COMPARATIVE INVERTEBRATE NEUROCHEMISTRY

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Neurochemistry is a rapidly advancing field of research and workers on mammalian and other vertebrate systems, as well as those interested in insects and other invertebrates, are turning their attention to invertebrates to show how neural transmission occurs in 'simple' systems. Hence the subject is attracting interest from many neurophysiologists and neuropharmacologists as well as from zoologists. It is also of relevance in applied fields such as the pesticide industry, since it is possible to produce pesticides which interfere with nervous transmitter systems of major insect pests, in a similar way to how drugs act in other systems.

This book presents a review of invertebrate neurochemistry at a level suitable for the advanced student or researcher in zoology, neuroscience or pharmacology. Most of the book is concerned with insects, but other invertebrate systems are also covered and comparisons are made with mammalian neurochemistry. The book is organised around the major neurotransmitter classes and in each case both 'pure' and applied aspects are covered.

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CROOM HELM
London & Sydney

Softcover reprint of the hardcover 1st edition 1988

Croom Helm Ltd, Provident House,
Burrell Row, Beckenham, Kent BR3 1AT
Croom Helm Australia, 44-50 Waterloo Road,
North Ryde, 2113, New South Wales

British Library Cataloguing in Publication Data

Comparative invertebrate neurochemistry.
1. Nervous system — Invertebrates
2. Neurons
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592'.0188 QL364

ISBN-13: 978-1-4615-9806-0 e-ISBN-13: 978-1-4615-9804-6
DOI: 10.1007/978-1-4615-9804-6

Typeset in Times Roman by Leaper & Gard Ltd, Bristol

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Preface

The attractions of invertebrate nervous systems have long been appreciated by neurophysiologists. Indeed some of the milestones in our understanding of nervous systems have their foundations in experiments done on invertebrate preparations, typified by the role of the squid axon in dissecting the events that constitute the action potential. More recently we have seen how the relatively simple nervous system of *Aplysia* has permitted new insights into the molecular mechanisms of memory and learning.

Neurochemists, however, have not been enthusiastic about invertebrate tissues as their experimental material. Much of the biochemical information on invertebrate nervous systems that has accrued has been incidental, almost as a by-product of what were primarily physiological investigations. Fortunately the field is changing, and research groups are making a positive choice to turn to invertebrate tissues.

Two important factors have contributed to this. First, the study of analogous systems in invertebrates and vertebrates can tell us much about the evolution of nervous systems. The application of the techniques of molecular genetics to the study of such molecules as receptors and ion channels can provide detailed information about their composition that, in turn, allows us to better understand their function. By extending such studies to the invertebrates we should be able to understand how such systems have developed. Secondly, invertebrate pests are responsible for enormous losses of agricultural crops and are major vectors of disease in man. The pesticide industry has in the past adopted a predominantly empirical approach to the control of pests. However, it is increasingly apparent that such an approach is no longer tenable. The industry needs new targets at which to direct more specific, safer, control agents. It is generally agreed that the nervous system is probably the most vulnerable target at which to aim such agents, and consequently there has been a major effort to promote research aimed at identifying potential pest-specific sites.

It is against this background of increasing emphasis on comparative studies that we have assembled this volume. We have sought to review our current understanding of the major neurotransmitter systems in invertebrates and to highlight their relationship to the generally much better characterised vertebrate systems. Our authors have all worked with invertebrate systems for many years and have been in part responsible for the current upsurge of interest. In addition to considering the major transmitter systems we have included two chapters that cover slightly different areas. Cell culture, and more particularly neuronal cell culture, is a relatively new discipline that has had a great impact on biology. Cultured cells

offer possibilities that the natural tissue cannot. Invertebrate neuronal culture is just beginning to realise its potential and is being enthusiastically taken up by a number of groups. Neurotoxins have provided neuroscientists with some of the most specific and potent research tools that we have; how could we study nicotinic acetylcholine receptors without α-bungarotoxin or the Na^+ channel without tetrodotoxin? There are toxins that differentiate between vertebrate and invertebrate targets: not only could such toxins provide new probes for the comparative neurochemist, but they may also give valuable leads to the pesticide chemist. The chapter on invertebrate neurotoxins constitutes one of the most comprehensive accounts of these fascinating agents.

A book of this kind depends entirely on the efforts of colleagues, most of whom would rather be doing neurochemistry than writing a chapter for a book! We are most grateful to each of them for contributing to our text. Our thanks must also go to our publisher, who has waited so patiently for the final manuscript.

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