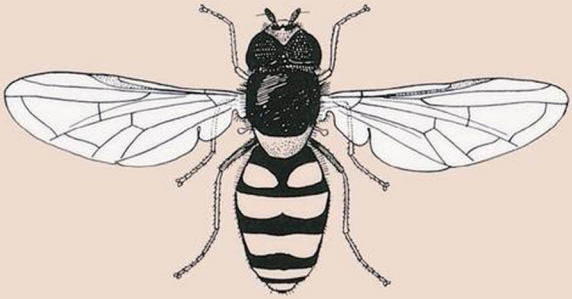
# PRINCIPLES of INSECT MORPHOLOGY



R. E. Snodgrass
*with a new foreword by*
George C. Eickwort

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BY
R. E. SNODGRASS

*With a New Foreword by George C. Eickwort*

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# FOREWORD TO THE 1993 PRINTING

George C. Eickwort

This is the most important textbook of insect morphology ever written in English, by the foremost arthropod morphologist of this century (Thurman 1959a, Richards 1973). Robert Evans Snodgrass (1875–1962) began his morphological research as a freshman at Standford University. After receiving his A.B. in 1901, he held a succession of short-term positions in entomology which he interspersed with jobs as an itinerant artist. In 1917 he began work with the Bureau of Entomology of the U.S. Department of Agriculture as an illustrator and anatomist. He remained with the USDA until his retirement in 1945, after which he continued research at the U.S. National Museum of Natural History until his death. During his eighty-seven years he published about ninety papers and books, totaling about six thousand pages (Thurman 1959b, Richards 1973). He gave guest lectures at Cornell University and published his most important later books with Cornell University Press (Snodgrass 1951, 1952, 1956). It is entirely fitting, therefore, that the Press should reissue his classic textbook.

Although *Principles of Insect Morphology* is considered Snodgrass's crowning achievement, it was by no means his last. The more important of his subsequent papers and books (cited in the references at the end of this foreword) led to major revisions in his understanding of the skeletomuscular system of arthropods. It is our loss that Snodgrass never revised *Principles*; he claimed that his publisher was unwilling to reset the type (Richards 1973).

Snodgrass's fluency in the English language illuminates this textbook, and his knowledge of French and German provides access to the vast European literature in morphology. No other textbook has since attempted such a thorough treatment of comparative insect anatomy and development. Above all, Snodgrass's beautiful drawings provide an unparalleled elucidation of structure; these figures are reproduced in most of today's entomology texts. (Abbreviations for the figures are provided by Bay and Elzinga [1980].) All modern studies in comparative and functional entomology begin with Snodgrass's *Principles*, and no student can afford not to have this book close at tarsus.

*Principles*, however, now almost sixty years old, in some ways shows its age. Snodgrass believed in comparing structures from an evolutionary perspective, but his text predates the development of phylogenetic analysis. He was also a strong proponent of functional interpretation of struc-

ture, although now functional analysis involves video recording, neuroethological investigation, and interpretation from engineering and physical perspectives. Because *Principles* was published before the invention of the electron microscope, details of histological and cellular structure are inaccurate. Physiology has advanced even more rapidly than morphology in the last half century, making most physiological statements obsolete. Even the references to genetics and behavior can be quaint: "The germ cells carry the determinants of heredity, called *genes*, whatever they may be" (p. 16).

A student should therefore seek a modern text like *The Insects* by Chapman (1982) for an up-to-date introduction to morphology. The multivolume set edited by Kerkut and Gilbert (1985) also provides the anatomical basis for physiology. But as much as the modern evolutionary biologist is still stimulated by Darwin's *Origin of Species* (1859), today's entomologist will be enlightened by Snodgrass's *Principles*, the "origin" of insect morphology.

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# PREFACE

The principal value of facts is that they give us something to think about. A scientific textbook, therefore, should contain a fair amount of reliable information, though it may be a matter of choice with the author whether he leaves it to the reader to formulate his own ideas as to the meaning of the facts, or whether he attempts to guide the reader's thoughts along what seem to him to be the proper channels. The writer of the present text, being convinced that generalizations are more important than mere knowledge of facts, and being also somewhat partial to his own way of thinking about insects, has not been able to refrain entirely from presenting the facts of insect anatomy in a way to suggest relations between them that possibly exist only in his own mind. Each of the several chapters of this book, in other words, is an attempt to give a coherent morphological view of the fundamental nature and the apparent evolution of a particular group of organs or associated structures. It is more than likely, practically certain, that many of the generalizations here offered will soon be modified or superseded by other generalizations, but they will have served their purpose if they induce critical students to make a wider and more thorough study of the problems of insect morphology.

Two notable books have appeared recently in entomology: one, "Lehrbuch der Entomologie," by Dr. Hermann Weber of Danzig, in its first edition; the other, "A General Textbook of Entomology," by Dr. A. D. Imms of Cambridge, England, in its third edition. In preparing the present text the writer has made a special effort to concur with the authors of these books in the matter of anatomical terms, in order that students may as far as possible be spared confusion in turning from one treatise to another. Unfortunately, however, there is still much unavoidable discrepancy in the use and application of anatomical names in entomology. The trouble, in large measure, can be blamed on the insects themselves, since they will not entirely conform with any plan of nomenclature or with any scheme we can devise for naming their parts consistently. To make clear the meaning of terms as used in this text, therefore, a glossary of definitions is appended to each chapter, wherein, also, will be found the German equivalents of many of our English and Latinized technical names.

In making acknowledgments, the writer must first of all declare his indebtedness to the Bureau of Entomology, United States Department

of Agriculture, for the experience and information acquired in the course of his many years of official service. Most of the illustrations accompanying the text that are not accredited to particular sources are the property of the Bureau of Entomology and Plant Quarantine, and many of them have been published in the *Miscellaneous Collections* and the *Annual Reports* of the Smithsonian Institution of Washington, D.C. For the use of these figures the writer hereby expresses his thanks both to the Bureau and to the Smithsonion Institution. With regard to illustrations borrowed from other works, the writer is particularly indebted to Professor Hermann Weber, of Danzig, for permission to use figures from his "Biologie der Hemipteren" and "Lehrbuch der Entomologie." The rest of the illustrations, each accredited to its proper source in the scientific journals, have been freely drawn from the common heritage of entomology contributed by the many workers in many lands who have devoted themselves to the study of insects. To my wife, Ruth H. Snodgrass, credit is due for the typing of the manuscript and for much of the work of indexing and proofreading.

R. E. SNODGRASS.

WASHINGTON, D. C.
*May*, 1935.