

BOOK REVIEWS

Soil Biotechnology

Microbial Factors in Crop Productivity

J. M. LYNCH (ED.)

Oxford, Blackwell Scientific Publications, 1983, 202 pp., \$21.60

This text reviews the ecology of micro-organisms in the soil and promotes soil biotechnology, which is defined as the manipulation of microbial activity to improve crop productivity. A range of topics is covered in 10 chapters, each beginning with an interesting, sometimes amusing, quotation from literature or science. The first part of the book (Ch. 1–3) outlines the physical, chemical, and biological characteristics of the soil as habitat for micro-organisms. Various microbial populations are described and the advantages and limitations of some analytical techniques are mentioned. Chapters 4–7 consider the role of micro-organisms in growth, decay, and nutrient cycling processes in the soil, interactions among various microbial populations, and their biological and chemical effects on plants. The remaining chapters (8–10) consider the effects of application of chemicals and organic wastes on soil micro-organisms, give examples of common agricultural problems caused by micro-organisms, and suggest beneficial uses of micro-organisms for crop production. Because the first two-thirds of the book presents material that is covered more thoroughly in microbiology, soil science, and ecology texts, the originality of this book lies in the concluding discussion of the current and future practice of soil biotechnology.

Most of the examples in this book are taken from studies in Great Britain and North America, and extensive references are cited from current work. The book is replete with figures, tables, and excellent photographs, especially scanning electron micrographs. However, interpretation of these graphics is uneven, and the reader frequently is left to arrive at conclusions that may or may not be those intended by the author. Similarly, important philosophical issues are raised, but only briefly dis-

cussed. The general lack of cohesiveness and transition between chapters may be attributed to the fact that the book originated as a series of lectures.

This book is probably too technical and succinct to reach all of the intended audience of farmers, foresters, and growers, as well as microbiologists, soil scientists, and plant scientists. However, it emphasizes that knowledge from all of these fields must be taken into account in order to successfully develop soil biotechnology.

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Petroleum Microbiology

RONALD M. ATLAS, ED.

*Macmillan, New York, ISBN#0-02-949000-6, 1984, 692 pp.,
\$55.00*

The primary focus of petroleum biotechnologists has been evolving from negative impacts (e.g., oil spills, contamination, well plugging) to constructive production and upgrading of petroleum and products. Examples of the latter are production of fuels, chemicals, and food components by petroleum bioconversion, enhanced oil recovery (EOR), bioextraction of shale and tar sands, and biorefining (e.g., desulfurization of petroleum stocks). Environmental impacts remain important, but productive applications share an equal spotlight. Advances in basic molecular biology (e.g., recombinant DNA), biochemistry, and instrumental characterization as well as bioengineering (improved fermenters, immobilized bioreactors, novel product recovery techniques) have sparked this evolution.

This volume includes a comprehensive and timely summary of the biochemistry and microbiology of petroleum component metabolism. Authoritative and extensively documented chapters on oxidation of straight-chain, branched, and cyclic alkanes and aromatics provide a valuable reference of the pathways, enzymes, and infrastructure. The control mechanisms used by bacterial, yeast, and fungal species that attack hydrocarbons are described. Attack of refractory hydrocarbons by cooxidation and commensalism is elucidated. The unique taxonomy and ultrastructure of methylotrophs is described. Anaerobic environments are depicted where methanogens serve as terminal electron acceptors for the hydrolytic and acetogenic bacteria degrading complex substrates.

One chapter focuses primarily on the genetics of aromatic oxidation pathways, particularly on the chromosomal and plasmid-borne bacterial genes that have been characterized and mapped and their homology, linkage, and regulation. Creation of recombinant genetic elements and vectors for cloning of oxidation genes is outlined. Broadening this coverage to the genetics of other pathways as well as that of hydrocarbon-

metabolizing yeast and fungi would have been useful, as well as discussion of the potentially enormous industrial impact of this genetic manipulation.

Five chapters are devoted to the environmental effects of petroleum, i.e., dissimulation and impact of crude oil, products, or waste effluents on marine, fresh water, and soil micro- and macro-ecosystems. Additional chapters cover (1) disposal of refinery wastes, (2) retarding the biodegradation of petroleum products such as lubricants, and (3) corrosion of petroleum pipelines and storage vessels caused by sulfate-reducing anaerobes.

This volume is strong in the traditional descriptive areas of petroleum microbiology, environmental impact, and biochemistry. The most significant shortcoming is the paucity of analysis of significance and potential application of many of the topics covered. The sections on hydrocarbon oxidation only briefly mention chemicals production, and the chapter covering industrial fermentations is also sparse. Little mention is made using microbial methanogenesis to produce fuel gas from agricultural or municipal wastes in digesters or landfills.

The chapters covering practical applications have significant gaps. Although a lucid discussion of petroleum genesis and maturation and bioextraction of heavy oils, bitumen, and kerogen, is given, only a brief outline is presented for potentially valuable microbial EOR. The review of biotransformations (hydrocarbon skeleton preserved) and industrial fermentations is dominated by single-cell protein, a product of marginal economic potential, whereas only brief mention is made of the production of chemicals such as dicarboxylic acids, alcohols, amino acids, and Krebs cycle intermediates. Virtually absent is any prediction of new products or processes enabled through recombinant DNA and other scientific advances, or novel bioreactors and process technology that has been developed for hydrocarbon processing. Also absent is any discussion of biorefining of petroleum.

In summary, this book is a valuable and current reference for microbiologists and biochemists interested in hydrocarbon metabolism and for environmental scientists concerned with petroleum-source effluents or wastes, and as an introduction to hydrocarbon genetics. Application of hydrocarbon microbiology for production of fuels, food ingredients, or chemicals and for the extraction of synthetic fuels is briefly covered, but petroleum biotechnologists must seek supplementary references for future trends and applications.

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Biochemical Research Techniques— A Practical Introduction

JOHN M. WRIGGLESWORTH, EDITOR

Wiley, 1983, 239 pp., \$41.95

This book is addressed mainly to a readership of research students. The volume covers a broad spectrum of techniques, ranging from methods in regular use in the biochemical laboratory to some of the newer techniques and approaches for which expert advice and guidance to potential users on practical as well as on fundamental aspects is often necessary.

The topics covered include: absorbance spectroscopy, fluorescence, spin labeling, high performance liquid chromatography, electron microscopy, monoclonal antibodies, and cell culture. One glaring omission is the absence of a chapter on nuclear magnetic resonance.

The various chapters are on the whole well and tightly organized. All contain a relatively brief overall view of the technique and its scope, including the necessary theory, followed by a section on practical details, instrumentation, measurement considerations, sample preparations, signal treatment, etc., and finally a survey of applications and potential uses in areas of interest to the practicing biochemist.

The presentations are concise and clearly written and in most cases successfully avoid the tedium one associates with overdetailed "methods" opera. Key references to original papers and selected references to more detailed texts (with full title in all cases) are given at the end of each chapter. The book contains a comprehensive subject index.

The organization of the book reflects the dramatic changes in emphasis that have taken place in biochemical research in the last decade, hence the inclusion of topics such as electron microscopy, monoclonal antibodies, and cell culture, which earlier would have been considered outside the scope of an introductory text dealing with biochemical techniques. Allowance is made for the diversity in background and training of students entering biochemical research. Thus, the chapters on the es-

established spectroscopic techniques provide an entry to basic physical concepts that will be of great value to readers with a background in the biological sciences.

The chapters on monoclonal antibodies and cell culture on the other hand take into account the needs of newcomers with a physicochemical background and guide the reader through the maze of terms and concepts used by cell biologists. This includes glossaries of terms, lists of abbreviations, and in one case a list of commercial sources of equipment and supplies. The usefulness of the latter is, however, somewhat restricted because the list is essentially limited to sources located within the United Kingdom.

In conclusion, *Biochemical Research Techniques* is a well-conceived, compact guide to current biochemical methodologies well adapted to the needs of the new generation of students and research workers.

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Proteins

Structures and Molecular Properties

THOMAS E. CREIGHTON

W. H. Freeman and Co., New York, 1983, \$36.95

This volume is rather unusual in that the text is organized to present the chronological events in the life of a protein from synthesis to eventual degradation. The topics, as represented by chapter titles, include: (1) Chemical Nature of Polypeptides, (2) Protein Biosynthesis, (3) Evolutionary and Genetic Origins of Protein Sequences, (4) Physical Forces that Determine the Properties of Proteins, (5) Conformational Properties of Polypeptide Chains, (6) Folded Conformations of Globular Proteins, (7) Proteins in Solution, (8) Interactions with other Molecules, (9) Catalysis, and (10) Degradation. Thus, the first three chapters deal with the properties of linear polypeptides as related to the primary structure; the next three chapters consider the three-dimensional aspects of proteins, which result from the folding of polypeptide chains following synthesis; and the remaining chapters discuss the functioning of these structures.

This book brings together much of the current knowledge of proteins in an organized, logical, and very readable manner. It presents a much more thorough discussion of the characteristics and properties of proteins than a biochemistry text, although of course, it is not a research text since such a broad topic could not be covered in a single research volume. This reviewer believes the book does a reasonable job of filling the void between the various detailed research texts and a general biochemistry text. It could serve well as a text for a graduate level course in proteins or for researchers who want a general introduction to or review of the proteins. The book contains many useful tables of characteristics of amino acids and proteins that the author has compiled from diverse sources. Also, the figures illustrating various principles of protein structure are well done. Although the volume is not heavily referenced, it does include the most pertinent references following the discussion of a particular topic.

Finally, the book is relatively free of typographical errors, although this reviewer did note a few. Also, in a few sections, the discussion relies heavily on the author's own work; however, this is not a serious criticism. In summary, the book is recommended reading for all current and aspiring protein chemists.

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Methods of Enzymatic Analysis

H. U. BERGMEYER, EDITOR-IN-CHIEF

*Third Ed., Vol. 1: "Fundamentals," Verlag Chemie,
Deerfield Beach, FL, 1983; 474 pp., \$95.00*

This is a well-known series that was first published as a single volume in German in 1962 and English in 1963. An enlarged four volume 2nd edition made its debut in 1974 in both languages. This 3rd edition, only in English, represents a further expansion and reorganization of the series to an estimated ten volumes. The objective of the series continues to be the detailed description of well-developed procedures for enzymatic assays. The expanded 3rd edition appears to be an attempt at a self-contained description of all the aspects of laboratory enzyme assays, including the various laboratory techniques and instrumentation needed to carry out the many enzymatic assays outlined in the later volumes.

Volume 1 contains background information that will be of interest to persons desiring an overall reference to the definitions, theory of the techniques, and instrumentation relevant to enzyme assays. The opening section on nomenclature presents a useful comparison of the differing viewpoints and terminology of chemists and enzymologists in describing the "catalytic activity" of enzymes. The other topics covered in the opening section include reliability, standardization, and economics and provide rather superficial coverage of material that should be known in much greater detail by any clinical laboratory director.

The second main section of Volume 1 contains a concise review of the theoretical considerations of non-enzymatic and enzymatic reaction kinetics, the determination of Michaelis constants for one and two substrate reactions and of inhibitor constants, and the effects of environmental factors, such as pH and temperature, on enzyme "catalytic activity." A short section is included on the activity of immobilized enzymes. In my opinion the kinetic material is easier to follow, but less thoroughly presented, in most biochemistry or enzymology textbooks. However, the discussion of (1) end-point vs kinetic basis for designing an enzyme as-

say, (2) indicator reactions for visualization of reaction progress, and (3) principles of enzyme immunoassays are particularly useful.

About half of Volume 1 covers general laboratory techniques, including pipeting, photometry, fluorimetry, luminescence, electrochemical methods, radiochemicals, automation, and microtechniques.

Volume 1 will be useful to those persons wishing to have the complete series or who are especially interested in having the theory and laboratory techniques summarized in a single source. The orientation of the volume is primarily towards clinical laboratories that do large numbers of assays rather than towards the individual laboratory research enzymologist. Thus, it is appropriate that most of the authors of the chapters in Volume 1 are from Boehringer Mannheim GmbH, a company well versed in the preparation of high purity enzymes and substrates for clinical assays.

*Third Ed., Vol. 2: "Samples, Reagents, Assessment of Results,"
Verlag Chemie, Deerfield Beach, FL, 1983; 539 pp., \$95.00*

The three major sections of this volume are (1) preparation and processing of specimens and samples, (2) properties and handling of reagents used in enzymatic analyses, and (3) workup and evaluation of experimental data.

The section on specimens and samples covers blood, mammalian organs, microorganisms, and plant cells as sources of samples. Description of the methodology in each case is relatively brief. However, extensive literature references are included, and would need to be consulted for application of specific techniques. A short but detailed description of four techniques (UV absorption, Biuret, Lowry, dye-binding) for protein determination is a more useful part of the first section.

By far, the most useful part of vol. 2 is the over 300-page section listing the properties of 143 enzymes and 100 coenzymes and substrates, as well as the storage conditions for a variety of reference substances used in enzymatic assays. A drawback to this section is the inclusion of Boehringer Mannheim tradename substances, without mentioning the sources of any other materials, thus placing in some question the overall objectivity of the volume.

The third section on calculations and evaluation of results gives only a very brief outline of many subjects. The inclusion of so many topics can be questioned; but the coverage may be helpful as a guide to some of the additional factors that need to be considered in carrying out or developing clinical laboratory enzymatic assays.

The major value of vol. 2 lies in the listing of properties of numerous enzymes and other biochemicals. No mention is made as to whether or not the results have been checked by the authors or by outside referees; and only a few references are given to the sources of the numbers for

specific properties. The value of the volume would have been increased markedly if the sources of the results had been more precisely documented.

*Third Ed., Vol. 3: "Enzymes 1: Oxidoreductases, Transferases,"
Verlag Chemie, Deerfield Beach, FL, 1983, \$95.00*

The main contents of this volume are the descriptions of alternative approaches, detailed procedures, and validation of sensitivity and results for the measurement of enzymatic activity of 39 different enzymes. These include (1) lactate, malate, and other dehydrogenases that act on CHOH groups; (2) other oxidation–reduction enzymes, such as xanthine and diamine oxidases, dihydrofolate reductase, catalase, peroxidase, and superoxide dismutase, that act on non-CHOH groups; (3) acyl and glycosyl transferases, such as UDP glucuronyltransferase and γ -glutamyltransferase; (4) alanine or aspartate aminotransferases; (5) several kinases; and (6) others. Each enzymatic analysis procedure is described by experts who have carried out the procedures, so that the writers should be authoritative and accurate.

The first 100 pages of vol. 3 contain a variety of topics that are treated superficially and are out of place and should either have been put in vol. 2 or omitted from the series.

Volume 3 should be very useful to anyone interested in the enzymatic analysis procedures for any of the included 39 enzymes. It is hoped that equally detailed discussion for other oxidation–reduction or transferase enzymes will be included in subsequent volumes of this series.

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Affinity Chromatography and Biological Recognition

I. M. CHAIKEN, M. WILCHEK, AND I. PARIKH, EDS.

Academic Press, New York, 1983; 515 pp, \$43.50

This book records the proceedings of the Fifth International Symposium on Affinity Chromatography and Biological Recognition held at Annapolis, Maryland, June 12–17, 1983. In addition to providing a rich compilation of state-of-the-art research in the development and application of affinity methods, the symposium also addressed the broad area of molecular interactions underlying biological recognition as exemplified by the special areas covered. After an introductory section, the topics are grouped into: Molecular interactions in biorecognitions, characterizing biomolecular interactions using affinity methods, affinity methods—design and development, antibodies in affinity methodology, and application in separation and biotechnology.

The section on design and development of affinity methods as well as on their applications contains reports of current development by the leading practitioners in this field such as affinity precipitation, high pressure liquid affinity chromatography, immobilized metal ion chromatography, hydrophobic chromatography, use of immobilized monoclonal antibodies in affinity chromatography. The inclusion of papers dealing with quantitative affinity chromatography will be helpful in the quest for predictive insights into macromolecular interactions.

The coverage under other topics is broad and diverse, ranging from cell-membrane receptors to drug targeting, connected still, however, by the central theme of molecular recognition. The presentations vary from detailed papers (up to 17 pages), some with critical discussions, to brief preliminary reports.

Some overlap is unavoidable in such groupings. There is a short subject index.

In summary, this book with its broad scope and diversity of topics will be of interest and utility to investigators active in the area of affinity methodology as well as to workers in related fields seeking to exploit the power of molecular recognition to novel applications.

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A Clinical Companion to Biochemical Studies

VICTOR SCHWARZ

*2nd ed., W. H. Freeman and Co., ISBN 0-7167-1601-1, New York,
NY, 1984, 162 pp., \$14.95*

The second edition of this primer on the biochemical bases of disease succeeds in demonstrating the relevance of biochemistry in today's clinical medicine. Twenty-seven topics spanning single enzyme defects, such as that responsible for fructose intolerance, to the complex pathogenesis of rheumatoid arthritis are briefly, but concisely, discussed. Six new chapters have been introduced in this edition, including two topics on collagen metabolism. Furthermore, major revisions and/or updates have been made on other chapters.

The organization of each chapter consists of a succinct case history with pertinent laboratory data, followed by a discussion of the biochemistry and explanation of the clinical and laboratory findings. In addition, selected references are provided, as well as questions well-suited for small group discussion. The author broadens the scope of some topics to encompass genetics, the basis of specific diagnostic tests, classical studies, and the rationale of dietary or pharmacologic intervention.

As the title indicates, this book would make a welcomed companion to more detailed biochemistry texts. Because this book sheds light on the contributions biochemistry has made and will continue to make in understanding human disease, the book undoubtedly will enhance the studies of medical and biochemistry graduate students, alike. The easy readability and effective use of figures, tables, and short chapters also make this text a refreshing review for practicing physicians and residents.

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