venerable problems of cell permeability consort with questions of hormone action; current theories of gene action are brought to bear on the regeneration of flatworms, and the seemingly specialized problem of suction in Suctoria comes into line with current work on the physics of cell surfaces.

A fair number of the papers included are not research reports at all, but expressions of ideas. Indeed, a selection of some of the ideas presented may serve to describe the state of fermentation that makes the life of the cell physiologist so interesting today. *Danielli*: molecules may enter the cell not only by simple diffusion or by active transport mechanisms but also by *facilitated* diffusion, in which molecules move without the performance of osmotic work at rates other than those predicted. *Koch*: cholinesterase, thus far associated mainly with nerve conduction, is shown to be a part of the mechanism of active transport of salts across certain membranes. *Ussing*: active transfer of water may occur across animal membranes and the pumps may be under hormonal control. *Yemm*: protein synthesis in plants may involve peptide intermediates and the action of genetic templates may be at an "assembly" stage rather than at the

stage of peptide bond synthesis. *Hoff-Jørgenson*: DNA may be stored in the cytoplasm of ova, and DNA synthesis during development may not begin until the stores are used up. *Brønsted*: polarity and bilaterality in regeneration (*Planaria*) may be analyzed in terms of time-gradation of gene activity. *Zeuthen and Scherbaum, Maaløe and Lark*: cell division may be synchronized by subjecting cell populations to temperature cycles. (The discussions of the theory of this important effect are of great interest.) *Swann*: the control of cell division in a nongrowing system (an ovum, for example) may be treated as a problem of the distribution of the cell's energy supply to various functions.

In addition, the volume includes papers by Keynes (on the correlation of ionic movements with nerve function), Klenow (on the biosynthesis of pentoses), Brachet (on the nuclear control of enzymatic activities), Waddington (a theoretical treatment of cell differentiation, largely in terms of the plasmagene concept), Westergaard and Hirsch (control of differentiation in *Neurospora*), and a very interesting account by Kitching of his work on suction in Suctoria.

The reader of this volume will not conclude that present-day cell physiology is moving in strong currents, and this is a healthy sign. If there is any trend, it is toward increasing attention to the problems of growth, reproduction, development, and heredity. No longer is cell physiology merely the application, for its own sake, of physics and chemistry to the static abstraction of a cell. The cell is coming to life, and nothing that it does seems to be beyond experimental attack.

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Insects of Micronesia. vol. 1, *Introduction*. J. Linsley Gressitt. Bernice P. Bishop Museum, Honolulu 17, 1954. viii + 257 pp. Illus. Paper, \$3.25.

Concealed under this book title is what is by all odds the best available general summary of information on the myriad of small islands, west of 180° longitude and mostly north of the equator in the Pacific, known as Micronesia. The emphasis is on geography, biogeography, ecology, and economic entomology, and a valuable gazetteer of place names is included. The islands covered are the Caroline, Marshall, Gilbert, Marianas, Volcano, and Bonin groups and the small isolated islands of Marcus, Wake, Ocean, and Nauru.

This is the first volume of a projected series on the insects of Micronesia and it is intended as a description of the geography and environment which may be used by the contributors to the remainder of the series, as well as by the general scientific public. The author, entomologist of the Bishop Museum, is director of a project to bring together and promote study of the enormous collections of insects from the Micronesian islands made by numerous investigators during and since World War II, as well as previous collections

by Japanese and others. This book summarizes much of the natural history and geographic information resulting from the many expeditions to Micronesia and the work of resident investigators there since the U.S. took over the islands at the end of the war. In addition, the author reads Japanese, which enables him to draw upon the extensive Japanese literature.

Sections on geology, soils, climate, flora, geography, fauna, ecology, economic entomology, as well as a list of principal collectors of insects and a gazetteer of place names, present in a brief space much of what is known for Micronesia in most of these fields. Some unpublished data were not available to the author, and some data he obtained from others were not as accurate nor as reliably interpreted as are his personal observations and researches. There are also many evidences of haste in certain parts, resulting from the necessity of making the work quickly available to the other collaborators in the series. Although this work would have unquestionably been better if written five years hence, after the accumulated collections have been identified and more information published, in its present form it is so much better than anything else, as a compendium of the geography and natural history of Micronesia, that criticism is scarcely in order. The volume can be freely commended to anyone interested in Micronesia or in the Pacific in general.

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Die Evolution der Organismen. Ergebnisse und Probleme der Abstammungslehre. Gerhard Heberer, Ed. Gustav Fischer, Stuttgart, ed. 2, 1954. Part I, *Grundlagen und Methoden*, 176 pp. Illus. DM 14.30, subscription, DM 12.10. Part II, *Die Geschichte der Organismen*, 248 pp. Illus. DM 21; subscription, DM 17.70. Part III, *Die Kausalität der Phylogenie*, 288 pp. Illus. DM 23.90; subscription, DM 20.20.

The number of completely revised editions of works in the field of evolution that were first published only 10 years ago indicates the rapidity of the recent advance in evolutionary biology. This would seem to belie the opinion of some outsiders that evolutionary research had matured to the point of stagnation. The revised edition of Heberer's *Die Evolution der Organismen* is, in many respects, a new work. Five of the 19 contributors to the first edition of 1943 have dropped out and have been replaced by six new contributors. The new edition is published in installments, three of which have now appeared, all in 1954. Nearly all the chapters have been completely rewritten, and are organized into four major sections: (i) Principles and methods; (ii) the history of organisms; (iii) the causes of evolutionary change; and (iv) phylogeny of the hominids.

The following new or completely rewritten chapters are specially noteworthy: Rensch on phylogenetic changes of ontogeny, Lorenz on psychology and phylogeny, Remane on the phylogeny of animals, and Friedrich-Freksa on the evolutionary role of viruses

and the problem of the origin of life. The other contributors are Dingler, Eickstedt, Gieseler, Heberer, Herre, Krogh, W. Lehmann, Lüers, Ludwig, Mägedrau, Reche, Rüger, Schwanitz, Ulrich, Weigelt, and W. Zimmermann. Remane's contribution is a brilliant survey of the phylogeny of animals which, particularly with respect to the invertebrates, presents many original concepts and observations. The emphasis in much of the volume is on phylogeny, as is characteristic for the evolutionary literature on the continent, yet two large chapters on genetics and evolutionary research in plants (127 pp.) and animals (110 pp.) present a full summary of modern research in systematics, cytogenetics, and population genetics. The work is well printed and lavishly illustrated (250 figs. in the first three installments).

The volume will be particularly useful to those who are unable to keep up with the flood of original papers in the field of evolution. There is no other single volume in any language that treats the subject even nearly as comprehensively.

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Earth Sciences

Nuclear Geology. A symposium on nuclear phenomena in the earth sciences. Henry Faul, Ed. Wiley, New York; Chapman & Hall, London, 1954. xvii + 414 pp. Illus. \$7.

Nuclear physics has always had strict relations with geologic problems and the interaction between the two sciences has been a most fruitful one. Suffice it to quote the extremely important part played by mineralogical and geologic considerations in the discovery of radioactivity, and the establishments of an absolute time scale for geology.

In the last years the progress of nuclear science has been conspicuous and also the special branch of the geologic application has made great strides. No systematic review had been published for many years and these circumstances make the present book very timely. As usual, the fact that probably no author exists who has the necessary encyclopedic knowledge, and the time to write a book such as this, has made the cooperative form of authorship necessary.

The parts of the book are: (i) Fundamental considerations, instruments, and techniques of detection and measurement; (ii) uranium and thorium; (iii) the abundance of potassium; (iv) rare gases and fission in nature; (v) heat from radioactivity; (vi) radiation damage and energy storage; (vii) hydrocarbons formed by the effects of radioactivity and their role in the origin of petroleum; (viii) geophysical exploration by nuclear methods; (ix) determination of absolute age; and (x) the origin of the earth.

The authors, 26 in number, represent an extremely well qualified and authoritative group; but in spite of this, occasional errors have escaped their attention.

Good indexes help very much in consulting this