Some important analytical questions are also ignored. How did organizational forms affect the quality of the finished work? What criteria should historians employ to weigh the intellectual significance of completed research? Did the changing social organization of knowledge affect the way people perceived and organized their ideas and investigative techniques? What were the relationships between scientific concepts and methods and the structure of the institutions housing them? Allen's essay is the only paper that confronts the last question squarely.

The history of the organization of knowledge in America may be too young to concern itself with large normative issues or to touch every inch of the territory. Internal evidence suggests as much. Components of a pattern for the institutional development of scholarship can be selected arbitrarily from several papers in the volume (with apologies to Rosenberg) to help us find where these historians of the subject are now. First, the contributors have passed the professional entrance requirement: they all appear to have the Ph.D. Nearly every one is connected to a university, most come to the subject from a broader discipline, and the group can be called an elite, though not one that tries to remove its scholarship (in Higham's words) "from common understanding and participation." The research and writing were sponsored by an honorific organization, a practice that was atypical during the 19th century. But by and large the research style chosen by the authors places them in Allen's "naturalist" tradition. Mainly, the essays are descriptive, factual, inductive, speculative. There is a reluctance to formulate hypotheses and then examine them systematically with quantitative evidence. The form of Dupree's paper is nearest to the "experimentalist" approach: he classifies functions of the National Academy and then methodically introduces evidence, including numerical data, to test how the organization performed in each category. Kevles also counts and compiles, but quantification is rare in the book. Finally, our specialists do not have a learned society of their own yet, or a society-controlled journal, though *Minerva* serves the latter's purpose.

In sum, the history of the organization of knowledge seems to be about where emerging specializations were just prior to 1920. One should not expect a youthful sub-subdiscipline to address every related moral question nagging society today, or to exhibit perfect theoretical symmetry during its pioneering years. At this stage such coherence and moral legitimacy are rather like what Veysey, writing about the annual meetings of the American Philosophical Association in earlier days, refers to as "the elusive promise . . . that they might actually bring about agreement on the nature of ultimate truth through deliberation by a committee" (p. 79).

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Magnetic Effects

Cosmical Magnetic Fields. Their Origin and Their Activity. E. N. PARKER. Clarendon (Oxford University Press), New York, 1979. xviii, 842 pp., illus. $95. International Series of Monographs on Physics.

Parker is the outstanding authority on the theory of the sun's magnetic field. In 1955 he published a crucial insight concerning the way in which the solar field is generated by a turbulent dynamo, and he has been contributing at a consistently high level ever since. Hence it is of great interest when he takes pen in hand to summarize his work. The resulting book, *Cosmical Magnetic Fields*, is a major contribution to the astrophysical literature.

Parker has a very definite point of view: he argues that except possibly for a small set of highly symmetric magnetic topologies it is impossible to permanently bind magnetic flux into stars. Thus, the magnetic fields we do observe in the sun, stars, and galaxies are ephemeral and require continual regeneration by some process. A key point is that a flux tube bearing stellar or galactic gas is lighter than its surroundings and is thus buoyed upward, ultimately to escape. Parker argues this point in the book by exploring many examples of possible equilibrium in detail.

If the field is to be regenerated, Parker argues that some type of dynamo must be at work, with differential rotation stretching meridional fields into azimuthal ones, and cyclonic turbulence twisting azimuthal fields back into meridional ones. Since the turbulence in most stars is due to thermal convection on a small scale, the newly generated meridional fields are small-scale, so that reconnection of the lines of force is necessary to regenerate the original large-scale fields. Parker explains dynamo theory and reconnection in precise mathematical detail.

I like Parker's style on the whole. Each chapter begins with a pictorial discussion of the physical problem and continues with several relevant physical models worked out mathematically; there is then a summary of the general conclusions that can be drawn from these examples.

The book is based on the equations of magnetohydrodynamics, so that many of the specifically plasma effects in cosmic magnetic fields, such as high-frequency oscillations and instabilities, are largely ignored. There is brief reference to ion-acoustic instabilities, plasma turbulence, and anomalous resistivity in relation to the necessity of rapid reconnection of lines of force in dynamo theory.

I have one complaint. At times the writing is repetitive, and at times more examples are considered than are necessary to make the point. The result is that the book is considerably longer and more expensive than it needs to be. But that is a cavil: Parker has written a book that will dominate the field. None of the other books on the subject, such as Moffatt's *Magnetic Field Generation in Electrically Conducting Fluids* (Cambridge University Press, 1978) and Cowling's *Magnetohydrodynamics* (Adam Hilger, 1976) is as deep and as comprehensive.

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Reproductive Adaptations

Reproductive Ecology of Marine Invertebrates. Papers from a symposium, Georgetown, S.C., May 1977. STEPHEN E. STANCYK, Ed. Published for the Belle W. Baruch Institute for Marine Biology and Coastal Research by University of South Carolina Press, Columbia, 1979. xxii, 284 pp., illus. $27.50. Belle W. Baruch Library in Marine Science, No. 9.

This book presents the proceedings of a very successful symposium that was dedicated to A. Giese of Stanford University, who has done pioneering work on the reproductive biology of marine invertebrates and has inspired many others to follow. The book is organized into four sections comprising 19 papers including original research reports as well as review articles. The four sections are: Egg Size and Nutrition; Recruitment, Survival and Distribution; Environmental Effects on Reproduction; and Reproductive Patterns in the Marine Environment. The book concludes with a brief but comprehensive summary by the editor.

In general the book is a useful documentation of current thought on its topic;

it deals with reproductive adaptations both at the subcellular and at the population and life history level. The majority of the papers emphasize empirical data on individual species. This is obviously a swing back from recent trends toward theoretical generalization based on assumption.

There are good papers in all four sections. The following are examples representing, perhaps, my personal bias. K. B. Clark *et al.* document a fascinating phenomenon in the reproduction of *Elysia* (an ascoglossan opisthobranch) that generates a number of unanswered questions concerning life history strategies. Studies of this sort should be encouraged. Turner and Lawrence provide, as expected, valuable information on the relationship of egg volume to organic composition and successfully refute some of the theoretical models. Strathmann and Branscomb present a new concept of larval settling behavior and recruitment. Their conclusion that "wide dispersal of larvae and spatial variation in the attributes of favorable sites combine to limit the effectiveness of cues available to settling larvae" is amenable to testing, and they have provided preliminary evidence on barnacle settling. Woodin's paper outlines an elegant theoretical argument backed by specific examples of a number of factors that must be considered in analyzing and interpreting recruitment patterns (temporal and spatial). This is an excellent review for studies of population ecology and benthic communities. Woodin is also careful to point out examples where her generalizations concerning recruitment can be negated by other types of selective pressures. R. B. Clark presents an extremely interesting review of the control of polychaete gametogenesis and of spawning, described in a most lucid style. He focuses on proximate rather than ultimate effects of the environment. His review is valuable to anyone working with invertebrate life histories in that it includes a thorough reassessment of the terms and concepts used, and dispels much confusion surrounding the terms. Woollacott discusses in detail the effect of the environment on ascidian reproduction, concentrating on organismal responses at the cellular and biochemical levels. Switzer-Dunlap and Hadfield furnish important quantitative data on life history parameters of aplysiid opisthobranchs. Their data indicate some interesting correlations among adult size, growth rate, fecundity, and age of onset of sexual maturity. Hines's paper on barnacle reproduction presents an interesting and intelligent interpretation of results. I feel this is another excellent contribution to the population ecology of benthic communities.

On the other hand, I find myself not entirely in agreement with the interpretation or conclusions in a number of papers. For example, Spight's assumption that related species tend to have similar life history features can easily be refuted by examples provided in this volume (in the papers by K. B. Clark *et al.* and R. B. Clark).

In summary, this is a valuable book. It contains rich resources of information, although more than two years old. Invertebrate zoologists and marine biologists of all types should benefit greatly from it.

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Gene Regulation

The Operon. Papers from a meeting, Cold Spring Harbor, N.Y., July 1976. JEFFREY H. MILLER and WILLIAM S. REZNIKOFF, Eds. Cold Spring Harbor Laboratory, Cold Spring Harbor, N.Y., 1978. x, 450 pp., illus. $42. Cold Spring Harbor Monograph Series.

What is the mechanism by which certain genes are expressed while other genes in the same cell are not? This question lies at the heart of the problem of cellular differentiation and has occupied geneticists and molecular biologists for decades. On the basis of their studies of *Escherichia coli* and its bacteriophage lambda, François Jacob and Jacques Monod formulated in 1961 the operon concept for the regulation of gene expression. A contiguous block of related genes (the operon) is coordinately regulated by an adjacent site (the operator) where a repressor acts to prevent operon expression. The activity of the repressor, in turn, is regulated by a small-molecule signal from the environment. Subsequent work by others showed that the operator is DNA physically continuous with the genes and that the repressor is a protein whose binding to the operator blocks initiation of transcription by preventing RNA polymerase from binding to the promoter site located very near the operator site. Although these studies were done with bacterial genes, it was supposed that a similar mechanism might regulate genes in other organisms, including eukaryotes.

The Operon is a collection of reviews of what we understand, as of 1976, of regulation of gene expression in enteric bacteria (*E. coli* and *Salmonella typhimurium*) and some of their viruses. The first half of the book presents a detailed analysis of the *lac* operon, confirming the basic proposal outlined by Jacob and Monod. Current research described in the book emphasizes the physical chemistry of the interaction between the controlling proteins and the controlling site. One can read about topics ranging from the isolation and mapping of over 1000 mutations in the *lac* repressor gene, to the nucleotide sequence of the *lac* promoter-operator complex, and on to the rate of dissociation of repressor from operator. Nucleotide sequence analysis has revealed the exact relation between the operator and promoter sites and the beginning of the gene itself. One gets the impression that the only piece missing from the picture is the determination via x-ray crystallography of the three-dimensional fit of the repressor onto the operator.

In the second half of the book, however, one learns that the world is not all one and the same. There are marvelous variations on the operon theme. In each of the six other systems reviewed (*trp*, *gal*, λ, *hut*, *ara*, and flagellar phase variation) the regulatory sites are controlled in a manner different from the *lac* site. In some cases transcription does not occur unless a regulatory site is coupled with an activator protein, which in turn is activated by a small molecule from the environment. Some operons are controlled by two or even three regulatory proteins acting in concert to turn the genes on or off in appropriate fashion. Although regulatory mechanisms of these types were not part of the original definition of the operon, they are clearly logical extensions of the operon concept.

Two quite different types of gene control are also discussed in the book. In one aspect of regulation of the *trp* operon, continued transcription through the operon is governed not by a regulatory protein but by the ability of ribosomes to translate the initial leader RNA. An adequate supply of tryptophan, and hence charged tryptophanyl-transfer RNA, allows translation, which by a not-yet-understood mechanism leads to termination of transcription before the *trp* structural genes. As in other operons, expression of the genes is regulated by the environment, but by a radically different mechanism that appears to be widespread among amino acid biosynthetic operons. In another case, that of switching from