OSMOTIC REGULATION IN AQUATIC ANIMALS, August Krogh, 242 pp., $1.75, Dover, New York, 1966.

Material in this book is presented in a systematic fashion with separate chapters devoted to osmotic regulation in each of the major phyla of invertebrates and vertebrates, and one chapter is devoted to osmotic problems encountered by eggs and embryos of aquatic animals. The scientific name of each animal discussed is given and at least some mention is made of osmoregulation in several hundred genera with some discussed at length.

A section perhaps as useful to the teacher of zoology or comparative physiology as any part of the book is the final short chapter dealing with methods. Among others, simple techniques for determination of osmotic concentration and of volume changes are included. The methods presented are ones feasible for use in student laboratories and do not require elaborate equipment.

An extensive list of references concludes the volume but, by the author's own admission, it is not a comprehensive list. Since the book was first published in 1939 and has not been altered, no recent references are included.

Information is presented in a fashion perhaps too sophisticated to make the book of great use to the beginning science student since the author presupposes some knowledge of biology and chemistry on the part of his reader. However, such an accumulation of material concerning osmoregulation as is presented by Professor Krogh would be difficult, if not impossible to find in any other single volume. For this reason, this book could well occupy a place in the library of any biologist.

Barbara Shirley
Department of Life Sciences
University of Tulsa
Tulsa, Oklahoma

AN INTRODUCTION TO GENERAL AND COMPARATIVE ANIMAL PHYSIOLOGY, Ernst Florey, 713 pp., $10.00, W. B. Saunders Co., Philadelphia, 1966.

This book is an excellent introductory text, carefully planned and written by an author with much experience in physiological research and education. It contains 18 informative chapters dealing with the various topics of physiology such as circulation and respiration. The diversity of physiological mechanisms in mammals and nonmammals is evident in each of these chapters, but the underlying relationships and principles are also stressed, thus giving these topics unity and coherence.

The author has further accomplished this synthesis of diverse mechanisms by strategic placement of 2 chapters on the structural organization of cells and animals, and 6 chapters dealing with physiological dynamics and kinetics. Thus, a fundamental discussion of enzymes, oxidative metabolism, and the solubility of gases in liquids precedes the chapters on respiration, circulation, and nutrition. The ionic basis of bioelectricity is presented in detail followed by units on muscle and the nervous system.

The chapters vary considerably in difficulty and the author intends that courses based on this text can be tailor-made to the interests and capabilities of the students, by selection from among the many chapters available. For students with sufficient mathematical experience, some topics such as nutrition and hemodynamics are treated quantitatively. Osmoregulatory mechanisms, for example, are also made more meaningful by the inclusion of a section based on Pott's procedure for calculating osmoregulatory work.

The book contains many illustrations, terms are carefully defined and illustrated, not just dutifully listed, and useful bibliographies are provided. Relevant molecular formulas and diagrams of metabolic pathways are conveniently placed, and some indication of experimental procedures is frequently given. Overall, much specific and detailed information about physiological mechanisms is presented and synthesized in a manner far more likely to stimulate rather than overwhelm the serious beginning student.

Roger D. Farley
Biology Department
Tufts University

COLD SPRING HARBOR SYMPOSIA ON QUANTITATIVE BIOLOGY, Vol. XXX, SENSORY RECEPTORS, 649 pp., Cold Spring Harbor Laboratory of Quantitative Biology, New York, 1965.

Sometime during June for thirty years, a group of investigators and specialists in some particular field of quantitative biology have met on Long Island at Cold Spring Harbor to present papers, and to discuss their mutual work and common interests. These papers and discussions are published as a volume of the Cold Spring Harbor Symposium on Quantitative Biology. Previous volumes have dealt with a variety of biological topics such as Protein Chemistry, Nucleic Acids and Nucleoproteins, The Neuron, Viruses, Population Studies, Cellular Regulatory Mechanisms, and Human Genetics. The last volume was on Sensory Receptors, a field currently receiving much attention from biologists, biochemists, neurophysiologists, biophysicists, and psychologists, each group well represented in the symposium

held in 1965. Not only were the various approaches to the problem of sensory transduction and perception represented, but the various receptors were all discussed. The fifty-five papers were organized into the following categories: General Physiology, Mechanoreceptors. Hearing, Olfactory Receptors, Electrical and Chemical receptors, Photoreceptors, and Data Processing. Photoreceptors had by far the largest number of participants who presented twenty-four papers on visual pigment chemistry, fine structure, neural organization, evolution, electrical responses, and other aspects of photoreception. The symposium was compiled by and for specialists, and may be difficult reading for a more generally oriented biologist. However, it serves as an excellent guide to the state of knowledge in sensory receptors as of 1965. Each paper contains a long and complete set of references, and the discussions at the end of each paper are lively, critical in a good-humored fashion, and often pin down the questions which remain to be investigated and answered. A set of candid photographs of the participants exchanging ideas in an informal setting adds interest to the reader.

Edith K. MacRae
University of Illinois Medical Center
Chicago, Illinois

MAMMALIAN CELL WATER, Edwin G. Olmstead, $8.00, Lea and Febiger, Philadelphia.

This is a concise volume presenting the physical chemistry and biological actions of water. It should serve as a ready reference for instructors interested in this ubiquitous substance. It presents, in accessible form, a number of hard to locate biophysical constants pertaining to water. Dr. Olmstead has done a creditable job in presenting a discussion that is necessarily made difficult bridging as it does two aspects for consideration: that of being too elementary for the established researcher and at the same time too sophisticated for the beginner.

Chapter I is devoted to the physical and chemical characteristics of the water molecule and Chapter II to the behaviour of electrolytes in aqueous solutions. The major defect of this presentation, as I see it, is that it is difficult to approach much of this material without a background in classical thermodynamics. In Chapter II the author rather abruptly introduces the partial derivatives of classical thermodynamics as the defining equations for partial molal free energies. Perhaps for a text that attempts to cover the broad aspects of the biological action of water there should be a brief discussion on thermodynamics included in the chapter on physical chemistry.

Chapter I concludes with a discussion of the effects of ionizing radiation on cellular water and the ultimate physiological effects on cellular function. The secondary action of irradiated water on cell function is brought about by means of the oxidation of cell solutes by the variety of hyperoxides and free radicals which are produced in the exchange of radiative energy with the water molecule. This mechanism seems to predominate in the inactivation of aqueous solutions of enzyme systems, but probably is of less importance in the intact mammalian cell. The direct or primary action of radiation on the DNA molecule is currently felt to be more important in radiation biology.

Dr. Olmstead's discussion of the derivation of the VantHoff equation for the development of the ideal osmotic pressure in electrolyte solutions is most adequate for the physical chemist. Yet, the everpresent problem arises with the introduction of the thermodynamic free energy considerations without the formal development of these quantities in the text.

The discussion of the mammalian cell as an osmometer uses the classical approach of Ponder et. al., in defining the iso-tonicity in terms of cell swelling or shrinking. Perhaps, as a deviation from the usual approach, osmotic flows might be considered purely with respect to the concentration of solute, or to solute activity across the membrane instead of being related to biological cell swelling or shrinking. The terms hypertonic and hypotonic would then not be used only in relation to a specific biological system, but rather to any system under consideration wherein the concentration of solute is defined on each side of a permeable membrane.

Chapter IV on the Kinetics of Cell Water Transfer is well written. The author summarizes the information concerning the fine structure of the cell membrane and problems of osmotic transfer in a most adequate style.

In considering the effect of osmotic gradients on water movement in biological systems the practical osmotic co-efficient Φ is introduced and then largely discounted as a number close to unity in these systems. In the light of recent publications of Kedem and Kachalsky, I think the discussion would be improved measurably if the Staverman co-efficient, sigma, were introduced with a treatment of the osmotic pressure which is induced across leaky semi-permeable membranes. Most biological membranes depart from the ideal system. They are not truly semi-permeable and it is necessary to utilize the concept of osmotic flows across leaky membranes in dealing with cell water