"menopause, surgery, 'empty nests,' retirement" (p. 132). At these times people feel detachment, loneliness, and terror; and Myerhoff's remedy would be to construct rituals to subvert such feelings. Would the attempt to celebrate these unfeted moments not belie the meaning of celebration as defined in this volume? Focusing inward on the private world of pain would, of necessity, curtail that spontaneous, joyous, ludic outpouring of the public festive spirit that inspires this communal enterprise.

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Ecology in Simple Settings

Cave Life. Evolution and Ecology. DAVID C. CULVER. Harvard University Press, Cambridge, Mass., 1982. x, 190 pp., illus. $25.

Ecology during the past quarter century has been strongly influenced by mathematical models. By developing these models, ecologists hoped to predict and to uncover generalizations about the way species are organized into communities. It was a new brand of natural history, one in which the biological peculiarities of individual species were judged to contribute little to the structure of communities. At the same time, population geneticists continued to develop models of the relative importance of selection and neutral mutation in the evolution of populations.

Many of the models are difficult to test empirically because their underlying assumptions are either violated or unverifiable in most communities. The relative simplicity of cave communities seemed to Culver to make caves ideal settings in which to evaluate the assumptions and predictions of theoretical ecology and population genetics. In this slim volume, which deals chiefly with caves in eastern North America and in Europe, Culver carefully lays out hypotheses and their alternatives based on predictions from general models and evaluates the predictions by reviewing previously published evidence.

The first topics to be discussed are the often grottesque features of cave animals. Are their long appendages, long life-spans, and reduced eyes and pigments adaptations to the rigors of the cave environment (low food supplies, high humidity, and darkness), or are they merely inevitable phenotypic responses to life in a natural dungeon? Culver is correct in pointing out the importance of this question for evolutionary biology, but the evidence from cave animals is equivocal, chiefly because experiments investigating the relative contribution of environment and genotype to phenotype have scarcely been done. Whether the loss of pigment and eyes resulted from selection or from the accumulation of selectively neutral mutations also remains uncertain. Culver's calculations suggest that the neutral-mutation explanation remains a possibility, but these calculations depend fundamentally on the estimation of divergence time of cave animals from their above-ground ancestors. The divergence time, in turn, must be calculated indirectly because of the virtual absence of fossil cave animals. Some of the estimates seem to be based on the degree of "regressive evolution" (pigment and eye loss) and thus add an element of circularity in the calculation of evolutionary rate.

The rest of the book is similarly characterized by the author's inability to decide unequivocally between alternatives. Is competition the chief factor determining patterns of habitat occupation by cave animals, or are predation and physical factors also important? Are large-scale patterns of distribution due chiefly to differences in habitat area between caves, or do such historical factors as glaciation, stream alteration, and richness of the above-ground biota also play a role? Usually there are arguments to be made on both sides of each of these questions, so that in most instances it is less a matter of distinguishing between alternatives than it is of establishing the relative importance of each factor.

Culver tends to blame inadequate data for most of his failures to accept or reject hypotheses definitively, and indeed there are great gaps in our knowledge of the natural history of cave animals. I am inclined to put more of the blame on the underlying models and on the methodology used to test the hypotheses that arise from them. The ecological importance of competition, for example, is inferred by calculating competition coefficients that are based on habitat overlaps between co-occurring species. The assumption is that habitat separation is effected and maintained by competitive exclusion where the two species come into contact. Aside from the likelihood that factors other than competition could bring about such a pattern, the less drastic effects of competition (reduced growth rates and fecundities of individuals, for example) are ignored, and there is no information on the resources being competed for or on the methods used by the species to monopolize these resources. Similar criticisms apply to the section on predation. This interaction may be important in some caves, as is suggested by the limited overlap between salamanders and some of their potential prey, but there is little discussion of methods of predation or of antipredatory characteristics. The extent to which competition, predation, and other biological interactions have influenced the evolution of cave animals is not considered. In short, current theoretical models of competition and predation, which are based on densities and growth rates of interacting populations, yield little insight into the ecological and evolutionary importance of these interactions and steer investigators away from the study of mechanisms.

Culver's thorough treatment of the literature makes it clear that much interesting biological work remains to be done in caves. If models are to guide this work, they will have to incorporate assumptions that are more verifiable, and they should emphasize the nature and consequences of individual interactions. I should like to see studies that compare cave communities with one another and with communities in other environments that are characterized by a chronic scarcity of such resources as food. Only in this way will it be possible to know whether the ecological responses and evolutionary pathways of cave animals are unique or whether they are typical of organisms in marginal environments of all kinds.

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Biogeography

Areography. Geographical Strategies of Species. EDUARDO H. RAPOPORT. Translated with revisions from the Spanish edition (1975) by Barbara Drausal. Published on behalf of the Fundación Bariloche by Pergamon, New York, 1982. xvi, 270 pp., illus. $29.50.

Areography is the first in a series of books to be published by the Fundación Bariloche, an Argentinian nonprofit organization devoted to supporting nonconventional creative research in a wide variety of disciplines. The intent of the series is to provide English-speaking readers access to a diversity of current thinking in Latin America.

Rapoport's book treats the study of the geographical ranges of taxa, from subspecies to supraspecific categories. His subject is the mathematical and statistical characterization of the form and size of geographical ranges and the inferences that can be drawn from such analyses regarding the ecology of the organisms in question. Rapoport likens the geographical distribution of taxa to "the Chinese-lantern shadows produced by the different taxa on the continental screen" and explains that areography "is like measuring, weighing, and studying the behavior of ghosts." And he demonstrates that he has been quite busy compiling and analyzing in detail the geometric patterns of his ghosts.

Areography owes a large debt to the Hutchinson-MacArthur school of ecology in that Rapoport too devotes his energies to searching for patterns from which process is inferred. Many familiar topics emerge: latitudinal diversity gradients, the role of barriers in species dispersal, random breakage models, factors influencing the degree of overlap of species ranges, even r and K selection. The discussion of these topics does not deviate from ecological thinking of the early 1970's. *Areography* is also a descendant of the dispersalist biogeographic lineage, despite the facts that figures 5.2 and 5.3 are what vicariance biogeographers would call "track diagrams" and that Croizat, the prime mover of the vicariance renaissance, is cited in the bibliography. However, little of Croizat's or other vicariance biogeographers' thinking occurs in *Areography*, and the book remains faithful to the kind of reasoning put forward in MacArthur's (1972) *Geographical Ecology*.

Areography covers many matters not considered in recent biogeographical texts, although, as Rapoport points out, aspects of what he deals with have been treated by other biogeographers such as S. A. Cain and M. Udvardy. For those not accustomed to thinking about patterns formed by distributional maps there will be some insights and some interesting methods of data analysis. I particularly liked the discussion of different techniques for establishing the size and shape of a species range. I also enjoyed Rapoport's anecdote that one has to clean insects from car radiators more frequently during trips in subtropical to temperate regions than in tropical or cold temperate regions. The implication is that population sizes of insects are greatest in intermediate climates.

It is most unfortunate that this book, first published in Spanish in 1975, had to wait so long to be translated into English. For despite the fact that it is listed as a revised and enlarged version of the original, only six of the more than 200 works cited were published more recently than 1975, and four of these are the author's own. The recent debate between vicariance and center-of-origin biogeographers about how best to do historical biogeography is not even mentioned here, and none of the ecological biogeographers' recent pleas for substituting experiments for correlational studies or the recent criticisms of the MacArthurian approach are discussed. These omissions drastically reduce the value of the book for those active in the field.

Despite these significant shortcomings, *Areography* allows English-speaking biogeographers a chance to learn how some of their South American colleagues think. *Areography* will not affect the field of biogeography to the extent the writings of Rapoport's South American-based colleague Leon Croizat have recently, but I applaud the Fundación Bariloche for providing access to a hitherto unexplored, yet substantial, body of work.

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Observing Molecular Collisions

Chemical Dynamics via Molecular Beam and Laser Techniques. The Hinshelwood Lectures, Oxford, 1980. RICHARD B. BERNSTEIN. Clarendon (Oxford University Press), New York, 1982. x, 262 pp., illus. Cloth, $49; paper, $24.95.

For about 20 years, a growing group of chemical physicists has been seeking to observe individual molecular collisions in as much detail as possible. The goal is to understand what happens with the greatest resolution in order to be able to predict and control the outcome of more complicated systems involving mixtures of collisions in a variety of environments. Prior to the introduction of molecular-beam techniques the major problem in observing molecular collisions was that an observable one was usually the result of a very inhomogeneous group of collisions, highly averaged over initial thermal distributions of translational, vibrational, and rotational energy. Sometimes, for example in hot-atom chemistry or in some photolyses, one could observe the results of nonthermal distributions of collisions, but it was molecular-beam techniques that revolutionized our understanding of chemical dynamics at the single-collision level. More recently the laser, often combined with molecular-beam techniques, has become the tool nonpareil in this quest for detail.

Richard Bernstein has not only been part of the quest from its earliest days, he has been the leader of many phases of it. He has now written another book on the subject.

The book is based on lectures that Bernstein delivered in 1980, updated through 1981. The exact date of the latest reference is actually not too important because the book should remain "a good read" for a very long time. Bernstein reviews the many different ways in which individual collisions have been studied, with incisive discussions of an assortment of the classic experiments in the field and interpretation of the results.

The field has become too large for a complete survey of all the available techniques and results by a single author, and Bernstein makes no attempt at completeness in that respect. The book is, however, remarkably complete in mentioning examples of the kinds of approaches and illustrating the kinds of information that can be obtained by each, even to the point of including some discussion of techniques that involve neither molecular beams nor lasers. Some of the techniques discussed are state selection of collision partners by laser excitation, by inhomogeneous electric fields, or by prereactors and final-state analysis by laser-induced fluorescence or a bolometer. The discussion is heavily weighted to reactive collisions, and especially to utilization and disposal of various kinds of energy in chemical reactions, but elastic scattering and rotationally and electronically inelastic scattering also get appreciable attention. The theoretical level of the interpretative sections is sufficient to bring out the most important features, but it stops short of the kind of detailed theory that would make the book unreadable for the uninitiated. The material is so clearly presented that the book could be understood by an undergraduate.

One of the strengths of the book is that one can trust the author both in his selection of what is important and in his presentation of details. I found very few errors, although there are of course a few details with which one might quibble. For example, in discussing the Kneba-Wellhausen-Wolfrum experiment on the rate constant of D reacting with vibrationally excited H_2, the author assumes that the disagreement with theory must be due to the inadequacy of the calculations. I would have appreciated a caution that the experiment might be wrong. In discussing electronically nonadiabatic collisions, the Landau-Zener approxima-