## *Book Reviews*

# The Sea Urchin Embryo. A Developmental Biological System

Giovanni Giudice
Springer-Verlag, Berlin, 1986
246 pages; 53 figures.

In the preface to this book the author sets out his aims which are to summarize the state of the art in each area of sea urchin embryology, and to review the experiments performed in the 12 years proceeding the publication of his earlier book, *Developmental Biology of the Sea Urchin Embryo* (1973). While the present book does not go back over the 'old' literature, it does mention reviews and key papers from which the reader can gain access to the older material.

The book is divided into two parts, the first on development, and the second on nucleic acids and proteins. There is an addendum in which the author summarizes the more recent papers published and which brings the coverage of the book up to 1984.

The first section is divided into a chapter on fertilization, which includes discussion of the various layers of the egg surface, the sperm cell membrane, and the acrosome reaction, with a detailed description of the processes associated with fertilization. The second chapter examines embryonic morphogenesis emphasizing the complex cell interactions that occur, and includes a detailed review of experimental investigations of these cell interactions. The final chapter of the first part is a brief examination of embryonic metabolism and covers oxygen consumption and carbohydrate metabolism.

In the second part, the chapter on DNA covers the organization of the genome, and looks in detail at some specific loci such as those for ribosomal RNA, actin, tubulin, and others. The chapter on RNA separately examines ribosomal, transfer, and messenger RNA, and there are detailed reviews of the differences between embryonic and adult mRNA, the control of mRNA translation, and the regulation of transcription. The chapter on protein synthesis reviews information on the rate of protein synthesis and looks at factors that may be responsible for the increase in rate that occurs at fertilization. The final chapter, on nucleomitochondrial interactions, is brief and emphasizes the differences in rates of synthesis of nuclear and mitochondrial DNA.

There is a reference list of about 1800 titles and a functional index.

This book is an excellent review in a field in which more than 2000 papers have been published in the last 10 years. It should be a valuable initial source for scientists starting research projects in echinoderm embryology and will be a useful addition to the libraries of existing research units.

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# The Female Animal

Irene Elia
Oxford University Press, Oxford, 1985
335 pp.
Price: R101,70

*The Female Animal*, written primarily as a semi-popular book, is about the consequences of being female in the animal world. As a physical anthropologist and also as a female in today's 'liberation' conscious society, Elia seeks to understand the present role and status of females, particularly of humans. She attempts this by tracing the biological and social development of 'femaleness' and mothering and their consequences in the evolution of different animal groups, from bacteria and algae to the higher primates.

After an amusing and intriguing preface, the first chapter concisely defines and reviews what it is to be female. This establishes a common background knowledge for all readers by discussing the role and evolution of the egg and gametes, phylogeny and ontogeny of eggs, sexual dimorphism and the consequences of these on theories of organic evolution, fitness, and natural selection. While this provides a quick and probably too rapid introduction to female reproductive physiology for the non-biologically informed reader, it is a superb review for those of us who had courses in reproductive physiology more years ago than we care to remember. Although a simple yet complete glossary exists at the end of the book, a convenient and highly commendable aspect of this introductory chapter is the 'in-text' definitions of various ominous-looking biological and evolutionary terms which, at first encounter, could discourage some people from further reading.

In each of the following chapters which cover invertebrates, fish, amphibians and reptiles, birds, mammals and primates, Elia traces the currently accepted evolutionary pathways which led to the changes or advances in development each group of animals made toward the present state of their femaleness and mothering. She provides many current examples of the 'usual' female situation and then notes those species which have taken femaleness to different extremes, be

that male-mimicry by female spotted hyenas, polyandrous promiscuity of female phalaropes and dotterels or the almost total female societies of some honey bees and ants. She also follows the parallels between increased mothering, intelligence, sociality, and incorporation of male help in offspring care, especially in the higher mammals.

Although the writing style is easy to read, in a few places, the logical stepwise progression of thought behind her 'if so ... then' statements are not as simple or as clear as the wording implies. Perhaps the logic is not hard to follow for someone more familiar with the evolutionary trends in specific fields but for the average reader, it would take considerable additional reading to fully comprehend the significance of her statements. Detailed and lengthy discussions of each evolutionary jump are avoided, perhaps this is to keep the book to a reasonable length and/or reader interest alive. Regardless of the reason, this unfortunately could leave many readers with some over-simplified ideas and possibly even some misconceptions about the evolutionary simplicity and the biological significance of some of the developments. There is a fine distinction between the circumstances for a certain development and the social consequences of such a development. Elia often gives the impression that the social consequences were the selective forces behind the evolution of such developments and not the result of them. Considering the potentially contentious underlying issues here, the easy acceptance of such statements and their reiteration as fact could put the book and the author in an unfortunately bad light.

While many of the over-simplified statements are supported and more explicitly explained in the suggested additional readings (a list is presented at the end of each chapter) a mention of these in the text would have been helpful. Most of her 'in-text' references are for specific studies which she uses as examples of female adaptations. Her use of cross-referencing points or examples either within or between chapters is helpful and, where she does speculate substantially, she makes it quite clear that this is her opinion.

Overall, I found this book extremely interesting and full of intriguing ideas for both the academic and the biologically interested lay-person to consider. While I do not recommend it as a course textbook, I also do not believe Elia ever intended it for that purpose. She has dealt with a contentious issue in as unbiased a manner as possible and has effectively held to the theme of the development of the female role in a highly diverse array of animals. The overtone of female exploitation which pervaded the early pages was not developed into a female liberationist's rallying cry but rather, the role of women today was shown to be but part of the continuing co-evolution of the two sexes. Nevertheless, she does contend that our human situation is different from the rest of the animal world because of *Homo sapiens'* ability to control not only reproductive processes but also to a large extent the environment. The material presented in this book has its greatest potential in creating stimulating, and for some highly controversial, discussions in both a social and an evolutionary content.

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## Seabirds: feeding ecology and role in marine ecosystems

Edited by J.P. Croxall
Cambridge University Press, Cambridge (1987)
408 pp.

Seabirds, especially pelagic seabirds, have long held a fascination for seafarers for whom they have provided company on long voyages, a source of food, an aid to navigation and, on occasions, a bearer of messages for shipwrecked sailors. However, despite a wealth of observation, most early accounts are anecdotal and it is only in recent years that seabirds have become subjects of more detailed, quantitative studies. The principal impetus for such studies has been a growing appreciation of the role of seabirds as predators of marine resources and the potential interactions between seabird communities and commercial fisheries. Despite constraints and limitations associated with studying far-ranging, pelagic species, the last decade or so has seen remarkable progress in elucidating aspects of seabird foraging ecology. *Seabirds* documents some of these exciting advances and synthesizes much of our current knowledge on the role of seabirds in marine ecosystems.

The book is divided broadly into two parts. The first comprises an introduction, a description of the physical environment, and seven chapters on the diets and feeding ecology (including adaptations for flight and diving) of the four principal seabird orders, and the second section contains six chapters on the role of seabirds in various marine ecosystems. Each chapter is by a different author or authors, most of them well known in the field of seabird ecology.

The first chapter by the editor is introductory. It describes briefly the origins of the book as well as its scope and also highlights some general characteristics of seabirds.

In Chapter 2 Hunt & Schneider discuss seabird distribution and abundance in the context of variability in their physical and biological environment.

In Chapter 3 Pennycuik describes flight adaptations of seabirds relative to a 'standard seabird' and discusses how changes in body mass and wing size and shape affect a species' flight capabilities. He concludes that despite a variety of feeding methods, only the adaptation of wings

for propulsion underwater has any dramatic effect on flight capabilities. This is taken to extremes in the penguins which, Pennycuik predicts, would have a cruising speed of 145 km $h^{-1}$ at a wingbeat frequency of 50 Hz and a minimum glide speed of 190 km $h^{-1}$ if they ever took to the air. Perhaps it is just as well that they are flightless.

In Chapter 4 Kooyman & Davis review diving behaviour and swimming performance in seabirds. Although empirical data are few, and mostly from penguins, the authors nevertheless overlooked at least one available measurement for diving depths of jackass penguins *Spheniscus demersus* (Wilson & Bain 1984, *J. Wildl. Manag.* 48: 1077-1084) and two papers on biochemical aspects of diving and swimming performance in penguins (Mill & Baldwin 1983, *Physiol. Zool.* 56: 242–254; Baldwin, Jardel, Montague & Tomkin 1984, *Molecular Physiol.* 6: 33–42). Overall, the chapter highlights how little we actually know about the diving and swimming capabilities of seabirds. However, data are accumulating continually and the recent development of remote-sensing devices suggests that significant advances may be made in this field in the near future.

In Chapter 5 Furness discusses kleptoparasitism (food-stealing or piracy) as a feeding technique among some species of seabirds and also considers briefly the possible evolution of this behaviour.

The following four chapters deal primarily with the diets of each of the four major orders of seabirds. Croxall & Lishman review diets and feeding ecology of penguins and also consider the role of feeding ecology in the segregation of species and congeneric species pairs. Their consideration of feeding ecology inevitably overlaps with that presented in the earlier chapter on diving and swimming performance. Prince & Morgan summarize available dietary information for Procellariiformes (albatrosses, petrels, diving petrels, and storm petrels) and also discuss feeding methods, prey detection, and activity patterns at sea. Schreiber & Clapp consider diet and feeding behaviour of Pelecaniformes (cormorants, gannets, pelicans, frigatebirds, and tropicbirds) and, in Chapter 9, Vermeer, Sealy & Sanger review foraging behaviour and diet of Alcidae (auks, puffins, murres, guillemots, and razorbills). This chapter confines its discussion to the eastern North Pacific, probably because the diet and feeding ecology of North Atlantic Alcidae has recently been comprehensively reviewed by Bradstreet & Brown (in The Atlantic Alcidae, D.N. Nettleship & T.R. Birkhead (eds), Academic Press, London). All of the above reviews are comprehensive in their coverage and, as with previous chapters, frequently emphasize how little is known of the diets of some species of seabirds, particularly outside their breeding seasons.

Chapter 10 begins the second section of the book on the role of seabirds in marine ecosystems. In this chapter, Sanger considers trophic levels and trophic relationships of seabirds in the gulf of Alaska using numerical average trophic levels for each of 19 species of seabirds. He concludes that, on average, seabirds feed as second order carnivores. Schneider & Hunt, in Chapter 11, compare energy flux to seabirds in two physically and biologically similar systems in the Bering Sea and the northwest Atlantic Ocean. Briggs & Chu model the trophic relationships and food requirements of Californian seabirds and attempt to place the timing and magnitude of the impact in a hydrographical context. Harrison & Seki estimate food consumption of 18 species of seabirds breeding in the north-western Hawaiian Islands. However, to this reader, the most interesting discussion in this chapter is that on feeding guilds among Hawaiian seabirds and seabird-fishery interaction.

A more unusual approach to modelling seabird food consumption is that of Duffy & Siegfried who utilize records of guano production to calculate historical variations in food consumption of breeding seabirds in the Humboldt and Benguela upwelling regions. They calculate that seabirds in South America consume only 11% of the anchovetta *Engraulis* stocks and those in southern Africa a maximum of 5% of the Cape pilchard *Sardinops* stocks. These data contrast sharply with other regions in which estimates of seabird consumption are often several times higher. The final chapter by Croxall & Prince examines the consumption of krill by breeding seabirds at South Georgia in the sub-Antarctic. Although by now a familiar story to most seabird ecologists (as are aspects of several of the chapters already discussed), Croxall & Prince's model is one of the most refined, especially in that it incorporates a number of empirical measurements of seabird energy requirements rather than estimates based on allometric equations. The book would not be complete without it. A concluding chapter by Croxall which summarizes, broadly, conclusions reached in the individual chapters, and an index complete the book.

Each chapter contains a list of references which, in some chapters, are extensive. Chapter 2, for example, lists 219 references. References in most chapters appear to include some from 1986 and some chapters even papers in press. Nevertheless, the review-type chapters which make up most of the first part of the book are inevitably, and unfortunately, rapidly becoming dated as further exciting advances are being made in the field of seabird ecology. The past year alone has seen the publication of numerous papers on diets, foraging ecology, ecological segregation, activity budgets at sea, and energetics of free-ranging seabirds, all areas in which the need for information has been highlighted throughout the book.

The chapters in the book are well written and easy to read, although this reader felt that in some of the diet review chapters there was, on occasions, a profusion of data in the text which might better have been presented in tables. The book is well edited and presented with clear figures and tables and very few typographical errors (I spotted only three). According to the editor, the book aims to provide 'an up-to-date conspectus of information on seabird adaptations for feeding in the marine environment and of the nature of recent and current studies seeking to integrate quantitative data on

seabird trophodynamics into an ecosystem perspective.' In this, I feel the book has succeeded admirably and I have no hesitation in recommending it to any serious ornithologist, seabird ecologist or fisheries biologist.

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## Reproductive physiology of marsupials

H. Tyndale-Biscoe and Marilyn Renfree
Cambridge University Press, 1987
476 pp.

This excellent review on marsupial reproduction covers 918 references from 1635 to 1986, with 33% of them published from 1980 onwards.

After a fascinating historical introduction, a chapter on breeding biology of each family of marsupials follows, where the diversity of marsupial reproduction is considered systematically. The remainder of the book deals with each of the main areas of reproductive physiology that have been actively studied in the past two decades.

In Chapter 3, sexual differentiation and development are reviewed. Marsupials have interesting mechanisms for dosage compensation of sex chromosomes. Since the young are born at the indifferent stage of sexual differentiation, this process is readily accessible for experimental investigation, especially as the number of chromosomes is low and their size is large.

Chapter 4 deals with the maturation of spermatozoa and the role of the epididymis in this, both of which differ from the eutherian patterns. In Chapter 5 the very unusual female genital tract, the function and endocrine control thereof, are reviewed. The different functions of the corpus luteum and its unusual control by the pituitary are treated in Chapter 6. Pregnancy and intrauterine development, from fertilization via blastocyst formation and the control of embryonic diapause, to placental function and parturition, are considered in Chapter 7. The physiology of lactation is discussed in Chapter 8. Reproductive investment is placed mainly in lactation rather than gestation and placentation in marsupials, with a consequent refinement of their mammary physiology.

The tammar wallaby, *Macropus eugenii*, is the most extensively studied marsupial and the central control of reproduction in this species is reviewed in Chapter 9. The roles of the pineal, the pituitary, and the ovary in regulating reproductive activity are of special interest in this species, since it is remarkably sensitive to photoperiod changes.

The last chapter discusses the evolution of mammalian reproduction: marsupials and eutherian mammals have been separated for more than 100 million years, and many of the differences between the two groups in terms of reproduction have evolved after the separation. At the end of most chapters, conclusions summarize what has been treated in the chapter, with emphasis on these differences.

The composition of the book is indeed elegant. The authors (both well known in the field of reproduction in marsupials) present an enormous amount of detailed information in a very lucid way. The content covers all main aspects on reproductive physiology in marsupials and the authors also point out that the evolutionary and ecological implications of common reproductive patterns within families, that are not dealt with in this book, are the subject of the companion volume in the series of 'Monographs on Marsupial Biology'.

I highly recommend this book for postgraduate students or anyone interested in reproductive physiology.

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## The Epididymis, Sperm Maturation and Fertilisation

T.G. Cooper
Springer-Verlag, Berlin, 1986
281 pages; 8 figures; 21 tables.

The epididymis has two principal functions, firstly, to promote development of the ability of spermatozoa to respond to conditions within the female reproductive tract so that fertilization will occur. And secondly to prevent the premature development of these capabilities within the male reproductive tract. This is the central theme of this book and all the chapters are built around it.

The book is a review work and the format is one of a large number of short chapters which fall into three parts. Each chapter has its own summary and reference list.

Part I serves as an introduction to the types of change that spermatozoa undergo during their sojourn in the epididymis, and some of the factors that control these developmental processes.

In Part II the author looks at sperm maturation in terms of the development of processes fundamental to fertilization, such as sperm motility, capacitation, sperm-

egg binding, the acrosome reaction, hyperactivation, and sperm-egg fusion. To further illustrate the theme of this book, the chapter on sperm motility emphasizes the way in which the epididymis facilitates the development of improved motility by supplying or removing ions and cofactors which act on the flagellum. By contrast, the chapter on capacitation illustrates the role of epididymal proteins and sterols in stabilizing the sperm cell membrane and thus preventing premature capacitation.

The secretions of the epididymis and their interactions with the spermatozoa are further discussed in Part III. There is a short introduction on epididymal structure and function which is followed by chapters looking at the secretion and/or removal, by the epididymis, of steroids, ions, glycophosphocholine, carnitine, *myo*-Inositol, and proteins. These chapters relate back to Part II, so that for example, the chapter on carnitine discusses its significance in relation to the development of sperm motility, and that on proteins reports on their importance in motility, sperm-egg recognition, and decapacitation.

This is a beautifully organized book in which the reader is encouraged not to see the many functions of the epididymis in isolation, but to relate these functions back to sperm maturation and the process of fertilization.

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