

Book reviews

Levels of Selection in Evolution. Laurent Keller (ed.). Princeton University Press, Princeton, N.J. 1999. Pp. 413. Price £10.15, paperback. ISBN 0 691 00703 9.

The question of the interplay between the effects of selection at different levels of biological organization emerged early in the development of population genetics. Haldane, in Chapter 5 of *The Causes of Evolution*, gave a particularly lucid account. He pointed out that competitive selection between individuals within a population, notably sexual selection, may lead to the evolution of traits that are deleterious with respect to the long-term survival of the species. He emphasized that selection between different gametic genotypes, even among those produced by the same individual, can lead to the spread of traits that are deleterious to the individual, especially in higher plants where genes are expressed in the pollen. He also discussed the evolution of altruistic traits by kin selection and group selection. In addition to conflicts between different levels of selection, there is also the possibility of conflict between entities at the same level of organization, but which are subject to different rules of inheritance. This was probably first noticed by D. H. Lewis in 1941, when considering the spread of nuclear and cytoplasmic genes that control male sterility in plants.

Levels of Selection in Evolution is the first book to provide an overview of the very diverse recent literature on these topics, which ultimately traces back to these pioneering contributions (neither Haldane's nor Lewis' work is cited, however!). It contains papers that deal with the evolution of replicators (Szmathmary), individuals (Michod), and animal (Kitchen and Packer) and human societies (Maynard Smith). Other papers treat conflicts and communities of interest between genes within the same organism (Pomiankowski), between the sexes (Lessells), parents and offspring (Godfray), members of social groups (Keller and Reeve), and species in ecological communities (Herre). The properties and consequences of selection at different levels are discussed in general papers by Leigh, Nunney, and Reeve and Keller.

The book contains a large quantity of fascinating biological information and descriptions of clever theoretical models, and will undoubtedly be a very useful resource for researchers in evolutionary biology. One question that it raises, however, is whether there is a useful general theory of conflict that can be applied painlessly to solve particular problems. My impression is that there is not; I can see very little in common between, for example, the application of ESS theory to parent–offspring conflict, and the use of population genetic dynamic modelling to study transposable elements or segregation distorters. The generalizations that are provided in the overview papers are, inevitably, bland and not very informative.

I also have the impression that different topics are at very different levels of scientific development, in the sense of

confronting theories with tests. Topics such as sex ratio distortion and worker conflict in insect societies seem to be in a healthy state, where details of biology can be successfully interpreted by plausible models. In contrast, I am not convinced that the discussions of the evolution of replicators and individuals, at one extreme, or human language at the other, are more than ingenious speculation, with little hope at present for hypothesis testing. It is interesting that different authors contradict each other on some of these topics; Michod, for example, accepts the role of hypercycles in prebiotic evolution, whereas Szmathmary is critical. Leigh believes that anisogamy arose to promote uniparental transmission of cytoplasmic organelles, whereas Lessells emphasizes the importance of the conflict between gamete number and gamete size. Of the more theoretical papers, Godfray's stands out as an example of caution in relating the ideas to the data. I would have liked to see this caution applied more widely; the development of hypotheses is essential for progress, but one should not confuse them with reality.

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Mosaic Evolution of Subterranean Mammals — Regression, Progression and Global Convergence. Eviatar Nevo. Oxford University Press, Oxford. 1999. Pp. 413. Price £95.00, hardback. ISBN 0 19 857572 6.

'The mole had been working very hard all the morning, spring cleaning his little home. First with brooms, then with dusters; then on ladders and steps and chairs, with a brush and a brimming pail, till he had dust in his throat, small splashes of white-wash all over his black fur, and an aching back and weary arms'. So begins *The Wind in the Willows* by Kenneth Grahame, creating an evocative image of an industrious creature living in a cosy subterranean home. But to quote the old cliché, truth is often stranger than fiction, and the labours of 'Mole' pale into insignificance when one considers the Herculean digging feats of many subterranean mammals, and the complex 'housekeeping' of the eusocial naked mole-rat. Furthermore, although predictable and stable, the subterranean niche is a nightmarish one for a terrestrial animal, with its claustrophobic darkness and potentially suffocating gas composition, but it is to this specialized microenvironment that subterranean animals throughout the globe have become exquisitely adapted.

The central premise of Nevo is that the adaptation of mammals to a subterranean life-style can be viewed as a global experiment in evolution, beginning with climatic changes in the Eocene and early Oligocene, with 'regression', 'progression' and 'global convergence' in structure and function, and he presents a wealth of information to support this thesis. From the title it is evident that the aim of this book is an ambitious one, but with 50 years of experience in this field, Nevo is suitably qualified for such a task, and a lifetime of enthusiasm for his subject shines through in the writing. The great strength of the book is its multidisciplinary approach, covering topics as diverse as palaeobiology, ecology, anatomy, physiology, behaviour, population genetics and speciation, all set within the context of evolutionary theory. As Nevo points out, this 'global experiment' is a wonderful opportunity to apply the comparative method in evolutionary biology, which is so much in vogue at present. After experiencing many peaks and, I have to say, some troughs during the course of reading the book I think that on balance Nevo largely succeeds in his objectives. The text is prone to become rather unwieldy in places, but in other parts the fascination of the author for the animals sparkles through to liven it. Although much is made of the comparative method, I found disappointingly little evidence of integration of the mass of data presented with the wealth of phylogenetic information that is now out there in the literature. The inclusion of some recent mammalian phylogenies in Chapter 16 seems superfluous, as they are almost totally ignored in the text. It seems a shame that the section of the book (mainly Part VI) containing the cross-taxa analysis was based on a questionnaire put out in 1987, and not updated, as there has been a mass of new papers on subterranean mammals since that time. Furthermore, although some 1999 references are included, disappointingly, these appeared to be somewhat selective, as discussion in some sections of the book were out of date. I also found the sections on the evolution of social structure and eusociality weakly argued and confusing, with several *non sequiturs*. For example, it is hard to understand how the statement 'the hystricomorph ovary is highly secretory' (p. 275) has any bearing on eusociality. I think that these criticisms arise mainly as a consequence of the all-encompassing nature of the book. With such a broad remit covering diverse topics, it is difficult for a single author to please everyone.

The book covers a lot of ground and does contain a mass of information, with many useful pictures and diagrams. The price tag of £95 will almost invariably restrict the book to libraries or dedicated researchers in the field, but it is certainly a valuable first port of call for those interested in subterranean mammals, and should have a broad interest to biologists of many disciplines. I certainly enjoyed just picking it up, dipping in at random and invariably finding an interesting snippet of information provoking further thought.

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Prokaryotic Gene Expression (Frontiers in Molecular Biology Series, 21). Simon Baumberg (ed.). Oxford University Press, Oxford. 1999. Pp 325. Price £32.95, paperback. ISBN 0 19 963603 6.

The chapter titles in this monograph whet the appetite for a volume that covers the subject from conception to current analyses of pathogenic bacteria. An instructive, historical perspective from the editor prefaces three foundation chapters concerned with the recognition of specific DNA- and RNA-binding sites by relevant proteins. Appropriately, Peter Stockley starts with a basic introduction to the sequence-dependence of nucleic acid conformations and the recognition potential of Watson-Crick base pairs, before documenting these principles with examples of defined structures. The chapter by John Heldman reviews RNA polymerases and their interactions with promoter sequences and that by Stephen Busby the interactions of repressors and activators with DNA, with each other, and with RNA polymerase. Zhiping Gu and Paul Lovett follow with a survey of modes of post-transcriptional regulation, principally those affecting translation. Karl Drlica and colleagues discuss the subtle effects of DNA topology on gene expression before Regine Hengge-Aronis integrates the control devices into a global regulatory network as currently understood for *Escherichia coli*. This leads logically to the two-component signal transduction systems reviewed by Mariette Atkinson and Alexander Ninfa. There is no specific review of the role of proteolysis.

Three chapters extend the topic of gene expression in bacteria to important problems of increased complexity. Jon Saunders covers those systems in which genes are switched on and off by one of a variety of novel mechanisms, including the rearrangement of DNA sequences, and Charles Dorman considers control devices relevant to bacterial pathogenicity. Michael Yudkin and Keith Chater combine to provide a lucid account of some of the complex interactions that control the developmental pathways of sporulation and antibiotic production in *Bacillus subtilis* and streptomycetes. The editor concludes with a brief reflection on evolutionary aspects in which he poses some questions that remain unanswered.

Inevitably, phage systems are mentioned by many authors, nevertheless, I feel that the book rather neglects their significance in the elucidation of basic principles. I was, for example, prompted to return to the enjoyable chapter in Jacob's autobiography in which, among other things, he documents the significance of his early experiments with phage λ in providing clues to an understanding of the induction of the *lac* genes. Jacob recognized a parallel between the mutants of λ that conferred a clear-plaque morphology, and repressor-negative mutants of the *lac* system. He was struck with the realization that zygotic induction of a λ prophage led to the immediate expression of a series of phage genes, suggesting their control as a unit. In his autobiography, *The Statue Within*, Jacob recalls his appreciation of the λ and *lac* systems: 'Where can the repressor act to stop everything all at once? The only simple answer, is on the DNA itself! In one way or another, the repressor must act on the DNA of the prophage to neutralize it, to prevent the activity of all its genes. And by