

Encyclopedia of Microbiology (2nd ed., 4-Volume Set)

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Encyclopedia of Microbiology is a huge reference work highly recommended for departments of microbiology, food sciences, and environmental sciences, as well as university libraries. The topics covered are both accurately and widely discussed, and written in such a way as to be understood by non-specialists. Yet this work is not what one would expect from the title. The 4000 pages that make up *Encyclopedia of Microbiology* comprise 298 articles distributed alphabetically in four volumes. Volume 4 includes a complete subject index for the entire work, an alphabetical list of the contributors, and a glossary of key terms used in the different articles. Dictionaries define an encyclopedia as a work containing information on all branches of knowledge or treating comprehensively a particular branch of knowledge, usually distributed in articles arranged alphabetically by subjects. Four thousand pages devoted to a single topic seem to be enough to cover it comprehensively. However, if the branch of knowledge is such a wide field as microbiology, calling *Encyclopedia* the work we are commenting on seems a bit pedantic. Joshua Lederberg of Rockefeller University—1958 Nobel Prize winner in Physiology or Medicine for his discoveries concerning genetic recombination and the organization of the genetic material of bacteria—is Editor-in-Chief of both editions of *Encyclopedia of Microbiology* (1992 and 2000). In the preface to this second edition, he states that containing a compendium of all available knowledge—as it was once expected of any encyclopedia—has become an elusive goal due to the exponential growth of scientific knowledge. Lederberg adds that the “encyclopedia’s function has moved to becoming the first word, the initial introduction to knowledge of a comprehensive range of subjects.” Lederberg’s statement seems to contradict the “Guide to the Encyclopedia” (pp. xxix–xxx), where one can read that

it “is a scholarly source of information on microorganisms” which “provides a comprehensive overview of the selected topic to inform a broad spectrum of readers, from research professionals to students to the interested general public.” However interesting it may be, its coverage is far from being encyclopedic.

The 298 review-type articles are arranged in a standard format. A two-column layout makes reading easy. The Index of headings at the beginning of each article along with an outline of the topic provides both information on the contents and an overview. Each article also has a glossary, which defines terms according to the context in which they are used. Besides, as mentioned, Volume 4 contains a comprehensive glossary of key terms. Although the articles do not contain references, they include a Bibliography for further reading on each topic.

There have been many changes from the first edition of this work, which was published in 1992. Microbiology has also undertaken many changes since then—one has just to compare professional journals to realize it—, which must surely be reflected in a general reference book. Nevertheless, one wonders whether there have been so many changes in eight years to justify that approximately 80% of the content of this work be entirely new, as stated in the “Guide to the Encyclopedia”. Does it mean that only 20% of the general knowledge we had in microbiology eight years ago is worthy being disseminated today? Or is it given for granted that some aspects of microbiology are already well known and do not need to be included in such a work? I keep the previous edition of *Encyclopedia of Microbiology* in my library, and even if it lacks articles on currently hot topics, I think it is a good reference book, mainly for students and non-specialists, and still useful.

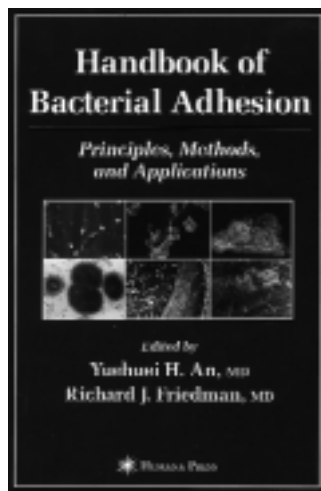
More than 450 authors have contributed to the present *Encyclopedia*; their expertise in their own fields of research is a guarantee of quality. A vast majority (about 70%) of them are from universities and research centers in the United States; 44 (about 9%), from the United Kingdom; 16 (3.5%), from Germany; 15 (3.2%), from Canada; 9 (1.9%), from France; and 8 (1.7%), from the Netherlands. Other countries, in some of which microbiology is a thriving research field, are poorly represented. Six associate editors from the United States and three other from the United Kingdom are the members of the Editorial Board chaired by Lederberg. Maybe this predominance of North-American authors is the reason why some articles, such as “Careers in Microbiology”, are apparently aimed at readers from the USA.

The *Encyclopedia* covers a great variety of topics from different fields of microbiology: applied microbiology (agriculture, environmental, food, industrial); careers and education; ecology; ethical and legal issues; general microbiology; genetics; history; infectious and non-infectious disease and pathogenesis (human pathogens, immunology,

plant pathogens, treatment); physiology; metabolism and gene expression; structure and morphogenesis; systematics and phylogeny; and techniques. One wonders what are the criteria to choose the articles for each field. For example, why such a topic as “Economic Consequences of Infectious Diseases” needs nineteen pages, whereas six pages seem to be enough to cover “Ecology, Microbial.” Or why does the authors consider alcoholic beverages more relevant than bread. At least this is the impression one may have at seeing that articles on beer and wine have “survived”, whereas that on bread has disappeared on the second edition—the word “bread” cannot even be found on the 90-page index at the end of Volume 4. Nor will you find in that index the word “Bergey”, not to mention an article on such a fundamental work as is the *Bergey's Manual of Systematic Microbiology*, especially when a new edition is being published now. One wonders also whoever will look up an entry under the title “Method, Philosophy of”, regardless its great interest, in an encyclopedia of microbiology.

If one disregards the misleading title of the work—surely forced by the other “encyclopedia” books from the same publisher which accompany this one in the online catalog—and considers *Encyclopedia of Microbiology* to be a collection of updated reviews on many diverse topics on microbiology, then one cannot help but praising its high level of quality and recommending it as an excellent reference work, to be found in those libraries which can afford its high price.

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Handbook of Bacterial Adhesion. Principles, Methods and Applications

YUEHUEI H. AN, RICHARD J. FRIEDMAN

2000. Humana Press, Totowa, New Jersey

644 pp , 26 × 18.5 cm
Price: US\$ 135.00
ISBN: 0-896-03794-0

Bacterial adhesion is a process whereby bacteria adhere firmly to a surface by interacting completely with it. The process includes an initial phase of reversible, physical contact, and a time-dependent phase of irreversible, chemical and cellular adherence. Adherence reflects a specific interaction between a ligand expressed on the bacterial surface and the receptor on

the epithelial cell surface. Bacterial biomass and extracellular materials (basically slime) accumulated on a solid surface compose biofilms. It has been estimated that, in natural environments, ninety-nine percent of all bacteria exist in biofilms, or at least reside at surfaces. The sessile biofilm mode of growth may protect adherent cells from surfactants, bacteriophages, phagocytic amoebae filter feeders, chemical biocides, antiseptics, antibiotics, disinfectants, antibodies, and phagocytic leukocytes. Bacterial adhesion is a main topic in microbial ecology, covering different scientific fields including marine science, soil and plant ecology, food microbiology and biotechnology, and, especially, the subject of this book, biomedical sciences.

Both editors, Yuehwei H. An and Richard J. Friedman, are orthopedic surgeons that have bacterial adhesion among their current research interests. They have gathered 94 contributors from 17 countries (46 of them from the USA), who have furnished the 34 chapters that constitute the *Handbook of Bacterial Adhesion. Principles, Methods, and Applications*. This book is the first inclusive and organized reference work on how to study bacterial adhesion to biomaterials and tissues, emphasizing laboratory testing methods, a topic which has not been covered adequately by previous books.

The book is structured in six parts. Part 1, “Mechanisms of Microbial Adhesion and Biofilm Formation”, is a good introduction to this field, both for biomechanical and bioengineering researchers and for students at all levels. The first four chapters, pathogenesis of implant and tissue infections, molecular basis, and genetics and factors influencing bacterial adhesion, are the basis for the rest of the book. Two more specific but necessary chapters complete this part. They discuss the contributions of biomaterial hydrophobicity and charge, and the effects of surface roughness and free energy on oral bacterial adhesion.

The four following parts are the main body of the book, and deal with methods, techniques, biomaterials and host tissue microbial adhesion. Part 2, “Methods for Studying Microbial Adhesion and Biofilm”, begins with a description of the basic equipment and microbiological techniques, and includes general considerations for studying bacterial adhesion to biomaterials. Two chapters provide information to beginners and nonmicrobiologists who want to set up a laboratory to study bacterial adhesion. One of the more extensive contributions follows: a review on the modeling of different types of biofilms; it focuses on appropriate in vitro methods for biofilms laboratory culture and analysis. A chapter follows that complements the previous one; it summarizes techniques useful for the analysis of the microbial organization in intact and disrupted biofilm communities. It also discusses useful techniques for elucidation of microbial interactions and metabolic characteristics that influence biofilm organization. The chapters which close this methodological part deal with mathematical models that include the adsorption, desorption and growth of bacteria during early stages of colonization on a surface; and with methods and

considerations for examining gene expression in adherent bacteria.

Part 3, "Techniques for Studying Microbial Adhesion and Biofilm," begins with a general approach to microbial colonization of biomaterials. It includes a discussion of critical controls and potential pitfalls, and an overview of the most common techniques. With the exception of optical density technique here analyzed, this overview is a reader's guide to the following chapters of this part, which present the details of other techniques: electron microscopy (EM), confocal laser scanning microscopy (CLMS) and fluorescence recovery after photobleaching technique (FRAP), quantitation by radiolabeling techniques, biochemical and immunochemical techniques, atomic force microscopy (AFM), and a novel technique for direct measurement of long-range interaction forces as a function of separation distance between bacteria and substrates using a three-dimensional optical trap (3DOT or "optical tweezers").

Part 4, "Studying Microbial Adhesion to Biomaterials", first discusses the staphylococcal factors involved in adhesion and biofilm formation on biomaterials. *Staphylococcus aureus* and *S. epidermidis* not only represent a significant proportion of all pathogens responsible for orthopedic-implant infections, but they may lead to dramatic metastatic, life-threatening complications. Microbial adhesions to five selected biomaterials are analyzed: (i) bacterial adhesion to irregular or porous surfaces that seem to promote adhesion and offer physical protection to microorganisms against antibiotics and host's immune defenses; (ii) bacterial colonization of tubular medical devices (most patients in intensive care settings or undergoing invasive surgery require temporary use of one or more of such tubular devices, and the infection of these devices is a major clinical problem and the most significant barrier to their use); (iii) plaque biofilms on various dental surfaces that have a marked effect on tooth decay, periodontal diseases, osseointegration and biocompatibility processes; (iv) microbial adhesion to biliary stents, where the major limitation to long-term biliary stenting is the problem of late stent occlusion by encrustation of amorphous material and bacterial accumulation on its surfaces; (v) bacterial adhesion to hydrogel contact lenses—more than 25 million individuals only in the United States wear hydrogel lenses for therapeutic or cosmetics purposes, and the initial adhesion of microorganisms to these hydrogels during insertion or the rate of microbial attachment in vivo may significantly affect the overall incidence or time of onset of infections. This section ends with a selection of in vivo models that help to characterize clinically relevant parameters of bacterial adhesion to biomaterial implants, and which may contribute to the development of novel anti-adhesive strategies for preventing implant-associated infections.

Part 5, "Studying Microbial Adhesion to Host Tissue", is introduced by a very extensive characterization of staphylococcal adhesins for adherence to host tissues. Five chapters follow which discuss bacterial adhesion to tooth

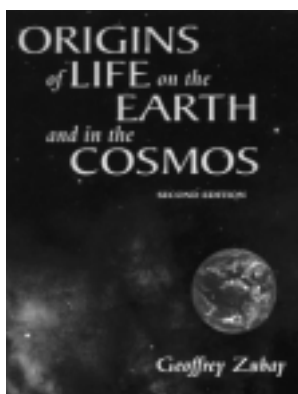
surfaces, respiratory mucosa, endothelial cells, human gastric epithelium and the urinary tract. Finally, two chapters deal with *Candida albicans* adhesion, which is responsible for most superficial and systemic fungal infections, and a general chapter discusses bacterial adhesion to cultured cells.

The last part, "Strategies for Prevention of Microbial Adhesion," has five chapters dealing with topics such as strategies for preventing group A streptococcal adhesion and infection, responsible for a number of clinical syndromes including pharyngitis, impetigo, pneumonia, puerperal sepsis, and myositis; changing material surface chemistry, which includes surface modification by physicochemical methods and chemical substances with antimicrobial properties; and antimicrobial agent incorporation, which discusses the antimicrobial vascular and urinary catheters that had been shown in animal and/or clinical studies to protect against catheter-related infection. This part ends with a study of bacterial adhesion to antibiotic impregnated polymethylmetacrylate, and an analysis of the surface coating of biomaterials. The book ends with a short basic glossary of 17 lexical entries.

Handbook of Bacterial Adhesion is recommended to those interested in a reference book with a complete overview of this phenomenon, mainly in the biomedical field. It is a useful book for any researcher facing the challenge of implant infections in all sort of devices, even contact lenses.

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Origins of Life on the Earth and in the Cosmos (2nd ed.)

GEOFFREY ZUBAY

2000. Academic Press, San Diego, CA

564 pp. 23.5 × 19 cm
ISBN 0-12-781910-X

How was the universe created? Once created, what changes did it undergo until it reached its present state? What had to happen for the biochemical processes which make up life to take place? How did the different cell components and biochemical pathways evolve from their ancestral forms, adapting to changing environments? Surely any person with a minimal interest in biology, biochemistry or any other life science has asked himself or herself these questions many times. For the researcher, they present an incredible challenge, because behind every answer thousands of new questions arise.

In this book Geoffrey Zubay, prebiotic chemistry professor at Columbia University, New York, tries to answer as many of these questions as possible, using the solid base provided by the works of many researchers in astrophysics, biochemistry, genetics and other disciplines. But that does not mean that you need to be an astrophysicist, a genetist and a biochemist to understand this book, because the author always handles the topics from a very didactic point of view. The beginning of each chapter introduces the reader into the topic dealt with, so that at the end of the chapter he or she can understand the conclusions and hypotheses presented.

The book consists of twenty-four chapters, grouped in four parts. The first part, "Creation of an Environment Suitable for the Origin of Life," includes five chapters and focuses on the events that, presumably, took place between the beginning of the universe (15,000 millions of years ago) and the formation of the Earth (4600 millions of years ago). Evidently, physics is the science predominantly used in these chapters to help the author explain, for example, what black holes are, how it is possible to know the distance to a certain star, how the different elements formed, and how this planet where we live was created. Earth, once formed, became a place where conditions necessary for the generation of life occurred. But the reader will have to wait until the third part of the book to learn more about this topic. In fact, the four chapters included in the second part of the book ("Logic of Living Systems") show the biochemical structure which made it possible for life to occur on this planet. The journey begins at the cellular level, moving on to the molecular level. In the last chapter of this part the genetic mechanisms that enabled these biochemical processes to be passed on to the next generation are disclosed.

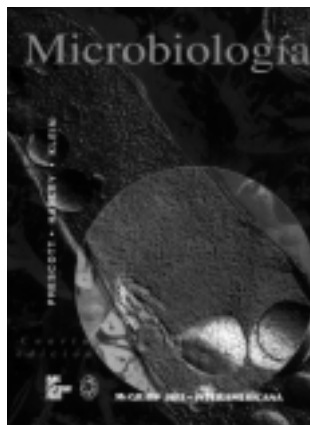
These two first parts of the book prepare the reader to understand the third part ("Biochemical and Prebiotic Pathways: A Comparison"), which contains eleven chapters that are the most interesting chapters in the book. The author compares biochemical pathways found in present organisms with those presumably operating in organisms at the dawn of life. The first chapter of this part explains how life began on Earth, or at least how it is now assumed to have started. In the other ten chapters, Zubay compares different metabolic pathways with their probable precursors, thus obtaining a global view of the evolution of these processes. The last part of the book ("Evolution of Living Systems") consists of four chapters. They deal with the evolution of living organisms as a whole, of the tricarboxylic acid cycle, of photosynthesis, and of the genetic code, respectively. All the facts presented throughout the book are unified in these chapters, and everything is intertwined, resulting in this biochemical miracle that enables us to exist as living organisms.

The book ends with a chapter called "Prospectus," which is a single unit. As the author states, the function of this chapter is "to highlight some of the major accomplishments that have been made in research on the origins of life and to indicate what remains to be done." The book also includes a useful,

complete glossary and an appendix of astronomical quantities and physical constants. Also, at the end of each chapter several questions are presented to the reader. The answers to these questions can be found at the end of the book. In summary, this book provides an interesting opportunity either for the researcher or for the student to begin facing the questions presented at the beginning of this review. Science has advanced a lot since, in the XVII century, Jan Baptiste van Helmont assured that, with the only help of a sweat-soaked shirt and a handful of wheat, he was able to short-circuit "thousands" of years of evolution and create mice. Luckily, nowadays researchers earn enough to wash their dirty clothes.

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Microbiología

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1999. McGraw-Hill,
Interamericana de España,
Madrid

1112 pp. 28 × 22 cm
Price: 11,400 PTA
ISBN 84-486-0261-7

"Dear God, what marvels there are in so small a creature!," wrote Anton van Leeuwenhoek more than three hundred years ago. Although microbes are interesting in and of themselves, they are doubly interesting because they impinge on nearly every aspect of humans existence, with beneficial or detrimental effects. Our knowledge of microorganisms has accumulated over the last decade, the study of the ultrastructure, metabolism and hereditary properties of microorganisms has greatly contributed to what we know today about the fundamental nature of living organisms.

The fields encompassed by microbiology are so diverse and complex that no simple book on the subjects can offer everything to everyone, but *Microbiología*, discusses all general topics needed to introduce microbiology to students in an exciting way.

The text is organized into 44 chapters grouped into eleven units of information. The first group of chapters is designed to develop the student's basic background on microbiology topics, such as historical perspectives, microbial structure, and structure and function of prokaryotic and eukaryotic cells. Part II, discusses the growth and nutritional requirements of microbes, and develops the "control" of microorganisms by using physical

and chemical agents. The five chapters which compose unit III, discuss microbial metabolism. The essential and current topics of microbial genetics and molecular biology are found in part IV. A brief description of virus is developed in part V. A comprehensive survey of the major groups of prokaryotic and eukaryotic microorganisms is found in part VI. A complete updating of classification system reflects the recent edition of the *Bergey's Manual of Systematic Bacteriology*. Although much attention is devoted to bacteria, eukaryotic microorganisms such as fungi, algae and protozoa, receive more coverage than it is usual in most books on general microbiology. This helps students to understand essential topics as clinical microbiology and microbial ecology. Three groups of chapters emphasize a survey of general topics of medical microbiology. The first group (part VII), explores the interactions between microorganisms and humans, especially symbiotic associations and parasitism, which provides the reader with good foundations for the later discussion of specific infectious diseases. The second section (part VIII), describes the bases of general defenses or immune reactions. Finally, part IX begins with an introduction to antimicrobial chemotherapy, epidemiology and clinical microbiology. Microbial infectious diseases caused by prokaryotes, viruses, protozoa and fungi are extensively described mainly those which have great clinical significance. Within each chapter, diseases are covered according to mode of transmission. This provides the student with an easy access to information about any disease of interest. Excellent photos characteristic of each infectious disease have been selected. The two last sections introduce the roles of microorganisms in aquatic and terrestrial environments of the earth (part X), and describe applications of microbial activities in food and industrial production (part XI). Included at the end of the book, are five appendices that help students to revise basic chemical concepts and other useful information about important topics not completely covered in the text.

Each chapter starts with a quote to catch the interest of the students, followed by a chapter index, that helps the reader to locate particular topics of interest, and basic concepts. Key

words appear in bold type and all of them are accompanied by a definition. Illustrations or pictures can be extremely helpful in understanding a process, structure or abstraction; there are also tables and graphs that condense information into an easily understandable format. Most chapters contain boxes, which describe items of interest that are not essential to the primary thrust of the chapter. They include a wide spectrum of information, such as exciting research areas, practical impact of microbial activities, items of medical significance, historical anecdotes and descriptions of extraordinary or unusual microorganisms. As an additional study help, some questions to revise studied topic concepts are included. Finally, each chapter concludes with a summary and key terms to emphasize the most significant facts and concepts. Each term is page referenced to the page on which the term is first introduced in the chapter.

Microbiology unlocks an invisible world that many humans never learn about or whose existence they never even suspected. *Microbiología* is a book that introduces general topics about microbiology. It is recommended not only to students of biology or health sciences, but to anybody who wishes to expand his knowledge of the biology of microorganisms, mainly because is a comprehensive text book. Note that microbiology is an exceptionally broad discipline encompassing specialties as diverse as biochemistry, genetics, taxonomy, pathogenic bacteriology, food and industrial microbiology, and ecology. *Microbiología* is an introduction ranging from basic microbiology to medical and applied microbiology, although clinical microbiology is more extensively exposed than interaction of microorganisms with their environment.

Students that are familiar with English language can find supplementary information at the website of the official English version of the book (<http://www.mcgraw-hill.co.uk>). There they will be able to learn more on the subject and to check their knowledge on microbiology.

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