which a single genotype can produce one of several alternative phenotypes in response to the environment. This approach is concerned with issues such as the constraints on selection due to genetic correlations between components of fitness in two environments. The emphasis is on variation among individuals within a population.

The second approach does not explicitly include genetics, but rather studies patterns of variation resulting from ontogenetic trajectories and allometric relationships among characters such as egg size and body size. The emphasis is on variation among related but not interbreeding taxa. Central to this approach is the notion of heterochrony, the relative timing of developmental events in related taxa.

In 1987 a conference was held in Grahamstown, South Africa, to discuss "the ways in which epigenesis . . . shapes the life-history styles of plants and animals." The organizing concept of the conference, and the volume that it spawned, was alternative life-history styles—that is, that organisms have bifurcations in their development in which they have genetic instructions to follow more than one pathway, with the environment determining which branch is taken.

The conference logo was a coelacanth fetus with a yin-and-yang yolk sac, and the first chapter, by Balon, entitled "The Tao of life," is a primer on Taoism and its application to evolution and developmental biology. Those of us who spent the '60s talking about life-history evolution will be amused by this chapter's summary table, which has "yin" and "yang" as column headings and such familiar pairs of concepts as *r* and *K* selection and altricial and precocial development as the entries. The epigenetic concepts of Goldschmidt, Waddington, Løvtrup, and Balon join the thoughts of Lao Tzu (the Old One) in other chapters.

One should read beyond this first chapter; the volume contains some very straight and empirical reviews of life-history diversity in fishes (Flegler-Balon), amphibians (Duellman), small mammals (Perrin), and birds (Siegfried and Brooke). These review chapters tend to be extensions of the post–G.C.–Williams era of adaptationist interpretations of life-history diversity. There are also some mixed chapters, such as one by Fabian on sex determination that first presents a concise review of mechanisms and then a brief speculation on "ontogenetic memory," by which organisms alter regulatory genes to recall phenotypes from their evolutionary past. Geist reviews phenotypic dimorphisms in mammals with a fascinating historical account of the experimental study of the effects of nutrition on growth and development of deer. He then presents his dichotomy of dispersal and maintenance phenotypes and argues that we are all the genetically fixed dispersal form of *Homo erectus*.

There is much to think about when reading this volume, but one must be prepared to cycle from dry factual recitations of the life histories of particular groups to reviews of conventional evolutionary theory to rather flaky excursions out of the mainstream. I found myself in a rather peculiar eddy with a chapter by Løvtrop reviving the Lamarckian dichotomy of divergent and progressive evolution. Divergent evolution is phylogenetic bifurcation (we call it speciation), which Løvtrop says requires isolation and the suspension of natural selection. Progressive evolution is said to occur whenever two taxa attempt to inhabit the same niche, with the competitive exclusion axiom driving the process. Progressive evolution is directed, with the branch resulting in the most secondary branches being on the progressive side of the bifurcation. Løvtrop develops a phylogenetic classification of the vertebrates, producing a progressive lineage leading to mammals. At one point he had to decide whether birds or mammals were the more progressive. He chose mammals by resorting to the ecological criterion "when flightless birds are exposed to competition with mammals they usually lose the battle."

This is a book about bifurcations. I found myself sorting the chapters into good ones and bad ones. The good ones summarize decades of empirical work. The bad ones are half-baked attempts to apply nonscientific approaches to legitimate evolutionary questions.

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Some Other Books of Interest

Biology and Utilization of the Cucurbitaceae. DAVID M. BATES, RICHARD W. ROBINSON, and CHARLES JEFFREY, Eds. Comstock (Cornell University Press), Ithaca, NY, 1990. xviii, 485 pp., illus. $69.50. Based on a conference, Ithaca and Geneva, NY, Aug. 1980.

The plant family Cucurbitaceae, best known through such fruits as squash, pumpkin, cucumber, and melon, is also a source of other useful products and has, as the editors note in the preface to this volume, been studied from a wide variety of perspectives. Among features of both biological and agricultural interest the editors note the widespread occurrence of bitter tetracyclic terpenoids, affecting relations with insects; unisexuality, expressed through both monoecy and dioecy; and "synergistic relationships with early agriculturalists." All these and other themes are represented in this volume, which has been expanded beyond the 1980 symposium in which it originated. The volume opens with a group of 14 papers on the systematics and evolution of the family, beginning with an overview by Jeffrey (who also provides an outline classification as an appendix to the volume) and including considerations of cytogenetics, isozymes, phytogeography, coevolution, and domestication of various species. There follow five papers on comparative morphology and four on sex expression. The remainder of the volume is devoted to more immediately practical concerns. A group of six papers under the heading Utilization includes discussions of pharmacological properties of New World tropical species, a program to develop the food potential of the New World buffalo gourd, and the possibility of cultivating the Namib Desert species *Acanthiosicyos horridus*, which has been utilized by foragers since antiquity. The final seven papers are devoted to crop improvement and protection. Among the approaches to genetic improvement discussed are cell, tissue, and organ culture techniques, addition of an extra chromosome, and manipulation of genes affecting capacity for chlorophyll synthesis. Other subjects discussed include resistance to viral and other diseases, encouragement of multiple fruiting to increase the efficiency of mechanical harvesting, and advantages of bush over vine cultivars. The book has an international authorship, including scientists from India and Africa as well as Europe and North America. It concludes with a 20-page index.—**K.L.**

Herbicides and Plant Metabolism. A. D. DODGE, Ed. Cambridge University Press, New York, 1990. x, 277 pp., illus. $65. Society for Experimental Biology Seminar Series, 38. From a seminar, York, U.K., April 1987.

In his preface Dodge notes that investigators of photosynthesis have long used herbicides as experimental tools and that the shikimic acid pathway and various other processes of biosynthesis in plants have attracted new attention because of the discovery of compounds that inhibit them. The Plant Metabolism Group of the Society for Experimental Biology has thus prepared this collection of 12 review papers by 19 (mostly British) authors in the hope that it will be useful to both students and research workers in the field. In an opening chapter K. B. Parry provides some background information on the use and development of herbicides, including data on the market for agrochemicals and discussing the cost and effectiveness of the four major approaches