Book Reviews

Early Life Histories of Fishes: New Developmental, Ecological and Evolutionary Perspectives

Edited by E.K. Balon
Dr W. Junk, Dordrecht
280 pp.
Price US $99,00

This book is the fifth volume in the series *Developments in environmental biology of fishes*. It comprises a collection of nine papers, an introduction, a section on methods, and synthesis. The papers are presented as reprints, giving a feeling of *déjà vu* almost throughout this book, as all the papers, the synthesis and the introduction have been published between 1976 and 1984 by the editor, his co-workers and students. The subtitle is therefore inaccurate, even at the time of publication, 1985.

The preface explains that the reason for publishing the book as a whole is to allow the reader to tackle the papers in the intended order to ensure that the concept presented is understood more easily and the confusion from reading papers out of sequence is avoided.

The introduction is entitled 'The theory of saltatory ontogeny and life history models revisited' which is an unabridged version of an article published in abbreviated form in the American Fisheries Society in 1984. In it Balon presents his ideas on saltatory ontogeny and the development of the concept from earlier workers.

The section on methodology by E.K. Balon and C. Flegler-Balon, entitled 'Microscopic techniques for studies of early ontogenies in fishes: problems and methods of composite descriptions', is new and it describes microscopic techniques useful in studies on embryology and ontogeny in fishes. This section will be particularly useful to students interested in this field of research. It details methodology on collection of gametes, incubation and feeding of larvae, alevins and juveniles. Equipment, procedures and methods of recording are given, including photography, drawing of live individuals and the preparation and staining of embryos and larvae for light and electron microscopy studies. The production of composite drawings is also described and the illustrations attest to the success of the techniques presented. Being new and thorough, this section may be the most valuable in the book.

The reprint section of the book begins with a paper by Balon entitled 'Additions to the classification of reproductive styles in fishes', which was originaly published as an editorial in his own journal, the *Environmental Biology of Fishes* (EBF). The second paper, also by Balon, is 'About processes which cause the evolution of guilds and species', which was originally published in EBF 6: 129–138. The next paper, also by Balon, is entitled 'Reproductive guilds and the ultimate structure of fish taxocenes: amended contribution to the discussion presented at the mini-symposium', which was published in EBF 3: 149–152. The next paper, 'About courtship rituals in fishes, but also about a false sense of security given by classification schemes, "comprehensive" reviews and committee decisions', was published by Balon in EBF 7: 193–197.

The next series of papers are detailed studies of early ontogenies of fishes in the form of full papers, rather than the editorial essays above. The first of these, by McElman & Balon, is entitled 'Early ontogeny of the walleye *Stizostedion vitreum*, with steps of saltatory development', and was first published in EBF 4: 309–348. 'Early development of the northern logperch, *Percina caprodes semifasciata*, according to the theory of saltatory ontogeny' by Paine & Balon (EBF 11: 173–190) is followed by 'Early ontogeny of white sucker, *Catostomus commersoni*, with steps of saltatory development' by McElman & Balon (EBF 5: 191–224). 'Early development of the rainbow darter, *Etheostoma caeruleum*, according to the theory of saltatory ontogeny' by Paine & Balon (EBF 11: 277–299) is followed by 'Early ontogeny of *Labeotropheus* Ahl, 1927 (Mbuna, Cichlidae, Lake Malawi), with a discussion on advanced protective styles in fish reproduction and development' by Balon (EBF 2: 147–176).

The final synthesis by the editor is 'a free handed rearrangement of my two already separately presented essays ...' and is entitled 'Reflections on epigenetic mechanisms: hypotheses and case histories'. It represents a review and recapitulation 'of my ideas over the past 30 years on evolutionary trends leading to patterns formed by reproductive styles and life histories of fishes ...'. In this recapitulation there is extensive review of the literature in often distant fields and the case studies he uses are charrs. Balon discusses his understanding of the process of genetic and epigenetic control of development in the ontogeny of fishes. The ideas are controversial and one of the strengths of the book does come out during these long, discursive essays: It is indeed necessary to keep track of some of the definitions he uses because one finds that this and other essays tend to meander a great deal, collecting philosophical and literary snippets on the way, little benefiting the scientific argument. He then ends the essay with a discussion of the possibility of sympatric evolution in the charrs, presenting a tentative cladogram of the salmonids.

This book has, indeed, brought together a series of papers which, if one did not have access to the *Environmental Biology of Fishes*, would involve a literature search of issues published over several years to obtain them. It is also convenient to have some of the papers frequently quoted by the editor at hand to re-read ideas he has set out, or words he has invented. This does have drawbacks, however, in that, by their editorial nature, many of the papers have a degree of repetition in

them already. Finally, one wonders how many individuals or even libraries will be able to afford a book which, although useful in its compilation of published papers, provides a relatively small amount of new information, in these days of financial stringency. The decision should now be somewhat easier to make knowing a large proportion of the contents of this volume.

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Comparative Aspects of Extracellular Acid-base Balance

J.P. Truchot
Springer, 1987
248 pp. 51 figures
Price DM 198,00

The title of this book as well as its initial impression is that it is a clear and simple treatise on acid-base physiology in a number of different species. Whilst in many instances the approach is clear, it is far from simple.

Chapter 1 is completely 'mind-boggling' for those of us who are not mathematically inclined. The author goes into the mathematical derivations of the formulae essential to this topic. Although it is essential that a researcher (or student) knows the relevant formulae and their use and interpretation, I am not convinced that they will take the time or the trouble to wade through these long and complicated derivations. The layout and sequence of these derivations was obviously carefully planned and I am sure, to the interested parties, it is clear and logical but to the average person I think Chapter 1 will either put you off or will be skimmed through.

Chapter 2 on the other hand, tends to approach the real side of things to a researcher — the methods. It draws the reader's attention to the fact that the validity of any data depends on the care with which the experiment is performed. Section 2.2 deals with the interpretation of data dealing with disturbances in acid-base state. This interesting section, however, was rather brief but does make a logical introduction to a discussion of methods specific to aquatic animals.

The comparison of the mechanisms in regulating the acid-base balance in air- and water-breathing species was both informative and interesting. Chapter 3 has some very useful tables of comparison e.g. Tables 3.3 and 3.4 which compare extracellular acid-base status in dual breathing fishes and amphibia related to extrapulmonary CO_2 excretion and temperature and hypoxia respectively. Chapter 4 extends this balance to ambient conditions e.g. CO_2, whilst Chapter 5 discusses the balance in aquatic animals as a function of the ionic composition (especially salinity) of the ambient water. Table 5.5 is a very clear and useful one as it briefly summarizes what has been discussed in the previous chapters with respect to factors affecting the balance in aquatic animals. Unfortunately the author tends to regard aquatic animals as being solely invertebrates, amphibia and fish.

Mammals are included in Chapter 6 where the body temperature and body fluid pH relationship is well summarized in Table 6.4. The evolution and comparison of the physiology and regulatory mechanisms of acid-base is discussed well in this chapter except that those dreaded formulae have crept in here and there. The discussion on the role of the skin in amphibia and the renal control in cartilagenous and bony fish is clear and understandable. Of course, as with all physiological situations there are exceptions and Chapter 8 is devoted to these, e.g. panting, muscular activity, diving, hibernation, etc.

The author obviously has gone to a lot of trouble in researching and summarizing the complex array of factors involved in acid-base balance, but unfortunately the book is not 'easy to read' and the number of formulae and their derivations aggrevate this. This is a pity as there is some very useful information especially for those interested in fish acid-base balance.

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Insect Flight: Dispersal and Migration

Edited by W. Danthanarayana
Springer-Verlag, Berlin, 1986
289 pp.
Price DM 144,00

This book is a collection of 18 papers delivered by specialists on various aspects of insect migration at the XVIIth International Congress of Entomology in Hamburg, Germany, in August 1984. The papers are reviews, research reports or a mixture of both.

In the editor's well-written introductory chapter the disparate papers are woven together into a tantalizing and cohesive whole and some key concepts are elucidated. 'Dispersal' includes migratory and non-migratory movements. Non-migratory movements involve travel within the habitat associated with such activities as feeding, mating, and oviposition, whereas migratory movements take insects beyond the habitat for the purposes of colonizing new habitats, re-colonizing old ones, aestivation or hibernation. Another key concept is the 'boundary layer' which is that volume of air directly above the earth's surface in which an insect's flight speed is greater than the wind speed and therefore within which the insect has a large degree of control over

its direction. Beyond the boundary layer, however, the insect is much more at the mercy of wind direction, and in instances in which migration involves moving out of the boundary layer, the insect has complete control only over its ascent into and descent from that airspace.

A recurring theme in the book is that migrating insects have to balance various costs involved with migrating with the benefits of arriving in the desired habitat. The first of these costs is that reproduction is generally sacrificed during the period before and during migration because of the demand for flight equipment (muscles and wings) and fuel (fat reserves). Once the migrants have arrived in the new habitat, the muscles are autolysed, and reproduction begins. This alternation of resource allocation between flight and reproduction is called the 'oogenesis-flight syndrome', and is the subject of two chapters (Chapters 3 & 4). Many examples of the classical oogenesis-flight syndrome are discussed and a chapter is devoted to this phenomenon in aphids (Chapter 10). Because of all these examples, it has generally been thought that flight and reproduction are mutually exclusive. However, in the exceptionally well-written and interesting Chapter 3 entitled 'The oogenesis-flight syndrome revisited', it is shown that flight and reproduction are in fact not necessarily exclusive; in some insects, reproductive development increases en route so that exploitation of the new habitat can commence immediately on arrival! This fine tuning of the two energy-expensive activities (reproduction and flight) is possible because both appear to be controlled by the same hormone — juvenile hormone (JH). In general, lower titers or less exposure to JH stimulates flight while higher JH titers or increased exposure to the hormone enhances reproduction. This hormone, as well as those regulating the release of fuel from the fat bodies (necessary because the fuels contained within the muscles themselves are sufficient only for take-off) are governed by changing environmental cues (e.g. daylength and temperature) via the neuro-endocrine system — the subject of Chapter 4.

The success of the above-mentioned chapters dealing with the endocrinology and biochemical aspects of flight, is that the migrant is presented as a dynamic, integrated organism, responding to habitat changes by changing its internal allocations of resources via a streamlined neuro-endocrine system. All too often these topics are presented in such a way that an organism appears to be a sum of more-or-less independent mechanisms. It really is a pleasure to read these first four chapters, which, incidentally, also include a totally comprehensible discussion on the genetics of migration (Chapter 2).

The other major cost of migration is the risk of dying on the way. Monarch butterflies migrate between north-eastern North America and Mexico (Chapter 12), a number of lepidopteran pests appear to be able to cross the widest parts of the Gulf of Mexico (Chapter 16) and the migration of various insects into Finland over distances of hundreds of kilometers is documented (Chapter 11). Animals as small as insects cannot propel themselves over such vast distances, and so they use wind power by moving out of the boundary layer into that part of the atmosphere where they can catch rides on headwinds and glide on thermals. The ascent out of the boundary layer and descent back into it are all that is firmly under the insect's control in such migrations. In those insects that take off at night, distinct lunar periodicity has been found in time of departure (related to those periods of the moon which are most abundant in polarized light) (Chapters 7 & 8).

Now comes the vexing question: How do the insects orientate while they are outside the boundary layer? In fact, are they able to orientate out there or are they entirely at the mercy of the winds? There are apparently two schools of thought: those who believe that migrants use compass orientation and those who believe that they take their direction from the wind. The evidence in favour of orientation by wind direction is so overwhelming that those in favour of compass orientation are forced to reply with the following stalemate: migrating insects hitch rides on winds going in the right compass direction. In a fascinating chapter on the monarch butterflies (Chapter 12), it is shown that despite the relative lack of control over orientation outside the boundary layer, the monarchs are excellent at keeping the right bearings, facing their bodies south-east on their southbound flight to Mexico, and even 'crabbing' crosswinds to maintain their orientation!

Because biologists look for explanations for phenomena, they focus on the organized parts of nature. The general impression obtained from most of the chapters discussed above is that migrating insects really have their act together as regards resource allocation, taking off at the right time and orientation. However, some sobering realities about the more chaotic events in the cosmos are apparent in a number of other chapters. Synoptic scale meteorology scatters micro-insects (insects $< 1{,}5$ cm long) throughout inland Australia (Chapter 13). An interesting chapter on arthropod fallout (Chapter 14) shows that the fallout of migrant arthropods blown off course onto volcanic peaks is of such a magnitude that it forms the first trophic level for a subsequent community of scavenging and predatory arthropods to establish there — classical succession in reverse. Other unfortunates end up in the sea: 4,5 billion insects per summer day drifting over the North Sea from a 30 km wide coastal strip! In short, a tiny fraction of the original migrants arrive at their destinations.

Another of the established theories about migration that is shaken in this book is that migration is a reaction to deteriorating habitat. My favourite chapter (Chapter 9) is a new look at migration in the African armyworm *Spodoptera exempta*. The moth usually lives at low population densities, but when population levels are locally high and the individuals encounter each other frequently, they undergo phase polyphenism, turning black in colour and settling at the tops of plants where their body temperatures rise (causing them to develop quicker) and then they migrate. High density populations are vulnerable to extensive mortality, especially owing to pathogens. The occurrence of migration is associated with rainstorms whose convergent winds concentrate reproductive adults

locally. The transformation into migratory phase is thus a response to a disturbance, and not to organized and predictable changes in weather as in many other instances of migration. However, the most fascinating point is that these animals get out of the habitat while it is still favourable! I quote from this chapter to entice you to read it: '... the main conclusion of this discussion is that stereotyped genetic determination of migratory capacity is likely to evolve not ... when reliable environmental cues of habitat favourability are absent (adequate cues are probably always available), *but when they are irrelevant* because the balance between the costs of staying or leaving is in favour of the latter, even when local conditions remain favourable for growth and development ...' (my italics).

The importance of the study of insect migration to biology in general is stressed in a number of chapters. Since insect movement determines where births and deaths occur, migration is central to population biology. The increased fitness of migrating individuals places migration at the hub of genetics and evolutionary theory. Regarding applied biology, the study of the causes and passages of migration is essential in the prediction and management of pest outbreaks (most pests are highly mobile oligo- or polyphages).

This book is a must to both students and researchers who require an up-to-date entrée to the main aspects of insect migration, and would be an asset to any library. However, my praise of the book is not unequivocal. The fact that 18 chapters are largely independent papers delivered at a conference has led to a lack of cohesion. Many facts are repeated in different chapters while some concepts and facts which I felt were important to the understanding of certain chapters were given only in subsequent chapters. For example, the concluding twentieth chapter is an analysis of the concept 'migration' in which insect migration is placed in context with other dictionary definitions of migration (migration of things, birds, fish, people and organs). Analyses of key concepts should surely be placed in the opening chapters. (Moreover, I found this analysis heavy and unilluminating, with relatively little attention paid to systematizing the different types of insect migration.) Again, a categorization of the various layers of the atmosphere in terms of their migratory potential for insects (boundary layer, planetary boundary layer and geostrophic layer) is given in Chapter 13 when one discovers that an important advantage of taking off at night, the subject of two previous papers (Chapters 7 & 8), is night-time accessibility of the geostrophic layer which has the highest potential for long-range dispersal of insects. In addition, some chapters are quite tangential (e.g. Chapter 5 on the sound of insects in flight) while the contents of others contributed very little indeed to the central themes of the book (e.g. Chapter 18 on the dispersal of insects of public health importance and Chapter 19 which describes various types of night-vision equipment with bits and pieces of biological information unsuccessfully included).

The fact that some papers were reviews, while others were research papers and yet others a mixture of both also upset the flow of reading. One oscillates between speeding through exciting chapters in which only pertinent results are woven into a gripping story (as in Chapters 3 & 9 on the oogenesis-flight syndrome and *Spodoptera exempta*, respectively) and laborious ones with badly written methods sections and in which entire paragraphs are spent giving various explanations for why one or two insects did not behave like all the rest.

In his introduction the editor specifies that he made no attempt at dividing the book into sections, an endeavour which I think would have improved the book markedly. One thus finds, for example, a number of chapters on orientation dotted between studies on specific insects. Lastly, although the title is *Insect flight: dispersal and migration*, and although insect dispersal is defined as including migration *and* non-migratory movement by the editor in his opening chapter, non-migratory movement is hardly given any attention at all in this book. I found this disappointing — and caused only by the title.

If the information contained in this book had been written as a unified whole instead of being left as an uncohesive collection of proceedings papers, the problems mentioned above would have been avoided and it would have been transformed from the good book that it is into a masterpiece.

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The Mammalian Herbivore Stomach. Comparative Anatomy, Function and Evolution

Peter Langer
Gustav Fischer, Stuttgart, 1988
557 pages, 246 figures and 72 tables
Price DM 248,00

This book is a comprehensive reference work as well as a coherent monograph which deals with the multi-chambered stomachs of even-toed ungulates, tree sloths, leaf monkeys, kangaroos, sea cows and opposums. The macroscopic anatomy is considered, followed by a description of the muscular architecture, vascular supply and epithelial lining. The importance of the volumes of the different gastric compartments, the innervation of the stomach, as well as its motility are discussed. A consideration of the implications of anatomical and functional specializations on the zoogeographical distribution concludes the volume.

The introductory chapter deals with the herbivore and its environment while the range of food eaten by different species of mammals is discussed and the herbivores are categorized. The different types of plant materials eaten by mammals are characterized to present

the basis for a differentiation of six classes of herbivore extending from omnivore to grazer. Grasslands are identified as biotopes producing a low quality food, to which grazing mammals are adapted. The different gastric adaptations are shown to be of a progressive or regressive evolutionary type.

The introduction also discusses mammals with hindgut and gastric adaptations in relation to biogeography and ecology, and examines aspects of the distribution of herbivores according to continents, latitude, type of vegetation, plant productivity, ecological variability and according to taxonomy. Finally, forestomach fermenters as domestic animals are considered since they are able to transform plant material that cannot be directly used by man into valuable and useful products.

The central chapters of the book deal in detail with gastric anatomy. After important and necessary comments on terminology, the general subdivision of the stomach and a description of its position in the abdomen are presented, while different gastric parts are described and their functions elucidated. Blood vessels, mesenteries, the muscular architecture of the tunica muscularis, and ontogenetic development are characterized for the Neoselenodontia, including the Pecora (ruminants with horns and antlers), Tragulina (chevrotoins and mouse deer), and Tylopoda (camels and llamas). The Neoselenodontia are followed by the Nonruminantia, namely Suidae (pigs), Tayassuidae (peccaries), and Hippopotamidae (hippos) which are treated similarly. The Sirenia, which are the only herbivorous mammals in the book with a single-chambered (unilocular) stomach, have a stomach that is followed by an ampulla duodeni that has a volume equivalent to that of the stomach. The highly complex stomach of the tree sloths (Bradypodidae) is described and discussed, followed by the Colobidae (leaf monkeys). The chapter on descriptive anatomy ends with the Macropodidae consisting of the true kangaroos (Macropodinae) and rat kangaroos (Potoroinae).

The comparative anatomy, and homology of structures, of the stomach are discussed in the fifth chapter. Three gastric regions are differentiated: the fornix, the corpus ventriculi and pars pylorica. In the majority of herbivore families the left wall of the fornix ventriculi is differentiated as a voluminous forestomach region, but also the right wall of the fornix and corpus ventriculi can participate in forestomach formation.

In the sixth chapter, the functional anatomy of the digestive tract of herbivores that utilize microbial symbionts for enzymatic digestion is discussed. Emphasis is again on forestomach-fermenters, and the ontogenetic development of different gastric parts is presented comparatively.

The influence of specific gastric structures on the flow of digesta is discussed. In the stomach of Macropodidae and Colobidae, and the hindgut of many herbivores and omnivores, taeniae, haustra and semilunar folds are of great efficiency in regulating digesta flow. The motility of unilocular and plurilocular stomachs is correlated to the musculature of the respective gastric region, which is necessary to understand the physical separation of coarse food particles from fine ones. These fine particles have a greater relative surface area and allow access of allo- and auto-enzymes to plant cell content and cell wall.

Auto- (mammalian host derived) and allo- (microbial symbiont derived) enzymatic digestions are subsequently considered in detail. Allo-enzymatic digestion can take place in the hindgut or in the forestomach, either behind or before the acid-secreting (proteolytic) gastric region. The distribution of hindgut- and forestomach-fermenters in relation to different taxa and geographical distribution of the respective herbivore is discussed. Forestomach-fermenters are able to live in biomes where a low quality food that is rich in structural carbohydrates, dominates. The herbivores are able to adapt to conditions where food quality and quantity deteriorates. The hindgut-fermenters are able to cope with situations of low food quality by increasing the speed of transit of digesta through the digestive tract. They quickly void themselves of bulk and ingest new food that includes only a limited amount of easily extractable substances.

Secretion and absorption into and from the unilocular and plurilocular stomachs are discussed under consideration of different types of mucosal lining and the increase of surface area. Rumination forms the end of the section on functional anatomy. Concluding remarks deal with a few fascinating selected topics. For example, body size, type of food, and the differentiation of digestion chambers present problems for herbivores, which are discussed, as is predation and its indirect influence on the differentiation of the digestive tract. The degradation of toxic and detrimental secondary plant compounds into harmless substances by microbial symbionts in the forestomach is elaborated. Behavioural changes such as thermoregulation, migrations, intra- and inter-specific differences in food selection are shown to influence digesta intake. Langer states that all these adaptations, and especially those of the anatomy of the stomach, widen the ecological niches and the geographical range that can be inhabited by herbivores. Finally the influences of food quality and/or food quantity as factors limiting well-being and survival of herbivores are discussed, comparing forestomach- and hindstomach-fermenters. Although the latter strategy is represented by many species, it is the ruminants that are the most successful larger herbivores.

This textbook is thoroughly professional in its presentation and is encyclopedic in its contents. The writing style is clear and precise, factual and regimented. It contains few typographical errors but I was surprised that the Latin binomials were not italicized. The text is supported by numerous figures, tables and plates. All of the informative figures have been redrawn for uniformity and have often been derived from several sources to demonstrate relationships, functions and processes. Interpretative diagrams explain functional components of gastric anatomy, while tables present any array of equations, facts and data sets. The photographs are of a very high quality being clear, sharp and well illuminated; they are informative, extensive and add an additional perspective. The bibliography is up to date and amazingly comprehensive.

This monograph represents a landmark in achievement not only for Peter Langer but for mammalian comparative anatomy. It should find space on the bookshelves of all university libraries and research institutes throughout the world, and will be an indispensable reference for specialists.

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Biology of the Integument. Vol. 2: Vertebrates

Edited by J. Bereiter-Hahn, A.G. Matoltsy and K.S. Richards
Springer, Berlin, 1986
855 pp.
Price DM 348,00

What a splendid book this is! Fourteen large chapters written by teams of experts with masses of worthwhile information and ideas in each. Your reviewer felt he could scarcely do justice to such a rich repast in the time available. It would be a useful source of recent information, combined no doubt with the first volume, in any department of biology. The first award of praise must go to the editing and to the book production — the results are remarkably smooth in style, referencing, printing, etc. In this era of editors and compilers who can be both lazy and greedy, it is a welcome change. Secondly, one is glad for the accessibility of topics which have developed recently: the chemistry, ultrastructure and relationships of many cellular and subcellular components. To name a few which I enjoyed reading, there were the chapters on desmosomes, involucrin, keratins, the stratum granulosum, basement membranes, intercellular lipid deposits, serous and mucous glands, reptilian skin, etc.

The chief aim of this survey seems to be to cover the fields as developed in the mid-70s to the mid-80s. It represents the newer outlook in biology starting from the molecule and working up to subcellular or extracellular structures and functions, as related to gene expression. This approach is applied to the whole vertebrate field, as far as is practicable. For the person primarily orientated towards the mammals, the teleosts and the birds could be found most confusing. This is not, however, the fault of the presenters, but depends on the diversity and incompleteness of our knowledge in these fields.

To one who was reared on the older sort of biology, dominated by taxonomy, evolution, *Entwicklungsmechanik*, and the grosser expressions of living structure, it is obvious that these earlier problems have not been solved by modern developments. It is truer to say that most of these problems have merely been shelved. The newer changes are therefore not always 'advances' on what went before, but rather 'displacements' of activity. This is not a bad thing; a displacement of one's viewpoint can have great value — from macro-scales to ultramicro-levels.

As a consequence, there is nothing holistic, nothing specially ecological, no time-scales, little comparative, no generalities, no 'trees' of gross relationships, and only the broadest references to phylogeny in certain critical places. Big questions such as the origin of hair, the intrusion of eccrine glands, the evolution of the stratum granulosum, are left out in the dark. Furthermore, there are a number of large topics which are deliberately excluded. Can one then still lay claim to call the subject 'biology'? In fact, the fields tackled are amazingly small, and the most that one can undertake thereafter is the scope and possible application of experimental results. Researchers are therefore likely to prefer consulting a chapter here and there, depending upon a special interest alone. Inevitably the topics comprise a patchwork, and not an identifiable pattern of themes. Differences between species or individuals are the consequence of genetic control, but there is no consideration of whys and wherefores. The role of the skin in evolution is taken very much as incidental.

There is a very small sprinkling of references to South African work, provided of course that it appeared in the survey period.

One must conclude that what is given is mostly excellent, but that one cannot expect more than what is offered: The views of activity over a recent decade when techniques and cytological detail dominated over all wider considerations. Darwinism, and the efforts of pioneers such as Leydig, Gegenbaur and Bolk in this field will have to await a period of re-integration before returning to 'biology'.

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Advances in the Biology of Turbellarians and related Platyhelminthes

Edited by Seth Tyler
Dr. W. Junk Publishers, 1986
357 pages; 253 figures
US $112,00

This book was reprinted from *Hydrobiologia*, Vol. 132 (1986) and covers current research on turbellarians and related Platyhelminthes. It is the proceedings of the fourth International Symposium on the Turbellaria held in Fredericton, New Brunswick, Canada, August 5–10, 1984.

It contains a total of 45 specialist articles each written by either one or more people with a total of 66 authors

from different parts of the world.

In the preface to this book the editor indicates that modern research on the Turbellaria covers a broad spectrum such as neurophysiology, embryology, regeneration, ecology and molecular studies. Unlike in the previous three International Symposia on the Turbellaria, invitations were not only sent to biologists publishing research dealing with turbellarians but the scope was expanded to include biologists working on parasitic platyhelminth taxa. The editor sets out the aim of this symposium as an attempt to gain a better perspective on the position of the Turbellaria in evolution and to bridge the artificial gap that now stands between studies on free-living and studies on parasitic Platyhelminthes. It appears, however, that the response from the parasitic studies was poor because only seven out of the 45 articles in this book refer directly or indirectly to the parasitic Platyhelminthes. The rest of the articles deal with turbellarians only.

Generally the articles in this book are divided into the following subheadings: abstract, introduction, material and methods (methodology), results, discussion, acknowledgements and references. However, there are deviations from this pattern depending on the style used by some authors. For instance, some articles have an abstract and the main body is not divided into subheadings, and in others there are no acknowledgements while in others the results and discussions are combined. Each article, however, has a list of references at the end which (in about 80% of these articles) is extensive.

The book is divided into nine categories, namely: phylogeny, nervous system and sensory structures, ontogeny, reproductive system, regeneration, systematics and cytology, ecology, symbiotic relationships and history. The number of articles in each category varies from a minimum of one to a maximum of ten.

The first category of this book (ten articles) discusses the phylogenetic system of the Platyhelminthes using certain features of members of this taxon in an attempt to explain the position of the Platyhelminthes as a whole. Both the free-living and the parasitic Platyhelminthes are referred to in this section.

In the second category (four articles) an attempt is made to establish similarities between free-living and parasitic Platyhelminthes using certain features of the nervous system.

In the third category (three articles) developmental characters such as oocyte and yolk cell structures, patterns of cleavage, and modes of gastrulation are used in explaining the phylogenetic relationships of the turbellarians as well as studying larval eye development in Polycladida.

The fourth category (seven articles) deals with certain aspects of the reproductive system of the Turbellaria while the fifth category (eight articles) concerns reports on regeneration among the turbellarians.

In the sixth category (five articles) the significance of cytological studies in the systematic review of the Turbellaria using some members of this group is discussed.

The seventh category (five articles) is on the ecology of certain members of the Turbellaria.

In the eighth category (two articles) the surface specialization of digenetic trematodes is reviewed and symbiotic turbellarians in the oyster, *Crassostrea virginica*, are studied.

The ninth and last category (one article) reviews the history of the study of Turbellaria in China and Japan.

An appendix consisting of 513 references on the bibliography of electron microscopy of turbellarian platyhelminths as well as an index to authors and an index to subjects is given at the end of the book. Also included is a photo and list of participants and contributors as well as their addresses.

The articles in this book were written by different specialists from different countries in several fields of study of the Platyhelminthes. Therefore they represent different lines of research and views of the contributors and there is no continuity from one article to the next. As a result, most of these articles stand out as isolated research papers concentrating on the free-living Platyhelminthes without referring to the parasitic Platyhelminthes.

The articles in this book are well written and well edited with adequate in-text references and excellent illustrations. There are very few typographical errors. I spotted only two.

While I do not recommend it as a course textbook, I also do not believe it was intended for that purpose. This book is suitable for the reader with specialist interest in Platyhelminthes, especially the Turbellaria. I therefore strongly recommend it for postgraduate students doing research on Platyhelminthes.

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Evolutionary Physiological Ecology

Edited by P. Calow
Cambridge University Press, Cambridge
239 pp.

This book is based on a symposium that took place as part of the Third International Congress of Systematics and Evolutionary Biology (ICSEB III) at the University of Sussex (Brighton, UK) in July 1985. Although it is a proceedings, it was well refereed and the contents are structured to make a coherent and biologically reasonable theme.

The title of this book indeed contains something of a tautology and the 'evolutionary' is redundant. As indicated by Peter Calow in his introduction it does, however, emphasize the change in approach where adaptive explanations of metabolism are formulated more explicitly rather than merely correlating metabolic with ecological variation.

The first five chapters are concerned with processes and are written with remarkable lucidity, considering the speculative and almost philosophical reasoning sometimes adopted. The Allocation Principle and thermodynamic restraints in the allocation of resources amongst different metabolic demands are addressed by Gnaiger in Chapter 2 and are definitely not meant for physiologists who are not mathematically inclined or not initiated. The same holds true for the fascinating chapter on growth and resource allocation. These authors' (Sibly and Calow) efforts to find functional explanations of growth patterns and to develop a functional model, are highly theoretical and rest heavily on assumptions not tested but considered reasonable. They also suggest a possible experimental programme based on their analysis which could be pursued further by an innovative student.

The mapping of physiological processes on to their demographic consequences received attention in Chapters 3 and 4. The Maximization Principle (Calow 1984) is discussed and applied in various chapters.

The genetic basis of physiological processes is generally assumed since resource allocation is enzyme modulated and must be gene specified. Also the precise relationship between genes and their physiological effects, and the genetic basis of interaction between physiological effects, trade-offs, is crucial to an understanding of the evolution of physiology. This book clearly points out those areas in which sound information is lacking. Apart from information of a molecular/genetic kind, classical quantitative genetic information on the genetic correlation between physiological traits is needed.

The debate on 'holism' versus 'reductionism' received its fair amount of attention in so far as the importance of the organism is highlighted. The gene-determined physiological process has to work in association with others and is subject to natural selection within the organismic context. An allele may express itself differently and have different fitnesses in different genetic backgrounds (Lynch & Gabriel, Chapter 5). One has therefore to follow the reductionist pathway to gain insight by decomposing complex wholes into the component processes, but a holistic appreciation must not be lacking. Chapters 6–12 deal largely with an organismic approach and will be rewarding reading material for conventional specialists on these different groups. A variety of issues are addressed ranging from the physiological ecology of prokaryotes, biological replicating systems (Koch, Chapter 6), plant form and function (Chapters 7 and 8), symbiosis in *Hydra* (Chapter 9), size and foraging behaviour of fishes (Chapter 11) and homoiothermy in mammals (Chapter 12).

The efforts of the editor to structure this book into a coherent theme are appreciated although the degree of success he has achieved is debatable in respect of certain topics included. Although a sound knowledge of mathematics is needed to appreciate certain chapters fully, the book as a whole is highly recommended to all zoologists with an appreciation for the functional approach towards zoology. The book is clearly not for the undergraduate level and no easy introduction to the subject. Evolutionary biologists will find it very valuable for teaching purposes on postgraduate level.

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Dragonflies

Peter L. Miller

Cambridge University Press, Cambridge, New York and Melbourne, 1987
84 pp.
Price: £6,00

This is the seventh and latest in the series of Naturalists' Handbooks published by Cambridge University Press who together with the author and those who assisted him with keys and illustrations must be complimented on a really quality publication.

The purpose of this book, as for the series as a whole, is clearly stated in the Editors' preface: 'The books in this series offer sixth formers and others without a university training in biology the information and ideas needed to plan an investigation, and the practical guidance needed to carry it out'. In respect of the dragonflies of Great Britain Peter Miller more than meets the stated objectives.

The book is divided into six chapters, the first of which provides a general introduction and sets the tone for the strong conservation message that continues through the text.

In Chapters 2 and 3 a highly readable account of the biology of dragonflies is given. In the 43 pages devoted to this topic attention is largely focussed on the behaviour and ecology of dragonflies, with a succinct but more than adequate coverage of the life cycle and morphology of the developmental stages being included. The information provided in these chapters is anything but out-of-date. With the support of the appended reading list it is an excellent review of the subject and meets in every sense the editors' view that it takes you to 'the frontiers of current knowledge'.

Identification keys to larvae and adults make up Chapter 4. Drawn up by Graham Vick and David Chelmick, respectively, these keys are technically sound and supported as they are by 103 simple but pertinent line drawings and four colour plates it goes without saying that they are easy to follow. For any aspiring taxonomist these keys will serve as a useful example to follow.

In Chapter 5 the author provides an interesting insight into the conservation of dragonfly habitats and the now revitalized dragonfly recording scheme in Great Britain. In South Africa where the number of odonatan species is more than four times that of the British Isles and where

there are at most three or four persons working on dragonflies for the foreseeable future such programmes can be no more than pipe-dreams.

Chapter 6 is titled 'Some techniques for studying dragonflies'. Very useful advice on collecting, laboratory rearing and conducting field studies is given. Of singular importance, however, is the short section on how to present your findings. This is essential reading for all amateurs, though this is not to say that many practising biologists would not benefit by being reminded of these basic principles of scientific communication.

To the interested amateur and secondary or tertiary level student in Great Britain this book will be an absolute boon. For his/her South African counterpart it is of only limited value owing to the focus being on the British fauna. However, for those teaching entomology and for specialist researchers, wherever they may be working, it would be a valuable addition to their libraries. For the former its value lies in its up-to-date coverage of odonatan biology and for the latter for the lessons to be learnt from the well-illustrated keys and for the example it sets in communication.

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