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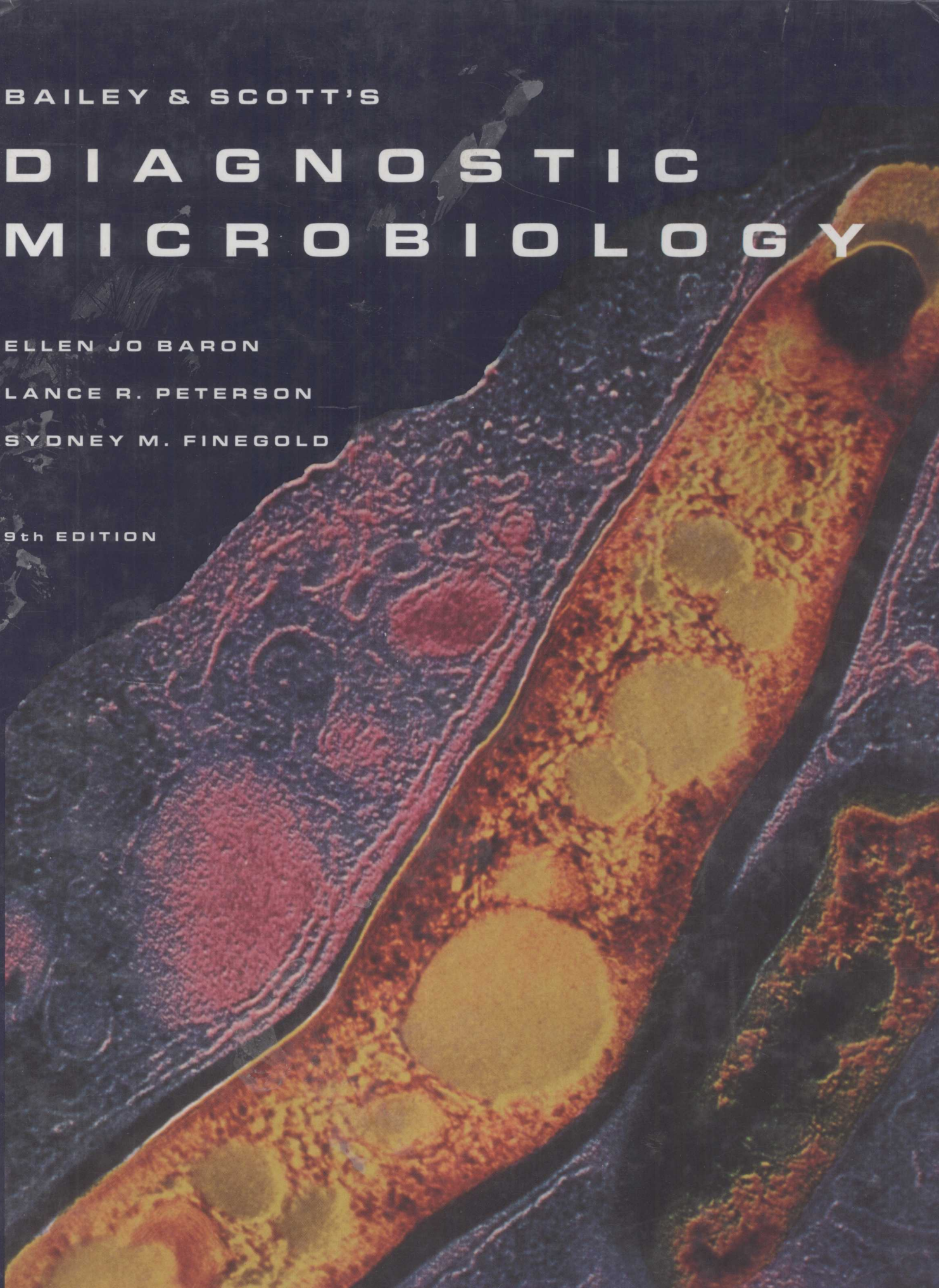
DIAGNOSTIC MICROBIOLOGY

ELLEN JO BARON

LANCE R. PETERSON

SYDNEY M. FINEGOLD

9th EDITION



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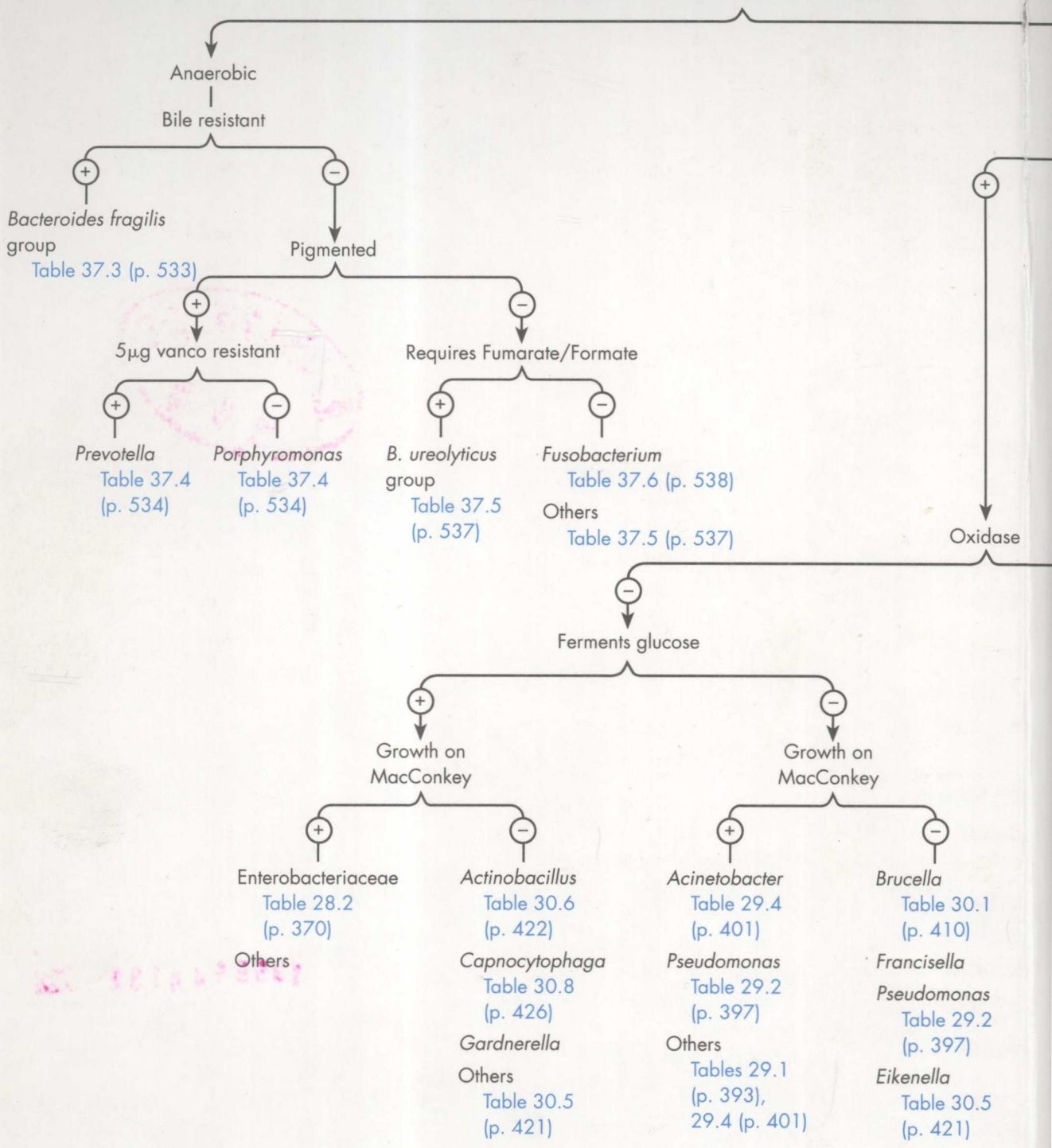
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On the cover:
An artificially colorized
electron micrograph of
Mycobacterium tuberculosis
inside a macrophage.

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Our work is dedicated to those
who faithfully support and care about us

To Jim, LoAnn, and Mary

FOREWORD

Forty-five years ago many knowledgeable scientists and physicians were convinced that the advent of antimicrobial agents spelled the death knell for clinical microbiology. They expected that the ensuing decade would provide the means to successfully eradicate all infectious agents. They did not count on the fantastic metabolic ingenuity of the microbial world, a behavior that permitted prokaryotic and eukaryotic microbes to triumph over the adversities presented by the constantly changing environments of the last 3 billion years. Surely, many if not most of the wonder drugs we call antimicrobial agents are but human modifications of molecules elaborated by microorganisms seeking an advantage in the perennial struggle for sustenance.

Indeed bacteria, fungi, protozoa, and viruses responded vigorously to the anthropocentric convictions of the optimists. Enzymes that modify the "killer" drugs became common. The inexhaustible microbial pool in nature permitted the intrusion of hitherto unknown organisms and those considered commensal saprophytes into the human biosphere, where they complicated the recovery of the very patients helped most effectively by the advance in science and medicine. The more antimicrobial agents were produced, the greater the variety of emerging resistance mechanisms and the appearance of heretofore unidentified pathogens.

Advances in our understanding of immunity offered an additional aspect in our comprehension of infectious disease and underlined the important role played by the individual host in overt expression of infectious disease. Thus the need for diagnostic clinical microbiology grew logarithmically, whereas competent practitioners of the discipline had diminished almost to the point of extinction. One of the few available guides for the neophyte clinical microbiologist was *Bailey & Scott's Diagnostic Microbiology*. It provided a logical approach to the often confusing world of clinically significant microorganisms obfuscated further by the dynamics of nomenclature and refinements in taxonomy.

This ninth edition continues in bolstering the accomplishments of previous contributors. It enhances its leadership by providing significant information on the clinical manifestations of infectious diseases that demand laboratory guidance for diagnosis and therapy. This edition, of course, has maintained its tradition of updating diagnostic procedures and provides in a singular fashion explanations of the many emerging technologies for clinical microbiology.

The authors have continued the tradition, started in earlier volumes, of highlighting procedures in simple terms explaining principles, methods, quality control, describing expected results, and providing performance schedules. Singling out procedures in the text where needed is an exceptional practice that deserves the applause of all users, be they student, technologist, microbiologist, pathologist, or infectious disease practitioner. The many texts that address the problems facing workers in diagnostic clinical microbiology do not provide such timely and ready access to procedural information. In addition, the organization of the entire text follows the logical work flow in the clinical microbiology laboratory and reflects not only the authors' superb command of the entire subject matter but also the fact that they know the problems confronting the worker at the bench. The major tasks of most

clinical microbiology laboratories concern all aspects of bacteriology. This vast subject is addressed precisely and completely. The authors bring the same thorough approach to virology, mycology, and parasitology with due respect for the limitation in those fields encountered in the average clinical microbiology setting.

I congratulate the authors for continuing to improve the pertinence of this respected and indispensable tool for all individuals who would venture into the fascinating world of clinical microbiology.

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PREFACE

The problem of controlling infectious disease and the important role of diagnostic microbiology in this effort are steadily increasing. During 1991, 4.3 million children died worldwide from acute respiratory diseases. In that year a total of 3.5 million people died from diarrhea, 1 million from malaria, and 900,000 from measles. By the end of 1991 there were a cumulative 1.5 million AIDS deaths. As a single cause of death among the infectious diseases, tuberculosis is the leader with nearly 3 million deaths annually. We as clinical microbiologists clearly need to remain current in our diagnostic acumen and active in developing new tests for management of infectious diseases.

The ninth edition of *Bailey & Scott's Diagnostic Microbiology* continues to present a comprehensive view of medical microbiology from the standpoint of the organization and function of a clinical microbiology laboratory; likely agents associated with infectious disease syndromes; and procedures for the detection, identification, and susceptibility testing of etiological agents. While the book has changed and grown over its life span of more than 50 years, its audience has developed to include students of medical technology, medical microbiology, pathology, infectious diseases, infection control, and other health-related disciplines. In addition, the book serves as a laboratory reference and procedure manual for practicing microbiologists. We have striven to continue serving the needs of all of these groups.

This edition has been modified dramatically from previous editions. With the addition of a new principal author, Lance Peterson, we have again redesigned the book to keep current with the rapidly changing times. The new format and greatly expanded number of full color illustrations (60% new or modified drawings and photographs) are testimony to our commitment to affirm *Bailey & Scott's Diagnostic Microbiology* as representative of the state of the art. We have tried to use color more specifically and effectively in this edition than has been done in previous editions. Color is used to highlight key tables, lists, charts, and procedures, and to aid the student in retaining the material visualized.

We have accommodated the need for more pages of scientific content by deleting the appendices that contained media and stain formulations and addresses of laboratory suppliers. That information is readily available from other sources. The additional space has been used to broaden the scope of the book. The glossary remains, and numerous new terms have been added. As in the previous editions, the glossary terms are printed in boldface in the text when they are first used. We have expanded identification tables and augmented our coverage of new technology, new etiological agents of infectious diseases, and the evolving interest in public health and preventive medicine.

An innovative comprehensive flow chart for bacterial identification with reference to the appropriate tables in the text has been added to the inside front and back covers. We hope that students new to the field will use this chart as a quick source of information and that experienced microbiologists who use the book as a bench reference will find the chart handy as a guide for quickly locating the information pertinent to their needs.

The ninth edition continues our tradition of providing the most up-to-date information possible concerning important agents of infectious diseases, such as the resurgent *Mycobacterium tuberculosis,* the newly discovered *Rochalimaea henselae,* and the recently newsworthy *Escherichia coli* O157:H7. Readers of the ninth edition will find state-of-the-art coverage of these and similarly in-

famous other microbes, including the latest strategies for laboratory diagnosis.

We are particularly excited about our new Chapter 5, prepared by the distinguished John A. Washington II, which addresses microbiologists' expanded responsibilities as advisors to clinicians and shapers of laboratory policy to benefit patient care. We continue to profit from the expertise of Lynne Shore Garcia (Parasitology) and Glenn D. Roberts (Mycology), whose authoritative chapters are essential components of this book. In addition, Richard B. Thomson, Jr. has built on the excellent foundation provided by W. Lawrence Drew, who created the original virology section in the seventh edition, by providing diagnostic virology studies for the first time. This edition also benefits from the expertise of Diane M. Citron, who updated the anaerobic chapters conceived originally by Martha A.C. Edelstein for the seventh edition.

As always, the authors are indebted to the many experts who reviewed our chapters. Their suggestions and modifications greatly enhance the usefulness and accuracy of the book. In an undertaking of this scope, errors and omissions seem to be inescapable, and we welcome your corrections, comments and suggestions. We have tried to respond to all of our readers who took the time to give us their input regarding the previous editions, and we urge you to continue to do so.

As reflected in the foreword by the eminent Henry D. Isenberg, the role of microbiologists continues to expand as they struggle to keep pace with the ever-evolving microbial world. And as we stated in the preface to the eighth edition, there will always be a need for conventional microbiology and competent microbiologists. *Bailey & Scott's Diagnostic Microbiology* endeavors to support these needs.

ELLEN JO BARON
LANCE R. PETERSON
SYDNEY M. FINEGOLD

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We want to acknowledge the support and commitment of our new editor, Jim Shanahan, and the energetic efforts of our new developmental editor, Lisa M. Potts. Jim is responsible for the new look of the book, and his attention to our needs is appreciated greatly. Chris Murphy, our production editor, has also been especially diligent.

We also thank all those students, scientists, and practitioners of diagnostic microbiology who share their work and observations by writing and speaking. We all learn through the sharing of insights in our discipline, and the field of diagnostic microbiology moves forward.

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DIAGNOSTIC MICROBIOLOGY

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