

## Memories are made of . . . ?

John C. Marshall

**Memory and Brain.** By Larry R. Squire. Oxford University Press: 1987. Pp. 315. Hbk £25, \$24.95; pbk £13.50, \$14.95.

In a well-known survey of eighteenth century science Lemuel Gulliver reports the following experiment on the biological basis of memory: "The proposition and demonstration were fairly written on a thin paper, with ink composed of a cephalic tincture. This the student was to swallow upon a fasting stomach, and for three days following eat nothing but bread and water. As the water digested, the tincture mounted to his brain, bearing the proposition along with it." Such swift 'learning by ingestion' continues to intrigue students on the eve of examinations and tourists on the borders of Bulgaria. The notion became scientifically respectable when Hering conjectured in 1870 that the phenomena of memory and of heredity have a common source. And thus the ground was laid for the purported demonstrations in the 1960s that naive flat-worms (*Planaria*) could acquire conditioned reflexes by cannibalizing their trained relatives. Unfortunately, these studies were of dubious replicability and their underlying assumptions were at best a red Hering. But if eating professors is indeed ineffective, what intellectual diet does the academy of Lagado currently recommend?

The last twenty years have seen very substantial advances in the investigation of how memory is represented in the brain. From studies of the biochemistry of synaptic plasticity, through clinico-pathological inquiry into the amnesic syndromes, to information-processing accounts of the functional organization of memory systems, the growth rate of interesting and reliable data has been truly impressive. Larry Squire's account of this work is up-to-date, lucid and comprehensive, with fine sections on the modulation of memory by hormones and neurotransmitter substances, and on the identification of brain structures crucial to (some aspects of) learning and long-term memory in the midline diencephalon and medial temporal region. The importance of these anatomical structures is convincingly demonstrated in patients with stroke, brain ablation, and Wernicke-Korsakoff syndrome, a condition which results from chronic alcohol abuse and involves major retrograde and anterograde amnesia.

In common with many neuroscientists active in this field, Squire has high hopes that "the recent development of an animal

model of human amnesia in the monkey" will resolve some of the anatomical and functional issues that are difficult to address in human cases with very variable pathology. But here I find Squire insufficiently critical. It is far from clear that the profound loss of autobiographical memories characteristic of human amnesia has any analogue in the brain-lesioned monkey's inability to perform delayed nonmatching-to-sample tasks. Whilst animals other than ourselves can clearly learn, it would require more evidence than we possess at present to persuade me that animals have any concept of (specific) memories. Can 'amnesic' monkeys confabulate fictitious autobiographies with the conviction of (some) amnesic patients?

Human patients continue to provide the most revealing data on the fractionation of memory and Squire documents well the surprising dissociations between failure of explicit recall with preservation of skill

learning and tacit memory that are such a striking feature of amnesia. The basic mystery is that these patients behave as if they have learnt from experience yet have no conscious recollection of the experience from which they have veritably learnt; the basic problem is that we are 'data-rich but theory-poor'.

All too often the patterns of memory impairment and preservation have been forced into dichotomous categories labelled by terms vaguely suggestive of different processing strategies or informational types. These labels are no substitute for genuine understanding, and especially so with respect to a system whose functional components are more likely to number two hundred than two. Squire's book provides the data and some useful ways of looking at them. The theory is yet to come. □

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## Light reading

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**General Photobiology.** By Donat-Peter Hader and Manfred Tevini. Pergamon: 1987. Pp. 323. Hbk £26.95, \$40; pbk £14.95, \$21.95.

THERE is a current upswing of interest in photobiology, as shown by the recent formation of the European Society for Photobiology and the imminent appearance of an associated new journal. The production of this text is therefore timely, both for new undergraduate courses and for newcomers to research in this field. Nevertheless it is a general experience of photobiology societies that the membership shows relatively little interest in the subject as a discipline, and tends to condense into research groups with little or no mutual contact. Given that the only common feature of the subjects under the photobiology umbrella is the absorption of light by primary pigments (bioluminescence is here reclassified as photochemistry), there is a limit to the usefulness of comparison between them: each subject forms more natural liaisons with wider biological fields.

The authors have faced this issue squarely; they have avoided the fragmentation that accompanies multi-author review collections, and have been able to group their topics efficiently. Thus under "Energy Fixation" they assemble bacteriorhodopsin- and chlorophyll-based photosynthesis (the shortest and longest chapters respectively), while photomorphogenesis, light-dependent rhythms, movement responses, vision and the biological effects of UV light are grouped

naturally as "Processes Controlled and Regulated by Light". The depth of coverage is certainly adequate for undergraduate studies, and will provide a stimulus to further study and research.

A second problem recognized by the authors is that biology students often lack a sound physical, chemical and technical background. Roughly a quarter of the text is an introduction to photophysics and photochemistry, introducing units, formulae and the principles and practice of instrumentation. This section comes closest to forging a unity in the subject. A photobiology course including laboratory work requiring both biological observation and proper physical measurement should perhaps become a central requirement in schools of biological sciences.

The presentation of 'physics for biologists' is a difficult educational problem, needing sympathetic teaching. Hader and Tevini's introductory section has some errors and may need reworking in the light of experience. Nevertheless this is a welcome addition to the photobiologist's bookshelf. □

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### New in paperback

- *Memoirs of an Unrepentant Field Geologist* by F.J. Pettijohn. Publisher is University of Chicago Press, price is \$10.95, £8.75. For review see *Nature* 312, 224 (1984).
- *Planetary Landscapes* by R. Greeley, with a new chapter on Uranus. Publisher is Unwin Hyman, price is £14.95, \$29.95. For review see *Nature* 320, 664 (1986).
- *Excitons, Selected Chapters*, an abridged version edited by E.I. Rashba and M.D. Sturge. Publisher is North-Holland, price is Dfl.95. For review see *Nature* 307, 572 (1984).