cedents of the 1960's student radicals, these early rebels strove to forge connections between their college experiences and the larger world outside, corresponding to the changing role of higher education in American life.

Horowitz recognizes that each campus had its own variations of these three cultures, and indeed that among different types of students they were played out in different ways. In a chapter entitled "College women and coeds," she discusses in some detail the "female" versions. Blacks and other minorities (except Jews, who came to be well represented at the types of institutions she focuses on) receive considerably less attention, nor are the special circumstances of junior colleges or commuter schools considered in much detail. There are some clear parallels to be drawn, though, as Howard London's analysis in *The Culture of a Community College* indicates with its discussion of the "oppositional" student culture at a two-year commuter school. Horowitz's analyses apply most directly to four-year residential liberal arts colleges, as she herself states in the preface; one might add to this the caveat that more prestigious schools receive greater coverage, and traditionally black institutions are hardly covered at all.

The ebb, flow, and interplay of these three cultures make fascinating reading. The clearest pictures that emerge from the analysis, however, are those from the 18th and 19th centuries. The period from 1900 to 1960 (approximately) is treated over several chapters, focusing on the three different cultures in turn, as though the period were of a single piece; the reader does not come away with much feeling for how the enormous changes that took place in higher education during this time were reflected (or not) in campus life. Even when specific events are considered (such as the GI Bill, whose impact on campus life Horowitz does discuss), movement of the narrative back and forth in time blurs the analysis of their impact.

The book's final chapters, which focus on the 1960s, '70s, and '80s, raise the perhaps inevitable difficulties of maintaining a historian's distanced objectivity when analyzing situations in which one is (or was) a participant. While Horowitz is frank about her own feelings and involvement in the issues being contended during this time, many readers will no doubt question her telling and interpretation of the events.

It is also in these final chapters that one feels most strongly the absence of an overriding analytical frame for this study. Though Horowitz attends to the roles played by social class, gender, ethnicity, religion, power relations, the economy, and even the psychology of adolescents in influencing the development of these cultures, she does so in a relatively unsystematic way. Narrative is consistently favored over analysis, and few links are explicitly drawn between the forces that motivated the early students to form their cultures and those that animate students today; the discussion in this portion of the book is thus bereft of what could be much of its power, and our historically informed insight into the "New Outsiders," Horowitz's term for those perplexing students of the 1980's, is thereby limited.

The scope of this work is, in the end, both its weakness and its strength. In the spanning of so many years and so much change, potentially important details are sacrificed. The sources that are used change with time—the early students are largely allowed to speak for themselves, via correspondence, autobiography, novels, and official college publications, whereas the 20th-century students are interpreted for us in surveys and interviews conducted by psychologists, sociologists, and others who are often also their teachers. Can one really control for the biases that such differences may introduce? Further, the sheer diversity and change that occur over this time raise serious questions as to the utility of comparing student cultures across this range.

Horowitz straightforwardly acknowledges these problems. Yet she asserts that what can be gained by this task is worth the risks entailed, and upon reflection I agree. This is a useful book that provides an abundance of "raw data" for the musings of professors who want to come to a better understanding of students of any era; indeed, anyone who deals with students can benefit from a thoughtful, but critical, reading of *Campus Life*.

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## Tried and True Prokaryotes

***Escherichia coli* and *Salmonella typhimurium***. Cellular and Molecular Biology. FREDERICK C. NEIDHARDT, JOHN L. INGRAHAM, K. BROOKS LOW, BORIS MAGASANIK, MOSELIO SCHAECHTER, and H. EDWIN UMBARGER, Eds. American Society for Microbiology, Washington, DC, 1987. 2 vols. xxvi, 1654 pp., illus., + index. $85; paper, $75. To members, $61; paper, $51.

This excellent two-volume work is probably the most ambitious and comprehensive survey of the life and times of an organism ever undertaken, comprising the accumulated knowledge of *Escherichia coli*, arguably the most important organism in the history of biological research, with treatment of *Salmonella typhimurium* as well. To read these volumes carefully is to come away thoroughly versed in most of the essentials of gene regulation, intermediary metabolism, macromolecular structure and function, and cell physiology. The pervading theme of the books is the interplay of genetics, biochemistry, and physiology in building up a detailed description of bacteria. Most of the authors discuss the genetic background and history of the particular subset of *E. coli* functions they are addressing, as well as describing the biochemical characteristics of the gene products. Readers who are relatively unfamiliar with the mass of detail accruing from work with *E. coli* will be well rewarded by a browse through these volumes as a means of becoming acquainted with the most complete paradigm available for the study of any organism.

The two volumes are divided into six parts and 104 chapters. Part 1 describes molecular architecture and assembly of cell components. It begins at the most basic chemical level, with the composition of *E. coli* in terms of masses and numbers of various common macromolecules as well as soluble components such as amino acids, nucleotides, lipids, and so forth. A further nine chapters describe structural aspects of the cell envelope, nucleoid, and ribosomes. The intention, presumably, is to set the general descriptive framework of the organism whose details we are to discover in subsequent sections.

Part 2 is the longest in the books. Headed Metabolism and General Physiology, it is divided into four sections and 42 chapters. Here is truly everything you wanted to know about intermediary metabolism, biosynthesis of small molecule building blocks, formation and processing of polymers, and the utilization of energy for cell activities. Most of the chapters are exhaustive, some stopping just short of satiety. Their quality is variable; some concentrate on biochemical details to the detriment of genetic aspects, some make excellent use of tables that relate genetic to biochemical information, and some lay out chemical pathways and models of regulation more clearly than others. I found the chapters by Maloney ("Energized membrane"), Reitzer and Magasanik ("Ammonia assimilation and amino acid biosynthesis"), and Neuhard and Nygaard ("Purines and pyrimidines") to be outstanding examples of organization and clarity.

The third section of part 2 contains ten chapters describing the heart of macromolecular synthesis in bacteria: DNA replication, protein synthesis, DNA and RNA processing and modification systems, lipo-

polysaccharide synthesis, and oligosaccharide synthesis. This is an excellent section that, because it deals with central aspects of polymer synthesis, overlaps with many other chapters in the books. Unfortunately, some of the chapters in this section, in striving to be succinct, underrepresent their subject matter.

Volume 2 leaves biochemistry behind, beginning with a frankly genetic section, part 3, headed Genome and Genetics. Section A, consisting of six chapters, starts with a surprising disappointment. The genetically inclined reader is just about to settle down to an enjoyable romp through the latest *E. coli* genetic map when he is brought up short, realizing that this is a reprint of good old Edition 7 instead of a Mark 8 version. In the flagship paper of the section on genetics, an up-to-date genetic map of *E. coli* would have been appropriate and welcome. The next chapter presents a somewhat revised linkage map of *S. typhimurium*. There follows a presentation by the Neidhart group that contains a wealth of new information on the gene-protein index, a painstaking compilation of polypeptides encoded by various plasmids in the Carbon plasmid collection. One does not envy the labor that the Neidhart lab—which has perhaps not received as much recognition as it deserves for this—is putting into this project, but one certainly welcomes the end result. The figure presented in this chapter points out the remaining large gaps in our knowledge of how to assign proteins and gene products to the *E. coli* genetic map. It also makes one realize, if after all these years of concerted effort on *E. coli* we are left with these large gaps, how difficult the comparable project with more complex life forms will be. The chapter by Riley and Krawiec on the organization of the *E. coli* genome provides some interesting facts and provocative speculation. This section concludes with a comprehensive compilation by Vinopal of selectable phenotypes in *E. coli* and *S. typhimurium*; it is absolutely astounding how many exist. The list will be very useful, although some selections are either inaccurate or missing. This first section of part 3 is clearly meant to be a compendium of useful and practical information for the bacterial geneticist. In general, it succeeds.

The second section, consisting of five chapters, is headed Alterations in the Genome and treats mutagenesis, recombination DNA repair, and transposition. Again, it is a mixture of the theoretical and the practical. In the space allotted, clearly several of the authors were faced with providing only the highlights of their subject at the expense of thoroughness. The chapter by Berg and Berg, which cross-references known insertion elements in the chromosomes of both *E. coli* and *S. typhimurium*, will no doubt be particularly useful.

The next sections contain a mixture of practical and background information regarding the mechanisms of conjugation, transduction, and transformation that bacteria, and therefore bacterial geneticists, use for manipulation of genetic information. I found the thorough exposé of the F-factor and mechanism of conjugation by Willetts and Skurray a fascinating survey of what is known about this mini-replicon.

One of the final chapters in part 3 contains the latest version by Bachmann of the *E. coli* K-12 family tree. The development of this genealogy, the fruit of Bachmann's long career as a microbial geneticist, is a fascinating bit of historical sleuthing.

Part 4, Regulation of Gene Expression, ventures into the real meat of modern prokaryotic molecular genetics. It is here that we see the profound general importance of *E. coli*. Reading through the chapters in this section, one realizes that many of the ideas and models presented therein continue to provide the basis for molecular biological understanding in all living systems. Section A, "General Mechanisms," contains five chapters on initiation, elongation, termination and attenuation of transcriptions, translational initiation, and regulation by proteolysis. The chapter on transcription by Hoopes and McClure is brief, whereas that by Yager and von Hippel is thorough and decidedly biochemical. Unfortunately, though the Yager and von Hippel chapter is dense with information and interesting models, this is at the cost of excluding a wealth of genetic information on RNA polymerase and its factors. The second section of part 4 contains eight chapters that deal with the regulation of various multigene systems, including carbon and nitrogen utilization, phosphate regulation, heat-shock response, SOS response, ribosomes and tRNA, regulation of aminoacyl-tRNA synthetases, and the stringent response. These chapters are of very high quality and provide a balance of viewpoints, particularly on subjects such as the regulation of ribosome biosynthesis, which, after all these years and truckloads of experimental data, is still somewhat controversial.

Section C, "Paradigms of Operon Regulation," presents a balanced portfolio of each of the major kinds of regulation: *lac* for archetypical importance, *ara* for a combination of positive and negative regulation, *trp* for attenuation, *mal* for a complex unlinked system with cell surface components.

Part 5, in six chapters, is titled Growth of Cells and Cultures; it could almost be subtitled "The Copenhagen View of the Bacterium." The chapters on growth-rate regulation, chromosome replication, cell division, and the cell cycle are dominated by authors who owe much to Maaløe; his spirit pervades this section, even if his prose is absent.

The shortest section, part 6, is a bit mystifying. Why, with the heading Ecology, Evolution, and Population Structure, are colicins in this section? And why not include Bachmann's family portrait of *E. coli* K-12 or Riley and Krowiec's treatise on genome organization? The chapter by Selander does, however, contain one of the few references in the volumes to the pathogenic aspects of *E. coli*.

That's what's in these volumes. What's missing? For one thing, there is almost no reference to bacteriophages. This is probably deliberate, since one could easily have a third volume on phages alone, and several recent books have dealt with individual phages. Nevertheless, this represents a major gap in the prokaryotic picture, since a great deal of information has accrued as a result of studying the host-bacteriophage interaction. Second, the volumes contain relatively little information on the practical aspects of modern recombinant DNA technology, including cloning vehicles, expression vehicles, and so forth. Again, this might be deliberate, since a number of excellent technical volumes on this subject exist. However, aside from one paper from the Neidhart lab correlating proteins with particular plasmids in the carbon collection, the volumes are strangely lacking in fundamental recombinant DNA information. I could find no list of regions of the *E. coli* chromosomes that have been sequenced or for which detailed restriction maps are available, although there is a table of many of the sections of the *E. coli* genome that have been isolated on specialized lambda transducing phages. It is a pity that the recently published complete restriction map of the *E. coli* genome from Isono's lab was not available at the time of printing. Third, there is little information about the toxic aspects of bacteria, except for passing references in some of the chapters on the cell envelope.

Who will find these volumes useful? Practically anybody who wants to learn cellular and molecular biology or who teaches it. The faithful will read them, but will the apostate? There is no doubt in my mind that any investigator who either has never had a background in prokaryotic biology or has scorned the base degrees by which he did ascend could benefit enormously from at least a casual stroll through these volumes, if for no other reason than to acquaint or reacquaint himself with his roots in molecular biology.

It is, unfortunately, true that the number of scientists who work on prokaryotes has declined significantly in recent years. There is a danger that prokaryotic biology will suffer and decline if young scientists, in considering research systems, choose the more glamorous newcomers to the biological repertoire. This would be tragic, since there is much important work still to be done with prokaryotes, and they will undoubtedly continue to provide the most accessible entry to many problems of fundamental importance. One hopes that these books will help convince young investigators of the wisdom of studying prokaryotes.

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## Endocrine Systems

**Endocrinology of Selected Invertebrate Types**. HANS LAUFER and ROGER G. H. DOWNER, Eds. Liss, New York, 1988. xxii, 500 pp., illus. $195; paper, $75. Invertebrate Endocrinology, vol. 2.

Invertebrate endocrine systems operate largely through neurosecretions and depend relatively less on the epithelial glands characteristic of vertebrates. In recent years the field of invertebrate endocrinology has grown in scope and gained rigor as a result of the application of contemporary technologies for isolation, sequencing, synthesis, and immunodetection of neuropeptides, as well as recombinant DNA technology for identification of peptide gene families.

This volume focuses on invertebrates other than insects, that group having been covered in the first volume. After an introductory account of concepts in comparative endocrinology, there are 19 contributions in five sections that treat different taxonomic groups. Although 60 percent of the volume is devoted, rightly, to crustaceans and mollusks, there are adequate descriptions of endocrine mechanisms in less intensively studied groups such as coelenterates, turbellarians, trematodes, cestodes, nemerteans, nematodes, and echinoderms. Additionally, three arthropod groups (merostomates, myriapods, and arachnids), often neglected in accounts of invertebrate endocrinology, are included.

In invertebrates other than mollusks and arthropods, much remains to be known about the chemistry of implicated hormones. An exception to this is the identification of an undecapeptide neurosecretory product that stimulates head and bud formation in hydra. An identical peptide has been found in mammalian hypothalamic and intestinal tissues, plasma, and tumors and tumor cell lines of neural and endocrine origin. This peptide represents an extraordinary case of structural conservation and widespread distribution. Equally interesting is the apparent role of thyroxine in the regulation of metagenesis, especially initiation of the transformation of polyp to medusa in jellyfish.

One of the best-studied invertebrate peptidergic systems is involved in the regulation of stereotyped behaviors associated with egg-laying in the sea hare *Aplysia* and the pond snail *Lymnaea*. This system is described in an extensive chapter containing excellent accounts of neurophysiological and ultrastructural characteristics of secretory cells; structure of bioactive peptides as well as their precursors and corresponding genes; post-translational processing of egg-laying hormones; and the role of various peptides on neuronal and non-neuronal targets that produce covert and overt behaviors associated with egg-laying.

Another well-studied molluscan peptide system includes FMRFamide and related peptides. This peptide family is known for its myotropic and neurotropic actions, relationship to opioid peptides, and widespread distribution; yet it is not covered in chapters dealing with molluscan endocrinology. The occurrence of FMRFamide-like peptides in arthropods and their role in the regulation of *Limulus* heart and crustacean stomatogastric system are discussed elsewhere in the book.

Crustacean endocrinology is presented in nine chapters, and the documented progress enhances understanding of the comparative organization and function of arthropod endocrine systems. Proctolin (a pentapeptide), first isolated from insects, is found in Crustacea, and in both cases it displays myotropic and neurotropic actions. The red pigment concentrating–adipokinetic hormone family is common to arthropods, but the identified members have distinct functions: chromatophoral pigment concentration in crustaceans and hyperglycemia, hypertrehalosemia, hyperlipemia, or cardioacceleration in insects. More recent work from our laboratory has shown that another neuropeptide family, composed of octadecapeptide pigment-dispersing hormones (which act on chromatophores and also cause light-adaptational eye pigment movements in crustaceans), is common to crustaceans and insects; the function of these peptides in insects remains unknown.

This book clearly shows that ecdysteroids serve as molting hormones in various arthropods. The regulation of ecdysone secretion may vary: crustaceans and chilopods utilize a neurosecretory molt-inhibiting hormone, whereas insects depend on the stimulatory prothoracicotropic hormone. Although the role of juvenile hormones (JH) in insects is well known, their occurrence and role in Crustacea remain unclear. This book presents recent findings of JH-analog, methylfarnesoate, which is secreted by mandibular organs in crustaceans and whose role is being examined.

Even though this is a multiauthored book with chapters that vary in organization and length (9 to 90 pages), it is marked by clarity of figures and text. It is an impressive record of recent progress, and it foreshadows exciting prospects for increased utilization of invertebrate models for endocrine research.

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## Books Received

**Interactions of Water in Ionic and Nonionic Hydrates**. H. Kleeberg, Ed. Springer-Verlag, New York, 1987. xiv, 311 pp., illus. Paper, $59.40. From a symposium, Marburg, F.R.G., April 1987.

**An Introduction to the Mathematics and Methods of Astrodynamics**. Richard H. Battin. American Institute of Aeronautics and Astronautics, New York, 1987. xxxii, 796 pp., illus. $49.50; $40 to AIAA members. AIAA Education Series.

**Ion Exchange and Sorption Processes in Hydrometallurgy**. M. Streat and D. Naden, Eds. Published for the Society of Chemical Industry by Wiley, New York, 1987. x, 229 pp., illus. $91.95. Critical Reports on Applied Chemistry, vol. 19.

**Lasers, Spectroscopy and New Ideas**. A Tribute to Arthur L. Schawlow. W. M. Yen and M. D. Levenson, Eds. Springer-Verlag, New York, 1987. xiv, 337 pp., illus. $45. Springer Series in Optical Sciences, vol. 54.

**Life Events and Psychiatric Disorders**. Controversial Issues. Heinz Katschnig. Cambridge University Press, New York, 1987. xiv, 265 pp. $49.50.

**Mechanisms of Photophysical Processes and Photochemical Reactions in Polymers**. Theory and Applications. Jan F. Rabek. Wiley, New York, 1987. xx, 756 pp., illus. $204.

**Memory Storage Patterns in Parallel Processing**. Mary E. Mace. Kluwer, Norwell, MA, 1987. xii, 139 pp., illus. $37. Kluwer International Series in Engineering and Computer Science.

**Modelling the Flow and Solidification of Metals**. T. J. Smith, Ed. Nijhoff, Dordrecht, 1987 (U.S. distributor, Kluwer, Norwell, MA). viii, 311 pp., illus. $79.90.

**Models of Urban and Regional Systems in Developing Countries**. Some Theories and Their Application in Physical Planning. George Chadwick. Pergamon, Elmsford, NY, 1987. xvi, 322 pp., illus. $61; paper, $30. Urban and Regional Planning Series, vol. 36.

**Modern Biotechnology**. S. B. Primrose. Blackwell Scientific, Palo Alto, CA, 1987. viii, 176 pp., illus. $50; paper, $25.

**Modern Selective Fungicides**. Properties, Applications, Mechanisms of Action. H. Lyr, Ed. Longman Scientific, Harlow, U.K., and Wiley, New York, 1987. 383 pp., illus. $101.

**Photochemistry and Photophysics of Coordination Compounds**. H. Yersin and A. Vogler, Eds. Springer-Verlag, New York, 1987. xii, 343 pp., illus. Paper, $59.20. From a symposium, Elmau, F.R.G., March–April 1987.

**Physics of the Galaxy and Interstellar Matter**. H. Scheffler and H. Elsässer. Springer-Verlag, New York, 1987. xii, 492 pp., illus. $69.50. Astronomy and Astrophysics Library. Translated from the German edition (Zürich, 1982) by A. H. Armstrong.