their flight times will be considerably shorter than those of vehicles using chemical systems. The history, description, and dynamics of various propulsion systems—electrothermal, electrostatic, magnetofluid-mechanic, and photon propulsion systems—are considered in the first three chapters. Chapter 4 deals with the flight mechanics of these systems in terms of specific energy, maximum payload ratio, terminal velocity, initial acceleration, flight distance, and time. Optimization for maximum payload, maximum terminal velocity, and minimum transfer time are considered.

Chapter 5 deals specifically with the ion motor—its components, the production of ions, space-charge effect, beam formation, and its neutralization and heavy particle systems. Sources of electrical power in space—solar, nuclear, thermionic, and thermodynamic are covered in the next chapter. The navigation and missions of electrically propelled space vehicles are dealt with in chapters 7 and 8. Cesium is the most promising material for the ion motor, and its physics, chemistry, and metallurgy are given in chapter 9. In the last chapter the author gives his conclusions and appraises the future prospects of such systems. No ion engines have been tested in space, and the most serious problem is that of developing efficient and reliable nuclear-electric power sources in the kilowatt and megawatt ranges.

The material is illustrated with many figures and tables, and nearly 500 references are given. The book is timely, and my only criticism is that Stuhlinger is not selective in considering details. But that is, perhaps, unavoidable at this stage in the development of the subject.

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Economic Entomology

Entomologie appliquée à l'agriculture, Traité. vol. 1, *Coléoptères.* Published under the direction of A. S. Balachowsky. Masson, Paris, 1962–1963. 2 parts, xxvii + 1391 pp. Illus. N.F. 162.

This is the first volume of a series on economic entomology, which will be composed of eight volumes in which some 60 contributors will treat the Coleoptera; the Lepidoptera; the Diptera and Hymenoptera; the Thysanoptera and Heteroptera; the Homoptera; Orthoptera, Dictyoptera, Dermaptera, and Isoptera; Lesser Insects, Mites, Myriapods, and Molluscs; and the Nematodes. Sixteen of the contributors helped with this volume. The area specifically covered is Europe (excluding the U.S.S.R.), North Africa, Asia Minor, and the Near East to the border of Pakistan and India. However, the European area of the U.S.S.R. is at least partially covered because much of the cited literature pertains to the U.S.S.R. This work reminds one of Balachowsky and Mesnil's huge work, *Les insectes nuisibles aux plantes cultivées* (1935–1936), in two volumes and 1921 pages. However, the *Traité*, because of its larger size and scope and its modernity, cannot be considered merely a revision of the older work. The new work is truly new. In the *Traité* only insects harmful to farm plants are considered. Thus, insects that affect farm animals are excluded; insects that are harmful to timber and ornamental trees are not included, but those that affect fruit trees are. Insects that attack stored products are discussed. The first volume, entirely on beetles except for a short introduction, is bound in two parts.

In the introduction, insects in relation to man and man's world are discussed. The contents are arranged according to the classification of beetles, beginning with the Carabidae and ending with the Platypodidae. A family is very briefly characterized and, when possible, generalizations on biologies of the family are given. Then each economically important species is discussed separately under the following headings: description (very brief, usually morphological but occasionally ecological, and often accompanied by an illustration of the adult); biology or life history (usually detailed, often with a picture of the larva or of damage caused by some stage of the beetle); and finally control measures. Then, extensive bibliographies, one general and one for each family discussed, are given. Finally, an index to insect taxa and a table of contents are provided at the end of the volume.

The literature cited (almost all of it quite recent) for each species is very helpful. Published information on the life histories of beetles is often hard to locate because it is scattered among various publications, often buried in articles, and usually not so well treated by abstracting journals as taxonomic information. The authors seem to have combed the Russian literature on beetle biologies.

The descriptions of the biologies of the species, based on information that the authors have brought together from many sources, will be the important contribution of these volumes. That different amounts of knowledge are available with respect to the various species has caused some treatments to be imbalanced, but this is to be expected. For example, 99 pages are devoted to the Colorado potato beetle alone, whereas all of the Elateridae are covered in 30 pages. Relative importance to agriculture has required that more than half of the total pages be given to the Curculionidae and Chrysomelidae; the Scarabaeidae rank third in the page allotment, with 21 other families ranged far behind. So much information is available on some species that subheadings are needed, such as oviposition, distribution, migration, and the like. Quite often life history, which occupies by far the most space, and damage are discussed under separate headings. The sections on control, which are placed at the end of the discussion of each species, seem very short and superficial for a book on economic insects. However, plans have been made to publish a separate series on control.

I saw few faults. One of the most exasperating, and important, is concerned with the literature citations. Far too often the author and year cited under the specific name is not accompanied by a full citation in the bibliographies at the end of the volume. Half the citations under some species of Tenebrionidae, for example, referred to nothing in the terminal bibliographies. These faults should be corrected, for the great amount of literature cited is one of the strong points of the book. I noted one error in the illustrations—the same photograph seems to have been used in Figs. 70 and 79 for two different species of scarab larvae. An index to host plants should have been provided, especially since the book is arranged according to beetle systematics. And finally, the American reader may have some difficulty with the scientific names used, especially those for the weevils. That usage of names should not be considered a fault, however; our differences of nomenclature are differences of interpretation, not of facts.

This is a fine start on an important series of books. Americans will find

discussions of some species and many genera that are also present in our area. And, besides, we can often learn how to study our own species by reading what has been found in related species in another area. This volume should prove very useful, especially to those interested in the biology of beetles. I have never seen so much detailed biological information on beetles assembled in one place.

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Aardvark to Zorilla

The Management of Wild Mammals in Captivity. Lee S. Crandall. University of Chicago Press, Chicago, 1964. xv + 761 pp. Illus. $13.50.

The modern zoological park has come a long way from the earlier menagerie, but its basic purpose is still the same—public exhibition, with emphasis on large, unusual, exotic animals. Bars and screen fencing have given way to moats or glass enclosures, but their purpose is still restraint of the animals and ease of viewing them. Maintenance is aimed at satisfying the animals' physical and psychological needs and displaying them with at least a suggestion of their normal habitats and ways of life. Today another objective is often the perpetuation of threatened species. Curators and keepers measure their success by the number and rarity of the species displayed, and by the general health of their specimens, as indicated by longevity records and breeding performance. Most of their technique has been acquired by dint of hard labor, trial and error, and frequent disappointment. There has long been a need for a compilation of husbandry data—a bible as well as a record-book—for the profession. Lee Crandall now provides such a book dealing with the mammals. No one is better qualified than he to do so, and he has done it magnificently.

At an early age the author forsook a medical tradition in favor of zoology. Schooled at Cornell and Columbia universities, in 1908 he joined the staff of the New York Zoological Park, without salary, and began learning the game the hard way, as a keeper's assistant. His talents were soon recognized, and he ascended through the ranks to the position of general curator in 1943. He worked as an associate of William T. Hornaday, Raymond L. Ditmars, and William Beebe. He participated in collecting expeditions to British Guiana (1909), Costa Rica (1914), New Guinea (1928), Australia (1929, when he was shipwrecked between Port Moresby and Sydney), and made frequent visits to zoos in Europe and elsewhere. He developed special interests in the breeding and speciation of marmosets, in birds of paradise, and in display forms for birds. Besides numerous journal articles, he wrote two books—*Pets and How to Care for Them* (1919) and *Paradise Quest* (1931). Known and honored internationally for his knowledge, judgment, and warm personality, he is a fellow or honorary member of many American and foreign societies. But above all, in the present connection, is that rare trait of mutual understanding between him and his charges, his intuitive perception of the animals' personalities and problems. In 1952 he was retired as Curator Emeritus. The years since have been just as busily occupied in gleaning, from his many friends throughout the world, from his personal experiences, and from an exhaustive survey of the literature, the materials for this volume.

In scope, the book considers all kinds of mammals with definite captivity histories. Cetaceans are excluded as inappropriate, but treated in detail are countless species, and occasionally subspecies, representing 82 families of 18 orders. Common and technical names are given; descriptions deal with color, general appearance, weight, shoulder height, and such external characters as may be observed on living animals; habits are discussed, particularly as they affect treatment in captivity; longevity records are presented; breeding habits, gestation periods, quantities and kinds of food, general care, and management methods employed are all covered as fully as may be. Related, among others, are accounts of the highly specialized care accorded a pair of platypuses, of the reception of a rhinoceros newly arrived from Africa, and of the attention that resulted in successful breeding by a pair of Florida otters. Data for each order are assembled by chapters, together with appropriate references. A good index is included. Far from a recital of dry technicalities, the book is filled with interesting observations, is written in an engaging style, and is enlivened with frequent anecdotes. It surely will prove indispensable to zoo keepers, pet dealers, and others concerned with the care of wild mammals, and will be of much popular and technical interest to a far larger audience.

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Botany in India

Maheshwari Commemoration Volume. *Journal of the Indian Botanical Society*, vol. 42-A. T. S. Sadasivan, Ed. Indian Botanical Society, Madras, 1963. xxxiv + 330 pp. Illus. $7.

This commemorative volume is dedicated to the distinguished botanist, Professor P. Maheshwari, on the occasion of his 60th birthday. The honor is bestowed on Maheshwari for his many accomplishments and for the great influence he has exerted on the development of botany in India. In the words of the editor of the volume, Maheshwari is "regarded as the father, mother, and attending gynaecologist for the subject of plant morphology and embryology in India." His writings, which number 134 titles over a broad range of topics in a span of 34 years, including several authoritative books, represent a tremendous accomplishment.

There is a dedication and a biography with a list of Maheshwari's publications, but the main body of the volume consists of 37 articles contributed by botanists from all over the world. Among the subjects and fields represented by the articles are algae, mycology and plant pathology, bryophytes, pteridophytes, angiosperm morphology and taxonomy, anatomy, palynology, embryology, cytology, cytogenetics, plant breeding, in vitro culture studies, and paleobotany. The character of the articles ranges from reports of original studies to limited reviews and discussions.

It is perhaps appropriate that emphasis on morphology should prevail, but the coverage should hold some interest for all readers. Most articles are timely, and many of them undoubtedly deserve to be considered as significant contributions. Notations concerning the specific topics presented cannot be made here. In general, the volume is well done. The Commemoration Com-