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Book reviews

Evolutionary Genetics. By JOHN MAYNARD SMITH. Oxford University Press. 1989. 325 pages. Paperback £16.95. ISBN 0 19 854215 1.

The challenge to writing an introductory textbook on evolutionary genetics (and indeed to teaching a course on this subject) is to present the major theoretical concepts in sufficient detail that their main conclusions can be appreciated and their limitations understood, without becoming so bogged down in technical details that the original problem is forgotten. In this text, intended for advanced undergraduates and graduates, John Maynard Smith has met this challenge admirably. The first chapters provide historical background and develop the basic concepts of population genetics: Hardy–Weinberg equilibrium, natural selection, mutation, selective maintenance of single-locus genetic variation, inbreeding, random genetic drift, migration, evolution at more than one locus, and quantitative genetic variation. Included in this part of the book is an introduction to the evolutionary game theory models of phenotypic evolution pioneered by Maynard Smith. In the later chapters these concepts are applied to topics of current research in evolution: the evolution of co-operative behaviour and kin selection; evolution of bacteria, viruses, plasmids and transposons; the organization and evolution of the eukaryotic genome; the evolution of sex and recombination; and speciation and macroevolution.

The author's stated objectives were to make evolutionary concepts accessible to students interested in whole organisms and population biology, and to those who wish to specialize in molecular biology; and to convey the impression that research in evolution is a dynamic and current activity. He has succeeded on both counts. The verbal exposition of each topic is exemplary and clear, and each section is well-illustrated with classic examples from the literature. Balanced accounts are given of current controversies, but the author does not shy away from stating his own opinion on occasion. Additional details and some mathematical derivations are given in supplementary boxes. Accompanying each chapter are suggestions for further reading, and problems of varying levels of difficulty. The answers to the problems are given at the back of the book. The suggested computer projects at the end of most chapters are a unique feature, although I suspect the majority are rather too difficult for the average undergraduate. Otherwise the only background knowledge assumed of the reader is of elementary transmission genetics, probability and statistics, algebra, and a tiny bit of calculus.

I thoroughly enjoyed reading this book, and can recommend its adoption as a reference text in advanced undergraduate/graduate courses in evolution.

TRUDY F. C. MACKAY
Department of Genetics,
North Carolina State University

Complex Organismal Functions: Integration and Evolution in Vertebrates. Edited by D. B. WAKE and G. ROTH. Chichester, UK: John Wiley and Sons. 1989. 451 pages. Cloth (£57.50). ISBN 0 471 92375 3.

'How did complex functional systems, apparently stabilized by high degrees of integration, evolve to their present diversity?' This question (quoted from the cover of their book) was tackled by 48 biologists from 12 countries who met at a Dahlem Workshop in Berlin, in the summer of 1988. They were a very distinguished group, including many of the world's leading vertebrate morphologists and a few of the principal evolutionary theorists. They were organised in sub-groups, each of which listened to several related papers presented by individuals and then worked as a committee to formulate conclusions. Their book presents both the papers and the group reports.

The conference dealt only with vertebrates but was presumably intended to discover principles that would apply to the evolution of organisms generally. One group considered feeding, one locomotion and one reproduction (especially viviparity). The fourth discussed the evolution of integrated systems more generally.

Many of the authors contribute to our understanding of evolution only by presenting what one of them (more aware, perhaps, of the dangers than some of the others) describes as 'persuasive scenarios': they were described more graphically in a famous paper as 'Just So Stories'. These stories are changing, sometimes in very interesting (and it must be admitted, persuasive) ways. We used to think of the sprawling gait of reptiles as inferior to the more erect gait of mammals because it seemed to require larger forces in some of the principal leg muscles, and so more energy expenditure. That view suffered a nasty blow when it was shown that the metabolic cost of running for lizards was about the same as for mammals of equal mass, running at the same speed. The new story (reviewed in Bramble's chapter in the book) depends on Carrier's demonstration that lizards do not and apparently cannot breathe when running, because these two activities require different patterns of activity in the muscles of the body wall. To become capable of sustained running, mammals had to evolve a gait that was compatible with breathing. That story now seems much more convincing than the old one, but it may be superceded (the old one seemed very convincing, in its time). It has changed our view of the evolution of mammalian gait, but it does not seem to me that the new story makes any difference to our general understanding of how integrated systems evolve. Many of the other persuasive scenarios in the book do not even have the merit of being novel.

Few of the morphologists at the conference succeeded in using the particular cases that they studied to throw general light on the evolution of complex systems. In this respect, Lauder and Liem did better than most. They stress that what is possible in evolution depends on the point from which you start. For example, the anabantoid fishes have evolved two mechanisms for breathing air that enable them to survive in foul, stagnant water. One group of them has evolved a mechanism that will work only when the fish is largely submerged but another has a mechanism that will still work if they leave the water. Only the second group could evolve the habits that have made *Anabas*, the climbing perch, famous.

Functional morphological studies often suggest that optimal performance depends on integration between characters, but seldom actually demonstrate it. Emerson and Arnold describe a study in which sprint speeds of new born garter snakes were measured, and also their numbers of vertebrae. Snakes with more than the average number of vertebrae in their tails crawl fastest if they also have more than the average number in the rest of the body, and snakes with fewer than average in the tail do best with fewer than average in the body. However, this might look less like interaction between characters if the characters had been defined differently, if instead of tail vertebra number and body vertebra number the authors had considered total vertebra number and fractional allocation to the tail.

Schluter makes a related point in his discussion of the evolution of finches. He points out that he might choose to describe beaks by giving their length and depth, or alternatively by giving measures of overall size and of proportions. Should evolution from a short, shallow beak to a long, deep one be regarded as two changes (in length and in depth) or as one (a change in size, while shape remains constant)? The question has disturbing implications for morphologists who use parsimony as a criterion for constructing evolutionary trees.

I return to garter snakes, which feature also in Bennett's paper. He describes an investigation in which young garter snakes were released into the wild after their maximum sprint and sustained speeds had been measured, and their survival was followed for several years. This is a rare example of an attempt to relate performance to fitness. Its potential value is greatly enhanced by the findings that the locomotor traits that were studied are highly variable, hereditable and repeatable from year to year. There was also little correlation between the traits.

Despite highlights like these, I found the book generally unsatisfactory. Many of the points made in the papers will be incomprehensible to readers who do not already have a good knowledge of vertebrate morphology. Few case studies are presented in detail and there are only 53 illustrations in a book of 451 pages. The group reports are bland consensus views though there are frequent references to two parties (internalists and externalists, or structuralists and functionalists) who seem to have squabbled at the meeting. I do not feel that my understanding of the evolution of complex systems has been very much increased.

R. MCNEILL ALEXANDER
Department of Pure and Applied Biology, University of Leeds

Handbook of Normal Physical Measurements. By JUDITH G. HALL. URSULA G. FROSTER-ISKENIUS and JUDITH E. ALLANSON. Oxford Medical Publications. 504 pages. Price £25.00 ISBN 0 19 261696 X.

The stated purpose of this handbook is to 'provide a practical collection of reference data on a variety of physical measurements for use in the evaluation of children and adults with dysmorphic features and/or structural anomalies'. By and large it succeeds admirably in this aim. There is an introduction and 17 chapters describing measurement techniques, height, length and weight, different body areas (including dermatoglyphics and trichoglyphics), developmental screening techniques and data and postmortem organ weights. There are useful chapters on prenatal ultrasound measurements, how to approach the differential diagnosis of a child with dysmorphic features and a chapter of growth curves for specific conditions such as Down and Turner syndromes.

In each chapter there is a brief but clear introduction to the relevant embryology, measurement landmarks, instruments and techniques plus relevant references. A glossary defines many of the specialist terms used. The data collected are wide-ranging and generally comprehensive.