Oceangoing Animals

Seabirds. Feeding Ecology and Role in Marine Ecosystems. J. P. CROXALL, Ed. Cambridge University Press, New York, 1987. viii, 408 pp., illus. $59.50. From a symposium, Moscow.

Marine ornithology has come a long way in the last 15 years. Oceanographers now think of seabirds as respectable marine animals, instead of casual, terrestrial vagrants. Ornithologists, in turn, have stopped thinking of the sea as a mysterious waste into which their birds disappear from time to time. They are trying instead to fit seabirds into the higher trophic levels of the appropriate marine ecosystems. The present volume gives us a summary of the current state of this art. It stems from a symposium held in 1982 at the XVIII International Ornithological Congress; the presentations have been updated to include material published as recently as 1986.

The 15 papers in the volume are about the relationships between seabirds and their prey, considered from many angles. Four of the papers are straightforward summaries of diet and feeding ecology: in penguins (Croxall and Lishman), procellariiforms (Prince and Morgan), pelecaniforms (Schreiber and Clapp), and Pacific alcids (Vermeer, Sealy, and Sanger). The alcid paper is a useful complement to Nettleship and Birkhead's *The Atlantic Alcidae*. Four more discuss the trophic relationships of seabird communities: in the Gulf of Alaska (Sanger) and off Hawaii (Harrison and Seki), California (Briggs and Chu), and South Georgia (Croxall and Prince). Schneider, Hunt, and Powers model energy flux and make interesting comparisons between the seabird communities in the Bering Sea and on Georges Bank off Massachusetts. Duffy and Siegfried look at food consumption by seabirds in the Humboldt and Benguela currents, the two major Southern Hemisphere eastern boundary upwellings, using guano statistics to obtain a historical perspective. The remaining papers deal with the ways in which seabirds actually find their food: reviews of kleptoparasitism (Furness), diving with particular reference to penguins (Kooyman and Davis), and the complexities of flight itself (Pennycuick). Hunt and Schneider turn the question on its head and discuss the spatial and temporal scales of the "patches" of prey that seabirds must exploit if they are to forage economically. Finally, Croxall considers the general factors that limit seabird populations and the restraints imposed by our own activities as marine polluters and rival fishermen.

I have a few quibbles. One is the limited number of species discussed in most of the papers—auks, penguins, pelecaniforms, and procellariiforms, all cold-water species. This reflects the bias of current seabird research, but it is clear that the restriction is to some extent self-imposed. There is some overlap in subject matter among papers—especially those about the North Pacific—but that is inevitable in a symposium. I did not find the treatment of seabird diets very inspiring—diet papers never are. The contributions on trophic interactions are much more interesting. However, my prize for the best paper in the book goes to Colin Pennycuick's lucid exposition of seabird flight.

John Croxall and his co-authors have pro-

duced a series of reviews that will be standard reading for the next five years or so. I mean this as a compliment; it is a measure of how far and fast marine ornithology has come in the last two decades. The next state-of-the-art review will inevitably have this one as a cornerstone.

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Muscle Contraction

Calcium in Muscle Activation. A Comparative Approach. JOHANN CASPAR RÜEGG. Springer-Verlag, New York, 1986. xiv, 300 pp., illus. $98. Zoophysiology, vol. 19.

This book explores "the common principles that govern calcium signalling in the regulation of muscle contraction and cell motility," describing those "features of calcium regulation [that] may be common or fundamental to all muscles" and those that "are probably specializations that have evolved because of their suitability for specific functions" (p. 250). Physiology is the central focus; nevertheless, the approach is broad. Findings on intact muscles are analyzed with the aid of experiments on permeabilized preparations and isolated proteins. Relevant structural and biochemical studies are also considered in the evaluation of possible mechanisms.

The comparative approach employed by Rüegg is particularly suited for the elucidation of muscle function. In recent decades, muscle has become an outstanding example of how the convergence of different disciplines can lead to a fuller understanding of function. Identification of the muscle proteins and knowledge of their reactions have been of paramount importance in interpreting muscle structure. Structural studies have led to our present understanding of contraction at the molecular level. Kinetics of the actomyosin-ATPase cycle are closely interwoven with analysis of mechanical transients. Our understanding of the structural, biochemical, kinetic, and mechanical properties of muscles has advanced in a mutually dependent fashion.

The knowledge of control of contraction has been particularly enriched by comparative studies. Contraction of all muscles is triggered by the appearance of calcium in the myoplasm. Calcium is released from membrane-bound compartments as a result of depolarization of the cell membrane that may or may not be propagated depending on muscle types and on species. Inward-conducting T-tubule membranes may or may not be present. The roles of specific calcium channels of the cell membrane and of secondary messengers such as cyclic AMP and inositoltrisphosphate in the production of calcium transients depend on muscle types and species. The variations that contribute to the adaptation of a particular muscle to specific functions, including speed, duration, efficiency, rhythmicity, and oscillation, are described in detail, and their effects are carefully evaluated.

Calcium is a universal triggering ion since proteins can bind it with a high affinity and it can move rapidly to and from the binding site. Thus, at rest, its myoplasmic concentration can be kept low, and relatively small amounts need be released for activation. The binding site representing a particular amino acid sequence, the E-F hand, is present in a number of calcium-binding proteins: troponin-C, calmodulin, parvalbumin, and myosin light chains. Since calmodulin is a subunit of a number of proteins, it serves as a calcium sensitizer of several different systems including myosin light-chain kinase.

Regulation of contraction is essentially the inhibition of the interaction between actin and myosin. Calcium reverses this inhibition. The "on-off" switch, however, is quite different in different muscles and species. In vertebrate striated and cardiac muscles the regulatory proteins, the tropomyosin-troponin complex, are part of the thin filaments and act on actin. In molluscan muscles, vertebrate smooth muscles, and various motile cells, myosin itself is regulated, and the light chains serve as regulatory subunits. Molluscan myosins bind calcium directly; in contrast, smooth-muscle and nonmuscle myosins are activated by phosphorylation of the regulatory light chains catalyzed by the calcium-dependent myosin light-chain kinase.

Scallop myosin is uniquely suited for the study of the role of light chains in the regulation of myosin since its regulatory light chains can be reversibly removed. The isolated myosin is controlled with the same fidelity as intact muscle, and activation by calcium is associated with the rearrangement of light chains. Activation of vertebrate smooth muscles and other motile cells by means of the myosin light-chain kinase involves a cascade of events and opens up access routes to hormones and to cyclic AMP to modulate the speed and extent of light-chain phosphorylation.

The book is a rich source of experimental background on these processes. The reference list is large (over 800 papers), up-to-date, and valuable. The condensed style and large amount of material presented do not make for rapid reading, but the book is carefully organized, with useful summaries after each chapter. The text is illustrated with a generous number of figures that help to acquaint readers with the experimental background of the conclusions and interpretations.

This is a rapidly growing field. Unanswered important questions remain. These include the mechanism of calcium release, the molecular mechanism of the action of regulatory proteins, the role of thin-filament regulation in smooth muscles, the nature and control of the maintained tension state, and "latch" and "catch" in smooth and molluscan muscles. Unresolved issues are pointed out without oversimplification, and alternatives in interpretation are presented fairly.

This is an unusually useful book for researchers and also for graduate and advanced undergraduate students interested in regulation. A less expensive paperback edition would facilitate the wide circulation it deserves.

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Books Received

Ab Initio Methods in Quantum Chemistry. Part 1. K. P. Lawley, Ed. Wiley-Interscience, New York, 1987. x, 556 pp., illus. $118. Advances in Chemical Physics, vol. 67.

Acid Rain 1986. A Handbook for States and Provinces. Acid Rain Foundation, St. Paul, MN, 1987. iv, 609 pp., illus. $55. From a conference, Sept. 1986.

Advances in Behavioral Economics. Vol. 1. Leonard Green and John H. Kagel, Eds. Ablex, Norwood, NJ, 1987. x, 307 pp., illus. $27.50.

Advances in Gene Technology. The Molecular Biology of Development. Richard W. Voellmy *et al.*, Eds. Cambridge University Press, New York, 1987. xviii, 162 pp., illus. $54.50. ICSU Short Reports, vol. 7. From a symposium, Miami, FL, Feb. 1987.

Advances in Turbulence. G. Comte-Bellot and J. Mathieu, Eds. Springer-Verlag, New York, 1987. xvi, 586 pp., illus. $87.80. From a conference, Lyon, France, July 1986.

Advancing Frontiers in Alzheimer's Disease Research. George G. Glenner and Richard J. Wurtman, Eds. University of Texas Press, Austin, TX, and Mind Science Foundation, San Antonio, TX, 1987. x, 269 pp., illus. $22.50. From a symposium, San Antonio, TX, June 1986.

Agricultural Biotechnology. Strategies for National Competitiveness. Committee on a National Strategy for Biotechnology in Agriculture, National Research Council. National Academy Press, Washington, DC, 1987. xvi, 205 pp., Paper, $14.95.

Catalyst Design. Progress and Perspectives. L. Louis Hegedus, Ed. Wiley-Interscience, New York, 1987. xiv, 288 pp., illus. $47.50.

Cell and Molecular Biology. E. D. P. De Robertis and E. M. F. De Robertis, Jr. 8th ed., Lea and Febiger, Philadelphia, 1987. xxx, 734 pp., illus. $39.50.

Cellular Biology and Pharmacology of the Placenta. Techniques and Applications. Richard K. Miller and Henry A. Thiede, Eds. Plenum Medical, New York, 1987. xiv, 625 pp., illus. $95. Trophoblast Research, vol. 2. Based on a conference, Rochester, NY, Oct. 1985.

Centennial Field Guide. Vol. 5. Northeastern Section of the Geological Society of America. David C. Roy,