are major determinants of the population densities of breeding birds. Moreover, Fretwell presents some evidence that individual field sparrows, *Spizella pusilla*, with breeding territories on their wintering grounds (broom sedge habitats) have higher winter survivorship than individuals nesting in habitats different from the wintering habitats; however, the latter are better breeding territories in that reproductive success per breeding season is higher in them. Because the longer-lived birds produce fewer progeny during any given reproductive season, the total production of offspring over the lifetimes of individuals with each type of breeding territory may be comparable.

Fretwell envisions a balanced system in which the average fitnesses of individuals breeding in different habitats are equalized by these means and by both intraspecific and interspecific density adjustments within each habitat type. This concept of a population is very appealing, and certainly Fretwell's thesis that winter is a critical season for many temperate-zone birds is amply documented and indisputable.

The preface contains a curious, yet lucid, explanation of Levins's fitness sets and adaptive functions couched in the anthropomorphism of "the strategy of being an ecologist," which could be useful to students to whom these concepts are new. Unfortunately, however, this exercise is entirely irrelevant in the context of the present book, since fitness sets are not used elsewhere. Instead, Fretwell develops a number of highly specific, largely graphical, models and theories to account for population densities under a variety of different assumptions and conditions. No truly general statement about population densities in seasonal environments seems to emerge except that seasons are important and that winter survival may constitute a "bottleneck."

The book is rather difficult reading, often unnecessarily so; some of the figures (for example 18, 24, and 46) are pretty cluttered and require considerable effort to fathom. The title is somewhat misleading as the book "concentrates too much on birds" (p. 205), although muskrats, thrips, the codling moth, and side-blotched lizards are briefly considered.

This book, the fifth in a series of monographs on population biology, seems much less likely to become a minor classic than some of its predecessors. Nevertheless, its purpose will presumably be served if avian ecologists consider the biology of their subjects in the winter as well as during the breeding season.

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The Motor Control System

Mechanisms Regulating the Discharge of Motoneurons. RAGNAR GRANIT. Thomas, Springfield, Ill., 1972. x, 78 pp., illus. $8.25. Sherrington Lectures, University of Liverpool, 11.

This monograph is a comprehensive account of a Sherrington lecture given by the author at Liverpool. The author has focused on the difference in behavior between phasic and tonic alpha motoneurons with special attention to their functional significance. It was about 16 years ago that the author and his collaborators first noticed that mammalian spinal motoneurons may be classified into phasic and tonic types by reflex discharge in response to sustained muscle stretch. Subsequent tests with several criteria, however, have shown a continuous gradation between the two types of motoneurons and failed to separate them qualitatively into two distinct categories. This was not disturbing to Granit, and he rather felt that it would be even more interesting to find out how the merely quantitative differences between these motoneurons are exploited by the organism to develop functionally distinct motor control systems. This book shows that relevance or irrelevance of the experimental results depends simply on what the investigator is looking for.

Any movement of the body is produced by contractions of skeletal muscle, and muscle contraction is brought about solely by the discharge of motoneurons. This is the principle on which the author's idea is based, and he defines the motor control system as the neural mechanisms which regulate the discharge of impulses from motoneurons. The author proceeds with the problem of phasic and tonic motoneurons step by step at the mechanistic level; yet, the outcome of each of the analyses is interpreted in terms of the overall function of motor control. The author warns that the basic neural mechanisms analyzed at the cellular level under laboratory conditions should not be generalized too freely. The results obtained from the observations on freely moving animals or on human subjects, no matter how crude the analyses, do not always fit with those predicted from the mechanisms analyzed under simplified conditions. The author intuitively speculates that phasic and tonic motoneurons act as partners and that the proportion of their contributions in each movement is determined by the program formed in the central nervous system. Thus, the properties of phasic and tonic motoneurons once adequately clarified by the author at the mechanistic level seem to be unfortunately merged into an ambiguous functional concept. Those who are mechanism-oriented may criticize this book because of some untestable speculations posed by the author, whereas others who are function-oriented would admire it because of the author's ingenious and imaginative synthetic approach. The judgment depends on how the reader is oriented or how he is biased. Whatever the reader's judgment, no one can deny the author's distinguished contributions to the neurosciences.

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Immunology

The Cells and Tissues of the Immune System. Structure, Functions, Interactions. LEON WEISS. Prentice-Hall, Englewood Cliffs, N.J., 1972. xvi, 252 pp., illus. Cloth, $9.95; paper, $6.95. Prentice-Hall Foundations of Immunology Series.

Contact with a foreign antigen, in the form of a macromolecule or tissue graft, results in the formation of a specific antibody or leads to graft rejection. The cells responsible for this type of immunological reaction are located in the lymph nodes, spleen, thymus, and bone marrow, and are part of the lymphoid system. During the last decade it has become clear that there are at least two types of lymphocytes—the T (thymus-derived) and the B (bone-marrow-derived).

Leon Weiss in *The Cells and Tissues of the Immune System* looks at immunological reactions through the eyes of a morphologist and electron microscopist. The first part of the book consists of a clear and concise discussion