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Insect Ultrastructure

Edited by Robert C. King and Hiromu Akai

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Volume 1

Edited by

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Insect Ultrastructure

Volume 1

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Preface

Fourteen years have passed since the publication of David Spencer Smith's *Insect Cells: Their Structure and Function*. Here the results of a decade of electronmicroscopic studies on insect cells were summarized in an organized and integrated fashion for the first time, and the ultrastructural characteristics of different specialized cells and tissues were abundantly illustrated in the 117 plates this monograph contained.

In the intervening period great progress has been made in the field of Insect Ultrastructure. Organelles not even mentioned in Smith's book, such as synaptonemal complexes, clathrin baskets, fusomes, and reticular junctions, have been identified and functions proposed for them. There have also been many technical advances that have profoundly influenced the direction of subsequent research. A spectacular example would be the development by Miller and Beatty of the chromosomal spreading technique which allowed for the first time ultrastructural studies on segments of chromosomes containing genes in various stages of replication and transcription. Then there is the freeze-fracture procedure first described by Moor and his colleagues. This technique permitted an analysis of intercellular junctions that was impossible with the conventional sectioning methods. The results greatly clarified our understanding of the channels for ion movement and the permeability barriers between cells and also the membrane changes that occur during the embryonic differentiation and metamorphosis of various types of insect cells.

Along with such scientific milestones involving technical methods there have also been instances where hypotheses have been advanced which explained for the first time findings of unclear significance. An example would be the explanation by Yves Bouligand that a helicoidal packing of microfibrils was responsible for the arced patterns seen in sectioned insect cuticles. Finally, advances made in the genetics, developmental biology, biochemistry, and physiology of a limited number of insect species have been integrated with the results of ultrastructural studies to supply functional interpretations for the intricate organization of various subcellular organelles.

The purpose of the volume that follows is to provide the interested reader with a series of up-to-date, well illustrated, reviews of selected aspects of

Insect Ultrastructure by authorities in the field. The topics fall into three groups, *i.e.*, those dealing with gametes, with developing cells, and with the differentiation and functioning of specialized tissues and organs.

The 16th International Congress of Entomology held in Kyoto, Japan in August of 1980 brought together an extremely diverse group of biologists with very different trainings, research interests and philosophies. In particular it provided a golden opportunity for experts from many countries to meet and discuss various aspects of Insect Ultrastructure. Many of the chapters that follow arose as a result of discussions held during the Kyoto meetings. We deeply appreciate the efforts of the many people who contributed to the success of the Kyoto Congress, and we wish to especially thank Dr. Shoziro Ishii, President of the Congress, Drs. Masatoshi Kobayashi and Yoshio Waku, Members of the Organizing Committee, Dr. Kazuo Hazama, Director of the Sericultural Experiment Station, Dr. Seijiro Morohoshi, President of the Tokyo University of Agriculture and Technology, and Mr. Genkichi Hara, Managing Director of the Kajima Foundation.

Work is underway upon a second volume of similar size that will cover a wide variety of topics. Under the general heading of the "Ultrastructure of Developing Cells" there will be chapters on oogenesis in telotrophic ovaries, on silkworm embryogenesis, and on the high resolution mapping of the giant polytene chromosomes of the larval salivary gland cells of *Drosophila*. Under the heading of the "Ultrastructure of the Development, Differentiation, and Functioning of Specialized Tissues and Organs" there will be chapters on muscle, fat body, digestive and excretory organs, endocrine glands and their target cells, wax glands, silk glands, photoreceptors, and glial cells. Finally there will be chapters dealing with the pathological changes occurring in cells infected by parasites, with tumor-forming cells and with the cell-mediated defense systems of insects. This volume should appear about one year after the first volume is published.

R. C. King and H. Akai
April 1982

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