of the currently popular 18-month field excursion. As an example, if the Euler-Lotka formula is actually to be applied to data, life tables must be provided, yet in spite of the large investment in research on primate societies there are essentially no life tables available for any primate species other than man.

Wilson acknowledges that sociobiological theory at present is dependent upon the current genetical models of competition between alleles at single loci and that these models may be revised and supplemented as work on polygenes, linkage disequilibria, and epistatic interactions proceeds. Classical selection theory is also currently confronted with evidence and increasingly accepted models emphasizing the role of random processes both in microevolution, as in the maintenance of high levels of genetic polymorphism, and in the broad patterns of emergence and extinction of phyletic groups on a geological time scale. Particularly among the vertebrates, individual adaptability and the flexibility of social systems suggest a degree of indeterminance between the gene and the environmental adaptation that is not fully accounted for in the simplistic single-locus models. Sociobiological studies may lead us into a period of profitable confusion and theoretical indigestion, and finally to a new level of understanding both in sociobiology and in evolutionary theory.

The greatest effort in empirical research should probably be directed to validating the postulated connections between the operation of social mechanisms and the values of the life-table parameters. The arguments about whether individual selection, kin selection, or higher levels of group selection are operating may really turn on how it is most convenient to classify the actual processes after the fact. Can they be distinguished in actual events in real populations? The problem becomes more difficult because random processes such as genetic drift also become important in the small, inbred groups in which kin selection is assumed to operate most effectively.

The quantitative theory of sociobiology has been most successfully applied to the social insects, and the societies of vertebrates remain incompletely explained. The trend in vertebrate evolution toward greater individuality, culminating in the mammals and particularly in man, seems difficult to reconcile with the fact that the most elaborate vertebrate societies are also found within this group. There is no reason to think that all the classes of models have yet been devised, or that all the ways of classifying the processes that result in natural selection have yet been exhausted. It is not proved that the ultimate analogy to the evolution of complex systems is found in the current models based upon capitalistic economic theory, where profits and losses in units of the hypothetical currency of genetic fitness are computed for each compromise in the life history of individuals.

To be complete, sociobiological theory must account for the emergence of man and absorb both anthropology and sociology, providing these disciplines with a truly scientific basis for their practice. The greatest and perhaps final challenge to sociobiology will come when it invades the province of the humanities and attempts to incorporate them, as it must or be proved false, into the strictly materialistic theory of evolutionary biology. In the humanities we see the trend in vertebrate evolution toward individuality carried to its extreme, and artistic expression, being channeled into unique cultural patterns and idiosyncratically enriched, surely is the aspect of the phenotype furthest removed from the determinism of the gene. The highly elaborate, multimodal communication systems among vertebrates may have evolved as devices of social integration in which large amounts of energy are invested to counteract the socially disintegrating trend toward individualization. Here again the humanities may present us with the maximum elaboration of a vertebrate trend. It may be that in order to achieve its final success sociobiology will have to turn somewhat away from the functional models of very general applicability emphasized in the current theory to examine the unique phylogenetic constraints and potentials operating within the specific phyletic line leading to man.

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Loxodonta

Elephants and Their Habitats. The Ecology of Elephants in North Bunyoro, Uganda. R. M. LAWS, I. S. C. PARKER, and R. C. B. JOHNSTONE. Clarendon (Oxford University Press), New York, 1975. xii, 376 pp., illus. $42.

The elephant epitomizes the conservation problems faced by all wildlife in Africa. With much of their range usurped by man, animals are increasingly confined to reserves whose boundaries are not ecological but political. Protected from hunting and unable to emigrate, ungulate populations tend to increase up to and beyond the limits of their food supply. As the carrying capacity of a habitat is reached, animals respond to crowded conditions by deferring maturity and reducing fecundity, but these adaptive responses may not prevent a population crash and damage to the habitat. Elephants are second only to man in their propensity to modify their environment. By breaking and pushing over trees elephants convert woodlands into grasslands, destroying their habitat as well as reducing the complexity of the ecosystem. Should elephants be allowed to find their own destiny no matter what the consequences, or should they be brought into balance with the habitat? This problem has generated an amazing amount of political indecision and emotional turbulence in East Africa. Laws and his co-workers build a solid case for the latter alternative, using the elephant population centered in Murchison Falls (Kabalega) National Park as an example.

The Bunyoro elephants' range has declined in 25 years from 6300 to 3200 square kilometers and the population from 22,000 to 7,900 animals. Some of this decrease was due to a haphazard control program by the Game Department aimed at reducing conflict between human and elephant interests. Laws *et al.* cropped 2000 elephants between 1965 and 1967, and the data from these animals form the basis for thorough chapters on nutrition and growth, reproduction, and population dynamics in this book. By shooting whole family units—the matriarch with her grown daughters, the subadults, and any attending bulls—not only was disturbance to the elephants' society as a whole reduced but fascinating information on the age and reproductive status of each family member was obtained. Over half of the population decrease has been due to a decline in recruitment, the result of the animals' living on a poor diet. Yet elephant biomass has remained almost constant since 1946, the animals now crowded into the small remaining range. The authors reason that the habitat can recover only if some 3500 elephants are shot immediately and the remainder cropped on a sustained yield basis of 5 percent of the population annually.

By censusing animals, autopsying carcases, and analyzing vegetation, the authors have produced an excellent ecological study of an elephant population, a study which concisely presents the facts and proposes sensible solutions to a management problem. Being wholly ecological in outlook, the authors made no special attempt to observe elephants and their society, but this important gap has been partially filled by other workers. In the scientific rigor of its field techniques and the depth of analysis of the data this study is

worthy of emulation by other ecologists. However, the relentlessly dry writing style may deter all but wildlife biologists and the most determined loxodontaphiles from digesting the contents of the book. Laws was the best ecologist working in Africa during the 1960's, and on the basis of his wide knowledge I would have welcomed an intellectual excursion into elephant problems outside of the parochial confines of Bunyoro.

The elephants' destruction of their habitat was first recorded in 1930, the implications of this were realized in 1949, and the first action was taken in 1965—an impressive lag in time. Although some of the recommendations in this book were implemented in 1972, Laws *et al.* nevertheless note, "We regard the current situation as regards conservation in North Bunyoro as extremely unpromising." The situation at present is just as good. In fact, time may be running out on this and other elephant populations. With the price of ivory at an all-time high, the illegal trade in tusks often involves prominent government officials, making it virtually impossible to control poaching and manage herds effectively. Are most ecological studies in Africa destined to remain grand exercises in academic futility, the recommendations ignored by inert bureaucracies? *Elephants and Their Habitats* may ultimately stand as an impressive monument to a vanished opportunity.

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Boron

Boron Hydride Chemistry. EARL MUETTERTIES, Ed. Academic Press, New York, 1975. xii, 532 pp., illus. $49.50.

Boron hydride chemistry has an aura of the exotic, and its development has involved sophisticated laboratory techniques and advanced quantum mechanical calculations. "Sophisticated" and "advanced" are words used to justify military funding of the research, which in turn may explain why a CIA agent once asked this reviewer if he had learned of any Russian breakthroughs. No, the Americans are safely ahead, and the notion that boron hydrides could be used for rocket fuels has been extinct for some years. Although borax is cheap to mine, it is not really abundant, and the energy cost of converting it to boron hydrides is high. These compounds may find specialized uses, but the real reasons for studying them are their unique suitability for testing the foundations of chemical theory, especially bonding and stereochemistry, and the infinite variety of new structures that can be synthesized, their chemistry rivaling organic chemistry in complexity.

Theoretical fields can accommodate relatively few practitioners, and the 14 contributors to this book represent a substantial fraction of the active boron chemists. One of the highlights is the chapter by Lipscomb, the master of advanced molecular orbital calculations, which describes his results in terms sophisticated enough for quantum mechanical experts and clear enough for ordinary chemists. Boron is particularly appropriate for such studies because the small number of electrons and the high symmetry of many of its compounds make detailed quantum mechanical calculations possible, and theoretical predictions can sometimes be made in advance of experimental verification, which is not often possible in the more developed branches of chemistry. The findings are relevant to other fields, and organic chemists confused by the controversy surrounding three-center bonding in elusive carbonium ion intermediates might note that "the three-center bond is alive and well, and residing in the laboratories of boron chemists."

Another highlight is the chapter on carborane complexes of transition metals by Dunks and Hawthorne. Hawthorne's unusually creative chemistry has led to a variety of novel cage structures, unusual oxidation states of transition metals, metal-metal bonding, and cage rearrangements. The coverage is not complete, since it omits much of Grimes's work on smaller carborane complexes of transition metals and Hawthorne's own work on α-bonded transition metal complexes of biscarborane, plus much very recent work by Hawthorne's group. Other chapters cover *nido* and *arachno* boron hydrides, *closo* boron hydrides, icosahedral carboranes, smaller carboranes, *nido* heteroboranes, and gas phase reactions of borane, BH_3, a short-lived intermediate involved in many contractions and expansions of boron cages.

The foregoing topics would constitute a coherent book, but they are interrupted in the middle by chapters on hydroboration, boron cations, and borazines, which belong to a different and more conventional sort of chemistry. Pasto's brief review of hydroboration with emphasis on mechanistic studies is a useful independent article, but true coverage of hydroboration and its significance to organic synthesis would require several long chapters by H. C. Brown or his students, which are conspicuous by their absence, and Brown has published his own books.

In summary, this is a useful reference on a number of topics in boron hydride chemistry, suitable for expanding the horizons of any inorganic, theoretical, or organic chemist interested in the fundamentals of chemical bonding and structure.

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Books Received

Abortion in a Crowded World. The Problem of Abortion with Special Reference to India. S. Chandrasekhar. University of Washington Press, Seattle, 1974. 184 pp. $6.95.

Acoustics 1974. Lectures presented at a congress, London, July 1974. R. W. B. Stephens, Ed. Chapman and Hall, London, 1975 (U.S. distributor, Wiley, New York). x, 194 pp., illus. $15.75.

Acupuncture and Moxibustion. A Handbook for the Barefoot Doctors of China. Translated from the Chinese edition (Peking, 1965) by Martin Elliot Silverstein, I-Lok Chang, and Nathaniel Macon. Schocken, New York, 1975. xx, 118 pp., illus. Cloth, $7; paper, $2.95.

Administration of Environmental Health Programmes. A Systems View. Morris Schaefer. World Health Organization, Geneva, 1974 (U.S. distributor, Q Corp., Albany, N.Y.). 244 pp., illus. Paper, $5.80. Public Health Papers No. 59.

Advances in Cancer Research. Vol. 21. George Klein and Sidney Weinhouse, Eds. Academic Press, New York, 1975. x, 438 pp., illus. $35.

Advances in Chromatography. Vol. 12. J. Calvin Giddings, Eli Grushka, Roy A. Keller, and Jack Cazes, Eds. Dekker, New York, 1975. xvi, 278 pp., illus. $22.75.

Advances in Heat Transfer. Vol. 11. Thomas F. Irvine, Jr., and James P. Hartnett, Eds. Academic Press, New York, 1975. xiv, 466 pp., illus. $42.50.

Advances in Microcirculation. Vol. 6. H. Harders, Ed. Karger, Basel, 1975. viii, 154 pp., illus. Paper, $41.

Advances in Protein Chemistry. Vol. 29. C. B. Anfinsen, John T. Edsall, and Frederic M. Richards, Eds. Academic Press, New York, 1975. viii, 324 pp., illus. $27.50.

Aerodynamics. L. J. Clancy. Halsted (Wiley), New York, 1975. xviii, 610 pp., illus. $27.50.

L'Alpha-l-Antitrypsine et le Système Pi. (Alpha-l-Antitrypsin and Pi System.) Papers from a colloquium, Bois-Guillaume, France, Jan. 1975. Jean-Pierre Martin, Ed. INSERM, Paris, 1975. 202 pp., illus. Paper, 30 F. Les Colloques de l'Institut National de la Santé et de la Recherche Médicale, vol. 40.

The American Community. Creation and Revival: A Multidisciplinary Perspective. Jack Kinton, Ed. Social Science and Sociological Resources, Aurora, Ill., 1975. vi, 172 pp. Cloth, $9.95; paper, $6.95.

Annual Review of Plant Physiology. Vol. 26. Winslow R. Briggs, Paul B. Green, and Russell L. Jones, Eds. Annual Reviews, Palo Alto, Calif., 1975. vi, 532 pp., illus. $15.

Anthropology and Society. Bela C. Maday, Ed. Anthropological Society of Washington, Washington, D.C., 1975. x, 118 pp. Cloth, $5; paper, $2.50.

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