immunology of glucagon, carefully expresses persistent doubts about the specificity of the antibodies currently in use for the glucagon radioimmunoassay.

Another noteworthy contribution is that of Roger Assan ("In vivo metabolism of glucagon"), who has received less than due recognition on this side of the Atlantic for his enormous amount of work on glucagon.

The two most important chapters in the book should be the one on the physiology of glucagon and the one on immunoassays for glucagon. The latter, by Alfred Luyckx, is both scholarly and satisfying in its fine details of this recondite art. The former, however, is disquieting, largely because of textual errors. As in several earlier publications from Unger's group, its statistics are occasionally enigmatic (for example, the "glucagon" curve in the graph on page 239). Another disturbing feature is repetition of the oft-quoted statement that hyperglucagonemia is characteristic of "severe" diabetic ketoacidosis, when that conclusion is based on defining *severity* by the amount of insulin subsequently administered rather than by the magnitude of metabolic derangements at the beginning of treatment.

There are some other jarring notes in the monograph. They begin with the dust jacket, which, I suppose for "artistic" reasons, bears the nonsensical peptide fragment (residues 16–29) from glucagon as well as the complete (1–29) sequence. The editors would do a service by providing their readers with an erratum sheet, which should include the following: the legend to the photomicrograph on page 14 should read ". . . nerves (N) are present to the *left* of the A-cell"; the photomicrograph on page 22 is upside down; the glucagon-degrading enzyme ("glucagonase") cleaves the N-terminal *di*peptide His-Ser from the chain and not a *tri*peptide (page 48); glucagon and secretin share 14 (not 13) common amino acids at identical positions in the two chains (page 199); ". . . glucagon secretion during starvation is essential to the prevention of fasting *hypo*glycemia . . ." and not *hyper*glycemia (page 219); the last sentence on page 227 is incomprehensible unless the authors mean "glucose" rather than "glucagon"; and the term "biohormonal response" on page 238 is meaningless unless the authors intended "bihormonal," referring to both glucagon and insulin (and even this term I would eschew). References in the texts of chapters 6 and 15 badly need to be corrected (including an undeserved umlaut for Murlin, the codiscoverer of glucagon); and the credit to "Dexter and Allen" on page 264 is omitted from the references of chapter 17.

One thing is clear from the monograph: now that we can distinguish between pancreatic and gut glucagon-like activity in plasma, there is promise that much of the confusion of the 1960's about the physiologic role of glucagon during acute flux of metabolic fuels may be dispelled. As Unger himself points out, it is time now for investigators outside of Dallas to attempt to corroborate his observations. Another exciting field to follow is the developing understanding of peptide hormone-membrane receptor interaction, which Rodbell describes in his chapter.

There is something in this monograph for chemists, biochemists, physiologists, immunologists, pharmacologists, internists, and cardiologists. The book is particularly useful for its 1400 references, and it should be made available to research fellows, house staff, and medical students. They probably won't be able to afford it for themselves. If that is your problem, too, then watch for Piero Foà's excellent paper "Glucagon: an incomplete and biased review with selected references," which should appear soon in the journal of the American Society of Zoologists (the *American Zoologist*).

PHILIP W. FELTS
Nashville Veterans Administration Hospital and *Department of Medicine, Vanderbilt University, Nashville, Tennessee*

Wild and Captive Animals

Behaviour of Wolves, Dogs and Related Canids. MICHAEL W. FOX. Harper and Row, New York, 1972. 220 pp., illus. $10.

In this monograph many aspects of the behavior and social organization of hand-reared wolves and other canids (mainly foxes, coyotes, jackals, and domestic dogs) are outlined, compared, and contrasted, with the aim of providing an understanding of behavioral evolution and some of the consequences of domestication. The author hopes in this way to provide a stimulus for further studies.

An adequate classification of canids is provided in the first chapter, but little is given on the evolution of behavior, and I was disappointed that the account of canine ancestry stops with *Tomarctus*, the forerunner of wolves, foxes, and dogs, since the subsequent evolutionary development, though its details can only be conjectured, is most instructive.

The most important section of the book is an account of the comparative aspects of behavior in several canids, with in addition an illuminating comparison of facial expression in canids and primates. This difficult subject is well presented in an easy, flowing style with superb photographs which enable the reader to judge the significance of visual signals (shoulder stripes, cheek spots, and the like) much more easily than would be possible from line drawings.

I found the description of events leading to the formation of a wolf pack in a four-acre enclosure the most stimulating passage of the book. This account vividly illustrates how studies of captive animals can assist in the understanding of wild animal behavior that is normally difficult to observe.

The chapters dealing with some of the finer points of canine social behavior (sexual and filial bonds, socialization, predation, and so on) are interesting, but are basically brief summaries of earlier works by the author and others and provide little new information. Apart from the section on predation, studies of the wolf dominate these chapters, which is annoying since one would hope to read more about the related canids as the title promises. Possibly more reference could have been made to ecological studies and behavioral field observations, and although the author clearly emphasizes in the preface that much of his description of behavior is derived from captive animals this is not always obvious in the text.

Possibly the worst segment of the book is the account of the relationships between canids and other species. It is poorly documented by field observations, and little is said about the implications of such relationships. Its inclusion detracts from the other chapters.

The final chapter deals with differences and similarities between domestic dogs and several other canids as well as briefly considering the effects of domestication. Several statements here are misleading. It cannot be unequivocally stated, for example, that wolves and foxes acquire information about the population density of like-species

through territorial marking. Also certain functions described, such as scratching and marking, are far more complicated and variable in reality than the text indicates.

Although this book is written basically for the behaviorist there are snippets throughout which will interest nonspecialists, pet keepers, and the like. For example, there is an exciting description of a provoked attack by wolves on the author, as well as descriptions of extrasensory perception, love in wolves, and the problems of raising wolves in the home. Of more significance are the clear distinctions drawn between tameness and domestication and the account of wolf-handler relationships.

All in all, the author has presented the comparative aspects of canine behavior in an excellent manner by the use of precise definitions and fine photographs. Although the experienced behaviorist may be irritated by the occasional bold statement and passage where discussion is inadequate, I think this is an essential book for students and others embarking on studies of canine behavior, since the author has indeed provided a framework for further research.

L. K. CORBETT
Division of Wildlife Research, Commonwealth Scientific and Industrial Research Organisation, Alice Springs, Australia

Production Problems

Aquaculture. The Farming and Husbandry of Freshwater and Marine Organisms. JOHN E. BARDACH, JOHN H. RYTHER, and WILLIAM O. MCLARNEY. Wiley-Interscience, New York, 1972. xvi, 868 pp., illus. $37.50.

It is usual in referring to the field of aquaculture to tout its role in feeding the starving populations of the world. This book does not do that. Its 43 chapters describe and discuss techniques and methods for culture of animals ranging from common carp and a number of other fresh- and saltwater fishes to various crustaceans and a number of species of mollusks. Even short chapters on the culture of seaweeds and edible freshwater plants are included. Each chapter attempts to follow a reasonably standard format to include background information on the species under consideration, specialized techniques that have been found suitable for particular areas, statistics on yields, harvests, and marketing, and thoughts on parasites, diseases, and difficulties. The treatment of individual species, depending largely upon information available from other sources, varies considerably in breadth and depth, but major references at the conclusion of each chaper will presumably enable the reader to pursue the matter in as much detail as he finds desirable. The authors have been liberal in their inclusion of tables and figures, many of which provide vital information concerning the yield that can be expected from a program of a particular size over a specific period of time. The appendix, "Pond siting and construction," should be extremely useful to those who are interested in beginning exploratory studies slightly below the level of a commercial venture. The index of persons, places, and institutions currently working in aquaculture should be invaluable to those who wish to communicate in search of additional information. There are also indexes of names of plants and animals and of subjects discussed.

The opening chapter, "General principles and economics," presents a candid consideration of the state of the art without beating the drums. Although the volume will not be of great use to scientists who are already involved in aquaculture, it provides for the first time a reasonably complete source of information from which a host of others can learn about the field. One hopes it will be read by those government agency officials who continue to claim that aquaculture will soon solve the world's food problems.

JOHN D. COSTLOW
Duke University Marine Laboratory, Beaufort, North Carolina

Salt-Adapted Plants

Biology of Halophytes. YOAV WAISEL. Academic Press, New York, 1972. xiv, 396 pp., illus. $18.50. Physiological Ecology.

In this monograph Waisel has drawn from an old and varied literature and from his own experience to attempt the first comprehensive synthesis in English of the biology of plants which grow and complete their life cycle in habitats of a high salt content. These plants, the halophytes, have amused plant biologists for generations while more practically motivated efforts have been directed to the salinity responses of salt-sensitive, agriculturally useful species. At a time when priorities are being reassessed and the central place of halophytes in valuable coastal marsh and inland saline ecosystems is increasingly appreciated, it is sobering to be reminded by the author that not much is known of halophytes.

The book begins with outlines of the sources of salinity and of the formation of salines and concludes with ecological notes on marine and terrestrial halophytes. Ranging across many aspects of the biology of diverse species the author naturally uncovers little which is adequately documented. The bulk of the book is devoted to the physiological and anatomical features of halophytes, and it is at this fundamental level that important questions are easier to specify. Osmotic adjustment, for example, is central to the water relations of halophytes, yet it is not clear how the ion absorption processes of halophytes are regulated to achieve this adjustment. Much attention has been given to the salt-secreting glands in leaves of halophytes, but, as the chapter dealing with these shows, the activity of glands is poorly correlated with overall salt relations of the shoot. There is a growing consensus that enzymic proteins of halophytes, unlike those of halophilic bacteria, are not particularly insensitive to high levels of electrolytes and show no salt-activation phenomena which distinguish them from enzymes of other plants. It seems possible that the regulation of ionic activity in metabolic compartments is an important feature of halophytes, yet specification of compartmental ionic activity remains extraordinarily difficult.

These are but a few of the "gaps in knowledge" which the author has undertaken to expose. He might have been more successful in doing so if the data had been presented in a more ordered way and if more critical assessment had been offered. It is often difficult to establish a balance between critical observations and marginally relevant extrapolation. Inconsistent arguments sometimes appear, as for example in the double standards adopted in the application of Lineweaver-Burk plots to ion absorption and to plant competition. For these reasons *Biology of Halophytes* may be unsatisfactory as a text, but it should stimulate physiologists and ecologists to repair the threadbare fabric of halophyte biology.

B. OSMOND
Department of Environmental Biology, Australian National University, Canberra