vanced farming methods, and new products ranging from drip-dry cotton shirts to frozen orange juice and shaving cream. Regulatory divisions within ARS conduct programs in animal and plant inspection and quarantine, animal and plant disease and pest eradication, and pesticide control.

For most of its history, Department of Agriculture research remained virtually unknown to the nonfarming public. The publication of Rachel Carson's *Silent Spring*, however, brought ARS into the full light of public comment and criticism. After considerable public and congressional debate, ARS had not only improved its public image but had also received additional research funds it had previously sought unsuccessfully.

Shifting political patterns have had their effect on ARS. Although agricultural research long ago lost its farm orientation, only recently has ARS recognized that its "clients" are predominantly city-dwellers. While basic research activities remain the same, ARS now directs its public information efforts more toward a consumer audience than toward farmers.

Moore has written a light, easily read summary of the administration and work of the Agricultural Research Service. Moore's background as ARS's information director and his attempt to write for a wide audience probably account for his conversational style. Unfortunately, faulty organization mars the book. The reader is frequently referred to future chapters, which often contain little more than second mention of previously encountered subjects. A chronological organization of the material would probably have overcome most of the difficulties. The specialist might wish that the author had furnished less summary and more information.

THOMAS R. WESSEL
Smithsonian Institution, Washington, D.C.

An Aspect of Sexual Behavior

Courtship. An Ethological Study. MARGARET BASTOCK. Aldine, Chicago, 1967. viii + 220 pp., illus. $6.

According to what is written on the dust cover of the British edition, this little book is intended for nonspecialists in animal behavior: sixth formers, university students, "specialists in other fields." It will serve this audience well. Neither the descriptions of facts nor the presentations of ideas are beyond the comprehension of the intelligent general reader, yet the book gives a scholarly treatment of its subject. But the book should also appeal to scientists whose business is the study of animal behavior. They may not find much factual information that is news to them; nor will they find revolutionary new ideas. They will find a concise, selective review that is representative of how European ethology has matured in Britain. They will also find clear thinking clearly expressed on topics about which there has been much muddled thinking and muddled writing. In this book the concept of genetic inheritance is used only as a genetic concept, not, in addition, as a concept standing in for knowledge about the ontogeny of behavior. Protean terms like "instinct" and "drive" either are avoided (neither of these is included in the index) or are introduced with such care that their issue-clouding propensities are given little scope.

The plan of the book is simple. A brief introduction outlines the nature of courtship behavior and the problems it poses. These themes are developed in the three parts which constitute the rest of the book. The first part presents a selection of descriptions of courtship behavior, drawn from fish, birds, and arthropods, which serves to illustrate ways in which patterns of courtship in different kinds of animals resemble and differ from one another. The second part is about evolutionary aspects of courtship: survival value, evolutionary antecedents, genetics. The third part is about the more immediate causal control of courtship: temporal and sequential patterns in courtship and what they imply or suggest, hormonal mechanisms, neural mechanisms.

Of the three parts, the one about evolutionary aspects is the longest and perhaps the most authoritative. On some of the topics dealt with here Bastock writes with the insight and firsthand knowledge of one who has contributed to their elucidation through her own research. But it might be said that, with its roots in what can be referred to as classical zoology, the ethological tradition in which Bastock stands has always had a bias in favor of evolutionary approaches to behavior, even though this bias has often gone unrecognized. For example, the facts on the basis of which Lorenz and Tinbergen built their theories of instinctive control systems tended to be facts about the adaptive significance or functional patterning of behavior, rather than facts about how sensory, neural, and hormonal systems work. The confusion latent in this sort of argument has been a weakness in much ethological theory. Fortunately there is little trace of it in Bastock's book. For the most part she has kept questions about adaptive significance and questions about proximate causation clearly apart; and for her discussion of causal mechanisms she manifestly has done her homework. (Incidentally, there is one little point here on which her homework let her down. On page 175 she cites a study on *Streptopelia roseogrisia* as the basis for a suggestion about the subject of another study, the "related species" *Streptopelia risoria.* In fact both of these studies were on the same species: the domestic ring dove, which is usually referred to as *risoria* and which is believed to be descended from the wild rosy-gray dove, *roseogrisia*, of North Africa.)

In her preface, Bastock points out that a short book cannot be comprehensive. Perhaps so. But one is surprised at some of the omissions here. For example, there is no mention of "redirection," a concept of considerable pertinence to the topics of conflict behavior and the evolutionary sources of displays, and one which Bastock herself helped to introduce into ethology. Even more to be wondered at is the complete absence of any discussion about ontogenetic aspects of courtship behavior. Admittedly, there is less that can definitely be said on this subject than on those the book does deal with; it has been the least well served by ethologists in general. But a book which purports to be a review of the subject of courtship—a discussion of "its importance in the study of animal behavior as a whole"—should surely at least explain why it makes no attempt to deal with one of the subject's major aspects. Moreover, it is perhaps on this aspect more than any other that we are in need of the kind of clear thinking that Bastock brings to her writing. Numerous other topics have been excluded, some, no doubt, too esoteric and technical for a book of this sort.

A fuller, more comprehensive review of courtship could be written, then. Such a work from Bastock's pen would be a boon to the science of animal behavior.

In the meantime we should be grateful for what she has given us. The prose style may not be the most sparkling we have encountered in recent books on animal behavior; and most of the drawing for the illustrations is embarrassingly bad. But this book is thoroughly sound. Indeed, although it was not the author's intention, one wishes that the book might reach the wide audience that more popularly written books on animal behavior have discovered. Would that all the books written about behavior for nonspecialists were as reliable and scholarly as this one.

C. G. BEER
Institute of Animal Behavior,
Rutgers University,
Newark, New Jersey

Structural Analysis

Mass Spectrometry of Organic Compounds. HERBERT BUDZIKIEWICZ, CARL DJERASSI, and DUDLEY H. WILLIAMS. Holden-Day, San Francisco, 1967. xviii + 690 pp., illus. $17.95.

Within the past ten years mass spectrometry has rapidly developed into a powerful and widely accepted technique for dealing with structural problems of organic compounds. Interest in the subject has been accompanied by a bewildering increase in the literature and in the number of journals reporting studies of fragmentation pathways of organic ions in the mass spectrometer. The present volume addresses itself largely to this problem by offering what is undoubtedly the most up-to-date (through early 1967) and comprehensive collection of facts concerning the mass spectrometric behavior of organic compounds.

The book consists of 27 chapters, each devoted to a specific functional group and its related fragmentation reactions. This organization is based on the view—generally justified—that knowledge of the fragmentation behavior of a simple compound can frequently be extrapolated in a predictive sense to other and more complex molecules. No attempt has been made to include the more complex natural products, which were covered in two earlier volumes by the same authors.

Although not central to the basic purpose of the book, the 44-page introduction is important for several reasons. It provides a much-needed, up-to-date outline of a number of ancillary techniques and concepts, including element mapping and the uses of metastable peaks. Also, the convincing discussion of charge localization and prediction of bond breakage is essential to proper understanding of the "mechanistic" rationale, of which the authors are the primary and most influential proponents. This concept, used throughout the text and frequently in the literature, attempts to describe fragmentation reactions in "ground-state" mechanistic terms familiar to the organic chemist.

The present volume was published within three months of the completion of the manuscript and in spite of its size is remarkably free of errors, an attribute of considerable importance in a rapidly growing field. It should be accessible in every laboratory concerned with organic mass spectrometry.

JAMES A. MCCLOSKEY
Institute for Lipid Research and
Department of Biochemistry,
Baylor University College of Medicine,
Houston, Texas

Describing Particle Systems

Developments in Transport Theory. A NATO Advanced Study Institute, Ankara, Turkey, Aug. 1965. E. INÖNÜ and P. F. ZWEIFEL, Eds. Academic Press, New York, 1967. xiv + 381 pp., illus. $19.50.

Transport theory, here meaning the description, by means of an appropriate equation for the one-particle distribution function, of systems of many particles which interact with each other and their environment, is a ubiquitous and proven tool in physics and engineering. The classical example of this technique is the kinetic theory of gases as initiated by Boltzmann with the introduction of his celebrated equation in the latter half of the last century. Since that time, the same notions have been extended to radiative transport, neutron transport, traffic theory, and other physical problems. The governing equation, be it partial differential or integrodifferential, is usually very difficult to solve, even in the simplest geometries with the most simplified of cross sections, especially in bounded media. Hence recourse is conventionally had to the study of idealized models, and to a variety of perturbation techniques.

The volume here reviewed collects the lectures and seminars given at the NATO Advanced Study Institute on Transport Theory held at Ankara, Turkey, in 1965. It comprises six major contributions from those who lectured, as well as summaries of eight seminars. It has the virtue of any collection of such a nature, namely that there is much material of current interest by leaders in the field; but it also suffers from the vices of disjointedness and of nonuniformity of notation and depth inherent in an undertaking where speed of publication has been deemed more important than the thankless task of coordination and protracted editing.

Two-thirds of the book is devoted to neutron diffusions. Of this fraction a considerable part is concerned with the method of singular normal modes appropriate to a class of linearized problems. Variations on this theme are provided by sections on radiative transport and on plasmas. The emphasis of the book is formal and mathematical, and it is clearly of greatest interest to theorists, for whom it provides a useful halfway house between appropriate original papers scattered through the literature on the one hand, and a balanced, digested, well-integrated, definitive treatise on the other. It has the virtues of the lecture notes of a course, presented by a variety of teachers, for those who are not privy to the lectures.

IRA B. BERNSTEIN
Department of Engineering and
Applied Science, Yale University,
New Haven, Connecticut

Developmental Biology

Calcium in Reproductive Physiology. A Comparative Study of Vertebrates. K. SIMKISS. Chapman and Hall, London; Reinhold, New York, 1967. xiv + 264 pp., illus. $11. Modern Biological Studies.

Advanced students and research investigators in the emerging discipline of reproductive physiology will find this excellent monograph by Kenneth Simkiss rewarding and refreshing. Simkiss focuses attention principally on two crucial problems in the study of the reproductive capacity of higher vertebrates: rates of calcium metabolism and utilization, and calcium pools and