

**Practical Handbook
of Microbiology**

Third Edition

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Edited by
Emanuel Goldman
Lorrence H Green

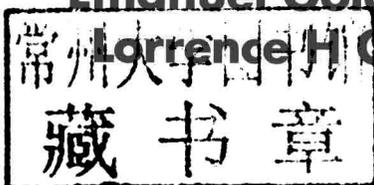
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Practical Handbook of Microbiology

Third Edition

*To Teddy and Lila Goldman, who represent the future, and to
Naomi Weinshenker, for her support and patience.*

—Emanuel Goldman

*To Susan and Rosalind Green, Emily and Adrian King, Michele
and Matthew and Jordan Green, and my newest sources of
inspiration, Allison and Sophie Green and Jaxton (JB) King.*

—Lorrence H. Green

Preface to the Third Edition

The second edition of the *Practical Handbook of Microbiology* was published in 2009, 20 years after the first edition. In recognition of the continued expansion and evolution of knowledge in the field, we have generated this third edition, in which every chapter in the second edition has been updated. Several new chapters have also been added, covering areas not included in the second edition. Most of our authors from the second edition stayed on for the third edition, but inevitably, there has been some turnover, and new authors have joined and contributed to this venture.

As noted in the Preface to the Second Edition, this book will provide basic knowledge and practical information about working with microorganisms in a clear and concise form. Although of use to anyone interested in the subject matter, the book is intended to especially benefit three groups: people trained as microbiologists that are highly specialized in working with one specific area of microbiology; people that have been trained in other disciplines and use microorganisms as simply another tool or *chemical reagent*; and, new in this edition, investors in microbiologically based companies who want to understand the technology as well as the underlying forces driving the industry.

Preface to the Second Edition

The first edition of the *Practical Handbook of Microbiology* was published in 1989. Since that time, the field of microbiology has undergone many changes and has grown to encompass other disciplines as well. New chapters have been added and a number of chapters from the first edition were dropped. Tables in the first edition that were outdated have been replaced by tables in the individual chapters. This edition also contains a new broad and concise survey table of selected eubacteria. Areas generally considered part of microbiology that were not covered or covered only briefly in the first edition are now included with comprehensive introductory chapters.

This book was written to provide basic knowledge and practical information about working with microorganisms, in a clear and concise form. Although of use to anyone interested in the subject matter, the book is intended to especially benefit two groups of microbiologists: people trained as microbiologists who are highly specialized in working with one specific area of microbiology and people who have been trained in other disciplines and use microorganisms as simply another tool or chemical reagent.

We hope our readers will share our enthusiasm for microbiology and find this book to be useful.

Acknowledgments

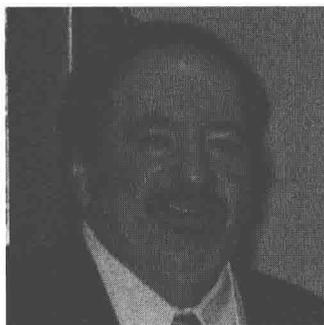
The resurrection of the *Practical Handbook of Microbiology* after 20 years, as a second edition, was due in large part to Judith Spiegel, a former editor at CRC Press. The third and current edition has been nurtured by other editors at CRC Press, Barbara Norwitz and Chuck Crumly, and especially by Jill Jurgensen, who was very instrumental in the production of both the second and third editions. This book would not have been possible without the great efforts of so many contributors, including two remaining authors who date back all the way to the first edition! We salute all our authors for sharing their knowledge and expertise and helping to make the *Practical Handbook of Microbiology* an essential resource for the field.

Editors



Emanuel Goldman is a professor in the Department of Microbiology, Biochemistry, and Molecular Genetics of the New Jersey Medical School (NJMS), Rutgers Biomedical and Health Sciences (RBHS), a division of Rutgers University, Newark, New Jersey. He graduated with honors from the Bronx High School of Science in 1962, received a BA (cum laude) from Brandeis University in 1966, where he was a chemistry major, and completed his PhD in biochemistry at the Massachusetts Institute of Technology in 1972. He performed postdoctoral research at Harvard Medical School and at the University of California, Irvine, before joining the faculty of the New Jersey

Medical School in 1979, where he rose through the ranks to professor in 1993. Among his awards and honors, Dr. Goldman was a Damon Runyon fellow, a Lievre senior fellow of the California Division, American Cancer Society, and a recipient of the Research Career Development Award from the National Cancer Institute. Among his service activities, he was an officer and organizer of the New York–New Jersey Molecular Biology Club, served as a full member of the American Cancer Society Study Section, and continues to serve on the editorial boards of *Protein Expression and Purification* and *Applied and Environmental Microbiology*. He was also twice elected by his colleagues to serve as the president of his university's chapter of the American Association of University Professors, and he was elected to serve as president of the Faculty Organization of NJMS. Among several areas of research activity, he has focused on the role of tRNA in the elongation of bacterial protein synthesis, including uncharged tRNA, codon bias, and programmed translational frameshifts. In addition to numerous scientific peer-reviewed publications and publications in the lay press, he has contributed a chapter to Zubay's *Biochemistry* textbook and four chapters to the *Encyclopedia of Life Sciences*.



Lorrence H. Green, PhD, president of Westbury Diagnostics, Inc., Farmingdale, New York, earned his PhD in cell and molecular biology from Indiana University, Bloomington, Indiana, in 1978. He followed this with three years of recombinant DNA and genetic research at Harvard University. In 1981, he moved into the industry by joining Analytab Products Inc., a major manufacturer of in vitro diagnostic test kits. During the next 12 years he helped to invent and manufacture more than 40 diagnostic test kits and rose to become the director of New Product Development and Product Support.

In 1993, Dr. Green founded Westbury Diagnostics, Inc., a microbiology-biotechnology-based contract research and development laboratory, also offering consulting services. Mixing his love for business with his love for teaching, he has served as an adjunct associate professor of microbiology at the New York College of Osteopathic Medicine and is currently an adjunct assistant professor of biology at Farmingdale State College and a director of the Fundamentals of the Bioscience Industry Program at Stony Brook University of the State University of New York.

Dr. Green is on the steering committee, and a former chairman, of the microbiology section of the New York Academy of Sciences, as well as the long-time treasurer of the New York City branch

of the American Society for Microbiology. From 2001 until 2004, he was a member of the Advisory Committee on Emerging Pathogens and Bioterrorism to the New York City Commissioner of Health. In 2013, he was appointed to the Board of Directors of the Long Island Advancement of Small Business.

His main interests involve using technology in the development of commercial products and in being an entrepreneur who invests in and develops companies. He enjoys providing mentorship and career advice to students at all levels. He has spoken at many career day events, judged many regional science fairs, and helped dozens of young people with applications to medical, nursing, and physician's assistant schools and with starting companies.

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Contents

Preface to the Third Edition	xiii
Preface to the Second Edition	xv
Acknowledgments	xvii
Editors	xix
Contributors	xxi

SECTION I Practical Information and Procedures for Microbiology

Chapter 1 Sterilization, Disinfection, and Antisepsis	3
<i>Michael G. Schmidt</i>	
Chapter 2 Quantitation of Microorganisms	19
<i>Peter S. Lee</i>	
Chapter 3 Culturing and Preserving Microorganisms	39
<i>Lorrence H. Green</i>	
Chapter 4 Stains for Light Microscopy	45
<i>Stuart Chaskes and Rita Austin</i>	
Chapter 5 Identification of Gram-Positive Organisms	61
<i>Peter M. Colaninno</i>	
Chapter 6 Identification of Aerobic Gram-Negative Bacteria	77
<i>Donna J. Kohlerschmidt, Lisa A. Mingle, and Nellie B. Dumas</i>	
Chapter 7 Plaque Assay for Bacteriophage	93
<i>Emanuel Goldman</i>	
Chapter 8 Phage Identification of Bacteria	99
<i>Catherine E.D. Rees, Lorrence H. Green, Emanuel Goldman, and Martin J. Loessner</i>	
Chapter 9 Phage Display and Selection of Protein Ligands	115
<i>Wlodek Mandecki, Emanuel Goldman, Inger Sandlie, and Geir Åge Løset</i>	