

Preface

Miniaturization is a widespread trend in animal evolution and one of the principal directions of evolution in insects. It is known that body size, especially when extremely small, is an important characteristic that largely determines the morphology, physiology, and biology of animals. Pattern of miniaturization-related structural changes have been described for many vertebrates, but until recently remained largely unknown for insects. Over the last few decades, extremely interesting finds about the structure of the smallest insects have attracted the interest of many researchers to the problem of miniaturization in insects. This book summarizes those finds.

Not only does the study of the structure of the smallest insects, the length of which is only several tenths of a millimeter, considerably expand our notions about the phenomenon of miniaturization in the animal kingdom, it is also of exceptional theoretical value and general fundamental importance: insects of such sizes live in a peculiar 'microworld,' in which surface tension of liquids and capillary and electrostatic forces are greater than the weight of an organism.

Furthermore, insects, displaying a huge range of sizes (the largest and smallest insects differ in body length by a factor of more than 2000, which is considerably greater than the range of sizes in any class of vertebrates), provide unique material for such a topical field of modern biology and biotechnology as the study of scaling in biological structures and processes. Moreover, the study of the scaling of insect organs provides novel material for discussing the factors that limit body size in animals in general.

Miniaturization is more than a principal trend in insect evolution: it is also an important field of modern engineering. The data that have been obtained and patterns that have been revealed about the structure of microinsects can be used in microbotics, nano-optics, and modeling of neural networks and sensory systems. The unique phenomenon of anucleate neurons may greatly change our notions about the structure and function of the central nervous system of non-human animals and humans and prove a key point in the study of memory storage and neuron regeneration.

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