such questions lighten the reading, the reader is encouraged and helped to ponder over and glean the wisdom brought forth. Of course, often it is the lack of it (and the author himself is very plain and candid about it), and it is very hard to decide if we have really become wiser. For example, compared to advances in animals, we are at a very early stage and one wonders if the genes discovered so far in the context of embryogenesis have anything to do with pattern formation in the strict sense. In certain other areas, the progress is more pronounced. Thus, there is solid advance in respect of mechanisms unravelling incompatibility through work of Nasrallahs, Adrienne Clarke and others but the diversity of the mechanisms is bewildering. Turning to the publishers, the Cambridge University Press too has done an excellent job by way of type-setting, printing and general get-up, although I have to say that some line diagrams have suffered in quality in adjusting them to the width of a column in a page.

However, I do see some problems with the length of the book (as apparent from the author's preface, this has been an issue of some controversy right from the beginning). Thus although the book will certainly be of great use to the researcher and graduate student (and that is what the author has aimed at) and there is strength in an extensive treatment, a large void is still left.

For younger students and the general plant biologist interested in advances in plant biology as a whole (but one who is not a specialist of embryology), going through the text and culling out real advances may be a somewhat daunting task. Still, more people should be attracted to research in the area.

My thinking is that another smaller text is necessary, *combining* the knowledge gleaned from older anatomical investigations and the newer biochemical findings and somewhat more selective but still well illustrated – for example a few scanning electron micrographs such as of young floral primordia or of young ovules or pollen and stigma should be of value as also a few colour plates such as of Ca^{++} spiking in pollen tubes now seen with new fluorescent markers. To introduce basic concepts such as of homeotic genes or of the switch that triggers meiosis (now that a *MEI 2* gene similar to that in fission yeast has been claimed to exist also in *Arabidopsis*) or the role of surface receptors in fertilization, some reference could also be made to yeast, *Drosophila* or other animal models – if not in the main text, as boxed items. I think it is also necessary to introduce terms such as apoptosis since caspases, etc. must doubtless be involved in degeneration of tapetum or extra megaspores. Also, one topic that I felt deserved more space and attention is apomixis, since it is of great significance for tomorrow's agriculture, and a number of molecular biology techniques such as RFLP mapping, and differential display are being applied to clone the apomixis genes. And who other than Raghavan can do this job?

Nevertheless, publications of *Molecular Embryology of Flowering Plants* is in itself a landmark in plant biology and Raghavan has done commendable service to the botanical community. The book is a must for all libraries in universities and agricultural institutes.

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Evolutionary Ecology of Freshwater Animals: Concepts and Case Studies. B. Streit, T. Städler and C. M. Lively, eds. Birkhäuser Verlag. PO Box 133, CH-4010, Basel, Switzerland, 1997. 366 pp. Price: not known.

The discipline of evolutionary ecology is an anastomosis of the diverse fields of population biology, population genetics, ecology, community structure, life-history theory, behaviour, evolutionary history and biogeography. The aim of this book as the editors claim and as the title suggests is to 'highlight some of the current hypotheses and approaches in the field using freshwater model systems as a unifying theme'. The contributors felt that many theoretical constructs in evolutionary ecology were based on terrestrial systems and they therefore wished to initiate communication between ecologists and evolutionary biologists who work in both terrestrial and aquatic ecosystems. The editors are obviously very keen on promoting research on freshwater systems and they enumerate several advantages for such a choice. Freshwater organisms are easier to work with because they are often small and have rapid population turnovers allowing for large sample sizes in experiments. Since freshwater systems are often transient at ecological and evolutionary time scales, they result in life-history strategies appropriate for variable environments. Also, for researchers interested in breeding system evolution, there are a variety of breeding systems in freshwater systems, e.g. cloning in bryozoans, parthenogenesis in cladocerans and rotifers, and self-fertilization in pulmonate snails.

The twelve papers in this book are divided into four sections: ecosystem structure and trophic interactions, life-history evolution, population biology and reproductive modes, and evolutionary processes following colonizations. Each paper is written as a very up-to-date review (many references are from 1997) and, moreover, a review with an obvious directive – to highlight the relevant conceptual framework, to review any freshwater research that has already been done within an evolutionary ecology perspective and, if not, to interpret the published work in the light of evolution.

It is in this spirit of conceptual synthesis that Leibold and Tessier have used models of Rosenzweig and Tilman's resource availability model developed for grasslands to examine resource competition in zooplankton and to relate it to the diel vertical migration of plankton between the hypolimnion and epilimnion. Brönmark *et al.*'s paper on benthic food chains is a fine exposition of trophic cascades wherein they refer to the HSS model (Hairston, Smith and Slobodkin) of tritrophic interactions in terrestrial community structure, according to which the world is kept green because predators control herbivores. This is examined in the fish–snail–algae and the crayfish–snail–algae systems. I liked the section on behavioural effects in food chains although the examples are mostly more than 10 years old, e.g. the famous sunfish study of Werner *et al.* (1983) in which juvenile sunfish shift their feeding into denser vegetation based on

vulnerability to predation by largemouth bass with subsequent effects on benthic macroinvertebrates within the vegetated littoral zone. This appears to be an area where much more work can be done. They highlight the importance of omnivory in food webs and call attention to the fact that piscivores have been neglected in the trophic dynamics of benthic communities. Brönmark *et al.* point out the shortcomings of exclusion experiments. Although mesh sizes that exclude predatory fish may be used, they may not exclude invertebrate predators and this may produce anomalous results since competition between fish and invertebrate predators is very likely to be asymmetrical. Furthermore, enclosures are often small, creating an artificially high density of predators which may produce biased results. Moreover, exclosures affect the natural process of immigration and emigration which might mask true mechanisms behind the observed effects. Wooster *et al.* continue the examination of experimental design begun by Brönmark *et al.* and stress the importance of examining the movement of prey in and out of exclosures when investigating predator impact on local prey density in streams. Variation in prey emigration response to different predators can also influence the magnitude of predator impact. Using meta-analysis on published studies, they conclude that the spatial scales at which predator–prey interactions are investigated can have profound effects on interpretations of predator impact. They recommend that experimental studies that manipulate predators at several spatial scales should be conducted for any meaningful insight into predator–prey dynamics.

Rotifer life-history strategies are examined in an evolutionary context by Walz and this is related to top-down versus bottom-up control of freshwater plankton communities. The impact of invertebrate versus vertebrate predation on rotifer life-history strategies is investigated along with the mechanical interference caused by cladocerans like *Daphnia*, which sweep in rotifers inadvertently with their filtering apparatus. A major portion of this paper is devoted to the bottom-up approach and the impact of various factors, such as food size, presence of toxic cyanobacteria, turbidity resulting from suspended clay particles, and food concentrations, on life history is reviewed. Finally, the relationship between body size and such life-history parameters as growth rate and egg volume is examined. Although this paper is information-dense, it is marred by no less than ten typographical errors and many more language ambiguities.

Ebert examines developmental canalization versus plasticity in *Daphnia* and addresses questions such as the importance of body size at birth for life-history traits in *Daphnia*. He looks at the process of maturation within a size threshold model and also examines the genetic and environmental variation in this threshold. One major point that the author does not address adequately is why there should be a size threshold for maturation in *Daphnia* while there is an age (cicada) or instar (tobacco horn worm) threshold for maturation in some insects. Ebert states that 'understanding the evolutionary pathways that determine which traits will be canalized is one of the most exciting aspects in current life-history research'. Unfortunately Ebert does not provide much insight into what these evolutionary trade-offs could be. Had this been done, it would have raised the level of this paper by several notches.

Jokela focuses on optimal energy allocation tactics in long-lived iteroparous bivalves and addresses the optimal schedule of allocation of resources to maintenance, growth, reproduction or storage in organisms like bivalves which, like plants, have indeterminate growth. Using Kozlowski's (1991) model of optimal energy allocation, he attempts to flesh out the factors that determine resource allocation. One is curious about how Kozlowski's model is different from or better than other resource allocation models, but Jokela does not tell us this, which is a shortcoming especially for a review paper. However, Jokela reviews all the major empirical studies of resource allocation in both marine and freshwater bivalves which is useful for a practitioner in this field.

Schwenk and Spaak examine the *Daphnia galeata* multi-species complex and find that the species and their hybrids do not form classical hybrid zones but occur in a patchy distribution. Hybrids actually range across wide geographic areas and, because of parthenogenetic reproduction, avoid genomic breakdown and achieve higher abundances than parental species. This is a fine paper which examines the ecology of this hybrid complex and makes the important point that zooplankton species like *Daphnia* are ideal subjects for evolutionary studies both at short- and long-term levels because they have short generation times and are easy to culture.

Städler and Jarne examine mating system evolution in freshwater snails. Breeding systems in these species range from self-fertilization in basommatophora to parthenogenesis in prosobranchs. They investigate the genetic consequences of subdivided populations under different mating systems and, very interestingly, use the models developed for seed plants in the discussion of inbreeding depression. Johnson *et al.'s* paper on the spatial and temporal correlates of uniparental (parthenogenetic) and biparental reproduction in freshwater snails is surely one of the best in this collection. They address various hypotheses for the maintenance of biparental sex versus parthenogenesis such as the lottery hypothesis, the Tangled Bank and the Red Queen hypotheses, and the reproductive assurance or sperm limitation hypothesis. They evaluate each of these hypotheses critically with the available data, point out lacunae in the testing of these ideas and suggest definitive experiments for the future. Importantly, they also allude to the problem of lag times between transitions from sexuals to asexuals and thereby the shortcoming of 'snapshot' types of research wherein populations are only monitored for brief moments in evolutionary time which may result in erroneous interpretation about the true direction of evolution. This is evolutionary ecology in its most exciting form – hopefully there is no personal bias in this statement!

Okamura's review of parasitism and clonality in the freshwater bryozoan *Cristatella mucedo* is a good synthesis because it compares life-history features of cladocerans and rotifers, aquatic macrophytes and freshwater bryozoans. It discusses reasons for the success of extended clonality in *C. mucedo* and interestingly finds that sex generates little genetic variation in this species

due to high levels of inbreeding among closely related clones. He addresses clonality and parasitism *vis-à-vis* the Red Queen especially with regard to myxozoan parasites and finds that the Red Queen hypothesis does not hold in this system. He then argues that high levels of clonality and little clonal diversity can be stable in this system because the species exists as a metapopulation. Therefore, *C. mucedo* escapes the Red Queen by dispersal within the metapopulation. Importantly, he speculates that statoblast formation as a means of producing uninfected daughter colonies must be investigated for its evolutionary consequences in this system. The spiny statoblasts can be easily dispersed by hooking on to the feathers of aquatic birds. This is an excellent paper which incorporates contemporary metapopulation theory and clearly articulates what sorts of experiments need to be done to further our understanding of such systems.

The paper of Bell and Andrews looks at evolutionary processes following colonizations and again vies for the best paper award in this selection. This paper is about the repeated colonization of freshwater by anadromous fish due to the deglaciation of the boreal Holarctic region. It investigates the adaptive radiation following such colonizations and looks at the phylogenetic racemes so formed in which freshwater phenotypes repeatedly and continually evolve from anadromous ancestors. The anadromous complexes that are reviewed are those of sticklebacks, lampreys, salmon, and the rainbow smelt. Phenotypic radiation in predator avoidance behaviour, body armour, foraging behaviour, trophic morphology, social and reproductive behaviour as well as locomotion and corresponding body form are all investigated. They make a case for phenotypic integration in this radiation whereby adaptation to one environmental factor may precipitate a phenotypic or developmental cascade which influences feeding growth, locomotion and reproduction, thus causing covariance among seemingly unrelated traits. Although this paper is the lone one in its section on evolutionary consequences following colonizations, I think that this is wise because Bell and Andrews would be a hard act to follow.

Having summarized the essence of the papers, what can I say about this book in general? This is a valuable collection of review papers and case studies which forms a timely synthesis of ideas, experimental results, important citations, and directions for future research. A perfect starting point for a researcher looking for a research problem or for an up-date on current research. On the down side, the index is very poor – only 147 entries which mostly signpost just a single occurrence of the entry. There is also not a single paper that is free of typographical errors. This is a pity because otherwise the book is well produced. Despite this, I think that the book has so much to offer that the content transcends these editing lapses and this book is surely one that anyone interested in freshwater systems and/or evolutionary ecology should read.

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Applications on plain paper are invited for the post given below for the DAE-sponsored project on 'The development of double beam polarimeter' under Prof. S. P. Tewari, School of Physics, University of Hyderabad, Hyderabad 500 046.

1. S.R.F. Qualification: M Sc with at least two years research experience in the field of laser optics; interferometry and a sound knowledge of optical instrumentation including ccd camera and data processing.

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The application must contain complete biodata and be accompanied by attested copies of certificates of all examinations passed and other credentials. Complete application must reach Prof. S. P. Tewari by post/hand within 15 days of the publication of the printed date on the cover of the issue of *Current Science* carrying this advertisement.

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