R Factors

Infectious Multiple Drug Resistance. S. FALKOW. Pion, London, 1975 (distributor, Academic Press, New York). xiv, 300 pp. + plates. $19.95. Pion Advanced Biochemistry Series, 4.

This book chronicles developments in plasmid research over the past 20 years, with primary but not exclusive attention to infectious antibiotic-resistance (R) plasmids. It is not a review of the literature of the subject but an attempt "to present the basic information that is available and to underscore the more abundant questions that remain." The early chapters focus on the molecular and genetic properties of plasmids and the later chapters are concerned with the biochemical basis of plasmid-mediated drug resistance, the serious consequences of R plasmids with respect to antibiotic therapy, and the pathogenic properties of bacteria that are specified by certain plasmid elements.

In general, the information is presented with clarity and fidelity. While the author often seizes the opportunity to speculate on the biological basis of plasmid-related phenomena, on the whole he presents the consensus of workers in the field.

One of the strengths of the book is the treatment of R plasmids within the framework of plasmid elements in general; that is, R plasmids are viewed as part of a larger family of plasmid elements including the classic sex factors of *Escherichia coli* and the colicinogenic, enterotoxin, and hemolysin plasmids. In addition, the author draws on information from other systems, such as the temperate bacteriophages, in order to obtain further insight into the maintenance of the plasmid state and the events of integration of a plasmid element with the host chromosome.

Each chapter includes a listing of relevant books, reviews, and original papers. No attempt was made to provide an exhaustive list of references, but in general the author has provided a well-balanced selection. I appreciated finding in the book a considerable quantity of data, including many of the author's heretofore unpublished observations, that are not easily obtainable elsewhere. This was particularly true in sections dealing with the ecology, incompatibility properties, and structural relationships of plasmids. The treatment of the ecology of R plasmids in the latter part of the book and of the implications of ecological properties of R plasmids with regard to medical and agricultural practices is also noteworthy. This book probably is the best compendium available on the subject.

Another strength of the book is its currentness. A striking example, in view of the publication date, is the section on the use of plasmids for the cloning of foreign DNA in bacteria. This topic certainly has stirred considerable interest among scientists in a number of disciplines in addition to some anxieties in segments of the scientific community and the general public.

The book is not unflawed. The chapters are somewhat uneven with regard to the amount of detail in which the topics are treated and to the finishing touches that have been applied. On the whole, however, this is an excellent book, timely and reflecting the author's involvement in developments in the field and his mastery of the subject. It will be a valuable source of information to students, teachers, and scientists in biology, medicine, and agriculture.

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Mammals in Ecosystems

Small Mammals. Their Productivity and Population Dynamics. F. B. GOLLEY, K. PETRUSEWICZ, and L. RYSZKOWSKI, Eds. Cambridge University Press, New York, 1975. xxvi, 452 pp., illus. $32.50.

This collection of papers is a refreshing variation in organization for IBP (the International Biological Program). Instead of being centered around a biome (such as a desert or tropical forest), it concentrates on a taxon, mammals. In fact, it is even more restrictive than its title would indicate, since almost all the contributions deal exclusively with rodents. It represents the proceedings of the fourth international meeting of the IBP Working Group on Small Mammals held in Poland in November 1973. The Working Group on Small Mammals is one of the "theme projects" of IBP.

The goals of this book project are those of the theme project, since it is a report on the results of the project. These goals include standardizing methods for collecting population data about small mammals and the collection of data, including "density, sex ratio, body weight distributions and sexual activity" in various biomes. Conversion of such data into energy flows allows the small mammal data to be plugged into larger models of whole ecosystems. Not different from other scientists, this group has devoted some time to detecting ways in which data collection procedures and data reduction can be improved. Also, they tried to understand the role small mammals actually play in influencing the control of ecosystem dynamics. Finally, they hoped to apply their knowledge to public health and pest control problems.

That set of goals is broad and ambitious. To help achieve it, the organizers and editors have included contributions from some investigators not actually involved in IBP. As a result of these goals and the selection of authors, many of the contributions are review articles of great scope, and nearly every topic in modern mammalian ecology is referred to, even if only peripherally. The book's unified 68-page reference section is an encyclopedic guide to current investigations. The book definitely succeeds in avoiding the parochialism that can characterize symposia.

Michael Smith and his colleagues begin the substantive reports with a first-rate treatment of the problems of censusing small mammals. From that point on, modern ecological topics such as energy flow, population interactions, species diversity, and physiological ecology permeate the investigations reported in the book.

Although the primary function of this volume is synthesis, novel conceptions also occur. The best example is Lidicker's piece on dispersal. Lidicker argues that many individuals are adapted to leave an environment and take up a transient existence before that environment becomes so full of their own kind that it deteriorates completely. He terms this phenomenon presaturation dispersal. A similar idea deriving from studies of birds was proposed by Fretwell and Lucas. Lidicker explores his idea and related modes of dispersal from the point of view of the evolutionary ecologist.

This same vantage point characterizes the chapter by French and his colleagues. They also discuss some novel concepts—these having to do with patterns of birth and death—but they arrive at their suggestions by an empirical route. Their article contains and is founded upon a 16-page summary table of all known small mammal survival and reproduction data in the literature! To the serious student of mammals, this table alone is worth the price of the volume.

The only topic that needed and does not receive extensive treatment in this book is competition. I think small mammals have proven most useful as model

organisms for students of competition. Starting with V. S. Summerhayes's classical experiments with voles during the 1930's, a significant literature has grown up that involves mammals as competitors or as agents that promote or relieve competition in other taxa. Since knowledge of competitive processes appears to be a key to understanding species diversity and extinction, the absence of a discussion of competition is a serious gap in terms of the book's and IBP's goals.

Several of the contributions at the end of the volume are addressed to applications of knowledge to rodent control for agricultural and health purposes. Other chapters refer to these problems either as worthy of attention or as motivating forces in their research. Unfortunately, at this stage, the best these authors can do is point out some of the opportunities for application and suggest untried philosophies and methodologies.

Remarks about applications throughout the volume are biased against rodents. Granted, rodents can be pests. Granted also that they can carry diseases. However, they also consume vast quantities of insects, and insects are also pests and vectors. In only one place in the book did I find any mention of the possibility that most rodents at most times are more helpful than harmful. And no one seems to have taken this possibility at all seriously. It is my belief that offending rodent species are more than equaled by inoffensive and beautiful forms in whose absence we would be esthetically poorer, at least.

The book accurately reflects the immaturity of the science of ecology as a whole. It reports observations made and data collected, but rarely indicates the hypotheses that were being tested. That is because hypotheses are usually not involved. It is not inaccurate to characterize most current ecology as Baconian—rooted in the faith that pure induction is the only (or the best) way to do science.

History, however, teaches a different lesson. As sciences mature, they develop a hypothetico-deductive philosophy. They progress by generating hypotheses and disproving them in controlled experiments. It is my opinion that such a maturation is now under way in ecology, and that after it is completed we shall be in a much better position to offer aid and advice to those involved in public health and agriculture and to those who would save our wild lands and their denizens from extinction. Inasmuch as this book hints at the ongoing change, it is like a beautiful larva caught spinning a cocoon; we can see the glory that was and anticipate that which is coming, all at the same instant. From this reviewer's point of view, three cheers for the metamorphosis!

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Pattern in Evolution

Complex Adaptations in Evolving Populations. T. H. FRAZZETTA. Sinauer, Sunderland, Mass., 1975. xiv, 270 pp., illus. Cloth, $11; paper, $4.95.

Why are there so many kinds of organisms, and how have so many complex structural patterns evolved? Frazzetta assumes that the evolution of complex adaptations occurs in a manner compatible with what is known concerning the evolution of simple characters, but seeks to determine if such knowledge is sufficient to explain the diversity of nature. This monograph deals with complex structures, and strives for answers to the questions set forth above. The examples are exclusively animal, and deal mainly with vertebrate hard parts, but the approach is general. In Frazzetta's view history, developmental canalization, and physical laws constrain lineages during phylogenesis. Ledyard Stebbins has proposed that these and other factors lead to a kind of evolutionary canalization, with groups being set on trajectories early in their history and from that point following paths of least resistance. Evolution runs in grooves, so to speak. If this is so, how do complex novel features appear, and how do they become incorporated into the genome?

This work is an attempt to integrate genetics, population ecology, morphogenesis, and biomechanics with some notions and hypotheses from a variety of fields to achieve a synthesis. It is a tall order. Frazzetta has articulated the problem clearly, and must be credited with courage for his struggle in this conceptually difficult area. His attempt at synthesis is only modestly successful, however. Gene duplication, the Britten-Davidson model, the Ludwig hypothesis, the Baldwin effect, and problems of relative growth all enter into his synthesis. Yet one is left with the numbing feeling that biologists remain unable to present convincing arguments to explain the evolution of callouses in mammals, divided maxillary bones in an obscure group of snakes (both discussed here), and many other structures. The author repeats his earlier arguments that bones broken during feeding in ancestral snakes gradually evolve into two separate bones in descendants living on an island lacking major competitors. The contrived explanation is an example of a pattern in this work, with stress on the possible more than the probable. Evolutionary biologists are indeed clever, but has the production of pattern in evolution really been explained, or has it been explained away?

The narrative flows well for the informed reader, but to one not already conversant with population ecology, genetics, and developmental biology the arguments may be obscure. The connections between seemingly disparate fields are not made smoothly, and the habit of using extensive, often esoteric, notes in every chapter is distracting. The author frequently generalizes broadly and speculates from a very few, narrowly defined experiments. Yet, he freely states again and again that evidence is "merely circumstantial," or that his arguments depend heavily on the validity of a fine, often controversial, point. Nearly every argument is heavily qualified, but there are some striking insights and some useful models. For example, arguing by analogy from the history of technological development, Frazzetta suggests that truly new complex adaptations can be effective even though very imperfect. What is important is novelty and progress, not precision. Population ecology is stressed out of proportion to the use made of the formulations later in the book. However, a model Frazzetta presents integrating parameters of population dynamics with aspects of natural selection (unified as a general factor—an intuitively defined "selective diversity") may have heuristic value.

Frazzetta concludes that there are but a few fundamental patterns underlying animal diversity. The differences we perceive are real, but their biological causes might be simpler than we think.

There is a vagueness in some instances approaching mysticism in this treatment, and it is difficult to know exactly how to use the book. It is, in effect, a long essay, appropriate for supplemental reading lists in advanced courses. Surely many would benefit from pondering anew some of the fundamental questions in evolutionary biology as perceived by this thoughtful and imaginative biologist.

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