

Certainly anyone working with high temperatures will find much of interest to him in these two volumes. On the other hand, he will also find much that he will wish had been eliminated. It is interesting to have descriptions of various furnaces collected in one place, but some of those described here would probably be of more interest to a scientific museum than to a modern research worker. The reviewer believes that the subject matter could have been condensed at least 30 per cent without detracting from the usefulness of the book. Such a reduction should not be applied to all chapters indiscriminately. Thus Chapter 3, on solar radiation, could be eliminated completely without any great loss, whereas many might like to see the chapter on powder metallurgy amplified. Also, it is doubtful that Chapter 12, which discusses the chemical phenomena caused by an electric discharge in a gas, belongs in a book of this type. In spite of these faults the reviewer believes that the book is of such usefulness that it will be a desirable addition to the libraries of those interested in high-temperature work of any kind.

Mechanically the book is excellent. It is well printed on good paper and substantially bound.

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The Chordates. Herbert W. Rand. Philadelphia: Blakiston, 1950. 862 pp. \$6.00.

To the field of comparative vertebrate morphology Professor Rand has contributed yet another textbook—a revised and fact-full version of his *Comparative Anatomy*, co-authored with Professor Neal. The present work emphasizes general structure and vertebrate types. In writing this treatise, Rand had in mind “to undertake a book which, to its content of anatomic fact, should add chapters (necessarily brief) giving the reader some knowledge of the history of anatomic science, the ideas and motives which have directed its progress through successive centuries, the theories and principles whereby it has worked, and, above all, an appreciation of its vital human import.”

The Chordates, like Gaul, is divided into three parts, and almost as arbitrarily. Part I describes the “basic structure” of vertebrates, after which follow sections on organogenesis and histology. This portion minimizes the comparative viewpoint; it includes, however, much of the content and many of the illustrations of the earlier work by the same author. Part II considers briefly the history, aim, and methods of comparative anatomy. Part III, “Comparative Morphology of the Chordates,” is a phylogenetic survey of chordate anatomy and relationships; it presents, by classes, discussions of animal structure, ancestry, phylogeny, and classification, the last relatively simplified. The feeling for comparative anatomy is developed slowly, and the reader has covered all the organ systems and half the book before an insight into comparative principles takes hold. The epilogue states a refreshing case for comparative morphology which, in essence, would have been welcome if proclaimed as an introductory point of view, perhaps in the prologue.

Only high praise can be offered for Rand’s command of morphological detail and his erudite presentation of structural relationships. The attractive format, including bold-face type for new terms and many excellent illustrations (a total of 609, approximately half of which were previously published in *Comparative Anatomy*), emphasizes for the student the countless number of facts with which the anatomist must deal.

It would be presumptuous to find fault with a work of this magnitude. Only an occasional lack of emphasis in the presentation seems to mar the decisiveness with which the chordate patterns have manifested themselves. “What is a vertebrate?” is inquired of the reader immediately upon opening the book, and in part this question is answered promptly with discussions of such characteristics as symmetry, body divisions, locomotor appendages, integument, notochord, coelom, and tube-within-a-tube structure. Yet it is not until the succeeding chapter that the branchial clefts are thought worthy of mention, and five chapters later that the dorsal tubular nervous system becomes significant. The evidence pertaining to the origin of the vertebrates is weakly treated, neither the possibility of prechordate affinities with echinoderms or the relationship of vertebrate ancestors to fresh-water jawed placoderms being sufficiently weighed. Finally, some unusual definitions have crept into the context without adequate explanation or derivation: e.g., “molar” and “molecular” activity to designate somatic and visceral nervous functions, respectively.

The Chordates is more than a book on anatomy. It is a morphological treatise supplemented with histological, embryological, paleontological, and historical concepts gleaned from Professor Rand’s personal storehouse of information and wide experience as a scholarly teacher. As a standard of reference and a survey of the field it is a worthy contribution and deserves a successful future.

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Variation and Evolution in Plants. G. Ledyard Stebbins, Jr. New York: Columbia Univ. Press, 1950. 643 pp. \$8.00.

Professor Stebbins’ latest work is indeed a magnum opus—an exhaustive and critical review of data that bear on the evolution of plants. The facts and examples are lucidly presented, and the arguments of which they are the bulwark are cogently and logically developed. The book is clearly the product of acute observation, matured reflection, and a governed imagination. It is an appropriate companion to its distinguished predecessors issuing from the Jesup lectures.

The announced intention is “to discuss the principles and dynamics of evolution” (p. 7). The approach is frankly taxonomic. “The fund of information built up by systematic botanists and zoologists during the past 300 years is the first source of [the evolutionist’s] factual data” (p. 4). Stress is placed on comparison of different patterns of evolution in various categories, particularly at the specific level, and an explanation is given in genetic, distributional, and historical terms.

As the title suggests might be the case, the book opens with a discussion of variation. Ten genera of seed plants belonging to 5 families are considered in varied detail, and the differences of pattern between them pointed out. "In *Crepis*, *Melica*, *Bromus*, and probably *Wyethia*," for example, "genetic diversity exists in the form of variants distinguishable when grown side by side under uniform conditions and occupying somewhat different habitats. These are ecotypes in the original sense of Turesson but they cannot be recognized as subspecies because they are not distinguished by morphological differences recognizable over a geographic range of any extent" (p. 70). "The generalization emerging . . . is that we cannot apply uncritically the criteria of species which have been developed in one group to situations existing in another, particularly if the groups are distantly related to each other and have very different modes of life" (p. 71). The methods described for the analysis and demonstration of such patterns will be of particular interest and usefulness to taxonomists.

There follow three chapters covering most of the discussion of the factors pertaining to evolution at the level of actual interbreeding. Chapter III is primarily concerned with a discussion of mutations. Chapter IV deals with natural selection, setting forth the experimental and historical evidence and exemplifying its results by differences of morphology in the genus *Camelina* and the families Compositae and Gramineae. It concludes with a brief discussion of the dynamics of selection and random variation, which, with the examples already cited, is "intended to show that individual variation, in the form of mutation (in the broadest sense) and gene recombination, exists in all populations; and that the molding of this raw material into variation on the level of populations, by means of natural selection, fluctuation in population size, random fixation, and isolation is sufficient to account for all the differences, both adaptive and nonadaptive, which exist between related races and species" (p. 152). Chapter V is concerned with genetic systems as factors of evolution. The principal subjects discussed are the origin and evolution of diploidy, heterokaryosis (an asexual means of combining different genotypes peculiar to certain lower plants), and the relation of growth form, longevity, and the trend in certain plants toward suppression of sexual reproduction. An interesting comparison is made of the effects on the respective genetic systems of plants and animals of differences in longevity, complexity of development, mobility, and the capacity for asexual reproduction.

The remainder of the book is concerned almost wholly with evolution at the specific level, and interspecific relations. The discussion of isolating mechanisms is extensive, concluding with a critique of various hypotheses bearing on the subject. "Our present knowledge of isolating mechanisms therefore supports the statement . . . that descent with modification and the origin of species are essentially different processes . . . and we can conclude that the evolutionist must deal, not with a single process, the origin of species, but with several different processes, the origins of species" (p. 250). The chapter on interspecific hybridization and its relation to the formation

of new types is important because of increased evidence relating to this phenomenon. The discussion of introgression between species seems, however, to include an inconsistency, for the author says first (p. 278) "that introgressive hybridization [the context indicates that Stebbins refers here to its effects] is in many ways similar to evolutionary divergence through mutation, recombination and selection" and that it "represents the crossing of genes from one 'adaptive peak' to another and makes possible the formation of gene combinations capable of climbing new 'peaks.'" Yet he says further (p. 279) that "It merely produces convergence between previously more distinct species." This paradox is met with frequently in discussions of introgression.

As one might expect from the author's distinguished research in those fields, the chapters on polyploidy and apomixis, no less than those that treat the evolutionary trends of karyotype and of external morphology, constitute an authoritative and penetrating review of these subjects. The book closes with a discussion of "Fossils, Modern Distributions and Rates of Evolution," and the presentation of a hypotheses concerning rates of evolution. The bibliography is extensive. The illustrations would have gained in clarity had they been printed on smoother paper.

Careful study of this book—and it is assuredly pregnant with opportunity for careful study—can lead only to the realization that it presents for the first time the grand patterns of evolution in the plant world, implicit in the facts of systematics, and interpreted now in the light of genetics and cytogenetics. Zoologists will be grateful that these data and their interpretation are now available for comparison with their own experiences and concepts. One might wish, however, that the author had placed more emphasis on the determinants of evolution at the level of actual interbreeding. It is true that taxonomic data have provided the evolutionist with the first source of his factual data—in a historical sense. They provide the materials for the patterns of evolution which the author has so ably delineated. But taxonomic data, the data which determine categories, do not disclose the ultimate determinants of evolutionary process: the factors which determine what particular and different individuals survive to sexual maturity and determine the potentials of recombination, that is, the adaptability, of the breeding groups to which they contribute. These factors are not only genetic, they are ecological as well, for adaptedness and adaptability are relationships of organism and environment. They are not properties of categories but of individuals in relation to their breeding groups. They operate far below the specific level, primarily in populations which accumulating evidence indicates are small, highly localized, and restricted to limited environments. These, not species, are the laboratories of evolution. For it is here and not at the specific level that restriction of gene exchange plays its most important role and determines the adaptability of the existent breeding groups to whatever changes of environment the advent of new species, among other changes, may induce. Professor Stebbins has adum-

brated the study of such populations, but a definitive discussion of their determinants remains to be written. Perhaps this must wait on the accumulation of data, for some of the most critical, especially concerned with the ecological relationships of breeding groups, are lacking. Nevertheless, summation and discussion of such as do exist would greatly advance our understanding of the processes of evolution.

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Reviewed in Brief

Cell Physiology and Pharmacology. J. F. Danielli. New York: Elsevier, 1950. 156 pp. \$3.00.

For some time it has been apparent that the field of pharmacology needed to be reexamined with a view toward reducing as many experimental observations as possible to the cellular level. Such an approach was attempted by A. J. Clark in 1929, and his book has remained a classic in the field of cellular pharmacology.

In this book, which resulted from a series of lectures given at University College, London, Professor Danielli reexamines the possibilities for physicochemical explanations of the mode of action of drugs at the cellular level. Many may find the analysis too speculative, and surely there is much one could criticize in some of the postulated mechanisms. One cannot deny, however, that the possibilities for the prediction of the pharmacological action of certain types of reagents is quite nicely demonstrated here. If the book does nothing more than cause commercial pharmacologists to give consideration to theoretical possibilities of predicting drug action over the hit-or-miss method of trying thousands of compounds, it will have served a very useful purpose.

The chapters are as follows: The Cell as a Physico-Chemical Unit, Possible Action of Drugs on Surfaces, Membrane Permeability and Drug Action, Enzymes and Drug Action, The Action of Narcotics, and Responses of Cells on the Biological Level.

Pneumoconiosis: Beryllium, Bauxite Fumes, Compensation. Arthur J. Vorwald, Ed. New York: Hoeber, 1950. 659 pp. \$7.50.

This volume, dedicated to Dr. Leroy U. Gardner, is a detailed record of the Sixth Saranac Symposium, held September 29 to October 3, 1947. In 1934, Dr. Gardner instituted the first of the series of Saranac Symposia in recognition of the need for informal discussion of problems resulting from the inhalation of dust—not only changes in the lungs (pneumoconiosis), but the industrial and legal phases as well. During the war years a new disease, which appeared to be caused by the inhalation of dust containing beryllium, was recognized among industrial workers. Concurrently with these observations, attention was directed to a disease entity occurring among workers exposed to the fumes arising from bauxite furnaces. The industrial uses of beryllium were so far-reaching that the symposium was organized to obtain a comprehensive and authoritative exposition of present

knowledge concerning the disease, its control, and the social and medicolegal implications. Thirty-nine papers were presented, and the discussions evoked are included in the volume. Twenty-nine cover the various aspects of the beryllium problem, 3 are devoted to the subject of bauxite, and 7 contributions are grouped under the heading "Compensation for Occupational Disease." A bibliography of 684 references brings the pertinent literature concerning beryllium up to January 1950.

The approach to the solution of the problem has been an outstanding example of cooperation between science and industry. It is hoped that this series of symposia will be continued and that the deliberations will be presented in the same effective manner as this one has been.

Viruses 1950. M. Delbrück, Ed. Pasadena, Calif.: California Inst. of Technology, 1950. 147 pp. \$2.50.

This small volume contains the proceedings of a conference, held at the California Institute of Technology, March 20–22, 1950, on the similarities and dissimilarities among viruses attacking animals, plants, and bacteria, respectively. There are 12 short essays on subjects ranging from bacteriophage to immunological properties of plant viruses. The concluding article, covering 47 pages, is: "A Syllabus on Procedures, Facts and Interpretations in Phage." The book is well printed and well edited. It can be unhesitatingly recommended to all interested in obtaining fundamental knowledge of the viruses.

Scientific Book Register

Advances in Radiochemistry and in the Methods of Producing Radioelements by Neutron Irradiation. Engelbert Broda. New York: Cambridge Univ. Press, 1950. 152 pp. \$2.75.

Fundamentals of Acoustics. Lawrence E. Kinsler and Austin R. Frey. New York: Wiley; London: Chapman & Hall, 1950. 516 pp. \$6.00.

New Atoms: Progress and Some Memories. Otto Hahn; W. Gaede, Ed. Elsevier, 1950. 183 pp. \$1.75.

The Flight of Thunderbolts. B. F. J. Schonland. New York: Oxford Univ. Press, 1950. 152 pp. \$3.00.

Textbook of Intermediate Plant Science. George B. Cummins *et al.* Minneapolis, Minn.: Burgess, 1950. 222 pp. \$3.25.

Cybernetics: Circular Causal, and Feedback Mechanisms in Biological and Social Systems. Transactions of the Sixth Conference, March 24–25, 1949. Heinz von Foerster, Ed. New York: Josiah Macy, Jr. Foundation, 1950. 209 pp. \$3.50.

Introduction to Algebraic Geometry. W. Gordon Welchman. New York: Cambridge Univ. Press, 1950. 349 pp. \$4.50.

Modern Chemical Processes. A series of articles describing chemical manufacturing plants by the editors of *Industrial and Engineering Chemistry*. New York: Reinhold, 1950. 222 pp. \$4.00.

Machine Shop Methods. Lorus J. Milne. New York: Prentice-Hall, 1950. 376 pp.