son and Ohta that as little as a single-gene, two-allele system may control oviposition behavior in the *Drosophila grimshawi* complex of Hawaii. Though the example is of an allopatric situation, it does provide evidence for the sympatric host-race shift model of G. L. Bush. And, of equal importance, it shows that much of the polarization of genetic and epigenetic views for evolutionary change may be more semantic, or an artifact of perspective, than real. Clearly, such single-gene changes can have significant secondary influences on aspects of morphology and behavior and thus have epigenetic consequences.

This is a successful volume. As in any such effort, neither the editors nor the symposium organizers have control over the specific contents and quality of the individual contributions. Nevertheless, the papers either present in-depth reviews or novel findings of considerable interest to a wide range of evolutionary biologists. The shelf life of the book will be limited owing to the currently intense investigations in most of the areas represented, but these papers will stand as a statement of our knowledge as of 1980.

JAMES L. PATTON
Museum of Vertebrate Zoology, University of California, Berkeley 94720

Grand Unified Theories

The Second Workshop on Grand Unification. Ann Arbor, Apr. 1981. JACQUES P. LEVEILLE, LAWRENCE R. SULAK, and DAVID G. UNGER, Eds. Birkhäuser, Boston, 1981. x, 322 pp., illus. $19.95.

The full importance of an experiment in physics is usually not realized until after it has been completed and sometimes not until years later. This is not the case with the proposed measurement of the lifetime of the proton, predicted to be of the order of 10^{31} years. One can safely say that if the proton does decay with the proposed lifetime the consequences are known to be of truly fundamental importance. Beyond the aphorism of Glashow that "diamonds are not forever" and the consequence that the matter in the universe will in approximately 10^{31} years have decayed into photons and neutrinos are some startling consequences for our views of elementary particle physics. These include the idea that a so-called grand unification holds, namely that the weak, electromagnetic, and strong forces are different manifestations of one underlying basic type of interaction and that in fact they were identical in strength during the very early history of the universe. If the proton is soon seen to decay, it is very likely to be viewed as the most important single experiment in physics in the past 20 years, once the far-reaching consequences are grasped.

The theoretical research on grand unified theories (GUT's) and the experimental efforts to measure the proton lifetime have acted to join together physicists with common interests. The contents of this book of proceedings reflect the special nature of the work. Experiments must be done deep underground to eliminate cosmic ray background (looking at 10^{31} protons for one year to measure one event is no mean feat) so the experimental papers are reports of work done either in mines (Miyake and Narasimham, Steinberg, Shupe, Wilson, and Sinclair and Jones) or in tunnels (Fiorini and Barloutaud). The papers provide detailed descriptions of the apparatus and the results the authors hope to achieve.

The theoretical papers, on the other hand, dwell mainly on the unification of the basic forces, with forays into cosmology. The latter subject is particularly relevant, since the GUT's predict that the three basic forces of nature began to enter onto their divergent paths early in the history of the universe, approximately 10^{-35} seconds after the big bang. The consequences of GUT's for cosmology and vice versa are pursued in the contributions of M. S. Turner and M. Yoshimura. The latter focuses particularly on how GUT's provide a scenario for the calculations of the ratio of the matter in the universe to the total entropy of the blackbody radiation.

Detailed papers that spell out the predictions for protein decay lifetime and decay modes particularly clearly are those by Langacker and Marciano. The volume also includes more speculative contributions on new theoretical subjects, in particular technicolor and supersymmetry, by Srednicki and Dimopoulos and Georgi.

The first paper in the book is an amusing set of conjectures by Glashow about a universe in which most neutrinos are unstable and have decayed away into massless spin zero particles. A summary, by Weinberg, discusses anticipated theoretical and experimental results.

GINO SEGRÈ
Department of Physics, University of Pennsylvania, Philadelphia 19104

Migration

Animal Migration. Papers from a symposium, Lancaster, England, Dec. 1979. D. J. AIDLEY, Ed. Cambridge University Press, New York, 1981. viii, 264 pp., illus. Cloth, $39.95; paper, $19.95. Society for Experimental Biology Seminar Series, 13.

This symposium and the resultant volume had two aims. The first was to survey some particular aspects of migration in a manner suitable for nonspecialists in the field, and the second was to illustrate the range of current studies. The book succeeds better with respect to the former than the latter. All the contributions are straightforward, clear, and free of specialist terminology, but the scope is somewhat narrow, and I found myself frequently noting cases where comparisons with a more catholic array of studies or organisms would have added both illumination and generality. What is apparent from the studies reported is that much more is known about birds and insects than about fish and whales. Partly this results from the technical difficulties of studying the latter, but it is also obvious that more conceptual sophistication has been applied to terrestrial migrants. There is no coverage of the interesting diversity present in daily or seasonal migrations of Crustacea.

Analysis of migration can be broken down into proximate and ultimate (evolutionary) questions, and some of the relevant issues are succinctly summarized by Aidley in his opening chapter. Ultimate causes are, of course, much less amenable to analysis than proximate, and that fact is illustrated by the relative paucity of treatment of the latter here. Southwood does survey the ecology of insect migration, and O'Connor attempts a statistical comparison of migrant and nonmigrant British farmland birds. Unfortunately, O'Connor's conclusions are confounded by taxonomic and other variables. His group of 31 "residents" ranges from ducks to finches but includes no sylviid warblers; of the 11 migrants, however, seven are warblers. O'Connor concludes that migrants exploit resources unexploited by residents, but somehow I doubt that warblers and ducks exploit the same resources anywhere. There is also uncritical acceptance of *r-K* selection theory. On the applied side of migration ecology, Joyce contributes an excellent chapter, with examples from synoptic surveys in eastern Africa, on the relevance of sound ecological thinking to the control of migrant and other crop pests. It should in