Bailey & Scott's

Diagnostic Microbiology

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To
James C. Taylor,
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and **Mary L. Finegold**
with loving appreciation for
their constant guidance
and continued understanding
again

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Preface

Diagnostic Microbiology presents a comprehensive view of medical microbiology from the standpoints of the organization and function of a clinical microbiology laboratory (Part One), likely agents associated with infectious syndromes (Part Three), and procedures for identification and susceptibility testing of infecting agents (Parts Two and Four). Reviews of the previous edition suggested that *Diagnostic Microbiology* is valuable as a textbook for students of medical technology, medical microbiology, pathology, infectious diseases, and infection control and as a laboratory reference manual and procedure book. We have strived to maintain that focus.

We welcome the continued participation of W. Lawrence Drew (virology), Martha A. C. Edelstein (anaerobes), Lynne Shore Garcia (parasitology), and Glenn D. Roberts (mycology), whose authoritative chapters add so much to the book. We have also received able assistance from several new contributors, George Berlin (mycobacteriology), Michael Pfaller (non-spore-forming, gram-positive bacilli), and Ella Swierkosz (chlamydiae), who helped to provide the updated information presented in this edition.

Certain chapters were evaluated extensively by Gerald Gilardi, Janet Hindler, J. Michael Janda, Richard Facklam, and Maurice White. Henry Isenberg's suggestions are always valuable. Several of the new photographs were taken by Peter Rose. We are grateful for their expert contributions. Stephanie Manning at Mosby and Mary Espenschied at CRACOM have been able editors, and we appreciate their support and expertise. As always, we welcome

input from our readers, many of whom helped us to correct errors and modify topics that were presented in the seventh edition.

The eighth edition continues the format introduced in the seventh edition, with chapter outlines listed at the beginning of each chapter. The major format change is the introduction of full color throughout, which allows all illustrations to be placed adjacent to their corresponding text. Procedures, still presented in boxes on one page or facing pages, now include a statement of the principle of the test, quality control guidelines, expected results, and performance schedule recommendations, in addition to the method itself. Chapter 4 has been retitled to reflect its current content, which has been expanded to include material on laboratory management and test selection. Of course, the entire book has been updated, and new identification tables have been added in certain areas. We urge readers to peruse How to Use This Book, p. xi, which explains the organization of the text and outlines the content.

The importance of microbiology continues to expand in this era of new infectious agents and difficult-to-manage infections. Although there is a definite trend toward automation and newer techniques, such as DNA probes, there will always be a place for conventional microbiology and for competent microbiologists.

Ellen Jo Baron
Sydney M. Finegold

How To Use This Book

The organization of the seventh edition of this book has been retained. Part One contains material of general importance to the practice of diagnostic clinical microbiology, including laboratory safety, quality assurance, and laboratory management, as well as the role of the microbiology laboratory in infection control and epidemiologic studies. Part Two encompasses methods for specimen handling, initial observations, and procedures used to detect agents of infectious diseases. New technologies, automation, and immunologic methods are included in this section, as are methods for susceptibility testing. The pathogenesis of infectious diseases in relation to the site of infection or the organ system involved is covered in Part Three, which highlights the agents likely to be recovered from each body site or syndrome. Part Four details methods for detection and identification of specific infectious agents.

Each chapter begins with an outline of the sections within to facilitate finding a particular area and to provide a quick overview of the contents. Reference material has been reorganized into three appendixes and the glossary. Appendix A contains formulas for media and reagents, Appendix B contains formulas for commonly used stains, and Appendix C lists the names and addresses of commercial product suppliers, whose names are simply mentioned in parentheses in the text when they are cited. Even companies not cited specifically in the book are listed; Appendix C should be a valuable resource for laboratory managers. The Glossary has been expanded to include numerous new terms and the abbreviations used throughout the text are incorporated alphabetically into the Glossary. The use of boldface type in the text identifies all terms that have been defined in the Glossary.

Bailey & Scott's Diagnostic Microbiology

Contents

Part One

Organization and Function of the Clinical Microbiology Laboratory

1 Diagnostic Microbiology: Purpose and Philosophy

Clinical microbiologists are part of the health team and serve an important role in the diagnosis, management, and prevention of infections in patients. Microbiologists should take pride in this role and should feel responsibility commensurate with it.

1.1. Purpose of Diagnostic Microbiology

The purpose of clinical microbiology is to work closely with clinicians and other health team members to provide diagnosis and optimum management of infectious disease in patients and to prevent the spread of infection to other individuals. In general, it is important to document the presence of infection, to determine its specific nature, and to provide appropriate therapy early in the course of the illness. Early diagnosis and treatment are usually more urgent with infectious diseases than with any other type of disease process. In many infections, speedy treatment is crucial. Both mortality and morbidity may be reduced significantly if proper treatment is provided early. In others, hospitalization may be avoided or shortened and surgery may be avoided if specific antimicrobial therapy is provided early. While the responsibility is large, the satisfaction that may be achieved in successfully diagnosing and treating patients with infectious diseases can be great. It is very gratifying to see rapid improvement in a critically ill patient; all members of the health team share in this gratification.

1.2. Responsibility to the Clinician and to the Patient

Microbiology laboratory service must be available at all times. This means that microbiologists must be

on call if it is not reasonable to have the laboratory staffed at all times. Others may be able to set up certain types of specimens in the absence of the microbiologist, but the expertise of the microbiologist may be required to properly interpret a Gram stain or colonial morphology late at night. In assessing early findings, one should provide as much detail as possible and one should not hesitate to indicate the various possibilities as to the microbiological diagnosis. The clinician sets up his or her own differential diagnosis based on the clinical picture, roentgenograms, blood studies, and so on. The diagnostic possibilities, as seen by a competent microbiologist, are of paramount importance to the clinician in further narrowing down or substantiating a diagnosis. The microbiologist must be alert to unusual findings. As suggested earlier, speed is critical in serious illness caused by infectious agents. Good microbiologists can usually find one or more ways to expedite presumptive identification of microorganisms in clinical specimens. If the health team is to function with maximum efficiency, the members of that team must communicate freely and frequently, particularly when dealing with seriously ill patients. The physician should lead in this respect, but if he or she does not, the others on the team should initiate communication when it may be helpful. Our primary concern always must be the patient. The clinician should supply the microbiologist with pertinent historical and other data regarding the patient's illness; the microbiologist should be able to utilize this information.

The microbiologist can also be of service to the clinician by instructing him or her concerning the importance of proper specimen collection and transport and regarding specific techniques to be used. An interested physician can be taught how to judge the quality of a sputum specimen and how to interpret a Gram stain properly.

Microbiologists also have a responsibility to notify infection control personnel or epidemiologists and public health authorities. Urgent matters should be communicated by telephone.

The microbiologist also has an obligation to the patient aside from considerations of rapid, accurate diagnosis. Professionalism demands that microbiologists, as well as other members of the health team, not hesitate to deal with certain specimens or patients and that they respect the patient's rights and feelings with regard to sensitive information. At times the microbiologist may be pressured to release information on a patient to the patient, his or her family, or others; such pressure must be resisted. Demands of this nature should be referred to the physician.

1.3. Specimen Collection and Transport

Specimen collection and transportation are urgent considerations because the quality of a laboratory's work may be limited by the nature of a specimen and its condition on arrival in the laboratory. Chapter 6 includes a detailed discussion of correct collection and transportation methods.

Specimens should be obtained so as to preclude or minimize the possibility of introducing extraneous microorganisms that are not involved in the infectious process. The problem is greatest when the specimen may become contaminated with elements of the normal (or colonizing) flora that may serve as pathogens in the entity being studied (e.g., *Klebsiella* as an oral cavity colonizer in a patient with pneumonia). Even normally sterile body fluids may be contaminated during specimen collection in such a way as to cause significant difficulty in interpretation. For example, a patient suspected of having bacterial endocarditis, although he does not really have the disease, has one or more blood cultures that have become contaminated with coagulase-negative staphylococci during venipuncture. Since this organism can cause endocarditis in numerous clinical settings, this patient's contaminated cultures may lead to additional testing, administration of unnecessary antibiotics, and a prolonged hospital stay for the patient. Careful skin preparation before procedures such as blood cultures and spinal taps and techniques for bypassing areas of normal flora when this is important and feasible (e.g., percutaneous transtracheal aspiration in critically ill patients with pneumonia) will prevent many problems. Personnel must be instructed to label all specimens submitted to the laboratory with data such as the patient's name, hospital number, date and time, and exact nature and source of the specimen, as discussed in Chapter 3.

1.4. Noncultural Methods of Diagnosis

As noted previously, the physician depends on data from many sources in arriving at tentative and definitive diagnoses. In addition to the usual medical history and physical examination, the competent clinician explores epidemiologic information (travel history; exposure to animals, ticks, or other vectors;