## Hooved Animals

**Reproductive Behaviour in Ungulates**. A. F. FRASER. Academic Press, New York, 1968. x + 202 pp., illus. $8.

This book is a brief, straightforward résumé of literature on reproductive activities and their determinants in hooved animals. According to the author there are more than 200 ungulate species extant; he makes at least fleeting reference to 65 of these. Neither by intent nor achievement has he provided an exhaustive account of any one species. More space is devoted to domesticated than to wild species, as is to be expected given the relative amounts of data available.

At several points Fraser emphasizes the nice relations that can exist between a wild ungulate's behavior and its environment. For example, he points out that breeding and gestation periods are related in ways that lead to parturition during clement weather. He also suggests that synchronized parturition and temporary abandonment of the young following the first nursing are characteristic of species that give birth in relative concealment. These biological ideas are useful in bringing together data from several species.

The information presented on domesticated species points up how many interesting problems have been raised but not yet fully resolved. Behavioral synchronization of estrus, the role of female novelty in increasing the male's copulatory activity, and the mechanisms of mother-young recognition are research areas that can be pursued in several domesticated species. Also, with respect just to the pig, the issues of teat preferences and maternal cannibalism offer good research opportunities.

Several features of the organization of the book are puzzling. The first two chapters present introductory material in endocrinology, ethology, and psychology. The treatment is unnecessary for a specialist and insufficient for a beginner or second-course student. Who is the intended audience? In later chapters there are several instances in which data that ought to be together are separated. This is particularly noticeable in the treatments of the effects of both light and temperature on receptivity (pp. 36 and 67, 37 and 47 respectively) and in the treatment of abnormal maternal behavior (pp. 129 and 155).

The behavior of ungulates has not yet figured largely in the schemes of American comparative psychology. In regard to mammalian reproduction, with a few exceptions, psychological attention has been focused on an "axis" that runs from rodent to man through carnivores (meaning domestic dogs and cats) and nonhuman primates (meaning until recently a few monkey species observed in zoos and laboratories). The reasons for this neglect have nothing to do with the value of ungulates as subjects of comparative behavioral study. The truth is that ungulates are large animals while psychologists have traditionally had relatively small laboratories and even smaller inclinations to leave them for the field or the farmyard. This situation is beginning to change, and Fraser's book may, one hopes, aid the progress of this evolution.

GORDON BERMANT
*Department of Psychology,*
*University of California, Davis*

## Physical Performance

**Exercise Physiology**. HAROLD B. FALLS, Ed. Academic Press, New York, 1968. xiv + 474 pp., illus. $17.50.

Exercise physiology today occupies a position comparable to that of pathology a hundred years ago when Carl von Rokitansky of Vienna persuaded the Emperor of Austria to issue a decree incorporating the subject in the medical curriculum. The problem in pathology then was, as it is today in exercise physiology, what the subject was to comprise.

About 20 books on exercise physiology have appeared during the past decade, some of them good, some mediocre, some bad. On the whole, the volume edited by H. B. Falls belongs in the first category, notwithstanding the fact that its 15 chapters are of varying quality. Most of the 19 authors of the opus are nonmedical. The arrangement of the book into three sections—Basic Physiology, Special Problems, and Running and Water Sports—exemplifies the difficulties ubiquitously encountered at present in the search for the identity of the subject. The chapters by E. Asmussen on "The neuromuscular system and exercise," by R. Margaria and P. Cerretelli on "The respiratory system and exercise," and by T. Adams and P. F. Iampietro on "Temperature regulation"—all of them expertly written—could form part of any up-to-date textbook of general human physiology. A chapter by Fred Wilt on "Training for competitive running" is of interest to track coaches. P. J. Rasch and I. Dodd Wilson discuss three clinical aspects of exercise, namely "athletic pseudonephritis," "march hemoglobinuria," and "myoglobinuria." Chapters on "Nutrition and exercise" by Geoffrey H. Bourne and on "Doping and athletic performance" by Richard V. Ganslen reiterate that "the role of diet in athletic performance remains controversial" and that "we do not know of a pharmaceutical substance which will improve the athlete's biological reserves for competition." James S. Skinner, the physiologist, surveys selected portions of the literature on "Longevity, general health, and exercise." Allan J. Ryan's essay "The physician and exercise physiology" begins with a three-page summary of "historical contributions made by physicians" and continues with brief accounts of such diverse themes as "special qualifications of the physician-physiologist," "the sport physician," and "the dynamic physical examination." Ryan also refers to rehabilitation, first aid, and injury sustained in exercise activities. A model of what a chapter in a book of the kind under review should be is the one by A. R. Behnke on "Physique and exercise."

In the not-too-far-distant future exercise physiology and the various branches of sports medicine of which it partakes will have to be more clearly delineated. Clinical sports medicine *sensu strictiori* is at present in its infancy and will have to include a number of aspects of which sports medicine in the United States has so far taken little cognizance, among them applied pharmacology and neuropsychiatry. The importance of the latter discipline must have been obvious even to laymen who saw the many manifestations of cerebral hypoxia in athletes during the Mexico City Olympic Games. Also, more attention ought to be given to such fundamentally important pathophysiological issues as the enhanced susceptibility of highly trained youths to virus infections, more especially of the respiratory and gastrointestinal as well as the central and peripheral nervous system. Sports traumatology must be treated as distinct from general surgery and concentrate on surgical problems of athletes, such as head injuries in boxing and football, on which Spillane in England and Unterharnscheidt in Germany have written important monographs. The indispensable role of exercise in rehabilitation

will have to be taken into account, with special consideration of sport for the handicapped, now being studied by such experts as Sir Ludwig Guttmann, Hans Lorenzen, Max Halhuber, and Daniel Brunner.

Eventually, the writer of a book on exercise physiology will have to be able to take it for granted that his readers are acquainted with standard works on medical physiology and biophysics such as those by Ruch, Bard, and Sodeman, as well as with the extensive literature on coaching. Much of the material contained in Harold B. Falls's new and well-produced volume will be found relevant to such a treatise.

ERNST JOKL
*Exercise Physiology Laboratory, University of Kentucky, Lexington*

## Plant, Soil, and Atmosphere

**Water Deficits and Plant Growth.** T. T. KOZLOWSKI, Ed. Vol. 1, Development, Control, and Measurement (xiv + 394 pp., illus. $17.50). Vol. 2, Plant Water Consumption and Response (xiv + 336 pp., illus. $15). Academic Press, New York, 1968.

Knowledge of plants as a factor in water consumption and of water as a factor in plant growth and development has never been so important as in this age of ever-increasing demands for water conservation and higher crop yields. This two-volume treatise on plant-water relations provides a timely and authoritative reference for workers of many disciplines involved in the surging research activity of this field.

Fourteen prominent plant, soil, and atmospheric scientists from the United States and abroad contributed to this work. Volume 1 is devoted largely to discussions of the physical properties of water in plants and soils and of the physics and dynamics of water movement through the complex soil-plant-atmosphere continuum. Here the authors make use of basic principles of heat and mass transfer and the tools of mathematics to emphasize the conceptual point of view. The concepts generally are related well to plant structure and function and supported by pertinent literature and experimental evidence. In some places, however, the physical descriptions are terse, and many readers probably will find it necessary to consult other references for full comprehension and appreciation of the particular matter being discussed.

The continuing terminology problem of how best to describe the energy state of water in soil and plant systems is considered in detail by the late S. A. Taylor and touched on from time to time by other authors. While it is good to see the term "water potential," based on the thermodynamic concept of chemical potential, somewhat formally adopted for the entire treatise, there are some inconsistencies in its use by various authors and some unnecessary uses of the related, but less meaningful, diffusion pressure deficit terminology.

Included in volume 1 is a long and exceptionally fine chapter by H. H. Barrs on the determination of plant water deficits. Although some readers will question some of his views of thermocouple psychrometry for measuring leaf water potential, his discussions of various methods nevertheless provide useful guidelines, and, one hopes, will help standardize the methodology of the field.

Volume 2 is concerned with applied aspects of plant-water relations. Included is a chapter by P. W. Talboys on vascular wilt diseases, a unique contribution not found in earlier works devoted to plant-water relations. Otherwise, the volume is concerned with evapotranspiration from agricultural crops and forest stands and with physiological and growth responses of herbaceous and woody plants to water deficits. However, probably not more than 25 percent of the combined text of the two volumes is devoted to growth responses. Even though this is an improvement over existing texts on plant-water relations, one can validly question whether the entire work is properly titled.

The relatively small coverage given to the physiological role of water in plant growth unfortunately reflects the amount of past research on the subject. C. T. Gates in his excellent chapter on the effects of water deficits on the development and growth of herbaceous plants acknowledges that most research on plant-water relations has been devoted to the study of water movement into, through, and from plants, and he makes a strong plea for future emphasis on truly definitive analyses of the growth response to water deficits.

Indeed, this approach to plant-water relations research deserves increasing attention. Perhaps one of the most successful ways we can increase the water use and production efficiency of crops is by incorporating into the plant genetic makeup adaptive mechanisms for maintaining favorable rates and quality of growth under suboptimum water conditions. This can best be achieved by generating selection criteria from a better understanding of the biochemistry and physiology of water in growth and in water-deficit control mechanisms.

The authors of this treatise do not emphasize this point of view, but their contributions summarize existing knowledge and concepts of plant and soil water relations on which the wide range of workers charged with the responsibility of increasing water use and production efficiency can build. These contributions are important and useful additions to the field.

EDWARD B. KNIPLING
*Soil and Water Conservation Research Division, Agricultural Research Service, Gainesville, Florida*

## Radiation Reactions

**Energetics and Mechanisms in Radiation Biology.** Proceedings of a NATO Advanced Study Institute, Portmeirion, Wales, 1967. GLYN O. PHILLIPS, Ed. Academic Press, New York, 1968. xviii + 530 pp., illus. $22.50.

Under the joint direction of G. O. Phillips and R. Mason, 36 radiation scientists gathered in Portmeirion, Wales, 1–11 April 1967, for an Institute sponsored by the North Atlantic Treaty Organization. Their subject: the fundamental physics and chemistry of radiobiology. Their intent: mutual education and enlightenment. Their contribution to radiation research: a large, well-produced volume consisting of 32 papers covering a gamut of topics from the production of elementary radiochemical species in water to radiation effects in living cells and tissues.

For the wider audience to whom this monograph is addressed, it should be noted straight away that more than 80 percent of the material concerns radiation physics and chemistry. Perhaps this is justified in view of the diverse nature of the radiation reactions involved even in homogeneous condensed matter, but it follows that the biological content is restricted with respect to topics and points of view. The Institute itself may have succeeded in developing a meaningful level of interdisciplinary communica-