versity in 1949. Prolonged illness thereafter prevented him from completing the manuscript for publication prior to his death in 1959. The present volume owes its existence to Sally Wilens, whose long association with the author has permitted her to select the text and illustrations with judicious perception and in keeping with the author's plan for presentation.

The volume is a summary of Harrison's major research contributions presented in the context of more general problems of embryonic development. Five of the seven chapters are reprintings of major published addresses delivered at various congresses, symposia, and conferences held between 1927 and 1939. The great body of the book, therefore, is the author at his most studied, incisive, and analytical best, which few have excelled. His own scientific work, as well as that of his predecessors and contemporaries, is objectively reviewed as part of discussions of cell differentiation, the significance of tissue culture, differentiation within the nervous system, the origins of symmetry in embryonic primordia, and the application of transplantation techniques to the analysis of embryonic systems. These chapters, although autonomous, collectively afford a rich source of historical perspectives, as well as provide insights into the status of experimental embryology in the third decade of this century as seen through the eyes of the preeminent American vertebrate experimental embryologist of his day. This selection of essays should take its place in the enduring literature of developmental biology.

It is desirable that the volume be read with an awareness of the time of its writing. One is impressed anew with the penetrating analyses and deductions that were possible prior to the application of more recent techniques of biochemistry, radiography, and electron microscopy. The tools of chemistry are almost totally absent from the experimental methods enumerated in this volume. The biological techniques of tissue culture, microsurgery, and transplantation which Harrison used in a masterly way and thereby helped to elevate as sovereign instruments for embryonic analysis are exploited in his classic studies on nerve outgrowth, as well as in his analyses of polar symmetries in the amphibian ear and limb. The sequential determination of anteroposterior, dorsoventral, and mediolateral axes within these primordia was revealed through elegantly simple transplantation and rotation experiments, and is described with eloquence. The interpretation of data clearly revealed a progressive acquisition of regional specificities in differentiation at a level of subtlety that probably cannot, even today, be duplicated by any chemical means. It is to be hoped that by bringing to the fore again the concepts of differentiation fields the accounts of these experiments will refresh memories of old problems and will reactivate interest in their solution.

The second chapter is a hitherto unpublished but long known work of the author on normal development in the spotted salamander, *Amblystoma punctatum*. All students of amphibian embryology will welcome the publication, at long last, of the elegant halftone illustrations of the "Harrison developmental stages" prepared under his direction by Lisbeth Krouse. The illustrations are accompanied by morphological definitions of each stage, and with developmental growth curves for this species at 15° and 20°C. This chapter will be an essential reference for embryologists as long as ontogenic studies are carried out on eggs of the spotted salamander. Omitted from this volume is any reference to the unremitting attempt by Harrison to reverse the law of priority in nomenclature and reestablish the intended name for the spotted salamander, which had been misspelled through a printer's error in the original listing. To all but the experimental embryologists following the Harrison tradition, the spotted salamander is known as *Ambystoma maculatum*.

The primary purpose of the volume can be read between the lines of the editor's preface. It is a biography of the author written with warmth and sensitivity. In addition, there are appendices giving complete bibliographic references of the author's publications and memorial tributes to him. Thus, although the volume is largely a compendium of writings by Harrison, it is also a memorial to him. The community of science owes a lasting debt of gratitude to the editor for bringing this major work in embryology to completion.

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Zoology for Zoos

International Zoo Yearbook. Vol. 10. JOSEPH LUCAS, Ed., assisted by Ruth Biegler. Zoological Society of London, London, 1970. x + 372 pp. + plates. $21.

Man and Animal in the Zoo. Zoo Biology. HEINI HEDIGER. Translated from the German edition (Zurich, 1963) by Gwynne Vevers and Winwood Reade. Delacorte, New York, 1969. vi + 306 pp. + plates. $11.95. A Seymour Lawrence Book.

The World's a Zoo. JOHN PERRY. Dodd, Mead, New York, 1969. x + 308 pp. $6.95.

However its critics may carp about its power structure and its pet peerage, the Zoological Society of London continues to deliver the goods. Under the shelter of the British Establishment energetic underlings manage to accomplish more for the science of zoology than all the other zoo societies put together. The *International Zoo Yearbook*, now in its tenth triumphant year, gets better and better, growing in quality rather than size. As it receives more support from academic zoologists, it begins to provide the practical zoo man with the intellectual ballast which his profession sorely needs, especially in the United States. This annual production provides the needed literary links between the zoo keeper, the veterinarian, the administrator, and even that archvillain of the zoo world, the architect. The latest volume has birds of prey as its main theme, but contains, as usual, a wide spectrum of zoological notes. It is very well illustrated, and benigly edited by Joseph Lucas.

Perhaps the voluminous reference sections on breeding records and zoo stocks are a necessary nod in the direction of conservation, but they must add greatly to the cost, without contributing much reliable or relevant information.

As zoology tends to be organized along ecclesiastical lines, one is tempted to regard Hediger's book as a doctrinal work by a bishop and Perry's as that of a lay preacher. Hediger's misfortune has been to be in advance of his time. When he cried out long ago for zoo reform and for a zoo philosophy, the animal worshipers couldn't have cared less. It is sad to reflect that one article in *Life* written by a disciple could produce so much more impact than the work of the master, merely by being read so much later. Now that Hediger's ideas are available in English anew, he

may get some of the credit he deserves.

Hediger's book handles a wide range of zoo problems, from the completely practical to the philosophical. His arguments are strongly supported by a splendid selection of photographs. Like many European professors, however, he tends to be hard on colleagues who dare to differ. He hammers without mercy on the head of Hans Wackernagel, who is a proponent of artificial diets. But one suspects that Wackernagel's sin is not so much his advocacy of the Ratcliffe-Philadelphia diets as his location in Hediger's former parish. In spite of this special pleading, perhaps partly because of it, this work is a classic in the sparse zoo literature.

John Perry, a former management consultant who is now assistant director of the (U.S.) National Zoological Park, has written a book so full of common sense and tolerance that it is a pleasure to read. It is, however, rather formless, being a discursive collection of anecdotes and ideas, and the author has been poorly served by his publishers, who allowed it to appear without illustrations. Perry shows an exceptional grasp of the management difficulties and domestic politics of the American zoo business. He makes generalizations with a simplicity lacking in the more earnest professionals. He inflicts no wounds and takes a constructive attitude even in the least hopeful of situations. Like Hediger's book, his is so personal that one is apt to review the man rather than his work. Let us pray for the conversion of more management consultants.

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Essential Accumulations

Natural History Collections. Past, Present, Future. A symposium, Washington, D.C., Oct. 1968. DANIEL M. COHEN and ROGER F. CRESSEY, Eds. Biological Society of Washington, National Museum of Natural History, Washington, 1969. Illus. Paper, $4. Proceedings of the Biological Society of Washington, vol. 82, pp. 559–762.

Space-consuming accumulations of dead animals, fossils, and dried plants, the tools of the systematist and evolutionist, are not held in the same high esteem as scintillation counters or electron accelerators, but as man modifies and pollutes the environment they may provide the only records we have of the disappearing fauna and flora. This symposium deals with the problems of preserving such records.

The recent shift of research emphasis in systematics and evolutionary biology as it affects ornithological collections is well presented in these proceedings by R. L. Zusi. Bird species, unlike most groups of invertebrates, are well known. Whereas in the past only the skin with feathers was preserved, present needs are for collections of skeletal material, collections of tissues and organs preserved in alcohol (esthetically not so pleasing as stuffed skins), tapes of bird songs, and x-ray pictures to resolve the many problems of phylogeny which remain puzzling. On the applied side, the medical requirement for parasite collections is discussed by W. W. Becklund. The collections are needed for studying what parasites cause or transmit disease, their distribution, their diagnostic features, and the hosts parasitized and for determining whether a species is new to science. In his report on electronic data processing R. B. Manning discusses the use of computers for storage and retrieval of data concerning stored specimens.

The vast use that is made of natural history collections is indicated by the report that 372,886 lots or specimens were loaned by the U.S. National Museum in 1967 and that 1195 students used its collections during a single year. The importance of the national resource that collections constitute is pointed out. The growth of collections and the increasingly burdensome and costly housekeeping are discussed by several authors. It is suggested that most collections could be housed in less expensive quarters away from exhibitions.

The symposium published here is somewhat one-sided, all the participants being members of the Smithsonian Institution or other government agencies. It is pointed out in the book that 34 percent of the herbaria are owned by government institutions and 59 percent are university facilities. (No comparable figures are given for zoological collections.) Although not so large as the government institutions, the university museums are probably in the majority. Many of these museums were originally started in agriculture schools to aid in determining plant and animal pest species. Their growth, especially in recent years, attests to their value in training and assisting new generations of biologists for systematic, evolutionary, and environmental studies.

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Chartings of Progress

A History of Technology and Invention. Progress through the Ages. MAURICE DAUMAS, Ed. Translated from the French edition (Paris, 1962 and 1964) by Eileen B. Hennessy. Vol. 1, The Origins of Technological Civilization (xii + 596 pp., illus.). Vol. 2, The First Stages of Mechanization (x + 694 pp., illus.). Crown, New York, 1969. $10 each volume.

As each new multivolume history of technology is published—this is the third in recent years—it becomes more amusing to read the editors' protestations regarding the uncertain state of knowledge in this new field of study. To those of us who have bet our careers upon the viability of the field as an intellectual discipline, however, the amusement is tempered by the uneasy feeling that, in a fundamental sense, the editors are right. The work under review compares very favorably with other histories of technology, but it does not bring us much closer to understanding the relations between technology and the social milieu in which it exists. Before arguing the point, however, let us look at the books themselves.

These are translations of the first two volumes of the projected four-volume *Histoire Générale des Techniques*, published by the Presses Universitaires de France. Most of the authors of individual chapters are scholars in French universities or museums; three or four are engineers not in universities. The editor is chief curator of the technical museum of the Conservatoire National des Arts et Métiers, in Paris.

The first volume departs radically and refreshingly from the usual preoccupation with Mediterranean origins