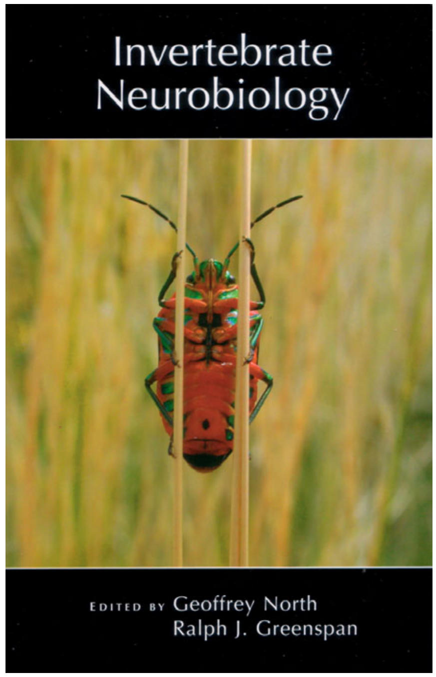
Book Review

INVERTEBRATE NEUROBIOLOGY – IT'S NOT JUST STAMP COLLECTING



Invertebrate Neurobiology

Edited by Geoffrey North and Ralph J. Greenspan

Cold Spring Harbor Laboratory Press (2007)
Hardback – 665pp. ISBN 978-0879698195
$135.00; £68.30

Why should neuroscientists be interested in the nervous systems of worms, flies and sea slugs? Nowadays an impressive array of experimental tools can be used to study details of how circuits of neurons in vertebrate brains work, so it is no longer necessary to find simpler, invertebrate models to elucidate how action potentials and synapses work. Two of the major themes of 'Invertebrate Neurobiology', edited by Geoffrey North and Ralph Greenspan, provide compelling reasons for paying attention to the nervous systems of animals without backbones. First, for a variety of reasons, the roles of individual neurons in controlling behaviour are much more easy to pin down in studies of invertebrates than vertebrates. But that does not mean invertebrates have limited, simple behaviour patterns, as chapters on cognition and on foraging behaviours by bees and ants show. A second major theme of the book, and a good reason for a catholic taste in experimental subjects, is to understand why nervous systems are the way they are – to understand how the neuronal pathways that control behaviour have evolved. North, in his foreword to the book, argues strongly that there is a danger that the revolution in molecular biology will reduce biology into a reductionism science, obscuring the importance of appreciating biological diversity that has originated through evolutionary history. He argues against Lord Rutherford's view that science is 'either physics or stamp-collecting'. This is a theme taken up again in the 'after-word' by Greenspan, who poses the tantalising question, 'What is the range of possibilities open to brains?' He invites Neurobiologists to consider how nervous systems have evolved by considering topics such as whether one way of building a brain is necessarily better than another.

The arrangement of a separate foreword and after-word reflects the different perspectives of the editors (one a professional editor, the other a research scientist). Sandwiched between them are 23 chapters arranged thematically into 6 sections. With contributions from nearly 50 experts in their fields, the book provides a good sample of authoritative accounts. The proportion of the book devoted to references is striking – nearly a third of the pages for some chapters. By way of a general introduction, Eve Marder starts by outlining how experiments with invertebrate preparations have revealed many of the fundamentals of neuroscience. Her introduction ends with what she calls 'the big challenge', which is essentially to be careful to try and choose those experimental subjects best suited to reveal significant new insights. That seems like good advice to any grant applicant.

The first section is called 'Emerging Techniques', with a chapter about genetic manipulation in *Drosophila* and another about optical imaging of neurons involved in odour processing and memory in the bee brain. Next is a section on sensory systems. Although this section is mostly about senses of insects, it covers the whole range of levels of study. For example, the section covers both the physics of eyes and the operation of a flying fly's cockpit. A section on motor systems includes chapters about insect flight and walking, and a useful account of some of the classical preparations for studying central pattern generators. Next is a section on learning and memory, including cognitive processes in hymenoptera, genetics of memory mechanisms in flies and nematodes, and the cellular neurophysiology of simple learning in *Aplysia*. The largest section of the book, called 'Behavior and Neuroethology Models', is an eclectic collection of accounts on a range of topics and phyla. It includes chapters on: the ecology of arthropod vision; fruit fly courtship behaviour; foraging by flies, worms, bees and ants; fruit fly sleep and activity;

choices by sea slugs; and insect eclosion. The final section is called Evolution, with a chapter on excitability in ‘lower’ invertebrates and a second on evolution of insect behavioural genes.

‘Invertebrate Neurobiology’ gathers chapters relevant to neuronal mechanisms of behaviour and its evolution. With this emphasis, some significant areas of invertebrate neurobiology, such as development and synaptic function, get relatively little coverage, as do several key neuronal systems, such as the crayfish lateral giant interneuron. Different approaches are included – genetic, neurophysiological and classical ethology. These approaches are mostly pigeonholed into different chapters, and I did think a weakness is that there is little internal cross-referencing between its chapters, or between the foreword and the after-word and the individual chapters. But this lack does reflect the current state of the field and it will be interesting to look at the book in a few years, when interdisciplinary approaches really do start to work. Some chapters begin with quite lengthy speculative essays. I particularly liked the speculations about how excitability in cells first arose, and why different ions do the things they do to cells. As a novice to genetics and molecular biology, I would have liked a more carefully worked introduction to some chapters in that area – for example, a clearer and illustrated account of targeted gene expression. The picture of a metallic shield bug on the front cover is really striking and I think that the book will be a useful source of information for researchers, as well as for teachers in preparing advanced level lectures. I recommend that every Neuroscientist ensures they have access to it.

10.1242/jeb.013854

Peter Simmons
Newcastle University
p.j.simmons@newcastle.ac.uk