In both cases he parries his own attack by invoking the possibility of hyperduplication during the course of evolution. Implicit in this argument—as I understand it—is the notion that if a system can generate enough gene copies in a given strand of DNA, then the tendency for further duplication will be so great that a steady state of invention and loss will be reached such that selection pressures on individual gene products cease to be an issue. Once past this critical point, only the system as a whole is subjected to Darwinian restraints—not a particular gene for a particular polypeptide sequence which may never encounter a suitable antigen in the course of countless generations.

Having disposed of these annoying challenges to germ-line supremacy, Smith goes on to a fine chapter on clonal selection, and then finishes up with a chapter of conjecture on the nature of joining up variable and constant regions in the genome. There are several appendices, one categorizing the known immunoglobulin sequences, another on allotypes, and finally an exposition on the phenomenon of multiple genes as it exists in the case of ribosomal RNA information.

The circumstantial evidence favoring a germ-line basis for antibody diversity has increased considerably over the past five years, and although one would have hoped that a clear-cut experiment (many have been proposed and some executed, but technical difficulties have rendered them equivocal) might have emerged to resolve the question once and for all, this review of the evidence for a germ-line basis is the next best thing. I enjoyed reading the book and believe it will prove useful to a wide range of persons in the fields of immunology and molecular biology.

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Essays in Ethology

Motivation of Human and Animal Behavior. An Ethological View. KONRAD LORENZ and PAUL LEYHAUSEN. Translated from the German by B. A. Tonkin. Van Nostrand Reinhold, New York, 1973. xx, 424 pp., illus. $15.95. Behavioral Science Series.

This is a collection of 11 essays that were originally published in German. The book is subtitled "An Ethological View," which is perhaps a better description than the title of this, the initial volume in Van Nostrand Reinhold's new Behavioral Science Series. The essays touch on all the major topics of concern to classical ethology.

Only the first essay is by Lorenz. This article was published in 1939 and is a classic. It sets forth the basic goal of ethology—the systematic and naturalistic study of animal behavior and the development of a theory of instinct to explain the empirical observations. The concepts of innate releasing mechanism, instinctive movements (fixed action patterns), and instinctive drive theory are presented clearly and enthusiastically. This essay defines the scope of the book and of the field.

The remainder of the book introduces the reader to the work and thought of Paul Leyhausen, who, as the editor of this series points out, is an important European ethologist not read sufficiently by American behavioral scientists. Leyhausen is important not just because he has made substantive contributions to our knowledge of animal behavior but because he is actively engaged in one of the most important enterprises of modern ethology: expanding the scope of the field from its early concentration on birds and fish to the more "complex" behavior of mammals, especially humans.

Leyhausen's ten essays cover most of the important problems in animal behavior. The papers are presented chronologically (they range in date from 1951 to 1967) instead of topically, so there is considerable contrast in material and treatment through the book. The second and last essays deal with expression and impression in social relations, a topic relatively neglected since Darwin's *The Expression of the Emotions in Man and Animals.* In his discussion of the topic, Leyhausen elaborates the difference between expression and impression in animals. This is an especially timely point since modern work in animal communication (such as that of W. J. Smith) is concerned with distinguishing the information contained in the signal from the meaning derived from it by the recipient.

In the third, fourth, and fifth essays, Leyhausen discusses with great analytic insight theoretical problems like the nature of displacement activities, the seminal work of von Holst on central nervous system automatisms and their relation to fixed action patterns, and the mechanisms responsible for creating new sequences of motor activity.

The interaction of animals' social behavior, social hierarchies, and territoriality is well treated in the sixth, eighth, and tenth essays. There is one long empirical study (essay 9), which is a comparative study of prey-catching in 15 species of cats. This includes a splendid discussion of the possible phylogeny of predatory behavior patterns. The precision of the Anglo-American laboratory is not present in this study, but the thorough and painstaking observations of the ethologist are. This article might prove useful for experimental psychologists to study as an essay in ethological method.

In general, Leyhausen's treatment of problems in animal behavior is intelligent and clear. There are, however, specific issues on which I think he is not totally successful. For example, in an attempt to reduce the complexity of mammalian behavior to ethological instinct theory, Leyhausen postulates the existence of more drives than exist in lower forms. Plasticity of mammalian behavior becomes a function of the interaction between these drives. Several authors, among them the British ethologist Robert Hinde, have been quite critical of the utility of classical drive theory. Although it is a brave attempt, Leyhausen's updated theory of drives seems susceptible to all the criticisms leveled against the older drive theory with the added disadvantage of postulating even more complexity.

It is, however, when Leyhausen expands his arguments to the human condition that his entire method can be criticized. The question whether theoretical ethology can successfully be applied to human behavior is really the question whether behavior in animals and men is the same in the sense of being biologically homologous. Both Lorenz and Leyhausen stress the importance of the phylogenetic history of behavior; and ever since the development of the concept by British anatomist Richard Owen, biological homology has been taken as the basis of phylogeny. The discovery of homologies in comparative anatomy is fairly straightforward: fossils are examined, embryological histories compared, and morphological details analyzed. Though the actual research is intellectually demanding, the objects of study are well defined. In the case of behavioral fixed action patterns, there is also a precision: the description of displays in ducks or killing movements in cats are exact and the behavior patterns stereotyped. With respect to behavioral phenomena like emotion, drive, and

territory, however, to demonstrate homology in animals and humans would require more evidence than Leyhausen or any other behavioral scientist could now present. In the essay on territoriality in animals and the need for space in humans (essay 6), Leyhausen concludes, "*Our individual and social need for space has been laid down by our phylogenetic history and is therefore a basic characteristic of the genus*, i.e. within certain limits it is an *immutable natural right*" (p. 109). He asserts that space utilization in man and territoriality in animals are basically homologous, and therefore the laws applying to the latter apply to the former. To prove the biological homology, Leyhausen goes through the classic steps of developing a logical analogy. First, he postulates certain characteristics of animal territoriality (for example the innate mechanism of its causation and its heritability). Then he must set up the basis of resemblance between the human and the animal case. If he is successful, he can apply the properties derived from the animal situation to the human. In setting up this basis of resemblance, though, Leyhausen uses arguments that are weak and speculative and do not adhere to the standards of rigor and clarity he uses when discussing ethological concepts like displacement movements. The empirical bases for this analogy include the following: "Although the information we have about the life of the anthropoid apes in the wilds is so far only scanty, it does reveal some striking correspondences with the social life of primitive hunting and food-gathering peoples . . . the main social community is the family or a tribe. . . . Relations between neighboring tribes are in general quite friendly. . . . Communal life within the tribes proceeds in circumstances of relatively loose spatial connection" (p. 103). "Especially common is the way that every social community . . . strives to reserve one certain area as its property and to repel any intrusion by others" (p. 104). These are broad, not precise, similarities and are more akin to biological analogs than to homologs.

While Leyhausen's attempts to expand instinct theory to the mammalian (and human) case often require him to use arguments weaker than those used in discussing other aspects of animal ethology, his attempts are always explicit and clear. Whereas other, more popularized books on human ethology often leave the basic theoretical framework unstated, Leyhausen's articles are consistently intellectually forthright—even when he is going beyond his evidence. Whether human ethology will ever blossom (as its parent discipline of animal ethology has) remains to be seen. For anyone interested in exploring the possibilities of this new field, or for those interested in a sampling of classical ethology, this volume is worthwhile. The translation by B. A. Tonkin is good and the material always interesting.

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Comparative Primatology

An Atlas of Primate Gross Anatomy. Baboon, Chimpanzee, and Man. DARIS R. SWINDLER and CHARLES D. WOOD. University of Washington Press, Seattle, 1973. xiv, 370 pp., illus. $30.

Recent years have witnessed a remarkable renaissance and modernization of comparative primate morphological studies, characterized by multivariate statistical approaches to large, diversified osteological data sets and experimentation with electromyographic and cineradiographic techniques on living animals. But no matter how refined the technology or how sophisticated the research strategy, a substantive part of the explanation of morphological complexes, in evolutionary perspective, will depend upon the comparative anatomical expertise of the theorist. Thus, an increasing number of evolutionary anthropology programs now include one or more courses on comparative primate morphology. Unfortunately, more often than not, the prospective primate morphologist must obtain whatever dissection materials are locally available and learn selected aspects of the subject free-lance.

Formal courses and independent study will now be greatly facilitated by Swindler and Wood's atlas of primate anatomy. The book is a generally well-organized comparison of common baboon, common chimpanzee, and human morphology. The approach is regional, beginning with a bone-by-bone survey of osteological features and progressing to head and neck, forelimb (or upper limb), back, thorax, abdomen, pelvis, and hindlimb (or lower limb). Neurological, angiological, and splanchnological features are presented. But most of the nonosteological sections focus on muscles.

The text is brief, useful, and generally accurate. The illustrations vary in quality and detail from good (plate 64, for example) to poor (plate 73). Readers should be informed that the left-hand figure on page 185, looking rather like Lenin during the lean years, is the senior author. The format seems inordinately expansive and the volume is expensive. Some typographical and factual errors occur, so students should be prepared to take their own specimens as the final authority in case of discrepancy. For instance, in plate 108 (p. 229) the distal segment of the penis of *Pan* is labeled "glans penis" when in fact the poor creatures lack this structure (Graham and Bradley in *The Chimpanzee*, G. H. Bourne, Ed., vol. 5, p. 122, University Park Press, 1971).

In brief, though not the Charles Atlas in an ideal realm, this volume should find a ready market among anthropologists, evolutionary biologists, veterinary scientists, and other researchers who employ catarrhine primates.

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Vespoidea

Wasps. An Account of the Biology and Natural History of Solitary and Social Wasps. J. PHILIP SPRADBERY. University of Washington Press, Seattle, 1973. xvi, 408 pp., illus., + plates. $17.50. Biology Series.

Since the first sentence on the dust jacket proclaims this to be the first major book on wasps since 1868, this reviewer may perhaps be forgiven if he begins his review by waspishly pricking this particular assertion. The statement is possibly true if one accepts the author's definition of a wasp as a member of one group, the Vespoidea, which he calls the "true wasps." But one looks in vain here for a review of the extensive literature on the vast majority of wasps, belonging to other groups and therefore by implication "false wasps." Furthermore, one quickly discovers that the book is primarily about British wasps, other faunas being mentioned mainly as they increase understanding of the British species. The British species consist chiefly of hornets and yellow jackets (Vespinae), even the common paper wasps (*Polistes*) being treated lightly since they occur in Bri-