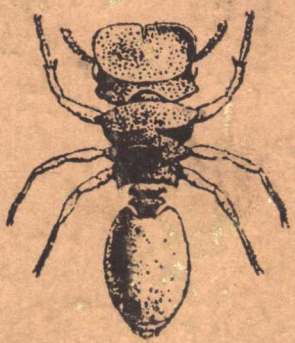
THE PHYSIOLOGY OF INSECTA

Second Edition



Volume IV

EDITED BY

MORRIS ROCKSTEIN

THE PHYSIOLOGY OF INSECTA

Second Edition

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PREFACE

Since the first edition of this multivolume treatise appeared well over eight years ago there has been a notable expansion of scientific endeavor in each of the now numerous aspects of insect physiology. Accordingly, revising this major reference work has been a challenging undertaking both to the original authors as well as to the several new contributors in areas in which the growth of research has led to such an increase in the relevant body of knowledge as to warrant this additional coverage. Consequently, the original three-volume work has now grown "like Topsy" to a thoroughly revised six-volume work.

Just as previous volumes of this edition have included entirely new and distinct chapters on Environmental Aspects—Radiation, Circadian Rhythms and Photoperiodism in Insects, and Insect Pheromones, this volume includes new chapters on The Pharmacology of the Insect Nervous System by Dr. Y. Pichon and on Protein Synthesis in Insects by Drs. Joseph and Judith Ilan.

Similarly, The Circulatory System of Insects, formerly covered in one chapter by Dr. Jack Jones, has now been subdivided in Volume V into three chapters: viz., Factors Affecting Heart Rates in Insects by Dr. Jones, Electrophysiology of the Insect Heart by Dr. Thomas A. Miller, and the Hemocytes of Insects by Dr. J. W. Arnold. A new chapter on the subject of Microsomal Mixed-Function Oxidases by Drs. M. Agosin and A. S. Perry has also been included in Volume V.

Likewise, the original chapter on Respiration: Aerial Gas Transport by Dr. P. L. Miller has been expanded in Volume VI into two chapters: Respiration: Aerial Gas Transport by Dr. Miller and Respiration in Aquatic Insects by Dr. P. L. Mill.

Once again, I am deeply indebted to my former teacher and mentor, Professor A. Glenn Richards, whose criticism and suggestions concerning the first edition have assisted me immeasurably in my endeavor to improve both the content and scope of this, the second edition. I am especially grateful to Mrs. Estella Cooney, Ricki Davidson, and to my daughter Susan, without those technical and editorial assistance (under the stress of exacting technical standards which a work of this nature demands) the completion of this volume would have been impossible. Once more, also, the cooperation of and concern for quality and content and accuracy by each of the authors of the various chapters must be recognized with appreciation.

Finally, the Editor cannot overemphasize the important role played by the staff of Academic Press, in their unfailing encouragement, cooperation and tactical assistance throughout the planning and the ultimate completion of the collation of the various components of this, the second edition of "The Physiology of Insecta."

MORRIS ROCKSTEIN

PREFACE TO FIRST EDITION

This multivolume treatise brings together the known facts, the controversial material, and the many still unsolved and unsettled problems of insect physiology in chapters written by the outstanding workers in each of a wide range of areas of insect function.

It is designed to meet a manifest need which has arisen from the phenomenal increase in research activity on insects (during the past two decades, especially) for an authoritative, comprehensive reference work in insect physiology.

Although the insect physiologist usually considers himself either a comparative physiologist or a general physiologist studying a particular process in insects, the fact is that each is a biologist whose primary interest is in the *total organism* in relation to a specific function. This viewpoint is reflected in the organization and arrangement of the chapters by section and volumes. Thus, instead of that classic arrangement of chapters which emphasizes organ or systemic physiology, this treatise has been organized into three main sections, each covering a major division of insect biology: the ontogeny of insects from reproduction to senescence of the individual; the insect's perception of and reaction to its external environment; and the mechanisms by which the internal homeostatic state is maintained. The last-mentioned division, especially, includes many classic functions—from the role of the nervous system to nutrition, metabolism, respiration, circulation, maintenance of salt and water balance, and cuticular functions. In addition, under this major division the heretofore unemphasized areas of immunological responses and mecha-

nisms of insect resistance to insecticides have been included, since the contributions of research investigators to these fields in recent times are widely recognized.

I hope that this diversified subject matter will serve an equally varied group of students of biology. To the student of comparative physiology as well as to the entomologist, the organization of the now extensive literature on insect physiology into one large work should be especially useful. To the applied entomologist, the chapters concerned with insect functions in relation to the external environment should prove especially interesting; they provide a basis for understanding the distribution, epidemiology, and bionomics of insects in general, but especially of those insects of medical and economic importance. Those chapters concerned with the maintenance of the constancy of the internal environment should be equally helpful, forming a rational basis for control of insect pests. Finally, the details of structure, both gross and histological, necessarily included in those chapters covering neurophysiology, circulation, respiration, digestion, and cuticular functions, should be of special interest to the anatomist or taxonomist concerned with the physiological implications of his own research interests in insects.

The responsibilities of editing an opus of this size include securing the complete cooperation and sustained efforts of one's co-authors. To this I can attest without qualification. I must also acknowledge the critical, but always helpful suggestions—especially in the early planning and in the reading of some of the manuscripts—of my many colleagues, namely, Dr. A. Glenn Richards, Dr. V. B. Wigglesworth, Dr. Carroll M. Williams, Dr. Leigh E. Chadwick, Dr. Vincent G. Dethier, Dr. Herbert H. Ross, Dr. Curtis W. Sabrosky, and the late Dr. R. N. Snodgrass.

To Miss Norma Moskovitz, special expression of appreciation is due for her untiring efforts and sustained dedication to achieving a final product of exacting technical standards.

On a more personal level, the early encouragement of the late Elaine S. Rockstein and the patience and forbearance of my ofttimes neglected daughters Susan and Madelaine, especially during the past year, must be gratefully acknowledged as well.

MORRIS ROCKSTEIN

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