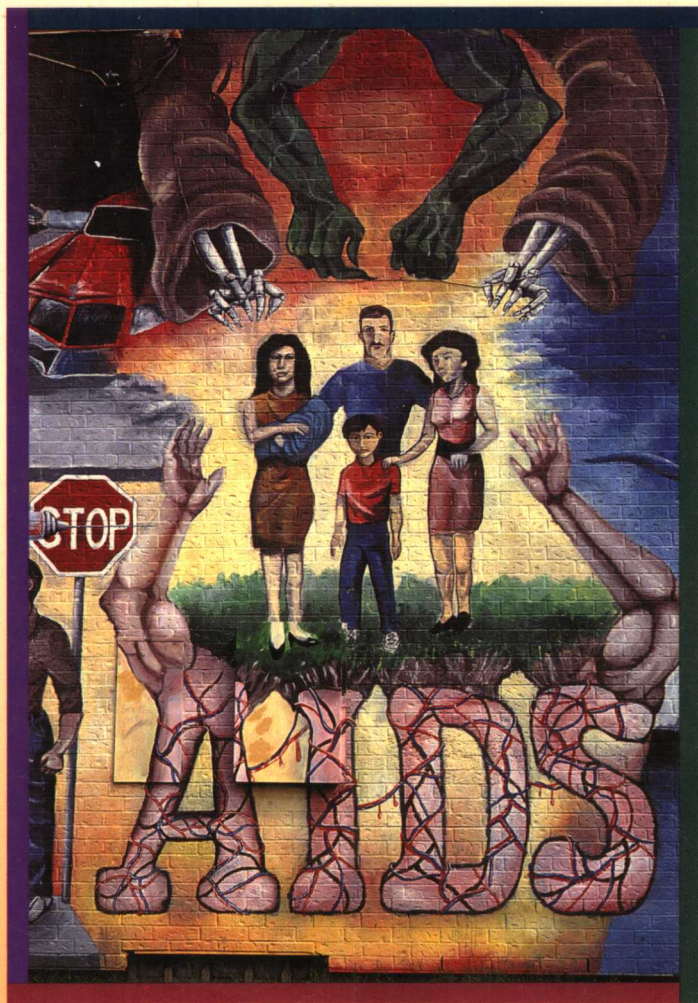


# AIDS

SCIENCE AND SOCIETY



HUNG FAN / ROSS F. CONNER / LUIS P. VILLARREAL

# AIDS

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## Science and Society

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JONES AND BARTLETT PUBLISHERS

*Sudbury, Massachusetts*

Boston

London

Singapore

*Editorial, Sales, and Customer Service Offices*

Jones and Bartlett Publishers

40 Tall Pine Drive  
Sudbury, MA 01776  
(508) 443-5000  
(800) 832-0034

Jones and Bartlett Publishers International

Barb House, Barb Mews  
London W6 7PA  
UK

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Portions of this book first appeared in *The Biology of AIDS, Third Edition*, by Hung Fan, Ross F. Conner, and Luis P. Villarreal © 1994 by Jones and Bartlett Publishers.

**Library of Congress Cataloging-in-Publication Data**

Fan, Hung, 1947–

AIDS: science and society / Hung Fan, Ross F. Conner, and Luis

P. Villarreal.

p. cm.

Includes index.

ISBN 0-86720-913-5

I. AIDS (Disease) I. Conner, Ross F. II. Villarreal, Luis P.

III. Title.

RC607.A26F353 1995

616.97'92—dc20

95-9108

CIP

*Acquisitions Editor:* David Phanco

*Assistant Production Manager/Coordinator:* Judy Songdahl

*Manufacturing Buyer:* Dana L. Cerrito

*Editorial Production Service:* Colophon

*Cover Design:* Hannus Design Associates

*Cover Printing:* New England Book Components

*Printing and Binding:* Edwards Brothers, Inc.

Printed in the United States of America

99 98 97 96            10 9 8 7 6 5 4 3 2

To our HIV-infected friends and acquaintances who are courageously battling the disease or who have succumbed to it. In their honor, and to hasten the day when this book is no longer necessary, a portion of the royalties from this book will be donated to foundations and community organizations dedicated to AIDS research and service.

# Preface

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The purpose of this text is to provide the nonspecialized student with a firm overview of AIDS from biomedical and psychosocial perspectives. The biological aspects include cellular and molecular descriptions of the immune system and the AIDS virus (Human Immunodeficiency Virus, or HIV). The consequences of HIV infection from cell to organism are also covered, along with a clinical description of the disease. We then move from the organism level to the interorganism level covering both the psychological and social aspects of HIV and AIDS. These topics can only be covered in a survey fashion due to the comprehensive nature of this approach and the additional aim of making this text appropriate for a one-quarter (or semester) course (or part of such a course). We have selected an approach that focuses first on presenting the relevant fundamental principles. Following a brief presentation of these principles for each particular topic, we generalize and apply these concepts to the case of AIDS.

This book incorporates and updates the third edition of *The Biology of AIDS* and also includes consideration of social issues related to HIV and AIDS: personal risk assessment, HIV prevention, and the human and societal dimensions of living with HIV and AIDS. We have provided the latest statistics on AIDS that were available as this book went to press.

This book is patterned after a one-quarter course, AIDS Fundamentals, taught at the University of California, Irvine. Approximately half the course covers biomedical aspects of AIDS, and the other part covers social issues raised by the disease. The text represents the material covered in the course. At

UCI, AIDS Fundamentals is open to all undergraduate students and is taught assuming that they have had a high school level modern-biology course. The material covered in Chapters 3 (immunology), 4 (virology), 6 (epidemiology), 9 (preventing HIV), and 10 (living with HIV and AIDS) is covered in three hours of lecture per chapter. Material covered in the other chapters is taught in a single one-and-a-half hour lecture per chapter. We have found that the students are able to assimilate and retain the material when delivered at this rate. The course includes another important component: small discussion groups led by students who previously took the class. These peer-led groups use experiential exercises as a catalyst for a deeper understanding of the human and social aspects of HIV and AIDS.

Most researchers and scholars in AIDS-related fields were unprepared for the dramatic impact of the emerging AIDS epidemic. As virologists and social scientists, we might have expected modern biomedical technology to provide a quick technical solution or to at least prevent, via vaccine development, the spread of this major new viral epidemic. It is now clear that even though this technology has hastened biomedical progress in AIDS, the AIDS epidemic poses new and unforeseen difficulties with no quick biological solution in sight. These difficulties challenge both our scientific abilities and the ability of our society to respond appropriately. It is our goal to provide students with a conceptual framework of the issues raised by the AIDS epidemic so that they will be better able to deal with the challenges posed by this disease. This is particularly important because new information about scientific aspects of AIDS appears almost daily; with this information come new implications for the clinical, social, psychological, legal, and ethical aspects of the disease. We hope that the framework provided in this book will help students understand and make informed decisions about AIDS-related issues as they develop in the future.

# Acknowledgments

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We wish to thank David Fan, Elaine Vaughan, Michael Gorman, David Prescott, Cedric Davern, David Baltimore, and Frank Lilly for reading parts of the manuscript prior to publication and providing many helpful substantive and editorial comments. Juan Moreno applied outstanding computer graphic skills in generating all the line drawings for the book, Arthur Durazo assisted with Spanish translation, and Mirella Marinelli provided speedy and accurate word-processing assistance. Bob Settineri of Sierra Productions was of great help in obtaining the other figures. Paula Carroll, Helen Shaw of Colophon, Deborah Haffner, and other editorial staff of Jones and Bartlett were responsible for production of the final volume. We are grateful for their assistance and gentle prodding. We also wish to thank Michael Feldman and Emmett Carlson for their love and support.

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Dr. Luis Villarreal is Professor of Virology in the Department of Molecular Biology and Biochemistry at the University of California, Irvine. Dr. Villarreal's research interest is in the strategy of how viruses replicate and how they cause disease.



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# Chapter 1

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## **Introduction: An Overview of AIDS**

**AIDS IN BRIEF**

**THE AIDS EPIDEMIC**

A report appeared in 1981 that initially drew little attention from infectious disease experts. In that report, Dr. Michael Gottlieb, at the University of California at Los Angeles, described a rare form of pneumonia occurring in homosexual men. Other reports from about the same time indicated that other homosexual men were developing rare forms of cancer. This new set of symptoms, a *syndrome* in medical terms, was eventually called *Acquired Immune Deficiency Syndrome* because the symptoms were consistent with damage to the immune system in previously healthy individuals. Moreover, this disease was not congenital or inherited but appeared to have been acquired. We now know that this resulted from infection by a virus. Since then, the acronym *AIDS*, which is used to describe this disease, has become a prominent and permanent fixture in our language. It evokes a range of responses, including fear, hate, and mistrust. Some of these responses (hate, mistrust) are related to the association of AIDS with subcultural groups within our society, such as male homosexuals, who already have experienced discrimination. Other responses (fear) are due to the grave nature of the AIDS disease and the threat it may pose to society. This is because the AIDS epidemic continues to grow—unlike most other major infectious diseases that have been controlled by a combination of clinical treatments and public health measures.

## AIDS IN BRIEF

We now know that AIDS is caused by *Human Immunodeficiency Virus (HIV)*, but it was originally observed by its effects on the immune system. An important clue was that AIDS patients often developed a lung infection (or pneumonia) caused by fungus called *Pneumocystis carinii*. This infection is very rare in healthy individuals, but patients with cancers of the immune system itself (lymphomas) were known to be susceptible to this disease. Lymphomas are usually treated by chemotherapy, which is intended to destroy the cancer cells. However, chemotherapy also will unavoidably destroy many healthy immune cells along with the cancerous lymphoma cells. Thus, this type of pneumonia predominantly occurs in patients with a damaged immune system. Examination of AIDS patients confirmed that their immune systems were damaged. The specific nature of this damage is discussed in greater detail in Chapters 3 and 4. It had been known for some time that various other viral infections could damage cells of the immune system, but such severe damage as is seen with AIDS was unprecedented. Although doctors suspected early on that AIDS resulted from infection by a virus, it was not until 1984 that the virus was finally isolated by both French and American researchers. That virus is now known as *HIV*.

In addition to pneumonia, AIDS is associated with numerous other infections. These secondary infections are caused by various bacteria, protozoa, fungi, and other viruses. Usually, it is these infections (known as *opportunistic infections*) that cause death in AIDS patients. In addition to secondary infections, AIDS patients frequently develop cancers, including *lymphomas* and an otherwise rare cancer called *Kaposi's sarcoma*. HIV infection also can result in damage to brain cells. This leads to loss of mental function, referred to as *AIDS dementia*. A more complete description of the clinical features of AIDS is presented in Chapter 5. Most of these opportunistic infections and some other effects of HIV infection can be explained by damage to the immune system.

HIV causes disease insidiously. The early stages of infection are often not apparent, without any visible symptoms. The infected person may feel healthy and appears to be completely normal during this time (the incubation period) but such a person is

able to transmit the infection. The HIV incubation period is of variable duration and can be quite long (on average 8 to 10 years). In contrast, for most common virus infections, such as colds or influenza, an incubation period of a few days or weeks will be followed by apparent disease. This adds greatly to the difficulty of studying and controlling AIDS, because many people infected with the virus have not yet developed the disease.

### THE AIDS EPIDEMIC

Despite the many different clinical symptoms that result from AIDS, medical investigators have already learned a great deal about how AIDS is spread in our population. For example, it is now clear that HIV transmission requires close contact and that infection occurs by one of three routes: blood, birth, or sex. Casual contact does not lead to disease transmission. AIDS epidemiology is further discussed in Chapter 6.

Between 1981 (the beginning of the AIDS epidemic) and the end of 1992, about 240,000 cases of AIDS in the United States were reported to the National Centers for Disease Control (CDC) in Atlanta, Georgia. Of these cases, about 160,000 (67 percent) have died. Sexually active homosexual males were originally the major afflicted group and represent about 60 percent of these reported cases. Another 21 percent of the cases were male or female intravenous drug users, and 7 percent were male homosexual drug users. The remaining 12 percent resulted from heterosexual transmission, birth, or by blood transfusion during the period when the American blood supply was not monitored for HIV antibodies (1981–1985).

The AIDS epidemic is not restricted to the United States. It can be found on all continents and hence is considered a *pandemic*. There may be as many as 10 million people in sub-Saharan Africa who are infected with HIV. In Africa, HIV transmission predominantly results from heterosexual contact and other modes. Given the relatively poor medical support available in much of Africa, the number of infected people may increase significantly. Very recently, HIV infection has been spreading explosively in South Asia as well, with Thailand and India strongly



affected. As there is no cure for AIDS, these numbers are alarming. They indicate the clear potential of AIDS to spread unchecked, in spite of recent advances in modern medicine, epidemiology, virology, and recombinant DNA technology. This reminds us of previous times when major infectious diseases devastated human populations (see Chapter 2). How can we control this epidemic? An overview of the relationship between epidemics and human populations may shed some light on this.