



# *A TEXTBOOK OF* **BACTERIOLOGY**

THE APPLICATION OF BACTERIOLOGY AND IMMUNOLOGY TO THE  
ETIOLOGY, DIAGNOSIS, SPECIFIC THERAPY AND PREVENTION OF  
INFECTIOUS DISEASES FOR STUDENTS AND PRACTITIONERS  
OF MEDICINE AND PUBLIC HEALTH

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# A TEXTBOOK OF BACTERIOLOGY

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**Dedicated**  
**to the memory of**  
**PHILIP HANSON HISS, JR., M.D.**

## PREFACE TO THE EIGHTH EDITION

INTENDED for students of medicine and public health this *Textbook* presents the fundamentals of bacteriology and immunology and the application of this knowledge to the understanding and control of infectious diseases. A primarily medical point of view has led naturally to a selection of material for inclusion in the book. The conception of medicine, however, as a division of biological and social sciences, in relation to other sciences, gives scope for both a general and practical treatise. A large amount of space has been devoted to the biology of bacteria and other infectious agents and to the physiology and chemistry of states of susceptibility and immunity in man and animals. We have attempted in this edition, as in previous editions, to coördinate the knowledge provided by the basic sciences with technical and practical information.

Rapid advances in bacteriology and immunology have been made during the past few years. To mention only a few of these: Systematic studies of genera and species of bacteria have disclosed new relationships and added new types. There is now a general acceptance of the main facts of bacterial variability, although the relation of forms to possible life-cycles is still uncertain. Many variants have been newly recognized. This is somewhat confusing and troublesome to the technician with the limited objective of tagging organisms but it is the breath of biological life in the body of the science. Studies of bacterial metabolism have resulted in the isolation of substances requisite for growth and of substances produced by growth of bacteria. Increased knowledge has been gained concerning the enzyme-systems of bacterial respiration and the relation of oxidation-reduction potentials to growth and activity. The toxins of diphtheria and tetanus have been highly purified. Improvements have been made in the serum treatment of pneumonia and in the methods for recognition of types of pneumococci. The serological grouping of streptococci has brought order into a chaotic field of knowledge. Certain antigens have been characterized chemically. New methods are available for the selection and preservation of strains of organisms bearing the so-called "Vi" antigen, essential for immunization against infection. Intensive investigation of the *Rickettsiae* has yielded improved methods of cultivation, the preparation of antigens and antisera through the use of these cultures, and a correlation of knowledge of relationships among the types of typhus fever and spotted fevers. Ultramicroscopic viruses have been recognized and handled with sharper precision. Chemical studies have indicated that certain viruses may be crystallizable proteins of large molecular size and weight, endowed with autocatalytic properties. Influenza has been recognized as a virus disease. The epidemiology of many virus diseases has been extended through methods of recognition and control. Vitamins and hormones have been brought into relation with states of susceptibility and immunity. Increased attention has been paid to the bearing of the hereditary constitution of animals upon their resistance to infection and intoxication. Bacterial chemotherapy, in the doldrums until recently, has been revived by the discovery and use of

sulfanilamide. Technical methods have been improved and new procedures devised.

The text of the seventh edition, published in 1934, contained much new material drawn from modern bacteriology and immunology. Corrections and partial revisions were made in 1935 and in 1937. For the eighth edition we have made many changes throughout the book and have rewritten large sections, in order to incorporate in this volume much of the newer knowledge which has been gained along the lines mentioned above and, in fact, in almost every division of the field.

The section on pathogenic protozoa has been omitted. Neither of us is competent to deal with protozoology. Furthermore, it seemed inappropriate to include that subject in a textbook concerned primarily with bacteria and related organisms. Redundant and obsolete material in other sections also has been deleted. The index has been shortened to provide better workability. A few new illustrations have been added. The eighth edition, therefore, is more compact and somewhat reduced in size.

We are deeply indebted to many colleagues, students and friendly critics for advice and help in the preparation of this text. In addition to references to authors, acknowledgments for special assistance are noted in appropriate places in the book. To these investigators and to others to whom we have offered thanks personally we wish to express our gratitude.

H. ZINSSER

S. BAYNE-JONES



## PREFACE TO THE FIRST EDITION

THE volume here presented is primarily a treatise on the fundamental laws and technic of bacteriology, as illustrated by their application to the study of pathogenic bacteria.

So ubiquitous are the bacteria and so manifold their activities that bacteriology, although one of the youngest of sciences, has already been divided into special fields—medical, sanitary, agricultural and industrial—having little in common, except problems of general bacterial physiology and certain fundamental technical procedures.

From no other point of approach, however, is such a breadth of conception attainable, as through the study of bacteria in their relation to disease processes in man and animals. Through such a study one must become familiar not only with the growth characteristics and products of the bacteria apart from the animal body, thus gaining a knowledge of methods and procedures common to the study of pathogenic and nonpathogenic organisms, but also with those complicated reactions taking place between the bacteria and their products on the one hand and the cells and fluids of the animal body on the other—reactions which often manifest themselves as symptoms and lesions of disease or by visible changes in the test tube.

Through a study and comprehension of the processes underlying these reactions, our knowledge of cell physiology has been broadened, and facts of inestimable value have been discovered, which have thrown light upon some of the most obscure problems of infection and immunity and have led to hitherto unsuspected methods of treatment and diagnosis. Thus, through medical bacteriology—that highly specialized offshoot of general biology and pathology—have been given back to the parent sciences and to medicine in general methods and knowledge of the widest application.

It has been our endeavor, therefore, to present this phase of our subject in as broad and critical a manner as possible in the sections dealing with infection and immunity and with methods of biological diagnosis and treatment of disease, so that the student and practitioner of medicine, by becoming familiar with underlying laws and principles, may not only be in a position to realize the meaning and scope of some of these newer discoveries and methods, but may be in better position to decide for themselves their proper application and limitations.

We have not hesitated, whenever necessary for a proper understanding of processes of bacterial nutrition or physiology, or for breadth of view in considering problems of the relation of bacteria to our food supply and environment, to make free use of illustrations from the more special fields of agricultural and sanitary bacteriology, and some special methods of the bacteriology of sanitation are given in the last division of the book, dealing with the bacteria in relation to our food and environment.

In conclusion it may be said that the scope and arrangement of subjects treated of in this book are the direct outcome of many years of experience in the instruction of students in medical and in advanced university courses in bacteriology, and that it is

our hope that this volume may not only meet the needs of such students but may prove of value to the practitioner of medicine for whom it has also been written.

It is a pleasure to acknowledge the courtesy of those who furnished us with illustrations for use in the text, and our indebtedness to Dr. Gardner Hopkins and Professor Francis Carter Wood for a number of the photomicrographs taken especially for this work.

P. H. H., JR.

H. Z.

# A TEXTBOOK OF BACTERIOLOGY

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