lying them are rarely mentioned. Beginners have no basis for distinguishing techniques little used in the past from methods commonly used at present. Practical advice is also lacking; for example, those starting to use the Zurich-Montpelier system are not told what proportion of the total ground area might be covered by identifiable associations, or how to recognize and sample fragments, transitions, and communities undergoing succession.

Thus the author has sacrificed detailed analysis to superficial coverage of the whole subject, and the book sometimes reads like a catalogue. In spite of this, parts of the text may be useful to undergraduates and postgraduates as background reading, as an introduction to the literature, especially the continental literature, or in choosing suitable methods for describing vegetation and analysing the results. T. J. KING

Biological Systems

Annual Review of Ecology and Systematics. Vol. 2. Edited by R. F. Johnston. In association with P. W. Frank and C. C. Michener. Pp. ix+510. (Annual Reviews: Palo Alto, California, 1971.)

ONE-THIRD of the reviews in this volume are good and most of the others are useful. In the first, Ayres and Kneese discuss the possibility of a stationary economy and show that in the United States the present problem of the use of material and the generation of waste is due not to population growth but to the increase in productivity. They accept the present UN projections of population growth and suggest four forms of solution, to estimate social costs, to develop technologies which conserve materials and energy, to develop clusters of small cities and to reduce the population growth rate to zero in such a way that the best age distribution is obtained. They extend their arguments to a period of more than 60 years ahead and argue the consequences of a stable population of $1.5–2.0 \times 10^{10}$. It is a most interesting review and doomwatchers should read it.

Theories of feeding strategy are reviewed by Schoener. These are based on time spent feeding, with or without search, in terms of metabolic cost to growth or survival benefit. Any animal has to maximize its future reproductive output in face of its deficit in time spent feeding and searching. There are a number of solutions to such a problem, for example, time minimization and energy minimization. There are specialist and generalist feeders and large animals are probably more efficient than small ones. Several models of feeding and predation are described, leading to the idea of an optional foraging space, a quantitative basis to the concept of territory. This article should be read by ecological model makers.

The tricky problems of river biology have been overcome to some extent by the use of laboratory streams, or fluvaria. Warren and Davis have studied the production and density dependent growth of a river fish, the sculpin. Growth depends on insect density which itself varies inversely as the biomass of sculpins, so there is density dependence in two parts of the two trophic layered system. Faller reviews the subject of oceanic turbulence very well and explains all the present arguments on scale and coefficients. He also analyses the Langmuir circulation which seeks to explain windrows on the surface of the sea and shows that it is generated by the ruffling or breaking of wave crests.

There are two difficult papers on numerical taxonomy: the source of difficulty lies partly in terminology and partly in the attempt to express continuous variables in rigid dendrograms. A paper on the biological control of insects notes that eighty-one successful programmes had been completed. Maguire discusses dispersal and colonization of protozoa in small patches of water (phytotelmata) on trees in a tropical forest; the balance of immigration and emigration was disturbed by predatory mosquitoes and no relation was found beween diversity and the coefficient of variation in the number of taxa.

These are some of several valuable reviews in what makes on balance a worthwhile volume. D. H. CUSHING

Ethology of Sheep

Mountain Sheep: a Study in Behaviour and Evolution. By Valerius Geist. Pp. xv+383. (University of Chicago: Chicago and London, 1971.) £6.55.

DR GEIST is an excellent naturalist writer drawing his reader into his own enthusiasm for his subject. He reports on an important ethological study of three races of mountain sheep, Dall's, Stone's and Big Horn sheep. He is also one of the pioneers in the study of the evolution of social behaviour. On which aspect of this book to find space to comment upon when praise can be so deservedly given to all?

The evolution of social behaviour is, of course, the most interesting and contentious topic discussed in *Mountain Sheep*. Dr Geist adopts the evidence of a geographic and evolutionary cline among the races of mountain sheep and a comparison of their morphology and behaviour as the basis of his powerful argument.

The flaw I find in his argument is that Dr Geist does not find a place in it for a consideration of the significance of differing sizes of home range groups among different races of sheep. Comparative data are lacking and it can also be agreed that the adaptive value of varying size of group requires proof. Nevertheless, I would suggest that as the primary productivity of the habitat varies so must the size of the home range group or the content of its range, or both, if the sheep are to adapt successfully to the environment and to colonize new areas.

In future editions Dr Geist may care to discuss this point, and I would also be glad to read a more detailed treatment of the interesting attempts to re-establish mountain sheep in various localities.

This is a well-written, interesting book, excellently produced with outstanding photographs.

R. F. HUNTER

Deformation and Flow

Advanced Rheology. By Markus Reiner. Pp. xiv+374. (H. K. Lewis: London, 1971.) £8.

PROFESSOR REINER, by his many published papers and books and by his lectures to international audiences spread over many years, has done as much as anyone to make rheology a respectable branch of physics. His latest work, which he describes in his preface as an essay at a textbook, is valuable in placing on record in one place his account of the historical development of the subject, and his perspective view of the basic concepts that the theoretical rheologist needs to have formulated in mathematical terms.

Except for a short final chapter on elementary structural theories (microrheology), the book is mainly concerned with equations of state describing idealized materials on which macrorheological theories can be based. The author shows what is now regarded as an excessive zeal for spring–dashpot models of some complexity, and for the laborious derivation of linear differential equations from them. He permits himself the non-rigorous rectangular-box type of argument to establish fundamental formulae such as the equation of continuity and the stress equations of motion, and the engineer's Mohr-circle diagram to represent a two-dimensional state of stress. He restricts the term

strain to mean what other authors would call recoverable strain, so that it is in general only a part of the deformation of a body. By attaching somewhat more importance than is usual to the particular mathematical measure of a physical concept (deformation, or rate of strain) the author is able to isolate, for separate treatment, linearity, parametric non-linearity, deformational non-linearity and tensorial non-linearity in equations of state.

The deformation and flow situations discussed in any detail are simple ones, for example those in which an element is subjected to an elongational or simple shearing flow. The reader is left to think out for himself what will happen in more complex situations, and perhaps the main value of this textbook will be to stimulate others, new to theoretical rheology, to take it up as a serious study. An index, a bibliography, notes on some of the more mathematical points at the ends of chapters, and many diagrams, make this an easy book to read and to use for reference. J. G. OLDROYD

Chemical Bonds

Coordination Chemistry. Edited by Arthur E. Martell. Vol. 1. Pp. xxii+577. (Van Nostrand Reinhold: New York and London, February 1972.) £16.25.

FROM a study of a group of transition metal compounds that did not seem to obey the inadequate theories of chemical bonding at the turn of the century, coordination chemistry has become an approach to inorganic chemistry that focuses attention upon bonding, stereochemistry, equilibrium and mechanism. This new series of three volumes seems to exhibit a desire to present the subject as it was in the glorious days of the late fifties and the early sixties and therefore suffers from all the consequences of trying to turn the clock back.

Volume 1 has apparently suffered an extremely long gestation period (one contribution was submitted in April 1967) and has been beset by unmet deadlines resulting in the need for some rearrangement in the series. It consists of two sections dealing with bonding and spectra and equilibrium and thermodynamics respectively. On the whole, the individual contributions are by distinguished and respected experts in their fields and are of a very high standard throughout. The first two chapters on electronic structures and electronic spectra are by Ballhausen and Gray and by McClure and Stephens respectively. Unfortunately, they overlap significantly at the edges because it should have been obvious that the two subjects do not separate readily. Nakamoto writes on infrared spectra and shows that 50 pages are quite inadequate to cover the topic. He chooses to ignore the work of Hirashi that reassigns the C=C stretching frequency in olefin complexes. The treatment of electron spin resonance by Kuska and Rogers is excellent and Good and Clausen show that, at the moment, if one is interested in the chemistry of iron and tin, it is possible to gain considerable information from Mössbauer spectroscopy whereas devotees of other elements may have to wait patiently for a little longer. Holm and Abbott write on the application of nuclear magnetic resonance to the investigation of structure and bonding and have also included discussion on dynamic ligand exchange processes.

The second part of the book is opened by Hindman and Sullivan on principles and methods: they provide a useful treatment of solvation and solvation number. The examples of complex formation that follow are highly selective and serve to show that the simplified approach that once served to make the study of stability constants highly fashionable is of little value in its own right. Anderegg writes on complexation by multidentate ligands but throws no new light on the chelate effect; and Lars Gunnar Sillen, whose tragic death has robbed this area of chemistry of its leading proponent, contributes a posthumous article on polynuclear complexes in solution. M. L. TOBE

Mouse Neuroanatomy

Atlas of the Mouse Brain and Spinal Cord. Edited by Richard L. Sidman, Jay B. Angevine jun. and Elizabeth Taber Pierce. Pp. xi+261. (Harvard University: Cambridge, Massachusetts; Oxford University: London, January 1972.) £12.

THIS is in fact an atlas of the central nervous system of the mouse strain C57BL/6J, chosen by the authors because of its interest to those concerned with the genetics of abnormalities in the central nervous system. It presents a large and comprehensive series of low power photomicrographs of the brain sectioned in all three planes, together with a series of cross sections of the spinal cord at all segmental levels. Additional diagrams of the gross external structure of the brain are provided with keys to enable the approximate position of each section to be determined relative to external features. There is little doubt that the nomenclature used in some regions will cause much blenching among specialists—as much by omission as supposed "error"—but the system chosen can be defended at very least on the grounds that so little work has been carried out on the mouse brain that it is better to err on the side of neutrality than over-confident committal. Taken as a whole the book provides an excellent base-line for those who have no special interest in neuroanatomy *per se*, and as such it can be thoroughly recommended. K. E. WEBSTER

Senescence

Principles of Mammalian Aging. By Robert R. Kohn. Pp. xiii+171. (Prentice Hall: Englewood Cliffs, New Jersey, October 1971.) $7.95 cloth; $4.95 paper.

MANY people in the field of gerontology will admit to having got there more or less accidentally. The reasons why biologists of any description should become interested in ageing are too numerous and mostly too obvious to mention. In this book the author sets out to map the main feaures of the field and thus make easier the tiro's first explorations. He succeeds well, providing a lucid factual account of the phenomena of ageing and outlining numerous areas of doubt and contention. Although the book is especially concerned with mammalian systems, the first two-thirds of it deal with the generalities of ageing at molecular and cellular levels, the relevance of which is by no means confined to the mammals.

Much is known about the ageing processes, but little is yet understood. Several groups of factors seem to contribute to ageing in mammals. Of these Kohn seems inclined to favour for the principal role those which are associated with changes in collagen, and he does perhaps a little less than full justice to possible cellular mechanisms. This may be partly because the literature since 1968 is not covered, and hence no account is taken of recent data which confirm the relationship between the limited life-span of human fibroblast strains *in vitro* and the ageing of cells *in vivo*. Similarly, neither Orgel's "error catastrophe" hypothesis nor the recent experimental work related to it is mentioned.

The dust-jacket states that "non-biologically oriented readers will find the answers to the questions about aging that plague everyone". They will not, and it seems most unlikely that the author himself would make any such claim. But the book will be a valuable introduction to the subject for many students of biology and medicine. H. S. MICKLEM