# TEXTBOOK OF
# VIROLOGY

*for Students and Practitioners of Medicine*

BY

A. J. RHODES, M.D., F.R.C.P. (Edin.)

*Research Associate, Connaught Medical Research Laboratories, and Professor of Virus Infections, School of Hygiene, University of Toronto; Virologist, Hospital for Sick Children, Toronto*

AND

C. E. van ROOYEN, M.D., D.Sc., (Edin.), M.R.C.P. (Lond.)

*Research Member, Connaught Medical Research Laboratories, and Professor of Virus Infections, School of Hygiene, University of Toronto*

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# Preface to Second Edition

The aim of this revised edition of "Textbook of Virology" is to present an account of the essential features of the virus and rickettsial diseases of man, in a form suitable for undergraduate and postgraduate students of medicine, bacteriology, virology, and public health.

The book should also prove of value to general medical practitioners and to specialists in dermatology, infectious diseases, internal medicine, ophthalmology, pathology, neurology, pediatrics, public health, and tropical medicine.

Since the first edition of this book appeared some three years ago, many advances in knowledge of virus and rickettsial infections have been made. Accordingly, it has been necessary to revise extensively several existing chapters and to add much new material.

At the request of many teachers of virology, selected bibliographies for further reading have been appended to each chapter. In choosing these bibliographies, preference has been given to review articles and those with full lists of references, so as to enable students to obtain as much knowledge of the subject as possible with the least amount of reading.

In the course of revision, the opportunity has been taken to increase the amount of space devoted to the specific treatment of virus and rickettsial diseases as currently practised in North America. Likewise, more attention has been paid to laboratory diagnostic procedures of proven and practical value.

It is a pleasure to record our appreciation of the help and assistance rendered to us by many friends and colleagues in Toronto and elsewhere, in particular: Dr. John Crawley (veterinary medicine); Dr. Angus Graham (biophysical and biochemical properties of viruses; bacteriophage); Mr. D. B. W. Reid (statistics); and Dr. Murray Sanders (epidemic keratoconjunctivitis). Many others have contributed photographs, or permitted us to reproduce previously published material, and to them suitable acknowledgment has been made in the text.

Finally, we wish to place on record our indebtedness to Miss Ruth Briggs, B.A., and Mrs. Patricia McCutcheon, B.A., Librarians, Connaught Medical Research Laboratories, University of Toronto, and to our secretarial staff,

especially Miss Hilda Lee, B.A., and Mrs. Doris Spicer; Dr. Angus Graham and Dr. George Dempster have assisted with the reading of proofs.

A. J. RHODES
C. E. VAN ROOYEN

*University of Toronto*

# Preface to First Edition

Our knowledge of viruses and Rickettsiae has increased so rapidly in the last few years, that it has become increasingly difficult for the medical student to obtain an up-to-date picture of the subject. The primary aim of this textbook, therefore, is to present a succinct account of the essential features of the virus and rickettsial diseases of man, in a form suitable for such students. It is hoped that students of veterinary medicine will also find the book helpful.

The medical practitioner who desires to keep abreast of the latest advances in the clinical aspects, pathology, diagnosis, etiology, method of spread, specific treatment, and prevention of this group of infectious diseases will also find information of interest.

The work should further serve as an introduction to more advanced reading for postgraduates undertaking courses of instruction leading to higher degrees in hygiene and other branches of medicine. Those who wish to read more widely will find essential references in our larger work (*Virus Diseases of Man*, 2nd Edition, Thomas Nelson & Sons, New York, 1948), or in other readily available reference volumes.

In this text, which has been evolved from courses of lectures delivered to students over a period of fifteen years, we have deemed it advisable to adopt a dogmatic attitude when dealing with certain controversial matters.

We trust the work will stimulate the interest of younger men in the field of virology, where so many outstanding fundamental as well as applied problems await solution.

Our cordial thanks are due to Dr. G. D. Scott, Department of Electron Optics, McLennan Laboratories, University of Toronto, under whose direction electron micrographs were prepared, with the skillful assistance of Mr. D. Welch.

We are indebted to various persons who have kindly supplied us with photographs, and suitable acknowledgment is made in the text.

Our colleague, Dr. A. F. Graham, has assisted us with proofreading and has provided much helpful criticism.

A. J. Rhodes,
C. E. van Rooyen.

*July 29th, 1949*
School of Hygiene,
University of Toronto

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# One

## THE FUNDAMENTAL CHARACTERISTICS OF VIRUS INFECTIONS

CHAPTER 1

# Classification and Biologic Relationships of Viruses and Rickettsiae

Students of bacteriology have benefited considerably from the adoption of a formal code of classification and the Linnean or binomial system of nomenclature. The viruses and rickettsiae have obvious biologic affinities with the bacteria, and it is desirable to attempt a similar classification of these agents. Nevertheless, the classification of viruses and rickettsiae is peculiarly difficult, mainly because these agents cannot be cultivated on bacteriologic media, and have no readily demonstrable biochemical or metabolic activities. It is therefore not possible to use in classification many of the criteria employed for bacteria.

Means of applying to viruses the "International Bacteriological Code of Nomenclature," which governs the classification of bacteria, have been explored. The first serious attempt to classify viruses on this basis is contained in the Sixth Edition of Bergey's "Manual of Determinative Bacteriology" (1948). In this scheme, drawn up by Dr. F. O. Holmes, the viruses are placed in the order *Virales*, divided into three suborders: Suborder I, viruses infecting bacteria (the *Phagineae*); Suborder II, viruses affecting higher plants (the *Phytophagineae*); and Suborder III, viruses attacking insects and mammals (the *Zoophagineae*). Each suborder is divided into families, and these in turn are composed of genera containing individual species. In Holmes' classification, grouping into families and genera has been made on a broad basis of predominant pathologic characteristics of the infection, and into species on the basis of antigenic structure and other properties of the individual viruses. Holmes has made use of terms derived from mythology as well as from the names of outstanding workers. The classification of Holmes has met with a considerable body of support from plant virologists, but a lesser measure of approval from virologists primarily interested in the study of viruses of man and animals. Modifications of this classification have been, and doubtless will continue to be, put forward by other workers, and the question is receiving consideration from certain international committees. It appears likely that before long a generally acceptable scheme of classification and nomenclature will be adopted, at any rate for those groups of viruses most thoroughly studied. We do not, therefore, feel justified at the moment in recommending the beginner

to memorize the classification of viruses proposed by Holmes, although advanced students may profit from consideration of this scheme.

An attempt has also been made in Bergey's Manual (1948) to classify the rickettsiae and certain viral agents with similar characteristics (Bengtson and Rake). These agents are placed in the Order *Rickettsiales*, comprising 3 families: Family I, *Rickettsiaceae*; Family II, *Bartonellaceae*; and Family III, *Chlamydozoaceae*. It is of interest that it has been considered that the members of the family *Bartonellaceae* such as the *Bartonella*, *Grahamella*, and *Eperythrozoon* have resemblances to the rickettsiae on the one hand, and the basophilic viruses or *Chlamydozoaceae* on the other. The classification of these agents is likewise receiving attention at the moment, and it is almost certain that an agreed classification will before long be adopted.

As a simple alternative to the study of a formal classification of viruses or rickettsiae we recommend the student to familiarize himself with the chief virus diseases of man and animals arranged according to the bodily organs mainly affected. In tables 1 and 2 are presented lists of virus and rickettsial diseases of man and animals, grouped according to tissues affected and clinicopathologic features.

TABLE 1

*Virus and Rickettsial Diseases of Man Grouped According to Tissue Affected anes Clinicopathologic Features*

*Diseases of the Skin or Mucous Membranes*

Contagious pustular dermatitis (of sheep)
Cowpox
Foot and mouth disease
Herpangina
Herpes simplex (herpes febrilis)
Herpes zoster (shingles, zona)
Molluscum contagiosum
Warts (verrucae)

*Exanthemata*

Alastrim (variola minor)
Chickenpox (varicella)
German measles (rubella)
Kaposi's varicelliform dermatitis
Measles (morbilli)
Smallpox (variola major)

*Respiratory Diseases*

Common cold
Epidemic influenza
Mumps
Ornithosis
Pandemic influenza
Pneumonitis
Primary atypical pneumonia
Psittacosis

*Diseases of Genito-Urinary System*

Herpes
Inclusion cervicitis and urethritis
Lymphogranuloma venereum (LGV)
Warts

*Eye Diseases*

Epidemic keratoconjunctivitis
Inclusion conjunctivitis
Newcastle virus conjunctivitis
Trachoma