

samples the breadth of the literature. Also, there are questions for the student; some are easy while others have no answer.

While Webb is nearly objective in reporting the current state of the distance scale, a lot of the public interest in this topic stems from the controversy surrounding it. But Webb gives only limited space to the human element that has fuelled the nearly religious fervour of the distance-scale debate for the past 25 years. His emphasis is probably appropriate, considering the target audience and the availability of Dennis Overbye's *Lonely Hearts of the Cosmos* (Little Brown, 1991). For those seeking an exposé of cosmologists' lives, this is not the book; but, for those interested in an understandable and enjoyable textbook that describes how astronomers measure real distances to real objects that are far away, *Measuring the Universe* hits the mark. ■

G. Jacoby is at the Kitt Peak National Observatory, 950 North Cherry Avenue, PO Box 26732, Tucson, Arizona 85726-6732, USA.

## Synchronizing situations

### Fast Oscillations in Cortical Circuits

by Roger D. Traub, John G. R. Jefferys and Miles A. Whittington  
MIT Press: 1999. 324 pp. \$57.50, £34.95

Dietmar Plenz

The dynamics of groups of nerve cells pose a major challenge in understanding brain function. In that context, *Fast Oscillations in Cortical Circuits* is a refreshing approach to unravelling one of the most intriguing phenomena displayed by the mammalian brain: the  $\gamma$  oscillation. This brain activity, during which neurons synchronize their firing at a rate of approximately 40 Hz, has been found during a vast variety of behavioural states, ranging from REM (rapid eye-movement) sleep to attentive behaviour in human and animal studies.

Traub, Jefferys and Whittington use a combination of neuronal modelling and electrophysiological experiments to outline their ideas on how  $\gamma$  oscillations are generated. This book is not for the novice. Its main focus resides at the minuscule level at which changes in the membrane potential occur in single neurons from a hippocampal slice. The authors show how these changes can be represented by compartmental modelling of neuronal networks. However, the authors also link these cellular-level descriptions to more complex phenomena such as epilepsy, opiate function and memory formation.

The central mechanism proposed to explain  $\gamma$  oscillations is based on the dy-

namics of networks of mutually coupled inhibitory interneurons. At the start of the decade, computational studies unravelled the conditions under which such networks display and sustain synchronized oscillatory activity. If the membranes of the interneurons depolarize (become activated) homogeneously and their synaptic connections hyperpolarize (become inhibitory) simultaneously, synchronized firing can occur at an oscillation period that is shorter than the duration of inhibition. In the case of hippocampal basket cells coupled through hyperpolarizing GABA<sub>A</sub> synapses, such synchronization occurs in the  $\gamma$  frequency range.

Traub, Jefferys and Whittington's central hypothesis is that the homogeneous depolarization necessary for the interneuron network to oscillate is brought about by the action of a single class of neurotransmitter receptor — the metabotropic glutamate receptor. Despite this uni-causal viewpoint, which is by no means universally espoused, the beauty of this book arises from the fact that such hypotheses are clearly formulated, logically argued, then tested by experiments and computational modelling.

The activities of complex neural networks are not always based on complicated rules. Using pharmacological manipulations, the authors skilfully demonstrate the straightforward relationship between the frequency of the  $\gamma$  oscillation and the time course and amplitude of activity at GABA<sub>A</sub> synapses. Furthermore, they use a two-site stimulation protocol in the CA1 region of a hippocampus slice as an *in vitro* model for long-range synchronization, and show how interneuron spike doublets are involved in this.

Overall, the book is succinct and informative, and leads the reader through difficult uncharted waters. Unfortunately, the data provided deal exclusively with the hippocampus, and it remains to be shown whether the authors' hypothesis holds true for the neocortex in general. Furthermore, the proposed role of metabotropic glutamate receptors in the generation of  $\gamma$  oscillations naturally invites a thorough review of the various subtypes of glutamate receptor to be found in the neuronal membrane. Finally, some parts of the book are heavy going. Facts are too often presented without being integrated into the authors' context and arguments.

Nevertheless, the interdisciplinary work summarized in the book is exactly the type of research necessary to fill the gap between mechanism and phenomenon in one of the fastest-moving fields in neuroscience. ■

Dietmar Plenz is in the Unit of Neural Network Physiology, Laboratory of Systems Neuroscience, National Institute of Mental Health, Bldg 36 2D-30, Bethesda, Maryland 20892-4075, USA.

## Diversity in the world of bugs

### Ecology of Insects: Concepts and Applications

by Martin R. Speight, Mark D. Hunter and Allan D. Watt

Blackwell Science: 1999. 350 pp. \$55, £26.50

Alison F. Hunter

There is considerable disagreement over whether the total number of insect species is closer to 2 million or 10 million. What is agreed upon is that insects outnumber all other species combined. With an adaptable body plan, complex life histories and diverse feeding modes, insects have successfully radiated into every terrestrial nook and cranny. Ants forage in the desert at close to their lethal temperature of 55°C, apparently by accumulating heat-shock proteins before leaving cool tunnels. Some moths have a leisurely 13-year life cycle in the Arctic, growing only during the brief summer weeks.

Insects also engage in an extremely diverse range of ecological roles. Bark beetles consume wood by associating with cellulose-digesting fungi, while innumerable species consume more easily digestible insect tissues. Many insects pollinate plants, help decompose organic material and prey on pests.

Given this range, anyone writing a text on the ecology of insects requires considerable audacity to pull it off. Speight, Hunter and Watt provide solid coverage of current ideas. They discuss controversial issues ('talking trees' — the possibility that trees communicate about herbivory using volatile chemicals — overcompensation for herbivory and estimation of the number of insect species, among others) without getting bogged down by details of the debates, providing an even-handed, to-the-point treatment of issues.

It would be easy to write a text that would leave readers bewildered by masses of both ecological and entomological jargon. The authors, however, have taken great pains to explain terminology so that no great prior knowledge of entomology or ecology is required. The material is suitable for students of 18 years and up.

This is a fine volume with few defects. But the mosquito larva in Fig. 9.16 is upside-down, several of the figures are poorly labelled, and it is generally difficult to comprehend the figures from their captions alone. The specialties of the authors, on forest Lepidoptera and other economically important groups, are evident in the choices of examples, but the bias is not overwhelming. ■

Alison F. Hunter is in the Department of Biological Sciences, University of Notre Dame, Notre Dame, Indiana 46556, USA.