Book Reviews

Effects of Electricity on Muscular Motion. Luigi Galvani. Trans. by Margaret Glover Foley. Burndy Library, Norwalk, Conn. 1954. 176 pp. Illus. + plates. $6.

This fine volume is the 10th publication in the Burndy Library series. It contains an English translation of Galvani's celebrated Latin monograph *De Viribus Electricitatis in Motu Musculari,* first issued in 1791, together with a facsimile reproduction of the original text. Margaret Foley supplies a clear and vigorous rendering of Galvani's rather complicated phraseology. I. Bernard Cohen has written an admirable introduction. By an unusual coincidence two English translations of the full text appeared within a few months of each other—the present volume and that prepared by Robert Montraville Green (Elizabeth Licht, Boston, 1953). Prior to this time only partial translations have been available, in particular the fragment published in 1935 by William Francis Magie.

A reading of the introduction and full text corrects certain misapprehensions that have been widely held concerning the scope and significance of Galvani's work. He was not the first to stimulate nerves and muscles with electric current. Earlier students, using discharges from the Leyden jar, or of atmospheric electricity, had observed such stimulation. Neither was he the first to detect animal electricity. John Walsh had demonstrated the electric character of the shock of *Torpedo* in 1774. Galvani's major contributions were, first, his observation that electric currents, generated by friction machines or by thunderstorms, could induce electric flow in metal conductors at some distance from the primary source, and, second, his discovery that pairs of dissimilar metals could excite living tissues.

The first discovery was not properly understood either by Galvani or by his contemporaries. He described with great enthusiasm the many ways in which he could stimulate nerves and muscles by touching them with metallic objects, scalpels, rods, or wires, in the vicinity of a frictional electric machine. With each spark contraction occurred, the living tissues acting as sensitive galvanometers to indicate current. He seems to have had clearly in mind the concept of electric induction, although he could not describe the phenomenon in modern terms and is not credited with its discovery. Forty years later Faraday discovered the phenomenon in all-metallic systems and inaugurated the modern electrical age.

His second discovery grew out of the first but revealed phenomena of a quite different character. He observed that, in the absence of a frictional machine or atmospheric electricity, he could stimulate nerve and muscle by touching them at two points by his "arcs" made by joining two dissimilar metals together. These curving metallic couples are a prominent feature of his illustrations. He believed that he thus led off electric charges that had accumulated in the tissues and thought that he had demonstrated the reality of animal electricity. Volta immediately built upon this work, shortly to reveal the existence of electrode potentials and to combat Galvani's interpretation. It is evident that Galvani did not clearly demonstrate animal electricity, but his faith in it was later vindicated in the growth of modern electrophysiology.

Galvani stands out in the stream of scientific history as a somewhat confused and neglected figure, yet one who, by his striking experimental demonstrations, compelled the attention of workers in several disciplines and opened the door to many fundamental discoveries. The present volume helps to bring his observations into proper focus and permits us to appreciate better the enthusiasm and devotion that he gave to his important pioneer work.

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The Distribution and Abundance of Animals. H. G. Andrewartha and L. C. Birch. Univ. of Chicago Press, Chicago, 1954. xv + 782 pp. Illus. $15.

The relatively new scientific field of animal ecology has, by now, split into two major divisions. Of these, in contrast with the more traditional ecology of communities, the newer is the ecology of individual species and populations. In recognizing this cleavage between methods and knowledge, the authors did not minimize the importance of the community approach in their own emphasis of the other; it is only that they undertook to explore and synthesize a literature that greatly needed exploration and synthesis, in order "to build a wide and satisfying general theory of ecology as we use the word to refer to the distribution and abundance of animals in nature."

Invertebrates, notably insects, furnish most of the examples of populations, and the original contributions of both authors are primarily entomologic, but the scope of the book nevertheless is about as broad as our collective knowledge of animal populations permits. Despite the obvious intentions of the authors to present the subject matter as simply, clearly, and logically as would be consistent with a comprehensive treatment—and in which I think they have succeeded—the natural complexities that are involved effectively limit the extent to which the subject matter may be simply presented. This is no book that any serious student of populations should read once and then consider himself through with; he should have convenient access to it for as many readings of particular parts as his own studies may require.

It is written for mature workers who can do their own thinking and, to them, it should be of outstand-

ing utility. Most practicing biologists may find more mathematics in it than they can easily digest, although they may be comforted by the authors' cautioning against *misuse* of mathematics (p. 11). Others may feel that some conclusions are presented a little too confidently, with insufficient allowance being made for alternative interpretations or for the still unknown. My impression, however, is that the tone of the writing is reasonable, good natured, and objective, and that certainly much of what is demolished is philosophically shaky anyway.

In appraising the factual content, I paid special attention to the parts dealing with the groups of higher vertebrates that I happen to have worked with, and, on the whole, feel satisfied with what I read there. Very nearly all the exceptions to the treatment of higher vertebrates that I would be disposed to take have to do either with minor points or with those about which no one has, as yet, conclusive answers, and about which some legitimate disagreement may be expected for a long time to come.

The book shows evidence of continued revision and probably came off the press in an exceptional state of up-to-dateness for such a big job in a difficult and rapidly advancing field.

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Entire Functions. Ralph Philip Boas, Jr. vol. V of *Pure and Applied Mathematics.* Paul A. Smith and Samuel Eilenberg, Eds. Academic Press, New York, 1954. xi + 276 pp. $6.

The theory of entire functions is a vast, rich chapter in the general theory of functions of a complex variable. Its literature is tremendous. The bibliography of the present monograph, which is concerned principally with the special class of entire functions of exponential type, consists of 17 pages. Intentionally, many topics of the general theory of entire functions, such as the Picard theorem and its developments, are omitted in this monograph. The result of this imposed restriction is a unity of theme and method. The interest of the special class of entire functions of exponential type is, of course, well known. As the author remarks, an account of the applications of functions of exponential type would call for a book by itself. What has been achieved here is a comprehensive account of the modern theory of functions of exponential type. The book is a valuable addition to the existing monographic literature on the theory of functions of a complex variable and is to be warmly recommended to both specialist and student.

The reader is expected to have a knowledge of the elements of the theory of analytic functions, including the theorems of Jensen, Carleman, and Phragmèn-Lindelöf, as well as some knowledge of the theory of subharmonic functions and of Lebesgue and Stieltjes integrals.

A summary of the contents follows: "Preliminaries"; "General properties of entire functions of finite order"; "The minimum modulus"; "Functions with real negative zeros"; "General properties of functions of exponential type"; "Functions of exponential type restricted on a line: I, Theorems in the large"; "Functions of exponential type restricted on a line: II, Asymptotic behavior in a half plane"; "Functions of exponential type: Connections between growth and distribution of zeros"; "Uniqueness theorems"; "Growth theorems"; "Operators and their extremal properties"; "Applications."

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Progress in the Chemistry of Organic Natural Products. vol. 10. L. Zechmeister, Ed. Springer, Vienna, 1953. ix + 529 pp. Illus. Paper, $19; cloth, $19.80.

This, the tenth volume of the Zechmeister series, follows the excellent tradition of the previous volumes with regard to the choice of subject matter and clarity of presentation. The authors, experts in their fields, have succeeded in conveying a well-rounded picture of the complexity and importance of the subject matter.

The first chapter, by K. Adler and M. Schumacher, deals with the applications of the "Diene synthesis" to the elucidation of the formation and constitution, as well as to the preparation, of natural products. The tremendous progress in this field becomes quite apparent if one compares the 347 references cited in this work with the 44 cited by O. Diels who covered the same topic in 1939 for the third volume of this series.

H. Mark discusses the physical chemistry of rubbers in the second chapter. The author utilizes only a minimum of mathematical equations in his presentation and treats, among other topics, the fundamental aspects of rubberiness, the structure of natural and synthetic rubbery polymers, and the kinetic theory of rubber elasticity.

The third chapter, by J. Asselineau and E. Lederer, treats the chemistry of the lipoids of bacilli. The various compounds that have been isolated from bacilli are enumerated, and structure proofs and syntheses are presented.

Syntheses of cortisone and related compounds are reviewed in a chapter by G. Rosenkranz and F. Sonderheimer. The authors give a number of useful charts in their discussion of the highly complex chemistry; they have covered the literature up to 1952.

The final two chapters, by A. Chatterjee and by L. Feinstein with M. Jacobson, deal, respectively, with the alkaloids of Rauwolfia plants and with the insecticidal principles of higher plants.

Not only researchers in the various fields presented but also all those who are interested in gaining a better insight into the complexity of natural products will profit from this volume.

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