

PREFACE

Introduction

The fourth edition of *The Physiology and Biochemistry of Prokaryotes*, designed for use in advanced undergraduate and beginning graduate-level biology courses, provides the most current, authoritative, and relevant presentation of prokaryotic physiology and biochemistry. It presents microbial metabolism in the context of the chemical and physical problems that cells must solve in order to grow. The text is organized by topic rather than by organism, therefore helping students understand the general principles of physiology and metabolism. This new edition builds in comprehensive coverage of energetics. It also adds broad coverage of molecular machinery, applied throughout the text to help create a unifying narrative across biological principles. Also added is broader coverage of chromosomes, macromolecular synthesis, biofilms, and cell-cell communications.

The prokaryotes are a diverse assemblage of organisms that consists of the Bacteria (also called eubacteria) and the Archaea (also called archaeobacteria). This text provides an updated description of the major aspects of the prokaryotes, such as cell structure, biochemistry, bacterial development, adaptation to environmental changes, and signaling interactions between the cells that occur in bacterial populations such as those living in biofilms. The text highlights signaling mechanisms that allow individual bacterial cells to sense and respond to the environment, and also to signal each other so that they can respond as a cooperating population of organisms.

Organization

The organization of the text is according to topics rather than organisms, although the

physiology of specific groups of prokaryotes is emphasized. This pattern of organization lends itself to the elucidation of general principles of physiology, metabolism, responses to environmental challenges, and cellular/multicellular development.

Topics include cellular structure and function, growth and cell division, chromosome replication and partitioning of chromosomes, membrane bioenergetics and the proton potential, electron transport, photosynthesis, the regulation of metabolic pathways, bioenergetics in the cytosol, central metabolic pathways, RNA and protein synthesis, cell wall and capsule biosynthesis, inorganic metabolism, C_1 metabolism, fermentations, responses to environmental stress, solute transport, protein transport and secretion, responses to environmental cues, chemotaxis, photoresponses, aerotaxis, microbial biofilms, cell-cell communication mechanisms, and bacterial development.

Distinctive Features

- **Topical organization** fosters understanding of the general principles and concepts of the biochemistry and physiology of prokaryotes, in addition to providing detailed data and conclusions about specific groups of prokaryotes.
- **End-of-chapter summaries and study questions** help students synthesize material and prepare for examinations.
- **An extensive references and notes section** is available in the chapters to aid further research and to provide access to the data that supports the conclusions made in the text.
- **Boxed sections** call out topics of special interest, adding historical information about earlier discoveries, covering experiments

that established the central tenets of microbiology and biochemistry, or exploring in detail especially engaging or important topics discussed in the text.

New to the Fourth Edition

- **New coauthors:** David White is joined by two colleagues from Indiana University: Jim Drummond adds expertise on biological macromolecules, while Clay Fuqua contributes authority on microbial interaction. Both are well-known authorities in their respective fields, as well as experienced educators:
- **New chapters:** The fourth edition adds a more detailed account of chromosome replication, protein and RNA synthesis, and a more complete description of the biology of biofilms and of intercellular communication between bacteria:

Chapter 11, RNA and Protein Synthesis

Chapter 21, Microbial Biofilms—Structured Multicellular Assemblies

Chapter 22, Cell–Cell Communication Mechanisms

All chapters from the previous edition have been thoroughly reviewed and revised to incorporate the most recent research.

- **New themes:** Two new themes have been incorporated across the text. A comprehensive coverage of energetics adds another perspective to the physiological and biochemical topics covered. A thorough incorporation of molecular machinery helps create a unifying narrative across biological principles.

A note on chemical notation of acidic and basic groups: Most of the carboxyl groups are drawn as nonionized and the primary amino groups as nonprotonated. However, at physiological pH these groups are ionized and protonated, respectively. The names of the organic acids indicate that they are ionized (e.g., acetate rather than acetic acid).

Ancillary Materials

- **Instructor's Resource Companion Website:** www.oup.com/us/white. All images are available to instructors for classroom use on a password-protected instructor's website. Please contact your Oxford sales representative for access.

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