ORAL MICROBIOLOGY
AND
INFECTIOUS DISEASE

A Textbook for Students and Practitioners of Dentistry

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WILLOUGHBY D. MILLER, A.B., D.D.S., M.D., Ph.D., Sc.D., (1853–1907)

The father of oral microbiology. As the formulator of the chemico-parasitic theory of dental caries he was the first to apply a basic science to the solution of dental disease. Dr. Miller was a great leader as an investigator, practicing dentist, teacher, and prolific author in all phases of dentistry. He wrote the first comprehensive textbook of oral microbiology, *Die Mikroorganismen der Mundhöhle,* published in Germany in 1889 and in the United States in 1890 as *The Micro-Organisms of the Human Mouth.* (From School of Dentistry, University of Michigan.)

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To the Memory of

WILLOUGHBY DAYTON MILLER

Founder of Oral Microbiology

His Concepts Have Never Been Superseded,

Only Amplified

PREFACE

The practice of dentistry in the maintenance of oral health depends on both the theory and practice of the science of microbiology. The task of presenting to the student of dentistry the principles of this science that are relevant to the practice of his profession offers an interesting challenge quite different from that confronting the writer of a treatise on medical microbiology for prospective physicians. Although the dentist requires at least as thorough an understanding of the interactions of microorganisms with the human body as does his confrêre, the physician, his needs in this field differ in several significant ways. In the first place, the majority of the dentist's problems are concerned directly or indirectly with two of the most prevalent and important human diseases, dental caries and periodontitis, each of which has a peculiar relationship to microorganisms. In dental caries, microorganisms initially invade a tissue that is essentially nonreactive in the sense that the usual responses of inflammation, repair, and antibody formation are not evoked as they are in the infection of most other tissues. In periodontal disease, in which these reactions may be elicited, the microorganisms flourish superficially. Notwithstanding extensive research, in neither disease entity has it been possible to demonstrate unequivocally a specific relationship between the disease and a single causative agent, whether it be microbial or not. The concept of infectious disease as a neat correspondence of one microorganism to a specific group of symptoms is of course incomplete but it must be acknowledged that in many cases the control of one species of microorganism results in the control of the disease. In dental caries and periodontitis, however, the lesions contain a complex microbial flora which, to be sure, is quite often characteristic but in which no single variety of microorganism has been shown to predominate sufficiently to be designated as the specific etiological agent.

Consequently, in those diseases which pertain especially to dentistry, specific microbial diagnosis and therapy have as yet found little application. For the present, the dental practitioner must rely on such mechanical aids in treatment as débridement, restoration or prosthesis; on "shotgun" chemoprophylaxis and chemotherapy; and, perhaps most important of all, on the natural defenses of the body. As long as this condition persists, the dentist has less need than the physician for *systematic* microbiology. Perhaps it is this lack of an explicit *need* that accounts for the present state of systematic oral microbiology. Knowledge of the taxonomy and pathogenic potentialities of such important oral bacteria as lactobacilli, *Veillonella*, indifferent and anaerobic streptococci, spirochetes, vibrios, fusiform bacilli, actinomycetes, and other filamentous forms is still inadequate. Indeed, the systematists do not recognize many of the "species" of microorganisms referred to so frequently in dental literature. *Bergey's Manual of Determinative Bacteriology*, for example, lists many of them by name only in a limbo of appendices, usually without description. Important progress is being made, however, as more general microbiologists and students of disease are being attracted by the abundance of stimulating problems in this field.

Certain aspects of applied microbiology are more important to the dentist than to the physician. Almost all of the dentist's manipulations are made in an area of the body which is very heavily populated with microorganisms. The circumstances

are such that the application of a strictly aseptic technique is practically impossible in all but a few dental operations. Consequently, the dentist is more often directly and intimately concerned with the *practices* of disinfection, sterilization, and hygiene than is the general surgeon. Furthermore, the nature of the environment in which he must work necessitates that the dentist have a thorough understanding of the mechanisms of infectious disease, for, even when he does not deal with infected tissue, his every manipulation may introduce into the patient's body a multitude of microbes, many of which are known to cause serious systemic disorders. The dentist should have an ingrained comprehension and appreciation of the defensive processes that ordinarily make it possible for him to commit this outrage on the human body without an untoward reaction.

Despite the lack of exact information concerning many of the oral microorganisms, a wealth of significant material is available for a textbook intended to introduce to the student of dentistry those aspects of infectious disease that pertain to his profession. The present volume emphasizes the basic principles of microbiology as they relate to infectious disease and illustrates them freely by prototypical examples. It was planned as a compendium and not as an encyclopedic reference. Accordingly, we have intentionally omitted extensive bibliographies. However, the student who wishes to explore a specific topic in detail will find adequate documentation in the references cited at the end of each chapter. To all investigators whose results we have referred to without citation, we acknowledge our deep indebtedness.

We have integrated into this book, for the medical student and physician as well as for the dentist, that borderland of oral microbiology which comprises the oral manifestations of infections progressing primarily elsewhere and systemic infections originating in the oral cavity. If because of this material the present volume should be useful to the student of medicine also, its original purpose will thereby be enlarged to a gratifying degree.

The present endeavor could not have been completed without the generous cooperation of so many of our colleagues that individual acknowledgement is impossible. To all who contributed freely of time and advice in consultation, we offer sincere thanks. We are especially indebted to Brigadier General Arthur L. Irons, Doctor Herbert R. Morgan, and Colonel Thomas A. McFall for their continued support and encouragement. Although acknowledgement is made of the source of each text figure, a general expression of appreciation goes to all who so willingly contributed illustrations; thanks are due specifically to the Illustration Section of the Walter Reed Army Institute of Research and to the Medical Illustration Service of the Armed Forces Institute of Pathology.

Our deepest gratitude must go to our families for accepting cheerfully the degree of absenteeism that inevitably accompanies authorship.

Washington, D. C.
Rochester, N. Y.
June, 1956

GEORGE W. BURNETT
HENRY W. SCHERP

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I

THE ORIGINS, DEVELOPMENT, AND SCOPE OF MICROBIOLOGY

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