Book reviews

*The Origins and Evolution of Larval Forms.* Edited by B. K. Hall and M. H. Wake, 1999 (San Diego: Academic Press) [Pp. 631]. Price $74.95 (hbk). ISBN 0 12 730935 7.

This is a useful collection of papers by authors with different backgrounds and areas of expertise giving their views on the broader aspects of the evolution of larvae. The morphology of living and fossil marine invertebrate larvae is discussed by C. S. Hickman, of fish larvae by J. F. Webb, and of amphibian larvae by J. Hanken. Several authors consider the role of heterochrony, and this is the subject of the contribution by M. W. Hart and G. A. Wray. Hormonal control in the development of amphibians is discussed by C. S. Rose, and of insects by H. F. Nijhout. R. A. Raff advocates the study of cell lineages in developing echinoderms, as do L. M. Nagy and M. Grbic in holometabolous insects. Feeding mechanisms in vertebrate larvae are discussed by S. L. Sanderson and S. J. Kupferberg and phenotypic variation in insect and amphibian larvae by E. Greene. The book, therefore, covers aspects of larval development in many phyla, but it wisely makes no attempt to cover all types of larvae.

The authors and editors follow Darwin’s assumption that larvae have always evolved within the same lineages as their corresponding adults. At the time of publication of *The Origin of Species*, Darwin had little reason to question this view, but the evidence against it has been mounting ever since. There are anomalies in all phyla with larvae, but I shall here limit my consideration to the echinoderms. In this phylum, bilaterally symmetrical larvae give rise to radially symmetrical adults, but the only proffered explanation in terms of conventional theory is that the original echinoderms were bilateral throughout life; the larvae have remained so, while the adults have become radial. This hypothesis is entirely lacking in supporting evidence, and it conflicts with the oft repeated assertion of the noted authority H. Barracough Fell that ‘echinoderm larvae do not reflect the relationships of the classes’. It also ignores the fact that, while all echinoderm larvae develop as enterocoelous deuterostomes, some echinoderms without larvae develop as schizocoelous protostomes. Also, while most brittle-stars have pluteus larvae, some have dolioraria larvae like those of sea-lilies. Sound theories do not have inexplicable anomalies. The alternative is the larval transfer hypothesis, which assumes that genetic recipes for larval forms have occasionally been transferred between taxa. It submits (1) that the genes specifying the basic forms of all larvae originated as the genomes of animals that matured without metamorphosis, (2) that such genomes were transferred by hybridization, and (3) that fertile hybrids have been produced at infrequent and irregular intervals between species at all levels of relationship during the course of animal evolution. Some larval forms arose when representatives of two taxa without larvae hybridized, the form of one parent becoming the adult, the other the larva in the hybrid and its descendants. Others arose when one or both the hybridizing parents already had larvae. Before and after these occasional hybridizations, larvae and adults evolved gradually by what Darwin called ‘descent with modification’.

Early echinoderms were radially symmetrical throughout life, and none had larvae until after the the modern classes had evolved. The first bilateral echinoderm larvae resulted from a cross between a holothurian and an enteropneust hemichordate with tornaria larvae. The first tornaria larvae arose when an enteropneust hybridized with a planktospheroid. Hybridization between different holothurians resulted in the spread of larvae within this class, and subsequently a holothurian with larvae hybridized with a starfish, a starfish with larvae hybridized with a sea-urchin, and a sea-urchin with larvae hybridized with a brittle-star.
The records of fossil larvae listed by Hickman are of great interest, but capable of more than one interpretation. The Upper Cambrian nauplioids described by Müller and Walossek from southern Sweden were, I suggest, not crustacean larvae but representatives of the non-crustacean taxon of arthropods from which several groups of crustaceans acquired nauplius larvae by hybridization. I am grateful to Hickman for the 1946 reference to descriptions of skeletons of echinoderm pluteus larvae from mid-Jurassic deposits in northern France. The American author implies that skeletons of both echinopluteus and ophiopluteus larvae were identified, but the French paper refers to echinopluteus only. This is consistent with my 1992 suggestion that the few species of sea-urchins that survived the mass extinctions of the Permian and Triassic eras had acquired pluteus larvae, but brittle-stars did not acquire larvae until later, and at least two families never did.

In the concluding pages of the book under review, Wake and Hall ask a number of unresolved questions, including, ‘Why are there larvae, and how did they come to be? What, indeed, is a larva? What is the interplay of developmental pattern and process with evolutionary pattern and process?’ I suggest that the larval transfer hypothesis offers at least partial answers to many of these problems, but it also poses new questions on the times and conditions of the various transfers. There are, in addition, many more questions on the evolution of larvae unanswered by the larval transfer hypothesis, and I hope that those with interests in different disciplines will co-operate in trying to reach solutions. Apart from ignoring larval transfer, this book is to be recommended as giving a valuable insight into current thinking on larvae.

D. I. Williamson

Atlas der Mollusken der Schweiz und Liechtensteins. Fauna Helvetica 2 by H. Turner, J. G. J. Kuiper, N. Thew, R. Bernasconi, J. Ruetschi, M. Wuthrich and M. Gosteli, 1998 (Neuchatel, Switzerland: CSCF/SEG) [Pp. 527]. Price DM90.00 (hbk).

This elegantly produced multilingual book is full of information covering the land and freshwater molluscan fauna of Switzerland and Liechtenstein. It is based on distribution maps and black and white photographs for each species, and colour photographs for the slugs.

The introductory and background chapters are in both German and French, neatly laid out in two columns. There is a potted history of malacologists and malacological research in Switzerland (chapter 1), a background to the mapping project, begun in 1981, and its principal aims (chapter 2). The maps are based on a 25 km$^2$ grid covering fossil records and the periods to 1900, 1901–1950, and 1951–1997, each of which are assigned different symbols which are used in the species distribution maps. Chapter 4 describes the variety of habitats of the two countries, in relation to altitude and geology, geography and climate, and human impact. This chapter ends with a list of threats to the species and those species already exterminated. The subsequent 10 pages comprise a systematic list of quaternary and recent molluscs (chapter 5) followed by a detailed chapter on general distributions of indigenous species, an index to distributions, the status of local populations, and a species list.

The main body of the book describes 279 taxa (species and subspecies) using maps and beautiful photographs of the shells, one species per page or spread over 1½ pages, with text appropriate to the distribution indices, synonymies, ecology and biology, threats, and bibliographic references. This text is only in German. The majority of the slugs are illustrated in colour at the back of the book. Also included in the colour plates are a selection of live snails and some shells.

Chapter 11 is a summary of the contents, results, and problems arising, in four languages of two pages each, followed by a bibliography, list of museums and collections consulted, and a four-language lexicon, which solves any difficulties encountered in the species section. Finally, there are indices to German and French common names, and a scientific index.

This work is a wonderful accomplishment, and should be an inspiration to all taxonomists and zoogeographers (those ‘dots on the map’ are significant after all!) and it is meticulous attention to detail, such as in this work, which can give us an accurate picture of the threats and rates of extinction facing so many species, in so many habitats.

Nathalie Yonow
**Centipedes and Millipedes with Emphasis on North American Fauna.** By ROWLAND M. SHELLEY, 1999 (The Kansas School Naturalist vol. 45 no. 3, Emporia State University) [Pp. 16] Gratis. ISSN 0022-877X.

Rowland Shelley, who has worked extensively on both millipedes and centipedes, has provided a concise account of these animals in a booklet which, although designed primarily for an American audience, is nevertheless an excellent introduction to these groups for students everywhere.

A brief mention of the other two classes of myriapods, the Symphyla and Pauropoda, puts the subjects of the booklet into perspective. The author certainly provides the accurate generalized information that can be passed on to students and the public by teachers and museum guides that he states is required. Seven pages are devoted to classification. Colour photos, mostly of living specimens, and short notes allow the five centipede orders to be distinguished easily. Fourteen of the 15 millipede orders are illustrated by photos and line drawings allowing the majority to be distinguished but the separation of some of the orders of juliform millipedes is a matter for the specialist. There are some excellent colour photos and the line drawings are appropriate and of high quality. This is a very useful section.

A succinct account of the biology of these myriapods deals with body form, legs, segments and development; reproduction; behaviour; feeding; predation and defence; and effects on humans. There are answers to all the common queries about them such as the difference between centipedes and millipedes, number of legs, and feeding habits. It is pointed out that centipedes and millipedes are among the world’s largest terrestrial invertebrates. The use of technical terms has been kept to a minimum but where their use is unavoidable they are defined when they occur. There is a brief discussion of the literature and a useful list of references. The introduction states that the booklet is divided into eight sections: as there is no hierarchy of headings, there appear to be many more but these are clearly set out so that it is very easy to find the required information.

Data are provided on the size range of centipedes and millipedes but with two exceptions, there are no scales for the illustrations. These would have been helpful for those unfamiliar with these animals. Millipedes of the order Polyxenida, for example, are only a few millimetres long.

I know of no other short introduction to centipedes and millipedes and Shelley’s booklet serves this purpose admirably. The Kansas School Naturalist is likewise an admirable series. It is copyright-free and teachers are encouraged to un staple and duplicate issues for educational non-profit uses. To date 160 titles have been produced, the most recent zoological numbers being on damsel flies, tardigrades, dragonflies of Kansas and collecting and studying ants. The KSN is sent free of charge and upon request to teachers, librarians, conservationists, and others interested in natural history and nature education. Correspondence should be addressed to Kansas School Naturalist, Division of Biological Sciences, Box 4050, Emporia State University, Emporia, KS 66801 – 5087, USA or to http://www.emporia.edu/s/www.biosci/ksn/public.htm

J. G. E. LEWIS

**Intertidal Fishes. Life in Two Worlds.** Edited by MICHAEL H. HORN, KAREN L. M. MARTIN and MICHAEL A. CHTOKOWSKI, 1999 (San Diego: Academic Press) [Pp. XII + 399]. Price $69.95 (hbk). ISBN 0 12 356040 3.

This book will be welcomed by all marine biologists concerned with littoral and coastal ecosystems, both as teachers and researchers. Too frequently, courses on littoral and coastal marine biology are founded on the interacting ecologies of seaweeds and invertebrates, and littoral fish feature scarcely at all. Fish biology, ecology and behaviour, and fisheries science, are well served by books and journals, and there is always plenty for researcher and teacher to get their teeth into. But, material relating to littoral fish faunas is usually diffuse and demands time to track down. This multi-authored volume thus serves a real need. Its three editors have ordered 17 well-referenced review articles into six sections. The first, ‘Background, methods and basic patterns’, introduces the special characteristics and adaptations of littoral fish species, providing the rationale for the volume, reviews techniques for their study, and categorizes distributions in relation to habitat, ecology and geography. The following sections
treat, successively, physiological specializations, behaviour and sensory systems, reproductive biology, ecology and recruitment, trophic relationships and communities, and finally, systematics, biogeography and evolution. The authorship is multi-national and the scope of the book is worldwide. This is quite probably the first comprehensive treatment of the biology of littoral fishes, and the editors are to be congratulated on their achievement.

P. J. Hayward