OUTLINE OF MEDICAL PARASITOLOGY

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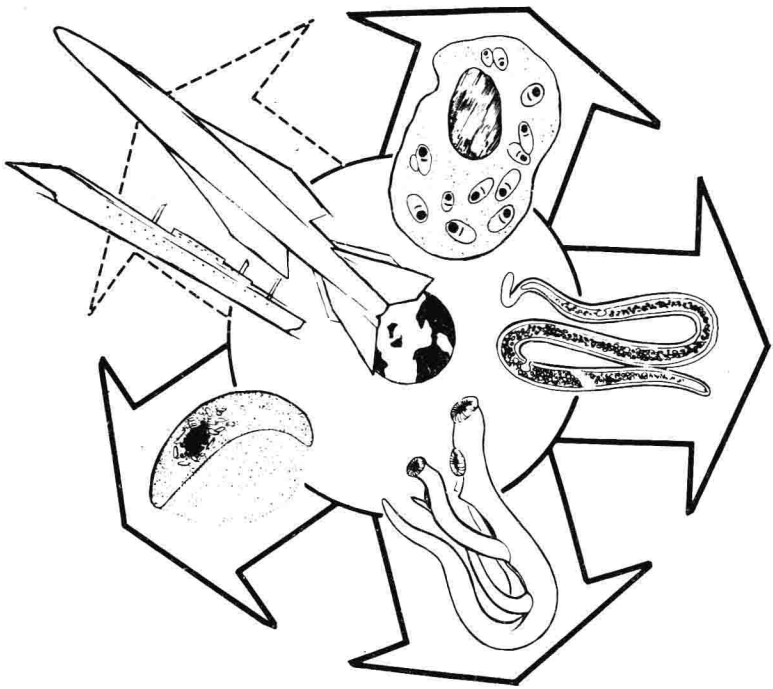

MEDICAL PARASITOLOGY IN THE "JET AGE"

Thanks to the revolutionary advances in transportation, the world has, in effect, shrunk to the point that, for example, New Delhi is practically a neighbor of New York. Millions of Americans (military personnel and civilians) travel annually to areas of high endemicity of parasitic diseases not at present endemic in the United States. Therefore, geographic isolation is no longer a protection against the so-called "exotic" diseases of other parts of the world. Already clinicians in the United States are frequently diagnosing parasitic diseases once disregarded entirely because of their geographic origin.

The parasitic infections selected for inclusion in this book, in decreasing order of frequency and emphasis, are (1) those endemic in the United States, (2) those diagnosed in travelers to, or immigrants from, endemic areas of "exotic diseases," and (3) those of concern as health problems to our Armed Forces, hence of considerable importance to our national defense.

To:

My wife, Ruth Ella,

and our children,

Robert Neal, John Charles,

and Margaret Jane

PREFACE

This *Outline of Medical Parasitology* is the outgrowth of 20 years' experience in teaching this subject to medical students at the University of North Carolina and at Duke University. It was encouraged, by, and is intended primarily for, medical students, but it is hoped that the subject as presented will be of interest and value to practicing physicians and others concerned with parasitic diseases of man.

This condensed version of the subject is not designed to take the place of any of the excellent standard textbooks on medical parasitology and tropical medicine. Rather, it should supplement them. It is intended to be an inexpensive aid for orientation to the subject, a general survey of the field before beginning the course, and a growing foundation during the course. It is especially designed to be a ready source of refresher material in preparation for examinations and can be used for future reference. With these objectives in mind, no attempt was made to cover all topics customarily considered in textbooks or even to give complete coverage to any single topic. This restricted approach is evident not only in the text but in the illustrations as well. They are semidiagrammatic, giving only the most important details of concern to medical students. Moreover, except for three figures, the maximum space per page is utilized to emphasize these details without giving magnifications or attempting to convey size relationships. The three exceptions appear in the laboratory-diagnosis unit of the book, where it is absolutely necessary to bring out these comparisons.

It will be noted that all parts, except Part VII, concern basic aspects of the subject. Part VII is supplementary in the sense that in the time available it is not usually possible to include the community aspects of parasitic diseases. It is, nevertheless, hoped that students will refer to this material when it relates to specific diseases being studied. The basic section of the book (Parts I to VI) provides a balance among the three different groups of parasites (protozoa, helminths, arthropods), in keeping with the number of clinically

important species in each group. The laboratory diagnosis of intestinal protozoa and helminths (Part IV) is treated separately with the hope it might be of value in the laboratory part of the course, regardless of the sequence of presentation of these two groups of parasites. The treatment of protozoan and helminthic infections (Part VI) was placed last in the basic section, since this subject cannot be presented properly as a unit until the student has mastered the diseases and their etiologic agents.

A serious attempt was made to tailor the book to the needs of medical students. Aside from the illustrations mentioned above, definitions were included where deemed valuable to introduce new concepts and/or new morphologic types, etc. Also, in the case of the helminthic infections and the most complicated protozoan infections, the life cycles of the parasites were arranged to begin at the time of human infection. This makes it easier to trace in point of time the pathologic and clinical manifestations due to the parasitic process. To assist in orienting students to the clinical aspects of parasitic diseases, a few case histories familiar to the author have been included at appropriate places. These have been modified and condensed, and are presented as "case abstracts." Finally, review tables have been included at intervals to cover the most important details of groups of diseases.

ACKNOWLEDGMENTS

Grateful appreciation is expressed to all who played a part in the completion of this undertaking. This includes a great many more names than can be listed, since the book is based on the studies of others. It was not possible to use documentation because of space limitations. However, the author hereby acknowledges explicitly that while the work reported involves hundreds of others, he accepts the responsibility for the selection of the material and for errors that may be present. It would be of inestimable value if students and others would bring such errors to the attention of the author.

It is a pleasure to make specific acknowledgment to all those who had a direct role in the preparation of the book. My wife, Ruth Ella Neal Larsh, typed the manuscript and offered moral support in the long and arduous task. Miss Adele Spiegler of the Medical Illustration Department on this campus is responsible for the skillful drawings. Former Dean Edward G. McGavran, of our School of Public Health, and Dr. John C. Cassel, Head of the Epidemiology Department in that school, were kind enough to offer suggestions in regard to the materials dealing with epidemiology and control. Members of the Department of Parasitology who assisted in a variety of ways are Miss Alice F. Johnson, and Drs. Norman F. Weatherly, Hilton T. Goulson, and James R. Hendricks

SPECIAL ACKNOWLEDGMENT TO CONSULTANTS

The author was most fortunate in having as consultants, for the treatment section of the book and for the case abstracts, two colleagues of many years who are outstanding authorities in tropical medicine: Harold W. Brown, M.D., Professor of Parasitology, College of Physicians and Surgeons, Columbia University, and Harry Most, M.D., Professor and Chairman, Department of Preventive Medicine, New York University School of Medicine. The author wishes to express sincere appreciation for their participation.

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Chapel Hill, N.C.

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Part VII SUPPLEMENTARY MATERIAL

TABLES

PART I
INTRODUCTION

1. INTRODUCTION TO MEDICAL PARASITOLOGY

1. The Origin of Parasitic Organisms. All forms of life originated and developed as free-living organisms, competing with each other for their existence. In this highly competitive situation various adjustments and adaptations were necessary for survival. Many species in different phyla of both the plant and animal kingdoms survived by making remarkable adaptations to a life dependent in some way upon other living organisms. Thus *parasites* were introduced as a new form of life. The evidence indicates that the first step in this transition occurred soon after life differentiated on this planet and that the adaptation to a parasitic life in some instances has existed for tens of thousands of years. It is not surprising, therefore, that today we can demonstrate parasites that are so well adapted to the host organism that neither seems to interfere with the other. But such a perfect host-parasite equilibrium requires many complex adaptations in the evolutionary process over a long period of time. Therefore, organisms that have more recently entered the parasitic mode of life are not so well adjusted to the host and vice versa. In fact, in these situations both the parasite and host usually react violently to the association, which may lead to the destruction of large numbers of the parasite and/or the host until necessary adjustments can be made. These "intermediate" parasites, in terms of evolution, are much in evidence today. Finally, we can see "new" parasites—organisms that have not yet become committed irreversibly to parasitic life.

The study of parasitic organisms and their hosts becomes more meaningful when one realizes the ancient origin of the parasitic mode of life, the never-ending struggle between parasites and their hosts, and the absolute necessity of considering both parasite and host when delving into the complexities of these common associations.

2. Medical Parasitology (Broad Sense). While all plants and animals serve as hosts for certain parasitic organisms, in the field of medicine the focus

is upon man. In a broad sense, all parasites of the human host can be grouped together for consideration in medical parasitology, since the principles apply equally well to both plant and animal parasites. However, it was realized early that such broad coverage is not practicable, and it became necessary to develop separate fields of specialization. Thus, today the plant parasites (bacteria, fungi, spirochetes, rickettsiae, viruses) are considered separately in bacteriology, mycology, and virology or are combined for study in microbiology.

3. Medical Parasitology (Strict Sense). By custom, and in this book, medical parasitology is restricted to the study of parasitic organisms of the animal kingdom that involve man as a host.

4. Major Groups of Animal Parasites of Man. The animal parasites of man belong to two major categories: *protozoa* (one-celled animals) and *metazoa* (many-celled animals). The most important metazoa are the *helminths* (parasitic worms) and the *arthropods* (true insects, ticks, mites, spiders, etc.). The helminths are represented by three morphologic types: the *nematodes* (roundworms), the *cestodes* (tapeworms), and the *trematodes* (flukes). The tapeworms and flukes are also known collectively as *flatworms.*

Thus, in all, there are five separate groups of important animal parasites of man: protozoa, roundworms, tapeworms, flukes, and arthropods (Fig. 1). By areas of specialization, medical parasitology may be subdivided into (1) medical protozoology, (2) medical helminthology, and (3) medical entomology.

5. Approach to the Study of Medical Parasitology. Man and his animal parasites form a complex association that cannot be understood when separated. Therefore, the study of parasitic diseases should include the important host-parasite relationships that bear on exposure to infection, means of infection, life cycle of the parasite in the human body, reactions of the host to the parasite (especially the pathologic conditions produced and the resulting striking signs and symptoms), exit of the parasite from the body, and extrinsic phase or phases of the parasite (in water, on the soil, or in the body of another host or hosts). Knowledge of these relationships provides the physician a rational approach to clinical and laboratory diagnosis, treatment, and control of parasitic diseases. Therefore, in the presentation to follow, the main topics to be considered for each disease are (1) morphology and life cycle of the parasite, (2) pathology, (3) clinical manifestations, (4) laboratory diagnosis, and (5) treatment. These are the basic areas of greatest concern to the clinician. The epidemiology and control of the most important of these diseases on a community basis are discussed briefly in a supplementary section (Part VII).