A Centennial

One Hundred Years of Anthropology. J. O. BREW, Ed. Harvard University Press, Cambridge, Mass., 1968. iv + 276 pp., illus. $5.95.

In 1886, when the Peabody Museum of Archaeology and Ethnology was founded at Harvard University, anthropology and its cognates, archeology and ethnology, were then at the beginning of their structured and organized existence. Only 20-odd years before, the American Ethnological Society had been established in New York. And a few years earlier still, similar societies had already been set up in London, Paris, and other European intellectual centers. But neither in Europe nor in the United States had these disciplines yet reached the dignity of formal recognition by the universities. In this country that came only tentatively and sporadically at the end of the 19th century. Clark, Columbia, Harvard, and the University of Pennsylvania were among the first to offer formal instruction. The enormous academic growth of the subject dates only to the past 30 or 40 years. Thus the history of the Peabody virtually embraces the span of the development of the anthropological sciences as organized and academic disciplines.

As one of the first museums in this country dedicated to archeology and ethnology, the Peabody's role as a formative agency in this new science was a major one both in research and in teaching.

It is appropriate, therefore, that in celebrating its centennial the Peabody Museum take a look at the last hundred years in the history of anthropology. The volume under review comprises a series of five lectures delivered during the centennial year and covers New World archeology, Old World prehistory, biological anthropology, ethnology and social anthropology, and anthropological linguistics. The authors of these lectures are distinguished representatives of their various specialties, and what they have to say about the history and development of their fields during the past 100 years is therefore of interest. The history of anthropology has been sadly neglected, and these essays, as far as they go, help to fill a gap and possibly a need. But even allowing for the limitation of space and lecture time, they do not, with one or two exceptions, go far or deep enough to be wholly satisfying. Lounsbury's chapter on linguistics seemed to me the best of the five. Daniel's foray into Old World prehistory is overburdened with anecdote and surprisingly neglectful of important phases of paleolithic history. Washburn also omits significant areas in his survey of biological anthropology—by implication, at least, wholly equating biological anthropology with human evolution.

Perhaps the time is ripe for historians of science to turn their attention to anthropology. The few products of such historical research that have appeared in the past decade have been highly illuminating.

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Complexity

The Sciences of the Artificial. HERBERT A. SIMON. M.I.T. Press, Cambridge, Mass., 1969. xiv + 130 pp., illus. $5.95. Karl Taylor Compton Lectures, 1968.

Herbert Simon is one of the leaders in the present development of a science of complex information processing. His contributions have been seminal in several different fields, yet always unified in their attempt to develop a precise and adequate theory of complex systems, whether social, political, or economic organizations or thinking, feeling, creating brains and computer-programmed models. *The Science of the Artificial* is a thoughtful synthesis of Simon's conception of complexity—how it arises, how it can be studied by a scientist, and how it can be coped with, adapted to, and understood by intelligent entities such as human beings and "artificial intelligence" programs.

"Artificial" is used by Simon in an unusual, and provocative, way to refer to structures that arise in order to cope with complexity. The things man designs—his buildings, his cities, his organizations, his scientific theories, his works of art—are clearly artificial. But Simon suggests that man himself, as he adapts to the complexities of his environment, can fruitfully be thought of as an artifact of that environment.

The book divides into three major sections. First Simon examines a variety of experimental findings from the psychology of thinking to document his contention that man, basically, is a simple system, one that becomes complex as it adapts to its world. At the same time, he draws together experimental findings to give a sketch of the human cognitive system, and a glimpse, via discussions of computer simulations, of its actual specifications and mechanisms in problem-solving, concept formation, organization of memory, and language processing. Next Simon tries, by developing and discussing a curriculum for a degree in the science of design, to pull together what we know, what we should know, and what we should do about the things that men make. Once again, a wide variety of design tasks is examined and integrated. Simon ends with a discussion of the "architecture of complexity"—the complexity that we find in our world and in our two major artifacts, man and man-made objects. He examines the great increase in power of functions, economy of effort, and even possibility of evolution that results when systems are hierarchical. He examines additional features, such as partial decomposability and redundancy, that can lead to further improvement.

A large number of computer programs have been written during the past 15 years to model one or another aspect of human cognitive processes, and a variety of mathematical models have been developed as part of a systems theory approach to organizations of interest to the biologist, social scientist, and electrical engineer. Much of this work has been piecemeal. Different computer simulations often develop the same methods for information processing over and over again for superficially different problems. Occasionally a mathematical model of organization is fruitfully applied across several different domains, but too often the systems approach has, when it has been used to generalize about underlying structures, tended toward the vacuous. We need both the powerful mechanisms for handling the great complexities of information processing systems, such as the brain, that must deal with highly structured and interrelated, interacting objects, and a conceptualizing, generalizing framework that keeps these mechanisms alive as steps toward general theoretical models, rather than ad hoc Rube Goldberg engineering curiosities. It is just this sort of concrete confrontation of the real problems of complex organizations, along with a constant interest in

general processes, that makes this book interesting.

A number of books have been written about models of thinking and about complex organizations, and this is one of the very best. It is authoritative and at the same time provocative—a rare combination.

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"Behavior"

Ethology of Mammals. R. F. EWER. Plenum, New York; Logos, London, 1968. xiv + 418 pp., illus. $26.

A book dedicated to meerkats can't avoid being interesting. When those meerkats are named Gollum, Gandalf, and Gimli, one knows without reading further that the book must have been by R. F. Ewer and that prejudices in its favor are justified. In fact, I did read *Ethology of Mammals*, so my declarations are based on more than empathy with keepers of meerkats.

Ewer has set herself three goals. First, she has attempted to describe various kinds of behavior in a variety of mammals. In doing this she has considerably broadened the amount of descriptive material available on library shelves, especially since she has included examples from the lesser—at least less well known—breeds. Her categories of behavior are conventional—communication, feeding, fighting, courtship, for example—and, for the most part, the species described are presented in phylogenetic sequence. Hence, although not encyclopedic in scope, the book does provide a useful reference supplement to such volumes as Bourlière's *Natural History of Mammals*. The style is sufficiently light to be entertaining, yet the documentation is adequate to the needs of the student. The usual pious pronouncement of the publisher that "this volume will appeal to amateur and specialist alike" is justified.

A second goal was an explication of traditional ethological theory, as annunciated by Lorenz and his disciples. In this, too, Ewer has acquitted herself well—too well, I would add, for she will surely convince the uncritically uncommitted. And, niceties of style notwithstanding, in this I believe Ewer to be perpetuating a major misconception. "Behavour is something which an animal has got in the same way as it may have horns, teeth, claws, or other structural features," she writes (p. 4), and this is where I take issue. The notion that behavior is a "noun," a palpable entity, has been responsible for much of the nonsense that ethologists have uttered. We read of "aggression" accumulating and needing discharge, as if it were a fluid liable to seep through cracks in the cranium. I believe we "contain" aggression about as much as a radio "contains" the music we hear issuing from it. Hardin ["Meaninglessness of the word protoplasm," *Sci. Monthly* **82**, 112 (1956)], extrapolating from the work of Benjamin Lee Whorf (*Language, Thought and Reality*, Wiley, 1956), has tried to show how the grammatical forms of English have influenced biologists' conceptions of the body. The polarized structure of our language, requiring phenomena to be described by sentences that consist of nouns *and* verbs, has often distracted us from the realization that a particular event might not lend itself to such treatment. Thus, "*it* thunders," and "lightning flashes," tautologies that obscure the "nounverb" nature of these events. In the study of behavior this kind of reification has done even more to retard understanding than in the areas discussed by Hardin (Klopfer, "Instincts and chromosomes," *Amer. Naturalist*, in press, and see a forthcoming volume on evolution and behavior by G. Bermant). Ewer, unhappily, has contributed to the retardation, though I grant she has provided a clear statement of the Lorenzian premises and arguments.

Finally, Ewer has sought to relate laboratory findings to naturalistic observations. This she has done, with understanding and clarity.

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The Fungi

Fundamentals of Mycology. J. H. BURNETT. St. Martin's, New York, 1968. xiv + 546 pp. + plates. $13.95.

This book is a landmark in mycological literature. Nothing like it has appeared since De Bary's classic work of the last century.

In this book Burnett presents many of the more recently discovered facts about this unique assemblage of plants, the fungi. The focal point happily is always the fungus, whatever aspect may be under discussion. In this respect the book is a biologist's paradise.

Since De Bary's time, experimental mycologists have uncovered a vast, nay stupendous, number of facts about fungi. These include many of the details of the ultrastructure of fungal cells, vegetative growth and morphogenesis, asexual and sexual reproduction, mating systems, production and germination of spores, mechanisms of transport of materials, primary and secondary metabolic pathways, interactions with other organisms, heterokaryosis and heteroplasmons, methods of genetic recombination, and speciation. As a consequence Burnett's book tends to be encyclopedic: there just may be too much material to down in one swallow.

The text is made even more complicated by the author's tendency to join independent clauses into long, cumbersome sentences. It is consequently not an easy book to read through, but it is the only one of its kind. Experimental mycologists and others interested in fungi will be grateful for Burnett's effort. If the book also alerts the writers of our general biology texts to the existence of the world of the fungi it will have served still another purpose.

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Physiological Measurement

Principles of Applied Biomedical Instrumentation. L. A. GEDDES and L. E. BAKER. Wiley, New York, 1968. xvi + 480 pp., illus. $13.50.

This book does not begin to cover the field of biomedical instrumentation, nor is that its intent. It is designed to describe, primarily to the life scientist, the basic principles by which physiological events are measured. This is an area in which the authors are recognized experts, and they are to be commended for resisting the temptation to include a variety of subject matter classified as biomedical instrumentation but outside their realm of expertise. However, considering the rather limited objective of the book, a more appropriate title would have been that of the first chapter, "The transduction and measurement of physiological events."

The authors, who are trained in both engineering and physiology, state