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*In India ternum pedum longitudinis esse traduntur,
cruribus et femuribus serrarum usum praebere,
cum inaruerint.*

(Plin. N.H. xi. 29. 103)

Anthony C. Neville

Biology of the Arthropod Cuticle

With 233 Figures



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For explanation of the cover motif see legend to Fig. 5.32 (page 188).

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To my wife Monica

Preface

Mention the words 'arthropod cuticle' to most biologists and they usually provoke a glazed expression. This is because the cuticle is commonly regarded as an inert substance. It is hoped that this book will dispel this fallacy. The study of cuticle in its proper context now involves many of the wider aspects of biology which are currently in vogue (e.g. how a hormone like ecdyson induces a specific enzyme like dopa decarboxylase; the unsolved major problem of cell gradient and polarity; the involvement of cyclic AMP in hormonal mechanisms; the extracellular control of cuticular enzymes, of the mechanical properties of cuticle structural proteins, and of the orientation of fibrous molecules; and the relation of chromosome puffing to the synthesis of specific proteins). Studies on cuticle demand a variety of techniques, and examples of the following are illustrated in this book (fluorescence, phase contrast, polarization and Nomarski interference microscopy; infrared absorption; transmission and scanning electron microscopy; autoradiography analyzed by electron microscopy; negative staining in the electron microscope; optical diffraction, high angle X-ray diffraction, low angle X-ray diffraction and selected area electron diffraction). I am well aware that the biophysical parts of this book are less incomplete than other aspects. A developmental biologist or a biochemist would have further elaborated other parts of the subject matter. Only one previous author, RICHARDS (1951) has devoted a book to arthropod cuticle. This is probably because the field covers so many aspects of biology, biochemistry and biophysics that one almost needs to be a megalomaniac to attempt a synthesis. Yet for that very reason the subject provides a fine heuristic model in which to bring to a focus the study of several fundamentals in those separate disciplines.

I have taken "time out" from my own research to read a broad spectrum of cuticle literature. I do not regard this in any way as a sacrifice. Diversity has to tend eventually toward generality, and by sitting on a fence it is possible to appreciate the produce of your neighbors' gardens. I hope that the cross pollination which has resulted will offset the amount of weeding which has been done.

WHITEHEAD the philosopher advised us to search for simplicity and suspect it. I do not subscribe to this cynical view:

throughout this book will be found criticisms of attempts to analyse complex systems before the rudiments have been established on simpler ones (e.g. in X-ray diffraction studies; mechanical analyses and amino acid analyses of protein mixtures).

To aid future research workers a final chapter deals with outstanding problems, and this is augmented by suggestions in the text. References are quoted with titles in full because I believe this to be the only civilized way.

Bristol, 1975

ANTHONY C. NEVILLE

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