for more theoretical meaning in the choice of cultures to map. One type of choice that would draw more attention would be to measure values of prominently competing cultures (Israelis and Arabs, perhaps). The question arises, however, whether attention is a good criterion of scientific meaning. On the other hand, one could ask for a more rigorous tie between theory and the data on educational choice. Such a demand would ask of Feather more than most psychological theories have accomplished. The point is that Feather's book may seem insignificant in the face of world problems but it represents where we are in psychology and takes a step beyond. It represents what has been called "normal science." In present parlance that phrase is often taken to mean dull and mediocre. Thomas Kuhn, however, used it to mean "research firmly based upon one or more past scientific achievements" (*The Structure of Scientific Revolutions*, p. 10), and Feather's book is certainly that. Kuhn has set us to look for new and exciting paradigms at every turn of a book cover. Feather's work does not present one, but he need not apologize for that. Progress in science (between revolutions, of course) usually occurs slowly, cumulatively, in "mopping up" and even "mapping out" operations. When carefully done, as Feather's work is, such research does not have to read like a novel to be useful.

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Giraffa camelopardalis

The Giraffe. Its Biology, Behavior, and Ecology. ANNE INNIS DAGG and J. BRISTOL FOSTER. Van Nostrand Reinhold, New York, 1976. xiv, 210 pp., illus. $13.95.

A monograph that assembles for the first time all that has been published about the biology of any large mammal must be a welcome book. This is doubly true when the animal is as extraordinary and important as the giraffe. Yet, as with most of the world's more spectacular mammals, the new research that is reported stands out against a background of past neglect. Anne Dagg and Bristol Foster are themselves responsible for much of the new work that is summarized in their book. Dagg first studied giraffes in the eastern Transvaal, and Foster studied them in the Nairobi National Park and its hinterland in Kenya; with D. Backhaus, who studied giraffes in Zaire, they were pioneers of fieldwork on this species.

The most important new work that the authors present has to do with behavior and ecology. This information, heretofore unpublished, is marshaled in three chapters. The account of individual activities consists mainly of an analysis of the time allocated to various activities, particularly feeding. The chapter on social grouping and activities is intriguing but inconclusive. It seems that giraffes are very variable and lax in their associations. Companions separate and reunite at long time intervals. Moreover, although individuals may be widely dispersed they can often, presumably, still see one another over great distances. Difficulties in the concept of a social group are raised. Foster's work is notable for his ingenuity in compiling a catalog of photographs of all the giraffes he saw and then gaining past records of individuals (all identifiable from their unique coat patterns) from old photographs and even from old postcards for tourists. His oldest record was of a bull and two adult females taken in 1948; the bull would have been at least 27 years old when seen in 1968. Clearly, once individuals have established themselves they stay in an area for a lifetime, but their home ranges can be very large. The chapter on reproduction and population structure gives particularly full data on births and mother-calf relationships, but what can at present be constructed about the population dynamics of the giraffe is very incomplete because of the rather atypical environment of Nairobi National Park and the fact that the group of giraffes studied in South Africa were on pastoral ranges.

If the book has shortcomings it is basically because our knowledge of the giraffe is still elementary. The authors have gathered a bibliography of over 700 papers, but much is speculation or opinion, and in discussing the biology of the giraffe they have often to resort to saying that some naturalists think this while others think that. This style is a little incongruous with the precise information interspersed concerning, for example, the dosages of drugs required to immobilize a giraffe.

Recently new work on the behavior of the giraffe has been conducted in the Serengeti in Tanzania, and intensive work continues there. The exhaustive account in this book, however, will provide the foundation for any new understanding of this species. Not only does the animal capture the imagination, but the fact that it is the only species that can exploit the high canopy and that it will browse a wide spectrum of the foliage makes it a herbivore of potentially great economic value.

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Biomechanics

Mechanical Design in Organisms. S. A. WAINWRIGHT, W. D. BIGGS, J. D. CURREY, and J. M. GOSLINE. Halsted (Wiley), New York, 1976. xii, 424 pp., illus. $19.50.

This is an interesting, important, and useful book. The authors end it with the statement that biomechanics represents a "useful point of view," and the volume makes that point convincingly. The book is strongest in its phenomenological descriptions of strength of materials, which introduce concepts such as viscoelasticity and the statistics of polymer chains, and in the exposition of the properties of biological materials. It is least detailed in its treatment of what is called ecological mechanics, but it does document that biomechanical approaches are now possible and may lead to important results when more intensively pursued.

The materials discussed are those used for support, and include both simple and compound substances, such as bone and collagen, silk and lignin, chitin and elastin; these are dealt with under the headings of tensile, pliant, and rigid materials, and the properties of individual fibers and crystals are analyzed as well as those of the composite structures. The book stresses that biological materials are unlikely to react in the simple fashion often depicted for the sake of convenience in biological textbooks. Consequently, there is continuous and refreshing emphasis on the limiting assumptions of the several tests. Conversely, the authors emphasize the problem of applying engineering approaches to biological systems.

This kind of treatment has long been desirable but has only recently become feasible (the majority of the references cited are later than 1960). It furnishes methods and data that may facilitate both ecological interpretations and reconstructions from the fossil record. It is particularly nice to find so many documentations of how competing influences keep organisms from achieving optimized adaptations for one particular set of living conditions, or how a particular tissue such as bone may show quite different stress responses in different parts

of a single animal. Many of the mechanical adaptations are shown to be subtle and to involve different kinds of molecular linkages, and these may be seen to change between similar species or conspecific populations. Here as in many other sections one encounters questions on multiple levels and suggestions for research. A feature that should have a particularly stimulating effect on subsequent work is the several sets of design principles and limiting conditions proposed. It is to be hoped that such semitheoretical predictions with their many components will reduce the frequency with which one sees adaptation explained in terms of single factors.

The writing is generally clear; assumptions and conclusions are set out in numerical sequence so that comparisons are facilitated. Only a few mathematical derivations are given, but some knowledge of calculus may be helpful. The book is illustrated with simple and uniform line drawings; there are neither photographs nor micrographs. The text is printed with an unjustified right margin. There is a list of symbols used, and the reference list conveniently indicates the place where each work is cited.

One hopes that the ready availability of this material will lead to its increased utilization and to more truly comparative studies of the way the structure of organisms adapts them to their environment.

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